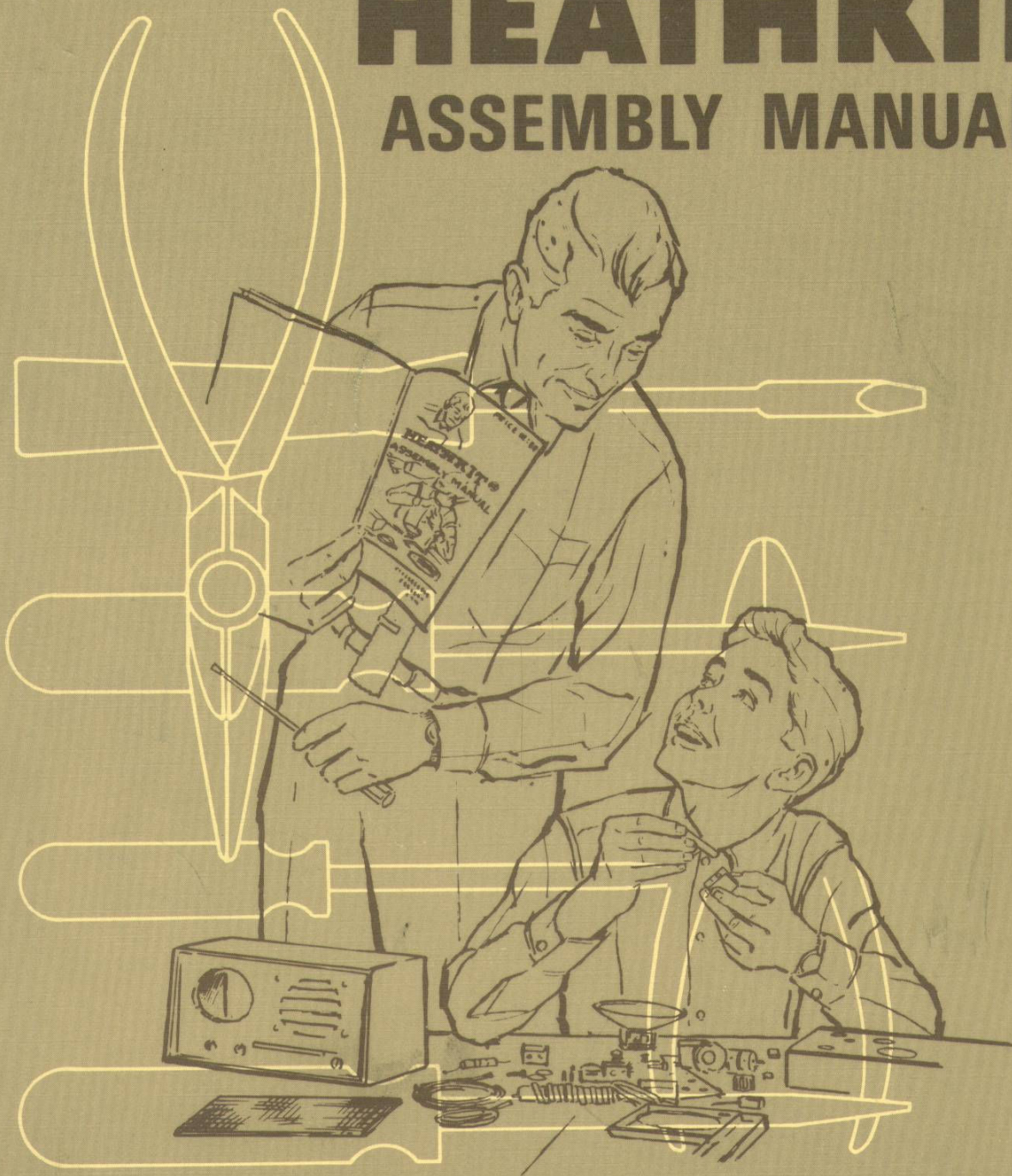


MODEL **GR-110 VHF Scanning Monitor**

HEATHKIT[®]

ASSEMBLY MANUAL

HEATH COMPANY • BENTON HARBOR, MICHIGAN



PRICE \$2.00

GR 110 - Ser# 03326



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595-1469-01

Dear Customer:

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

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

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

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Sincerely,

HEATH COMPANY
Benton Harbor, Michigan 49022

Assembly
and
Operation
of the



VHF SCANNING MONITOR
MODEL GR-110



HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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INTRODUCTION

The Heathkit Model GR-110 VHF Scanning Monitor is an eight-channel, crystal-controlled, high frequency receiver that can be tuned to any selected 9 MHz segment of the 146 through 174 MHz band of frequencies. These frequencies are used by public service organizations such as MARS, CAP, Police Departments, Fire Departments, Ambulance services, and Marine Rescue services. The crystal* that you use in each channel will determine the frequency, or station, which that channel receives.

Tuning can be accomplished either manually or automatically. With manual tuning, you can have the Monitor remain tuned to any desired channel. For automatic operation, the Monitor will automatically scan through each of the channels you are using, and will lock in on the first one that starts to transmit. It will then remain locked in on that channel as long as the transmitting continues. After the transmission stops, the Monitor will wait for four seconds. If there is no further transmission, the channel will be released and the Monitor will resume scanning. Should you desire, you can make the Monitor bypass one (or more) of the channels by pushing the appropriate front panel pushbutton.

A priority channel, Channel "0," is provided which has precedence over all other channels. The Monitor will

automatically lock on Channel "0" whenever a station is transmitting on that frequency, even though the Monitor was already locked on another channel.

The readout tube can be connected to display a channel number only when the Monitor locks on a transmitted signal, or to continuously display each channel number in sequence while scanning the channels. A jack on the rear panel allows you to connect an external four-ohm speaker. A speaker plug is supplied with the kit.

The Monitor is designed to operate from either a 120 volt, 50/60 Hz power source, or from a 13.8 VDC source such as a vehicle battery. A gimbal bracket is supplied so the Monitor may be mounted in any desired location in a vehicle. Optimum operation will be obtained when you use an antenna with an impedance of 50 ohms.

*These crystals must be ordered separately, one for each frequency you intend to receive. See "How to Order Crystals," on Page 5. NOTE: Check local and state ordinances governing the use of police radios before ordering crystals for law enforcement frequencies; in some areas it is illegal to monitor police bands from a mobile receiver.

INTRODUCTION

The Heathkit... is designed to provide a comprehensive... for the user.

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The Heathkit... is designed to provide a comprehensive... for the user.

The Heathkit... is designed to provide a comprehensive... for the user.

HOW TO ORDER CRYSTALS

Your VHF Scanning Monitor will need a crystal for each channel you intend to use. Determine your crystal requirements and obtain the necessary crystals in the following manner.

First, decide what stations you want to listen to. Note that, although this Monitor will operate from 146 MHz to 174 MHz, all of the stations you want to hear must be within a 9 MHz frequency band (must not be separated from each other by more than 9 MHz). You could, for example, use frequencies between 153.71 MHz and 162.71 MHz, or between 146 MHz and 155 MHz.

Learn the exact operating frequency of each station by contacting those in charge of it.

Then order the crystals in the following manner:

1. Order a "Crystal Certificate" from the Heath Company for each crystal.

Model Number: GRA-110-1
Cost: \$4.95 each


2. When you receive your Crystal Certificates, fill one in for each crystal as shown below. Then cut off the receipt, place a stamp on the card, and mail it to CTS KNIGHTS, INC. Your crystals will be quickly mailed back to you.

NOTE: If you wish to obtain crystals from another source, you will have to provide the following information:

Case Type HE-025-0.
 R_s less than 25 ohms.
 C_o 7 pF.
 Frequency (MHz)

Desired operating frequency (MHz) – 10.7 (MHz).

3

CTS KNIGHTS, INC. 22208 CONVERTER-MONITOR CRYSTAL CERTIFICATE VALID FOR 1 CRYSTAL PLEASE FILL IN FOLLOWING INFORMATION: PLEASE PRINT		FILL IN:
MONITOR MAKE _____	HEATHKIT	
MONITOR MODEL _____	GR-110	
OPERATING FREQ. _____	OPERATING FREQUENCY OF STATION YOU WANT TO HEAR	
PREPAID SHIPMENT WILL BE MADE WITHIN 10 DAYS OF CERTIFICATE RECEIPT BY:		
CTS KNIGHTS, INC. SANDWICH, ILL. 60548	22208	
NAME _____	YOUR NAME AND ADDRESS	
ADDRESS _____		
ZIP _____		
CUT → _____ CUT CTS KNIGHTS, INC. SANDWICH, ILL.		
PLACE OF PURCHASE _____	YOUR RECEIPT	
DATE _____ MODEL _____		
MODEL _____ FREQ. _____		
10 DAY SHIPMENT _____ POSTAGE PREPAID		
CUSTOMER RECEIPT 22208		

CRYSTAL CERTIFICATE

UNPACKING INSTRUCTIONS

DO NOT UNPACK your Receiver packaging until the Manual tells you to do so.

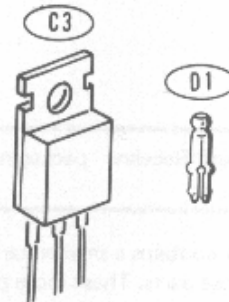
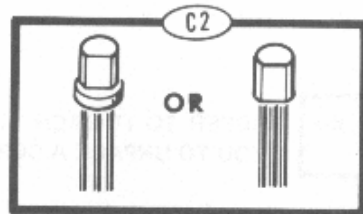
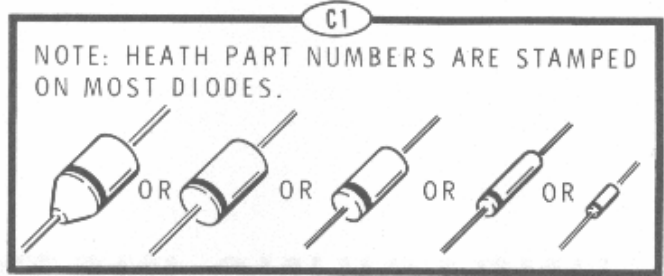
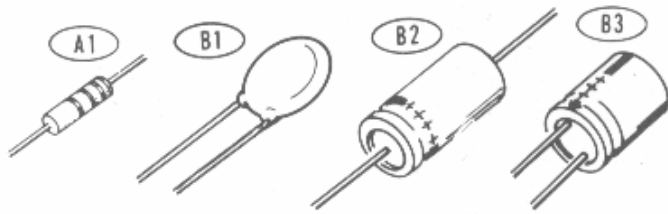
The main shipping carton contains a smaller carton (marked PACKS 1-3) and some loose parts. These loose parts are part of PACK 3, even though they may not be marked as such.

The "Pack Index Sheet" inside the smaller carton shows the location of the packs. **KEEP THIS INDEX SHEET AND**

REFER TO IT EACH TIME THE MANUAL INSTRUCTS YOU TO UNPACK A CERTAIN PACK.

NOTE: Any part, or group of parts, that is packaged in an individual container with a part number on it should be returned to its container after it is identified and remain there until actually used in a step. This will prevent intermixing of parts and aid in part identification.

AUDIO CIRCUIT BOARD PARTS PICTORIAL



AUDIO CIRCUIT BOARD

PARTS LIST

Unpack the package marked #1 and check each part against the following list. The Key numbers correspond to the

numbers on the "Audio Circuit Board Parts Pictorial"

KEY PART No.	KEY PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
RESISTORS				
1/2-Watt, 10%				
A1	1-49	3 ✓	22 Ω (red-red-black)	.10
A1	1-3	1 ✓	100 Ω (brown-black-brown)	.10
A1	1-45	1 ✓	220 Ω (red-red-brown)	.10
A1	1-4	1 ✓	330 Ω (orange-orange-brown)	.10
A1	1-9	1 ✓	1000 Ω (brown-black-red)	.10
A1	1-11	1 ✓	1500 Ω (brown-green-red)	.10
A1	1-19	1 ✓	6800 Ω (blue-gray-red)	.10
A1	1-20	3 ✓	10 kΩ (brown-black-orange)	.10
A1	1-22	2 ✓	22 kΩ (red-red-orange)	.10

CAPACITORS

KEY PART No.	KEY PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
Disc				
B1	21-143	1 ✓	.05 μF	.20
B1	21-95	1 ✓	.1 μF	.15
B1	21-99	1 ✓	.2 μF	.25
Electrolytic				
B2	25-98	1 ✓	50 μF	.25
B3	25-257	3 ✓	10 μF vertical	.25
B3	25-248	2 ✓	100 μF vertical	.40

DIODES-TRANSISTORS

KEY PART No.	KEY PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
C1	56-56	1 ✓	1N4149 diode	.20

KEY PART No.	KEY PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
Diodes-Transistors (cont'd.)				
C1	56-58	1 ✓	1N709A zener diode	.65
C1	56-74	1 ✓	MZ2362 diode	.65

NOTE: Transistors are marked for identification in one of the following four ways.

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

KEY PART No.	KEY PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
C2	417-91	3 ✓	2N5232A transistor	.85
C2	417-201	2 ✓	X29A829 transistor	.50
C3	417-175	3 ✓	2N5294 transistor	1.45

MISCELLANEOUS

KEY PART No.	KEY PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
	85-1207-1	1 ✓	Audio circuit board	1.05
D1	432-121	9 ✓	Connector pin (2 extra included)	.10
	344-51	1 ✓	Brown hookup wire Solder (Additional 3' rolls of solder, #331-6, can be ordered for 15 cents each.)	.05/ft

ITEMS FROM FINAL PACK

KEY PART No.	KEY PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
	597-260	1	Parts Order Form	
	597-308	1	Kit Builders Guide	
		1	Manual (See front cover for part number.)	2.00

NOTE: Refer to Page 72 for "Replacement Parts and Price Information."



STEP-BY-STEP ASSEMBLY

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

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

Solder a part or a group of parts only when instructed to. All resistors will be called out by the resistance value (in Ω

or $k\Omega$) and color code. Capacitors will be called out by the capacitance value and type.

When a circuit board is finished, set it aside until it is called for later in the assembly instructions.

NOTE: Be sure you have ordered the crystals you will need to operate this Monitor after it is assembled. If you have not yet ordered them, do this as soon as possible. See "How to Order Crystals" on Page 5.

START



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



NOTE: Position the audio circuit board as shown; then install the following parts as instructed.

() 1000 Ω (brown-black-red).

() 22 kΩ (red-red-orange).

() 1500 Ω (brown-green-red).

() 22 kΩ (red-red-orange).

() 220 Ω (red-red-brown).

() 10 kΩ (brown-black-orange).

() 10 kΩ (brown-black-orange).

SAFETY WARNING: Avoid eye injury when you clip off excess leads. We suggest that 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.

() 6800 Ω (blue-gray-red).

() 330 Ω (orange-orange-brown).

() 100 Ω (brown-black-brown).

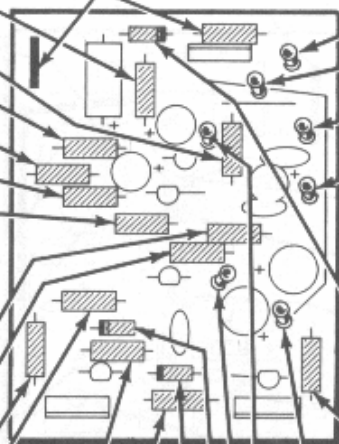
() 22 Ω (red-red-black).

() 22 Ω (red-red-black).

() 10 kΩ (brown-black-orange).

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

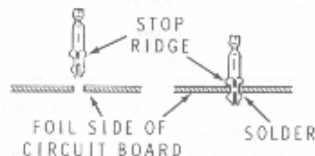
PART NUMBER



CONTINUE



NOTE: Install connector pins in the following steps. Solder each pin to the foil as it is installed.



() Connector pin at SHLD.

() Connector pin at +5.

() Connector pin at BLK.

() Connector pin at IN.

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



() 1N709A diode (#56-58) at D303.

() 22 Ω (red-red-black).

() Connector pin at +12.

() Connector pin at WHT.

() Connector pin at AUDIO.

() 1N4149 diode (#56-56) at D302.

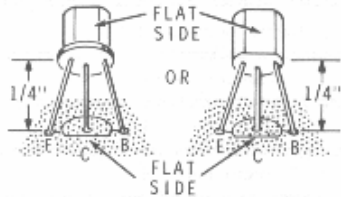
() MZ2362 diode (#56-74) at D301.

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

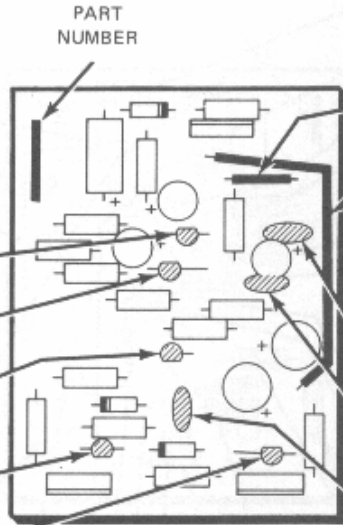
PICTORIAL 1-1

START

NOTE: Install each of the following transistors as shown. Solder each lead to the foil and cut off the excess lead lengths.



- () 2N5232A transistor (#417-91) at Q301.
- () 2N5232A transistor (#417-91) at Q302.
- () X29A829 transistor (#417-201) at Q303.
- () X29A829 transistor (#417-201) at Q305.
- () 2N5232A transistor (#417-91) at Q304.



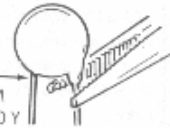
CONTINUE

NOTE: To prepare jumper wires, as in the following steps, use brown hookup wire cut to the indicated length. Then remove 1/4" of insulation from each end of the wire. When the jumpers are installed, be sure they are pushed down flush against the surface of the circuit board.

- () 1" jumper wire.
- () 3" jumper wire.

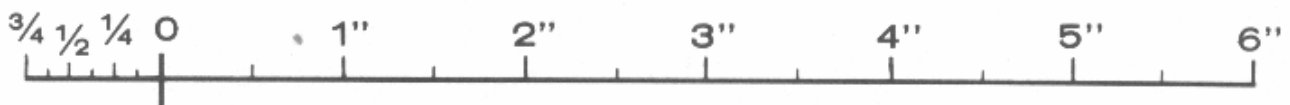
NOTE: Before you install the following disc capacitors, use long-nose pliers to remove the excess insulation from the capacitor leads. Solder the leads as each capacitor is installed.

REMOVE COATING EVEN WITH BOTTOM OF CAPACITOR BODY



- () .2 μ F disc.
- () .05 μ F disc.
- () .1 μ F disc.
- () Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 1-2



START

Position the positive (+) end of the following capacitors as shown.

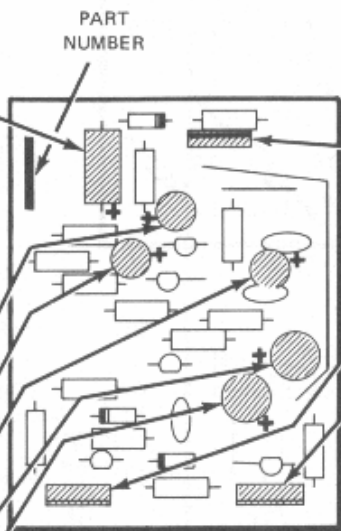


- 50 μ F electrolytic.

NOTE: When you install vertical electrolytic capacitors, be sure you match the positive (+) marking on the capacitor with the positive (+) marking on the circuit board.



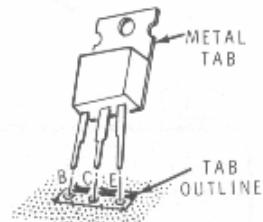
- 10 μ F electrolytic.
- 10 μ F electrolytic.
- 10 μ F electrolytic.
- 100 μ F electrolytic.
- 100 μ F electrolytic.
- Solder the leads to the foil and cut off the excess lead lengths.



CONTINUE



NOTE: Install the following transistors as shown. Match metal tab on the transistor with the tab outlined on the circuit board. Solder the leads to the foil and cut off the excess lead lengths. Be sure none of these transistors extend more than 1" above the surface of the board.



- 2N5294 transistor (#417-175) at Q308.
- 2N5294 transistor (#417-175) at Q307.
- 2N5294 transistor (#417-175) at Q306.

CIRCUIT BOARD CHECKOUT

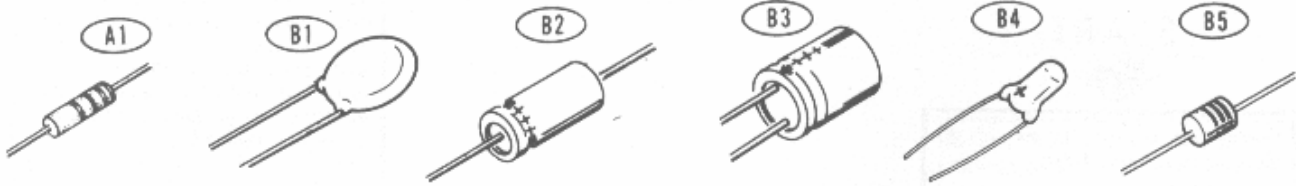
Carefully inspect the circuit board for the following conditions.

- Unsoldered connections.
- "Cold" solder connections.
- Solder bridges between foil patterns.
- Protruding leads. No leads or lugs should be longer than 1/8".
- Transistors for the proper type and installation.
- Electrolytic capacitors for the correct position of the positive (+) end.
- Diodes for the correct position of the banded end.

FINISH

PICTORIAL 1-3

IF CIRCUIT BOARD PARTS PICTORIAL



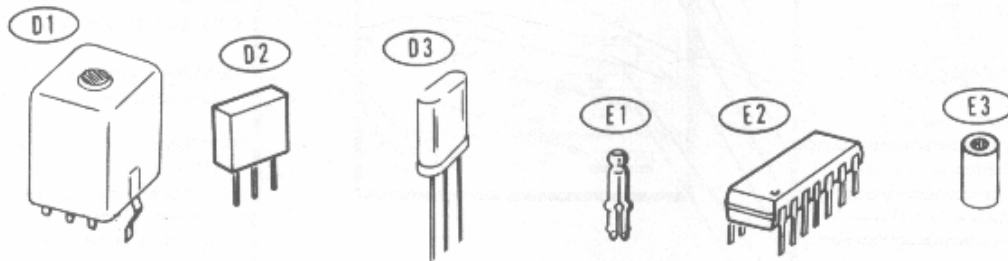
C1

NOTE: HEATH PART NUMBERS ARE STAMPED ON MOST DIODES.

Five different diode types are shown, separated by the word "OR". They include a diode with a circular body and a band, a diode with a cylindrical body and a band, a diode with a cylindrical body and a band, a diode with a cylindrical body and a band, and a small diode with a cylindrical body.

C2

Two diode types are shown, separated by the word "OR". Both have cylindrical bodies and two leads.



IF CIRCUIT BOARD

PARTS LIST

Unpack the package marked #2 and check each part against the following list. The Key numbers correspond to the

numbers on the "IF Circuit Board Parts Pictorial."

KEY PART No.	No.	PARTS Per Kit	DESCRIPTION	PRICE Each
RESISTORS				
1/2-Watt, 10%				
A1	1-3	2 ✓	100 Ω (brown-black-brown)	.10
A1	1-42	3 ✓	270 Ω (red-violet-brown)	.10
A1	1-6	1 ✓	470 Ω (yellow-violet-brown)	.10
A1	1-9	1 ✓	1000 Ω (brown-black-red)	.10
A1	1-44	6 ✓	2200 Ω (red-red-red)	.10
A1	1-14	4 ✓	3300 Ω (orange-orange-red)	.10
A1	1-16	1 ✓	4700 Ω (yellow-violet-red)	.10
A1	1-73	1 ✓	8200 Ω (gray-red-red)	.10
A1	1-20	3 ✓	10 kΩ (brown-black-orange)	.10
A1	1-22	2 ✓	22 kΩ (red-red-orange)	.10
A1	1-25	1 ✓	47 kΩ (yellow-violet-orange)	.10
A1	1-102	1 ✓	82 kΩ (gray-red-orange)	.10
CAPACITORS				
Disc				
B1	21-111	1	15 pF	.10
B1	21-9	1	100 pF	.10
B1	21-56	1	470 pF	.10
B1	21-46	1	.005 μF	.10
B1	21-47	12	.01 μF	.10
B1	21-95	9	.1 μF	.15
Electrolytic				
B2	25-54	1	10 μF	.20
B3	25-257	2	10 μF vertical	.25
B3	25-233	1	22 μF vertical	.45
B3	25-248	3	100 μF vertical	.40

KEY PART No.	No.	PARTS Per Kit	DESCRIPTION	PRICE Each
Other Capacitors				
B4	25-200	1	.68 μF tantalum	.50
B5	28-3	1	.56 pF phenolic (green-blue-gray)	.10
DIODES-TRANSISTORS				
C1	56-26	2	1N191 diode (brown-white-brown)	.25
NOTE: Transistors are marked for identification in one of the following four ways:				
1. Part number.				
2. Type number.				
3. Part number and type number.				
4. Part number with a type number other than the one listed.				
C2	417-91	8 ✓	2N5232A transistor	.85
TRANSFORMERS-FILTERS				
D1	52-162 ✓	1 ✓	IF coil	.85
D1	52-163 ✓	1 ✓	IF transformer	.85
D1	52-154 ✓	1 ✓	IF transformer	.70
D2	404-530 ✓	1 ✓	Ceramic filter	2.40
D3	404-535	2 ✓	Crystal filter	5.00
MISCELLANEOUS				
	85-1208-1	1 ✓	IF circuit board	1.95
E1	432-121	7 ✓	Connector pin	.10
E2	442-28	2 ✓	MC1357P integrated circuit	2.10
E3	475-10	4 ✓	Ferrite bead	.10
NOTE: Refer to Page 72 for "Replacement Parts and Price Information."				

STEP-BY-STEP ASSEMBLY

START

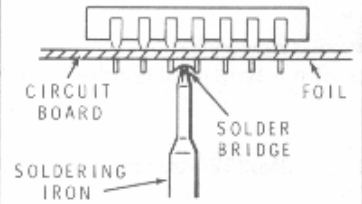


Position the IF circuit board as shown in the Pictorial. Then proceed with the following steps.

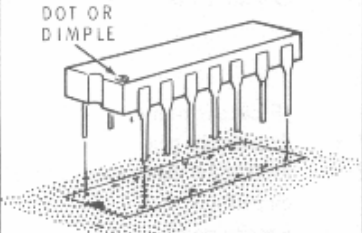
NOTE: Read this information carefully before you install the IC (integrated circuit) in the following steps. First, be sure to position the IC, as shown, with the dot or dimple pointing toward the dot on the circuit board.

Use a small-tip soldering iron if possible. The IC pins are very close together. Therefore, be sure you do not bridge solder between pins on different foils. When removing the soldering iron, move the tip of the iron straight up from the pin to avoid bridging solder to another pin. Do not place the soldering iron tip between the IC pins when soldering, as this increases the possibility of a solder bridge.

If a solder bridge does occur, turn the circuit board foil side down as shown, and hold the soldering iron tip between the two points that are bridged. The solder will flow down the soldering iron tip.



() Install a MC1357P integrated circuit (#442-28) at IC201. Position the end with the dot to match the dot on the circuit board. Be very careful when inserting the pins in the holes, as they bend easily. Solder the leads to the foil.

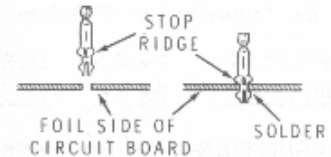


() In the same manner, install another MC1357P IC (#442-28) at IC202. Solder the leads to the foil.

CONTINUE



NOTE: When you install a connector pin (#432-121), as in the following steps, press the pin firmly into the board; then solder the pin to the foil.

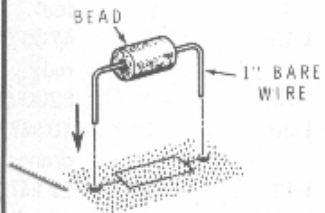


() Connector pin at D.

() Connector pin at +12.

() Connector pin at AUDIO.

NOTE: When you install ferrite beads, as in the following steps, remove the insulation from a 1" length of brown hookup wire. Then slide the bare wire through the bead, bend the wire ends, and mount the leads through the circuit board holes. Solder the leads to the foil.



() Ferrite bead.

() Connector pin at A.

() Ferrite bead.

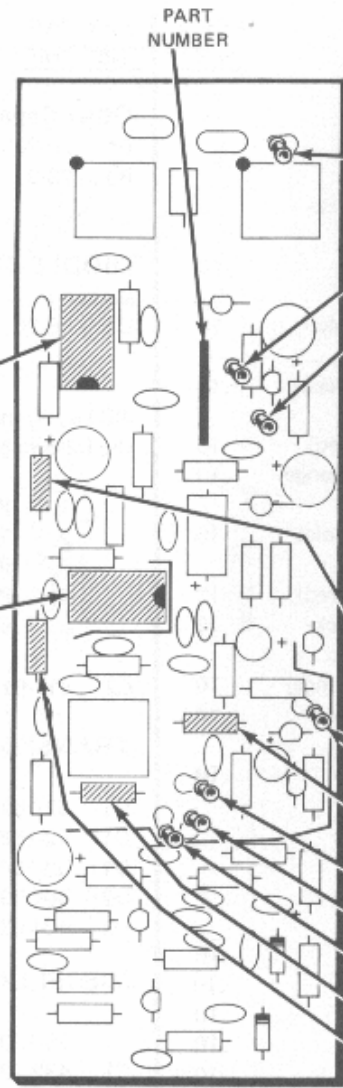
() Connector pin at W.

() Connector pin at S.

() Connector pin at B.

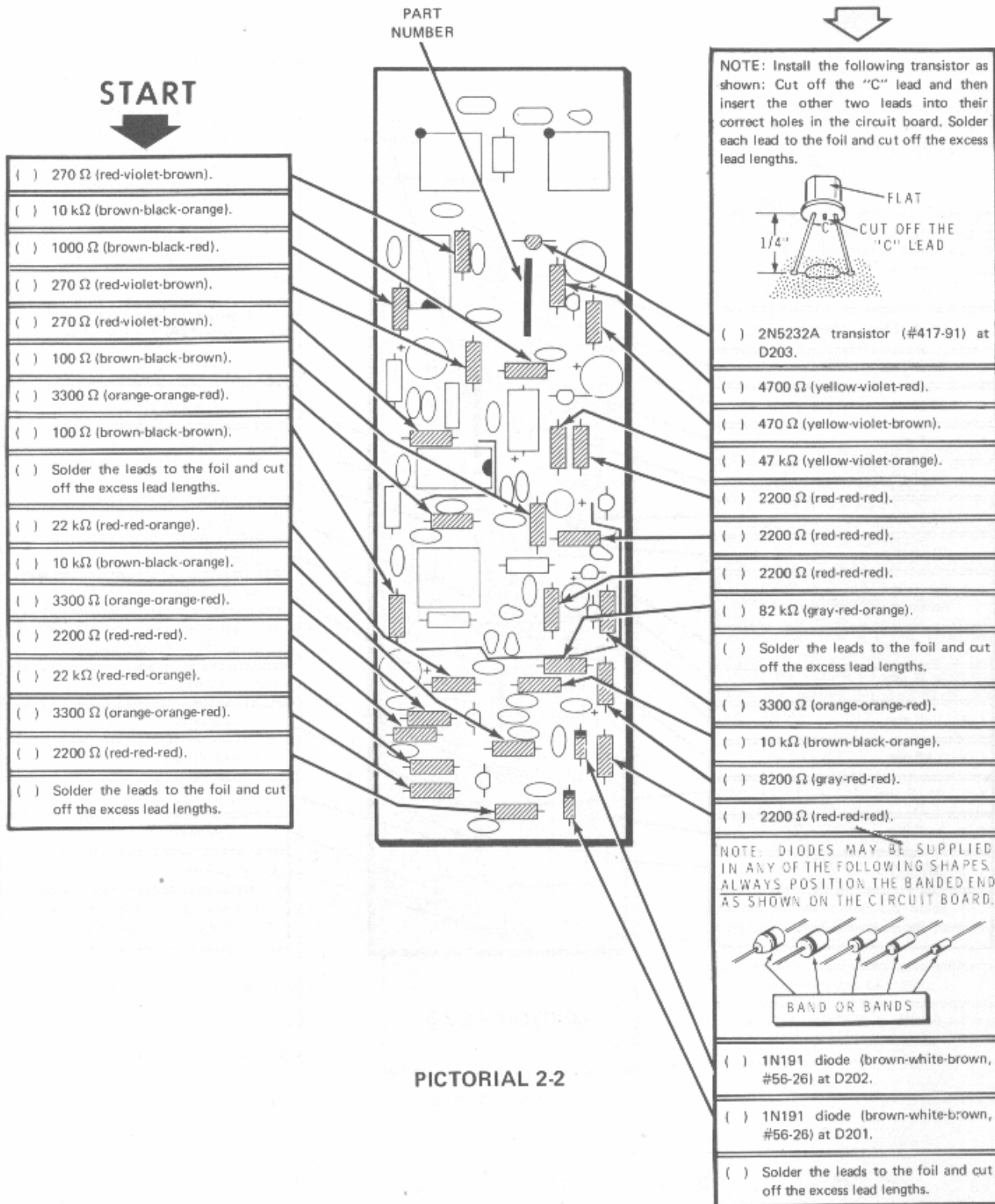
() Ferrite bead.

() Ferrite bead.



PICTORIAL 2-1

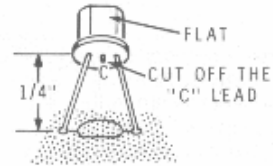
CONTINUE



START

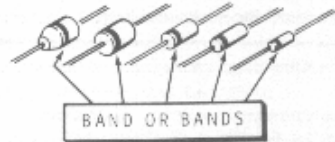
- () 270 Ω (red-violet-brown).
- () 10 kΩ (brown-black-orange).
- () 1000 Ω (brown-black-red).
- () 270 Ω (red-violet-brown).
- () 270 Ω (red-violet-brown).
- () 100 Ω (brown-black-brown).
- () 3300 Ω (orange-orange-red).
- () 100 Ω (brown-black-brown).
- () Solder the leads to the foil and cut off the excess lead lengths.
- () 22 kΩ (red-red-orange).
- () 10 kΩ (brown-black-orange).
- () 3300 Ω (orange-orange-red).
- () 2200 Ω (red-red-red).
- () 22 kΩ (red-red-orange).
- () 3300 Ω (orange-orange-red).
- () 2200 Ω (red-red-red).
- () Solder the leads to the foil and cut off the excess lead lengths.

NOTE: Install the following transistor as shown: Cut off the "C" lead and then insert the other two leads into their correct holes in the circuit board. Solder each lead to the foil and cut off the excess lead lengths.



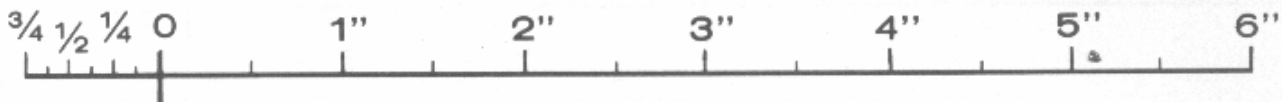
- () 2N5232A transistor (#417-91) at D203.
- () 4700 Ω (yellow-violet-red).
- () 470 Ω (yellow-violet-brown).
- () 47 kΩ (yellow-violet-orange).
- () 2200 Ω (red-red-red).
- () 2200 Ω (red-red-red).
- () 2200 Ω (red-red-red).
- () 82 kΩ (gray-red-orange).
- () Solder the leads to the foil and cut off the excess lead lengths.
- () 3300 Ω (orange-orange-red).
- () 10 kΩ (brown-black-orange).
- () 8200 Ω (gray-red-red).
- () 2200 Ω (red-red-red).

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



- () 1N191 diode (brown-white-brown, #56-26) at D202.
- () 1N191 diode (brown-white-brown, #56-26) at D201.
- () Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-2



START

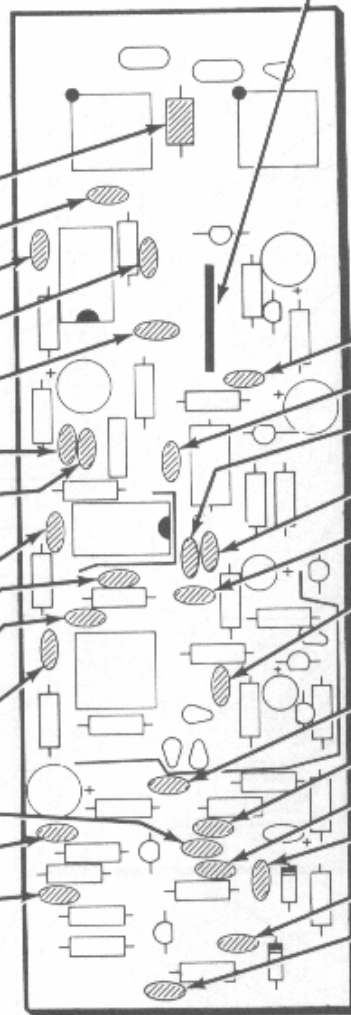


NOTE: Check the leads of each disc capacitor as you install it. Remove the coating from each capacitor lead as shown. This coating could cause a bad solder connection.



- () .56 pF phenolic (green-blue-gray).
- () .01 μ F disc.
- () .01 μ F disc.
- () .1 μ F disc.
- () .01 μ F disc.
- () .01 μ F disc.
- () .01 μ F disc.
- () Solder the leads to the foil and cut off the excess lead lengths.
- () .01 μ F disc.
- () 15 pF disc.
- () .1 μ F disc.
- () .1 μ F disc.
- () .01 μ F disc.
- () .1 μ F disc.
- () .01 μ F disc.
- () Solder the leads to the foil and cut off the excess lead lengths.

PART NUMBER



CONTINUE



- () .1 μ F disc.
- () .01 μ F disc.
- () 100 pF disc.
- () .01 μ F disc.
- () .01 μ F disc.
- () .01 μ F disc.
- () Solder the leads to the foil and cut off the excess lead lengths.
- () .1 μ F disc.
- () .005 μ F disc.
- () 470 pF disc.
- () .1 μ F disc.
- () .1 μ F disc.
- () .1 μ F disc.
- () Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-3

START

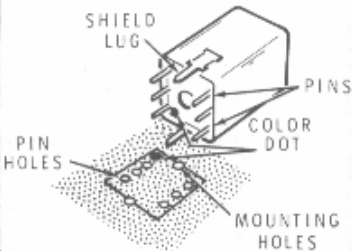


NOTE: As you install each part in this column, solder its leads to the foil and cut off the excess lead lengths.

() Crystal filter (#404-535) at Y201.

() Crystal filter (#404-535) at Y202.

NOTE: When you install the following transformers, line up the color dot on the underside of the transformer with the dot on the circuit board. Push the transformer firmly down onto the surface of the circuit board; then solder all lugs and pins that have foil around them. Cut off the shield lugs and pins from IF coils and transformers.



() IF transformer (#52-162) at T201.

() IF coil (#52-163) at L201.

NOTE: When you install the following electrolytic capacitors, be sure you match the positive (+) marking on the capacitor with the positive (+) marking on the circuit board.



() 100 μ F vertical electrolytic.

() Ceramic filter (#404-530) at Y203.

() 100 μ F electrolytic.

() 1-3/4" jumper wire.

() Detector coil (#52-154) at T202.

CONTINUE



() 10 μ F electrolytic. Always match the positive (+) marking on the capacitor with the positive (+) marking on the circuit board.



() 22 μ F vertical electrolytic.

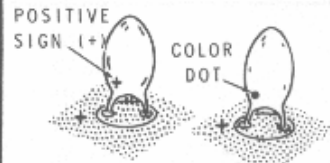
() 10 μ F vertical electrolytic.

() 10 μ F vertical electrolytic.

() 3-3/4" jumper wire.

NOTE: Tantalum capacitors may be marked two ways as shown. When you install the following capacitor, be sure to match the positive (+) sign or color dot with the positive (+) marking on the circuit board.

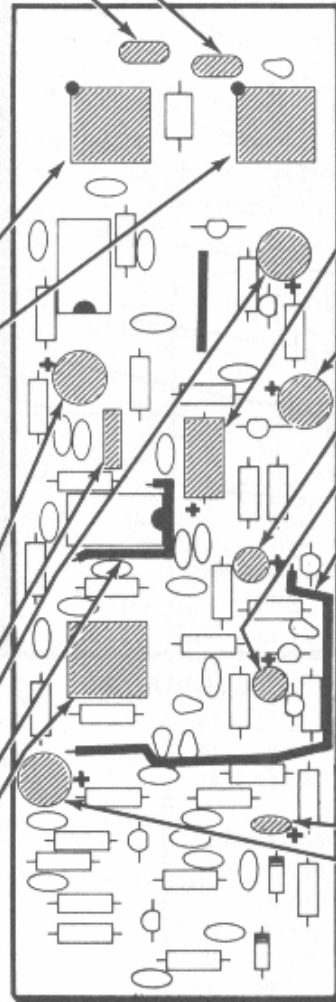
MAY BE MARKED WITH POSITIVE SIGN (+) OR COLOR DOT



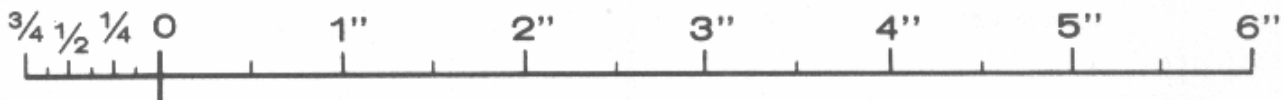
() .68 μ F tantalum.

() 100 μ F vertical electrolytic.

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

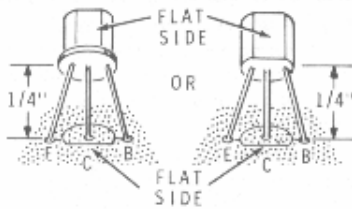


PICTORIAL 2-4



START

NOTE: Install each of the following transistors as shown. Solder each lead to the foil and cut off the excess lead lengths.



() 2N5232A transistor (#417-91) at Q207.

() 2N5232A transistor (#417-91) at Q201.

() 2N5232A transistor (#417-91) at Q206.

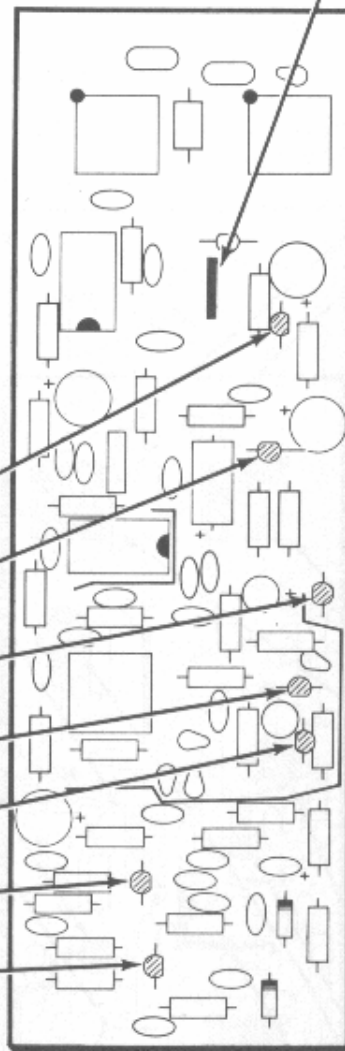
() 2N5232A transistor (#417-91) at Q205.

() 2N5232A transistor (#417-91) at Q204.

() 2N5232A transistor (#417-91) at Q202.

() 2N5232A transistor (#417-91) at Q203.

PART NUMBER



PICTORIAL 2-5

CONTINUE

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 leads or lugs should be longer than 1/8".
- () Transistors for the proper type and installation.
- () Electrolytic capacitors for the correct position of the positive (+) end.
- () Diodes for the correct position of the banded end.

FINISH

SCAN CIRCUIT BOARD

PARTS LIST

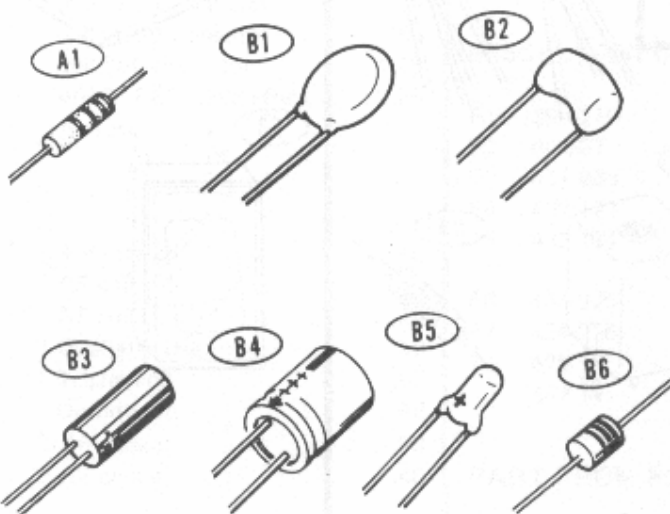
Unpack the package marked #3 and check each part against the following list. The Key numbers correspond to the

numbers on the "Scan Circuit Board Parts Pictorial" (fold-out from this page).

KEY PART No.	PARTS No.	Per Kit	DESCRIPTION	PRICE Each
RESISTORS				
1/2-Watt, 10%				
A1	1-3	2 ✓	100 Ω (brown-black-brown)	.10
A1	1-4	1 ✓	330 Ω (orange-orange-brown)	.10
A1	1-9	13 ✓	1000 Ω (brown-black-red)	.10
A1	1-10	8 ✓	1200 Ω (brown-red-red)	.10
A1	1-11	1 ✓	1500 Ω (brown-green-red)	.10
A1	1-44	4 ✓	2200 Ω (red-red-red)	.10
A1	1-14	1 ✓	3300 Ω (orange-orange-red)	.10
A1	1-18	1 ✓	5600 Ω (green-blue-red)	.10
A1	1-20	4 ✓	10 kΩ (brown-black-orange)	.10
A1	1-21	2 ✓ ³	15 kΩ (brown-green-orange)	.10
A1	1-22	2 ✓	22 kΩ (red-red-orange)	.10
A1	1-25	3 ✓	47 kΩ (yellow-violet-orange)	.10
A1	1-26	9 ✓	100 kΩ (brown-black-yellow)	.10
A1	1-34	1 ✓	680 kΩ (blue-gray-yellow)	.10

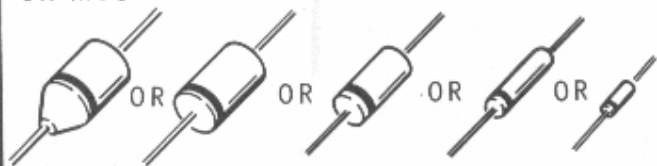
KEY PART No.	PARTS No.	Per Kit	DESCRIPTION	PRICE Each
Other Resistors				
A1	1-112	3 ✓	180 Ω, 5% (brown-gray-brown-gold)	.10
CAPACITORS				
Disc				
B1	21-33	1 ✓	3.3 pF	.10
B1	21-78	6 ✓	5 pF	.10
B1	21-61	9 ✓	6.8 pF	.10
B1	21-3	1 ✓	10 pF	.10
B1	21-111	9 ✓	15 pF	.10
B1	21-7	1 ✓	33 pF	.10
B1	21-32	1 ✓	47 pF	.10
B1	21-9	2 ✓	100 pF	.10
B1	21-56	8 ✓	470 pF	.10
B1	21-47	15 ✓	.01 μF	.10
Other Capacitors				
B2	20-110	1 ✓	75 pF mica	.15
B3	25-149	1 ✓	5 μF electrolytic	.50
B4	25-116	1 ✓	50 μF electrolytic	.50
B5	25-200	1 ✓	.68 μF tantalum	.50
B6	28-3	2 ✓	.56 pF phenolic (green-blue-gray)	.10
DIODES-TRANSISTORS				
C1	56-56	8	1N4149 diode	.20

SCAN CIRCUIT BOARD PARTS PICTORIAL

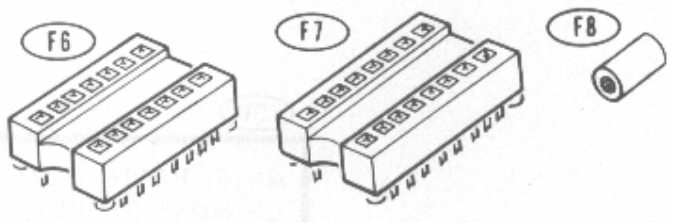
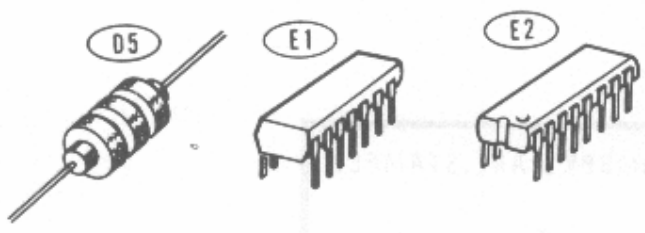
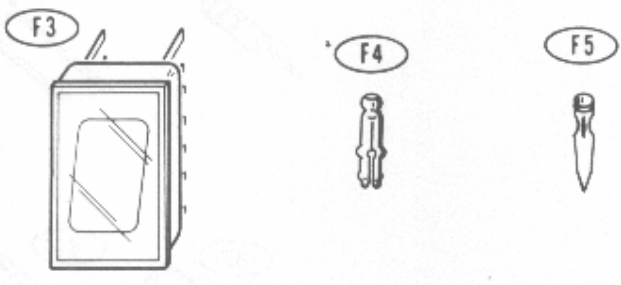
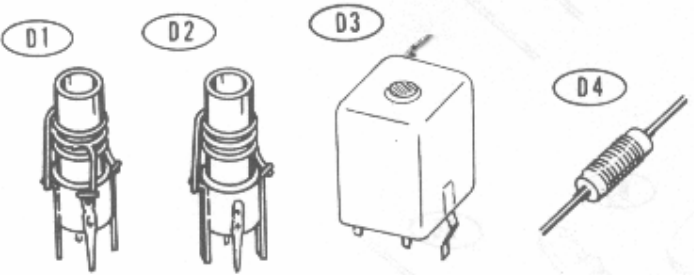
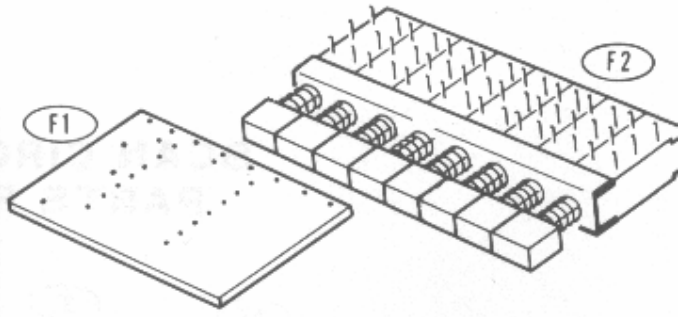
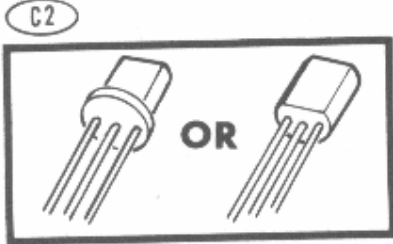


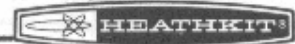
C1

NOTE: HEATH PART NUMBERS ARE STAMPED
ON MOST DIODES.



SCAN CIRCUIT BOARD PARTS PICTORIAL (Cont'd.)





KEY PART No.	KEY PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
-----------------	-----------------	------------------	-------------	---------------

Diodes-Transistors (cont'd.)

NOTE: Transistors are marked for identification in one of the following four ways:

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

C2	417-91	6	2N5232A transistor	.85
C2	417-201	2	X29A829 transistor	.50
C3	417-154	3	2N2369 transistor	1.65
C4	417-274	3	40673 FET (field effect transistor)	2.25

COILS-CHOKES

D1	40-1613	1	Antenna coil	.40
D1	40-1625	2	RF coil	.40
D2	40-1614	2	RF coil	.40
D3	40-1615	1	Oscillator coil	.50
D3	40-1616	1	Tripler coil	.60
D3	40-1617	1	Output coil	.45
D4	45-75	8	RF choke	.30
D5	45-82	1	RF choke	.40

INTEGRATED CIRCUITS

NOTE: If either the part number or the "Description" number is on a transistor or integrated circuit, you have the correct part. Do not be concerned about any other numbers.

KEY PART No.	KEY PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
-----------------	-----------------	------------------	-------------	---------------

Integrated Circuits (cont'd.)

[On integrated circuits, the description number may have additional letters and numbers other than those given in the list. Example: SN(7490)N or MC(7490)P.]

E1	443-7	1	7490 integrated circuit	1.95
E1	443-12	2	7410 integrated circuit	.45
E1	443-18	1	7404 integrated circuit	.50
E2	443-35	1	7441 integrated circuit	2.85
E2	443-36	1	7447 integrated circuit	3.30

MISCELLANEOUS

F1	85-1210	1	Indicator circuit board	.95
F2	64-607	1	Switch assembly	5.00
F3	411-283	1	Display indicator	5.40
F4	432-121	9	Connector pin	.10
F5	432-134	20	Wire connector (3 extra included)	.10
F6	434-225	4	14-pin IC socket	.20
F7	434-226	2	16-pin IC socket	.20
F8	475-10	11	Ferrite bead	.10
	347-1	1	8-conductor cable	.15

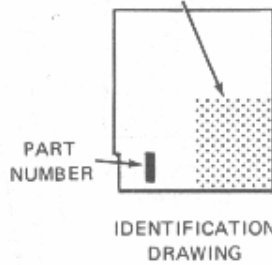
PART FROM FINAL PACK

	85-1209-1	1	Scan circuit board	4.35
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NOTE: Refer to Page 72 for "Replacement Parts and Price Information."

STEP-BY-STEP ASSEMBLY

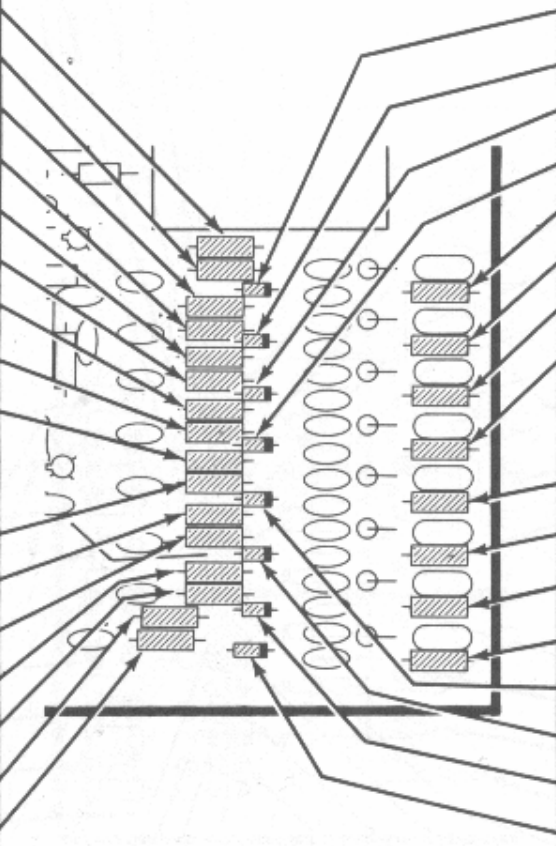
The steps performed in this Pictorial are in this area of the circuit board.



CONTINUE

START

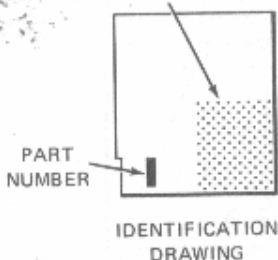
- Position the scan circuit board as shown in the identification drawing. Then proceed with the following steps.
- () 100 kΩ (brown-black-yellow).
 - () 1200 Ω (brown-red-red).
 - () 100 kΩ (brown-black-yellow).
 - () 1200 Ω (brown-red-red).
 - () 100 kΩ (brown-black-yellow).
 - () 1200 Ω (brown-red-red).
 - () 100 kΩ (brown-black-yellow).
 - () 1200 Ω (brown-red-red).
 - () 100 kΩ (brown-black-yellow).
 - () Solder the leads to the foil and cut off the excess lead lengths.
 - () 1200 Ω (brown-red-red).
 - () 100 kΩ (brown-black-yellow).
 - () 1200 Ω (brown-red-red).
 - () 100 kΩ (brown-black-yellow).
 - () 1200 Ω (brown-red-red).
 - () 100 kΩ (brown-black-yellow).
 - () 1200 Ω (brown-red-red).
 - () Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 3-1

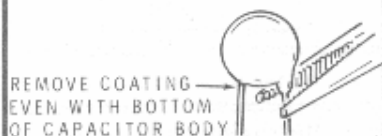
- NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES. ALWAYS POSITION THE BANDED END AS SHOWN ON THE CIRCUIT BOARD.
-
- (✓) 1N4149 diode (#56-56) at D101.
 - (✓) 1N4149 diode (#56-56) at D102.
 - (✓) 1N4149 diode (#56-56) at D103.
 - (✓) 1N4149 diode (#56-56) at D104.
 - (✓) 1000 Ω (brown-black-red).
 - (✓) 1000 Ω (brown-black-red).
 - (✓) 1000 Ω (brown-black-red).
 - (✓) 1000 Ω (brown-black-red).
 - () Solder the leads to the foil and cut off the excess lead lengths.
 - (✓) 1000 Ω (brown-black-red).
 - (✓) 1000 Ω (brown-black-red).
 - (✓) 1000 Ω (brown-black-red).
 - (✓) 1000 Ω (brown-black-red).
 - (✓) 1N4149 diode (#56-56) at D105.
 - (✓) 1N4149 diode (#56-56) at D106.
 - (✓) 1N4149 diode (#56-56) at D107.
 - (✓) 1N4149 diode (#56-56) at D108.
 - () Solder the leads to the foil and cut off the excess lead lengths.

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



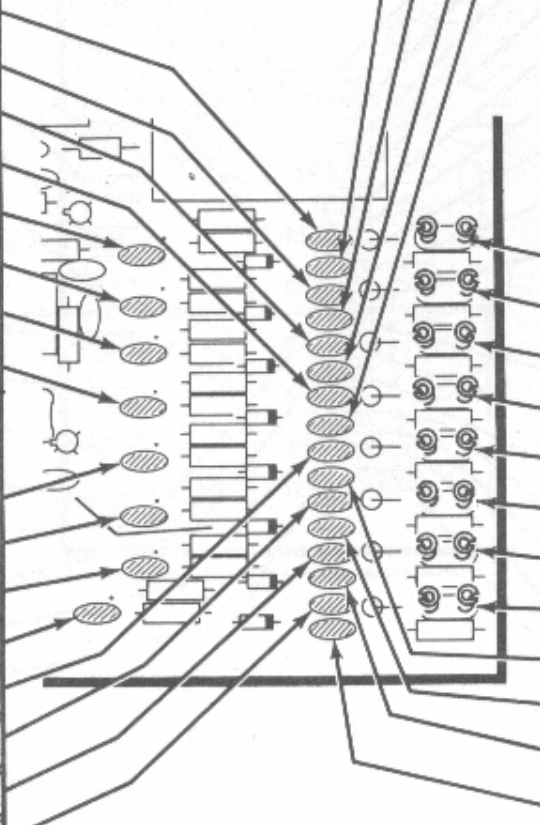
START

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



- () 6.8 pF disc.
- () 6.8 pF disc.
- () 6.8 pF disc.
- () 6.8 pF disc.
- () .01 μ F disc.
- () .01 μ F disc.
- () .01 μ F disc.
- () .01 μ F disc.
- () Solder the leads to the foil and cut off the excess lead lengths.
- () .01 μ F disc.
- () .01 μ F disc.
- () .01 μ F disc.
- () .01 μ F disc.
- () 6.8 pF disc.
- () 6.8 pF disc.
- () 6.8 pF disc.
- () 6.8 pF disc.

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

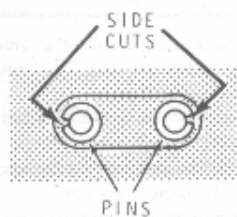


PICTORIAL 3-2

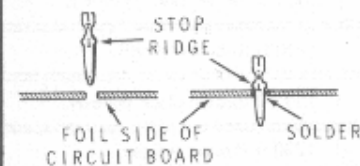
CONTINUE

- () 15 pF disc.
- () 15 pF disc.
- () 15 pF disc.
- () 15 pF disc.
- () Solder the leads to the foil and cut off the excess lead lengths.

NOTE: As you install connector pins in the following steps, position each pair of pins so the side cuts face outward, as in this illustration.



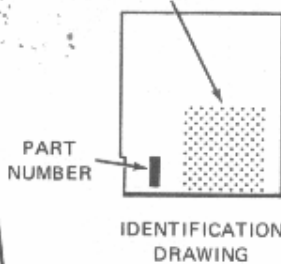
Install and solder wire connectors (#432-134) as shown.



- () Two wire connectors at Y100.
- () Two wire connectors at Y101.
- () Two wire connectors at Y102.
- () Two wire connectors at Y103.
- () Two wire connectors at Y104.
- () Two wire connectors at Y105.
- () Two wire connectors at Y106.
- () Two wire connectors at Y107.
- () 15 pF disc.
- () 15 pF disc.
- () 15 pF disc.
- () 15 pF disc.
- () Solder the leads to the foil and cut off the excess lead lengths.

START

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



CONTINUE

NOTE: To install RF chokes, as in the following steps, bend one lead as shown and mount the choke onto the circuit board.



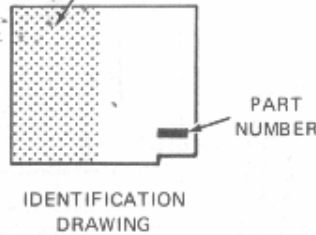
- () Wire connector (#432-134) at TP.
 - () .01 μ F disc.
 - () 330 Ω (orange-orange-brown).
 - () 2200 Ω (red-red-red).
 - () 10 k Ω (brown-black-orange).
 - () 47 pF disc.
 - () 15 pF disc.
 - () 10 k Ω (brown-black-orange).
- NOTE: When you install ferrite beads, as in the following steps, remove the insulation from a 1" length of brown hookup wire. Then slide the bare wire through the bead, bend the wire ends, and mount the leads through the circuit board holes. Solder the leads to the foil.
-
- BEAD
- 1" BARE WIRE
- () Ferrite bead.
 - () Connector pin (#432-121) at ORG.
 - () Solder the leads to the foil and cut off the excess lead lengths.
 - () .01 μ F disc.
 - () 1000 Ω (brown-black-red).
 - () Connector pin (#432-121) at OPTION.
 - () .01 μ F disc.
 - () 47 k Ω (yellow-violet-orange).
 - () 75 pF mica.
 - () 33 pF disc. NOTE: Do not use the 3.3 pF disc capacitor.
 - () Ferrite bead.
 - () Connector pin (#432-121) at GRN.
 - () 1-1/2" jumper wire.
 - () Solder the leads to the foil and cut off the excess lead lengths.

- () RF choke (#45-75) at L110.
- () RF choke (#45-75) at L111.
- () RF choke (#45-75) at L112.
- () RF choke (#45-75) at L113.
- () RF choke (#45-75) at L114.
- () RF choke (#45-75) at L115.
- () RF choke (#45-75) at L116.
- () RF choke (#45-75) at L117.
- () Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 3-3



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

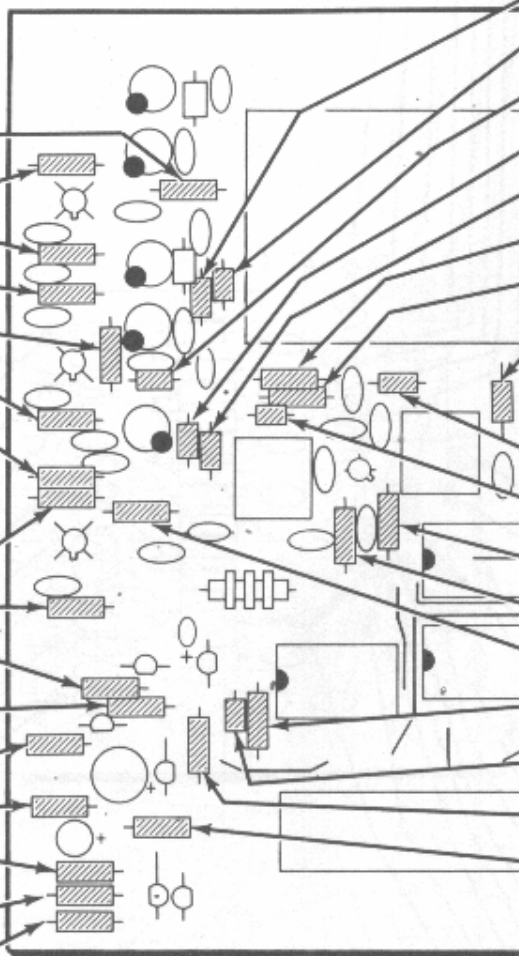


CONTINUE

START

NOTE: Reposition the circuit board as shown in the identification drawing. Then perform the following steps.

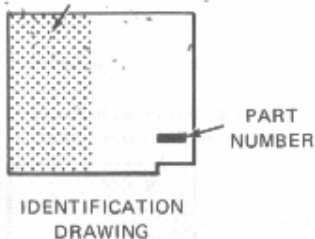
- () ³³ ~~10~~ kΩ (brown-green-orange).
- () 10 kΩ (brown-black-orange).
- () 180 Ω (brown-gray-brown-gold).
- () 10 kΩ (brown-black-orange).
- () ³³ ~~10~~ kΩ (brown-green-orange).
- () 180 Ω (brown-gray-brown-gold).
- () 47 kΩ (yellow-violet-orange).
- () Solder the leads to the foil and cut off the excess lead lengths.
- () 5600 Ω (green-blue-red).
- () 180 Ω (brown-gray-brown-gold).
- () 1000 Ω (brown-black-red).
- () 2200 Ω (red-red-red).
- () 2200 Ω (red-red-red).
- () 100 Ω (brown-black-brown).
- () 680 kΩ (blue-gray-yellow).
- () 1000 Ω (brown-black-red).
- () 1000 Ω (brown-black-red).
- () Solder the leads to the foil and cut off the excess lead lengths.



- () Remove the insulation from a 9" length of brown wire. Then cut the bare 9" wire into 1" lengths to be used with the ferrite beads in the following steps.
- () Ferrite bead.
- () Ferrite bead.
- () Ferrite bead.
- () Ferrite bead.
- () Ferrite bead.
- () 22 kΩ (red-red-orange).
- () 2200 Ω (red-red-red).
- () Ferrite bead.
- () Solder the leads to the foil and cut off the excess lead lengths.
- () Ferrite bead.
- () Ferrite bead.
- () 100 Ω (brown-black-brown).
- () 3300 Ω (orange-orange-red).
- () 47 kΩ (yellow-violet-orange).
- () 1000 Ω (brown-black-red).
- () Ferrite bead.
- () 100 kΩ (brown-black-yellow).
- () 22 kΩ (red-red-orange).
- () Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 3-4

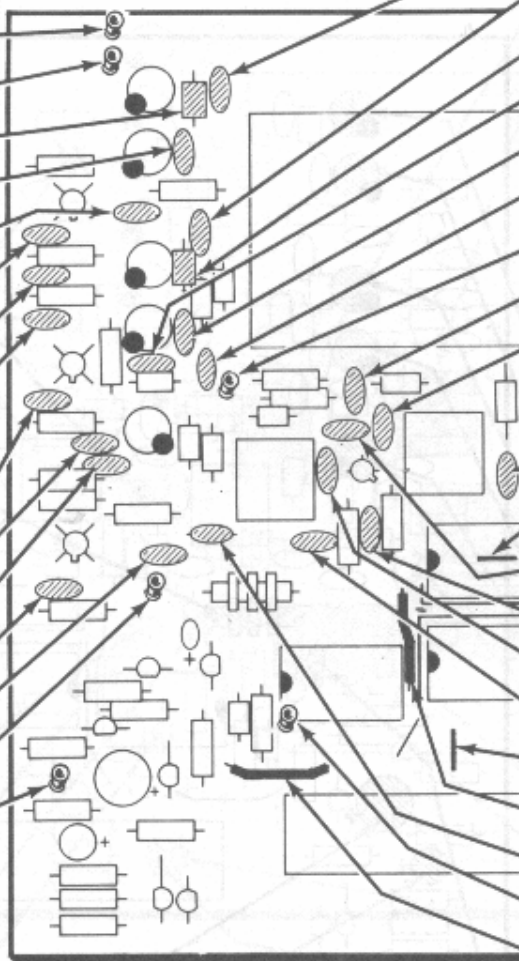
The steps performed in this Pictorial are in this area of the circuit board.



CONTINUE

START

- () Connector pin (#432-121) at GND.
- () Connector pin (#432-121) at ANT.
- () .56 pF phenolic (green-blue-gray).
- () 6.8 pF disc.
- () 470 pF disc.
- () 100 pF disc.
- () 470 pF disc.
- () 470 pF disc.
- () Solder the leads to the foil and cut off the excess lead lengths.
- () 100 pF disc.
- () 470 pF disc.
- () 5 pF disc.
- () .01 μ F disc.
- () .01 μ F disc.
- () Connector pin (#432-121) at IF.
- () Connector pin (#432-121) at BLK.
- () Solder the lead to the foil and cut off the excess lead lengths.



- () 10 pF disc.
- () 5 pF disc.
- () .56 pF phenolic (green-blue-gray).
- () 470 pF disc.
- () 5 pF disc.
- () .01 μ F disc.
- () Connector pin (#432-121) at RED.
- () 5 pF disc.
- () 470 pF disc.
- () Solder the leads to the foil and cut off the excess lead lengths.
- () .01 μ F disc.
- () 3/4" bare jumper wire.
- () 3.3 pF disc.
- () 470 pF disc.
- () 470 pF disc.
- () 5 pF disc.
- () 3/4" bare jumper wire.
- () 1-1/4" jumper wire.
- () 5 pF disc.
- () Connector pin (#432-121) at YEL.
- () 1-1/4" jumper wire.
- () Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 3-5

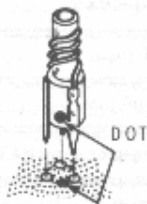


START

NOTE: Carefully study each of the following five coils and note that one or two lugs on each coil are not used (no coil wire connected to the lug). Twist the unused lug or lugs from the coil form before you mount the coil. Then straighten the remaining lugs with long-nose pliers.



When you install these five coils, be sure to match the dot on the coil with the dot on the circuit board. Solder the lugs of each coil to the board as the coil is installed.



() Antenna coil (#40-1613) at L101. Remove 1 unused lug.

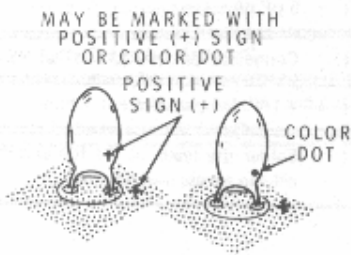
() RF coil (#40-1625) at L102. Remove 1 unused lug.

() RF coil (#40-1614) at L103. Remove 2 unused lugs.

() RF coil (#40-1625) at L104. Remove 1 unused lug.

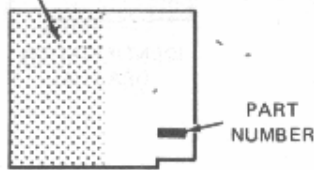
() RF coil (#40-1614) at L105. Remove 2 unused lugs.

NOTE: Tantalum capacitors may be marked two ways as shown. When you install the following capacitor, be sure to match the positive (+) sign or color dot with the positive (+) marking on the circuit board.

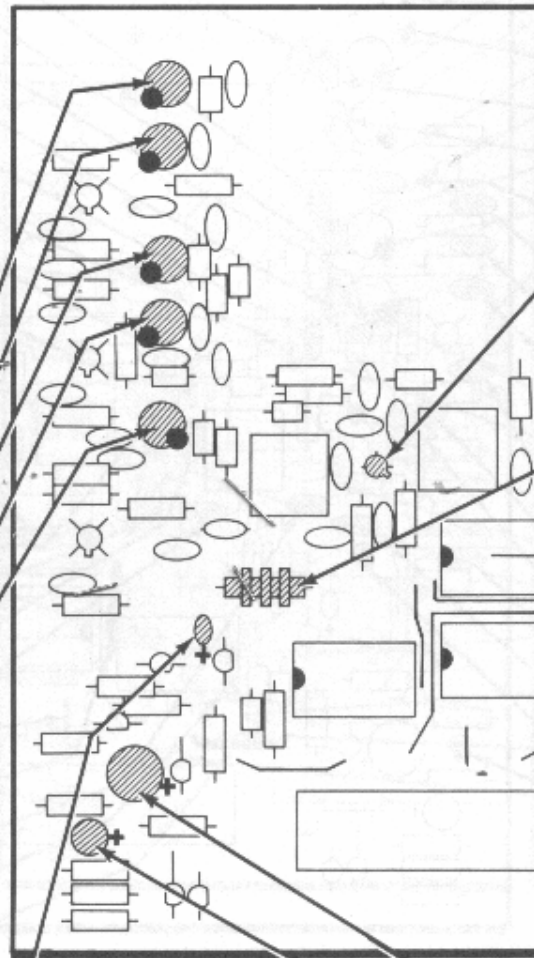


() .68 μ F tantalum. Position the positive (+) lead as shown.

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

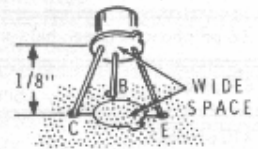


IDENTIFICATION DRAWING

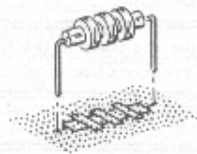


CONTINUE

NOTE: Install the following transistor as shown. Solder each lead to the foil and cut off the excess lead lengths.

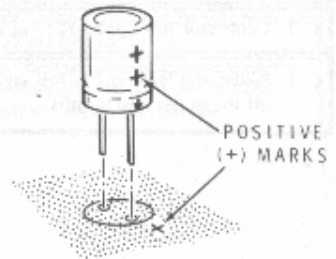


() 2N2369 transistor (#417-154) at Q114.



() RF choke (#45-82) at RFC101. Carefully bend the leads toward the slots in the body of the coil.

NOTE: When you install the following electrolytic capacitors, be sure you match the positive (+) marking on the capacitor with the positive (+) marking on the circuit board.



() 50 μ F electrolytic.

() 5 μ F electrolytic.

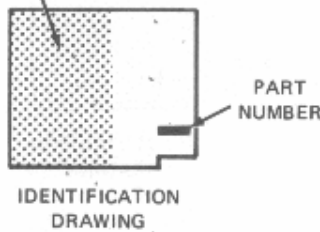
() Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 3-6

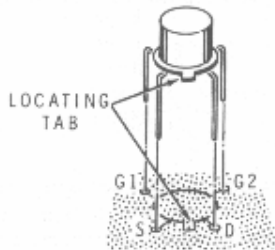
CONTINUE

START

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

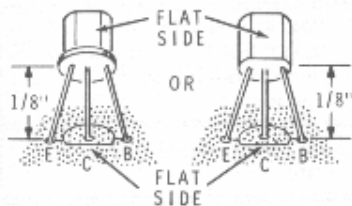


NOTE: Bend the leads of three 40673 FET's (#417-274) as shown. When these transistors are mounted on the circuit board, they should be approximately 1/16" above the board. Be sure none of the bent leads touch the transistor case.

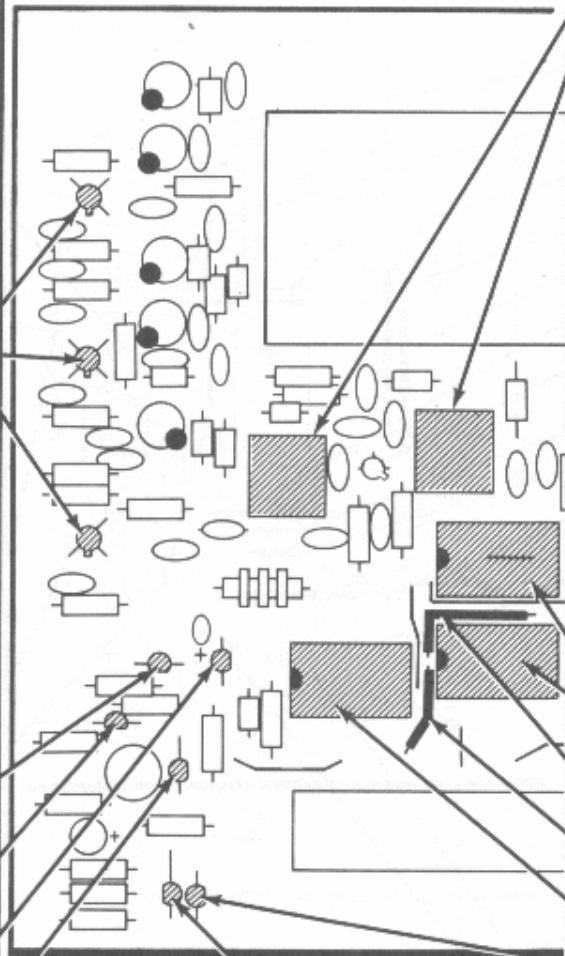


- () 40673 FET (#417-274) at Q101.
- () 40673 FET (#417-274) at Q102.
- () 40673 FET (#417-274) at Q103.

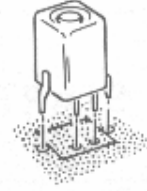
NOTE: Install each of the following transistors as shown. Solder each lead to the foil and cut off the excess lead lengths.



- () 2N5232A transistor (#417-91) at Q109.
- () 2N5232A transistor (#417-91) at Q111.
- () X29A829 transistor (#417-201) at Q108.
- () 2N5232A transistor (#417-91) at Q110.

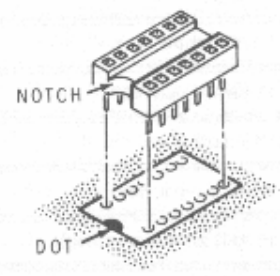


NOTE: The lugs of the following coils are spaced so they can be mounted only one way. Make sure the coil is pushed against the circuit board; then solder the lugs to the foil and cut off the excess lug lengths.



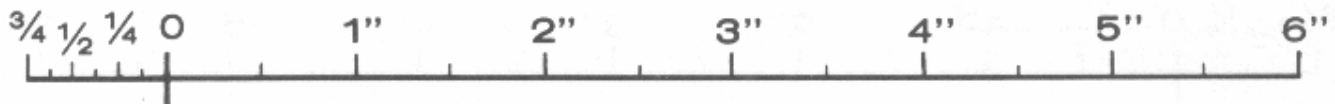
- () Output coil (#40-1617) at L109.
- () Tripler coil (#40-1616) at L108.

NOTE: Both 14-pin and 16-pin dual-in-line IC's and sockets are used in this kit. Be very careful when you install the sockets, as it is possible to erroneously place a 14-pin socket in a 16-pin socket location. Match the cutout on one end of each socket to the similarly-shaped mark on the socket outline on the circuit board. Solder the pins of each socket to the foil as it is installed.

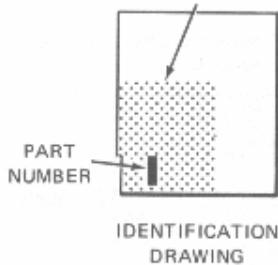


- () 14-pin IC socket at IC102.
- () 14-pin IC socket at IC103.
- () 1-1/2" jumper wire. Solder both wire ends to the foil.
- () 1-1/4" jumper wire. Solder both wire ends to the foil.
- () 14 pin IC socket at IC101.
- () 2N5232A transistor (#417-91) at Q107.
- () X29A829 transistor (#417-201) at Q106.

PICTORIAL 3-7



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



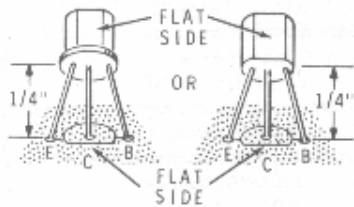
CONTINUE

START

NOTE: Reposition the circuit board as shown in the identification drawing. Then proceed with the following steps.

- (/) 1" bare jumper wire.
- (/) 1-3/4" jumper wire.
- (/) 1" bare jumper wire.
- () 2" jumper wire.
- () 2" jumper wire.
- () 1" bare jumper wire.
- () 1-1/4" jumper wire.
- () 1" bare jumper wire.
- () 1" jumper wire.
- () 2-1/4" jumper wire.
- () 1500 Ω (brown-green-red).
- () Solder the leads to the foil and cut off the excess lead lengths.

NOTE: Install each of the following transistors as shown. Solder each lead to the foil and cut off the excess lead lengths.



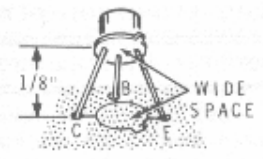
- () 2N5232A transistor (#417-91) at Q104.
- () 2N5232A transistor (#417-91) at Q105.

NOTE: The lugs of the following coil are spaced so it can be mounted only one way. Make sure coil is pushed against the circuit board; then solder the lugs to the foil and cut off the excess lug lengths.

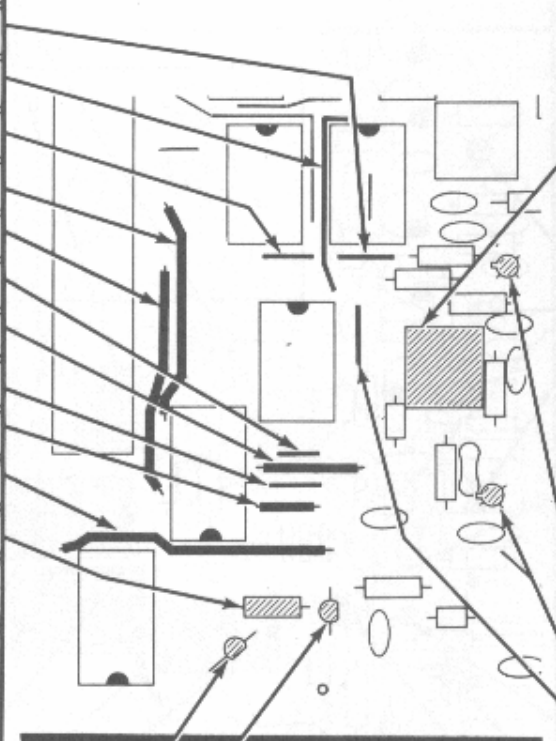


- () Oscillator coil (#40-1615) at L107.

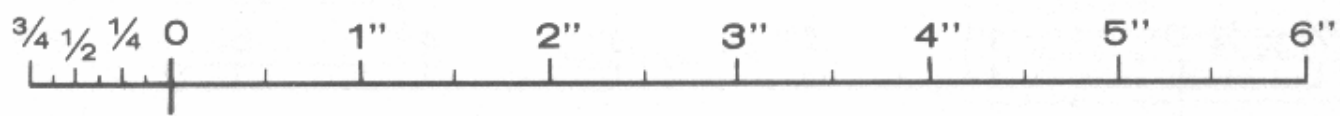
NOTE: Install the next two transistors as shown. Solder each lead to the foil and cut off the excess lead lengths.



- () 2N2369 transistor (#417-154) at Q113. NOTE: Do not short the case of this transistor to the "TP" wire connector.
- () 2N2369 transistor (#417-154) at Q112.
- () 3/4" bare jumper wire.
- () Solder the leads to the foil and cut off the excess lead lengths.



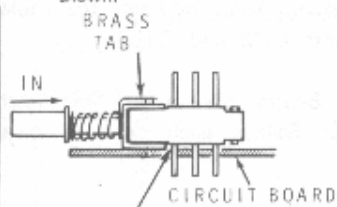
PICTORIAL 3-8



START

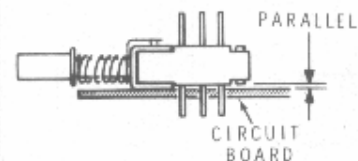
NOTE: Position the scan circuit board as shown in the identification drawing. Then proceed with the following steps.

() Install the switch assembly on the circuit board. Carefully insert all of the switch lugs in their mounting holes. Then push the assembly onto the circuit board alternately pressing each switch. Be sure the brass tabs are on the top of the assembly as shown. Push all the buttons in as shown.

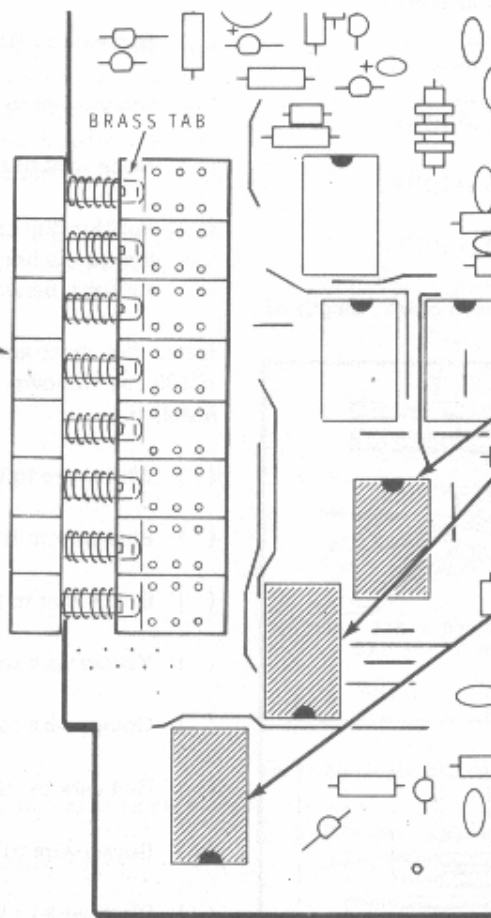
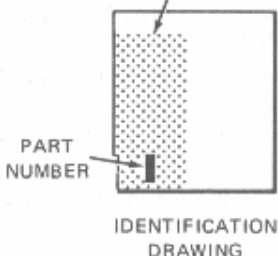


Make sure the switch body is flat against the circuit board along its entire length.

Also, make sure the assembly is parallel with the circuit board. Then turn the assembly over and solder two lugs on each end of the switch assembly. Check the switch assembly to make sure it is straight. If the assembly is straight, solder the other switch lugs. Cut off the excess lugs from the foil side of the board.



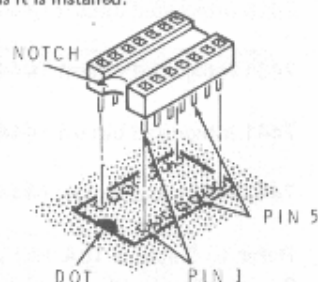
The steps performed in this Pictorial are in this area of the circuit board.



PICTORIAL 3-9

CONTINUE

NOTE: Both 14-pin and 16-pin dual-in-line IC's and sockets are used in this kit. Be very careful when you install the sockets, as it is possible to erroneously place a 14-pin socket in a 16-pin socket location. Match the cutout on one end of each socket to the similarly-shaped mark on the socket outline on the circuit board. Solder the pins of each socket to the foil as it is installed.



() 14-pin IC socket at IC104.

() 16-pin IC socket at IC105.

NOTE: Locate pin 5 of a 16-pin IC socket and cut it off before installing the socket in the following step.

() 16-pin IC socket at IC106.

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

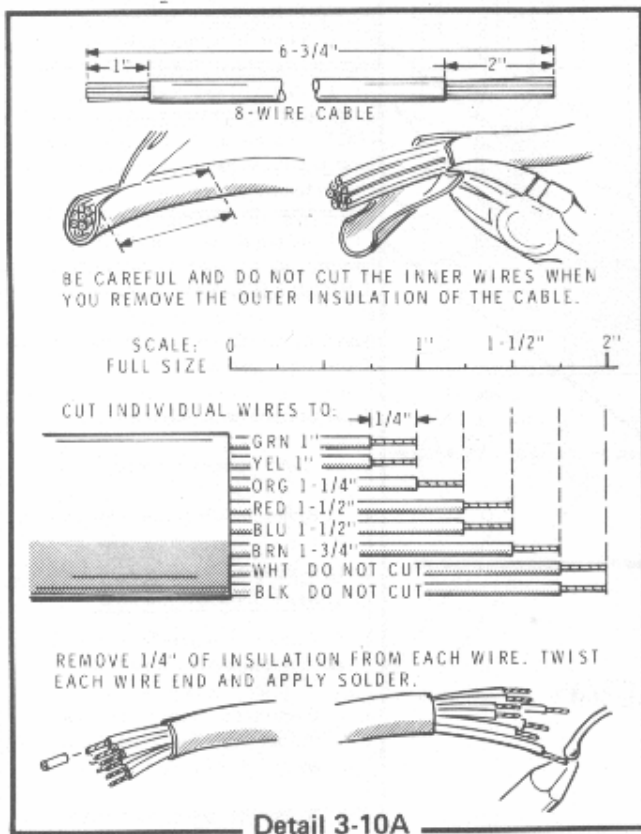
- () Unsoldered connections.
- () "Cold" solder connections.
- () Solder bridges between foil patterns.
- () Protruding leads. No leads or lugs should be longer than 1/8".
- () Transistors for the proper type and installation.
- () Electrolytic capacitors for the correct position of the positive (+) end.
- () Diodes for the correct position of the banded end.

FINISH

Refer to Pictorial 3-10 (fold-out from Page 35) for the following steps.

NOTE: As you install integrated circuits (frequently referred to as "IC's") in the following steps, be sure that each pin is straight, and that it enters the proper hole in its socket. Be sure to position each integrated circuit so the dot or dimple matches the cutout in the end of the IC socket. Note also that prefix and suffix letters may be different; the numerals will be as shown.

- () 7490 integrated circuit (#443-7) at IC101.
- () 7410 integrated circuit (#443-12) at IC102.
- () 7410 integrated circuit (#443-12) at IC103.
- () 7404 integrated circuit (#443-18) at IC104.
- () 7441 integrated circuit (#443-35) at IC105.
- () 7447 integrated circuit (#443-36) at IC106.
- () Refer to Detail 3-10A and prepare a 6-3/4" length of 8-wire cable as shown.

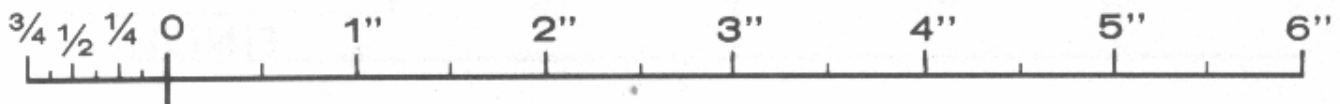


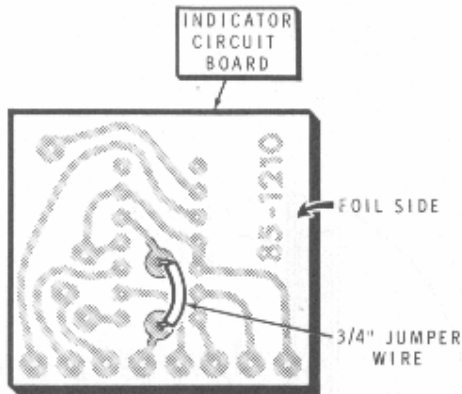
Refer to the Pictorial and install the long end of the 8-wire cable at the rear of the scan circuit board as follows (NOTE: Solder each wire as it is installed.):

- () Green wire to GRN.
- () Yellow wire to YEL.
- () Blue wire to BLUE.
- () White wire to WHT.
- () Orange wire to ORG.
- () Red wire to RED.
- () Brown wire to BRN.
- () Black wire to BLK.
- () Position the cable wires to the rear of the eight .01 μ F disc capacitors as shown. Then position the cable forward, between sockets IC105 and IC106.

Install the short end of the 8-wire cable in the holes near IC106 as follows: (NOTE: Solder each wire as it is installed.)

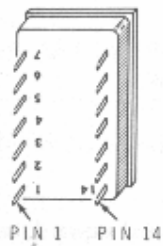
- () White wire to WHT.
- () Blue wire to BLUE.
- () Green wire to GRN.
- () Yellow wire to YEL.
- () Orange wire to ORG.
- () Red wire to RED.
- () Brown wire to BRN.
- () Black wire to BLK.
- () Locate the indicator circuit board (#85-1210).
- () Prepare a 3/4" length of brown hookup wire by removing 1/4" of insulation from each end. NOTE: Be sure to leave the 1/4" of insulation in the center, as this wire will be used to jump over foil leads on the back of the circuit board.



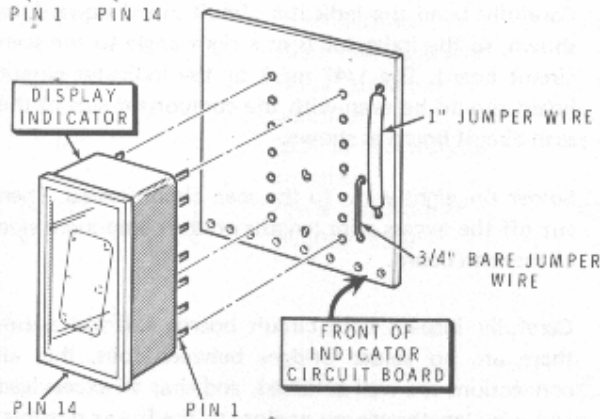


Detail 3-10B

- () Refer to Detail 3-10B and install the 3/4" jumper wire in the indicated holes on the foil side of the indicator circuit board. Solder both wire ends to the foil. Then cut off the excess wire ends from the front side of the board. Push the wire flat against the board.
- () Locate the display indicator (#411-283). Turn it so you can read the small numbers on the pin-side of the indicator.



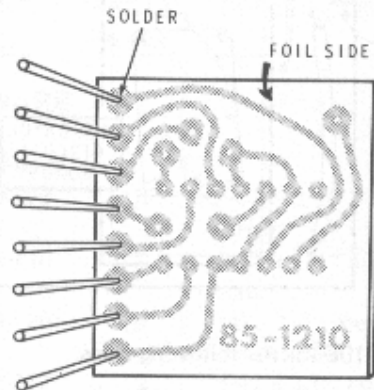
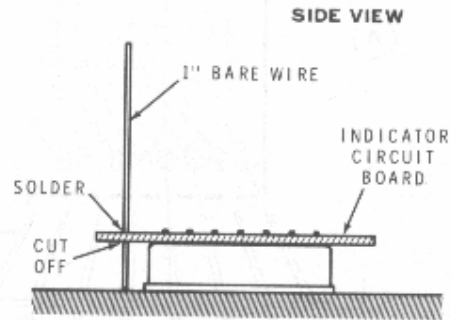
PIN 1 PIN 14



Detail 3-10C

- () Now observe the front of the indicator board, and note that there are eight holes along one edge. Position the display indicator so pins 1 and 14 will be installed into the holes nearest these eight edge holes. See Detail 3-10C.
- () Install the display indicator as shown and carefully solder the pins to the foil.

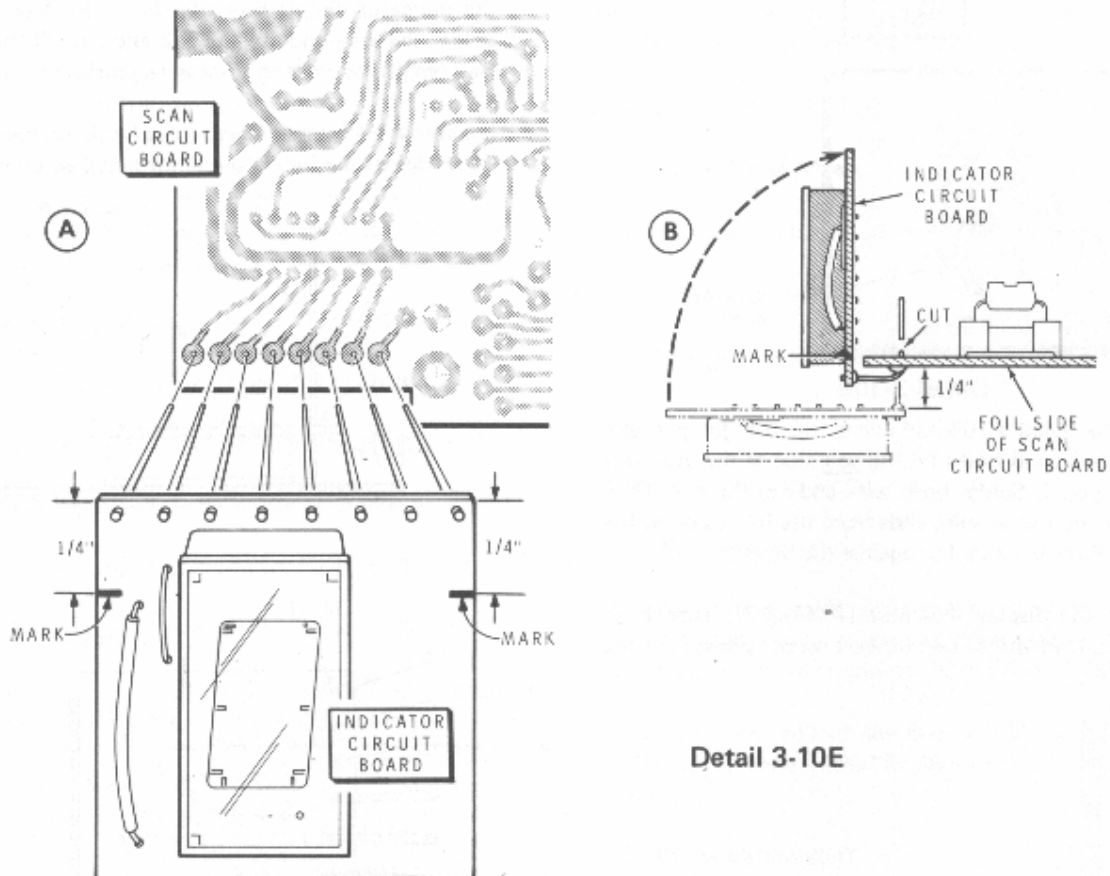
- () Install a 3/4" bare jumper wire near the right edge of the indicator circuit board as shown in Detail 3-10C. Solder the wire-ends to the foil and cut off the excess wire lengths as close to the foil as possible.
- () Prepare a 1" jumper wire. Install this jumper at the right edge of the indicator circuit board as shown.



Detail 3-10D

Refer to Detail 3-10D for the following steps.

- () Remove the insulation from an 8" length of brown wire. Then cut the bare wire into eight 1" lengths.
- () Turn the indicator circuit board foil-side-up as shown in the Detail. Then place a 1" bare wire into each of the holes in the edge of the board as shown. The ends of the wires will extend approximately 1/4" through the board onto the surface of the work area.
- () Solder each of the eight wires to the foil side of the indicator circuit board. Then cut the excess wire lengths from the front side of the board.
- () Bend these eight wires as necessary so they stand straight up from the foil side of the circuit board.

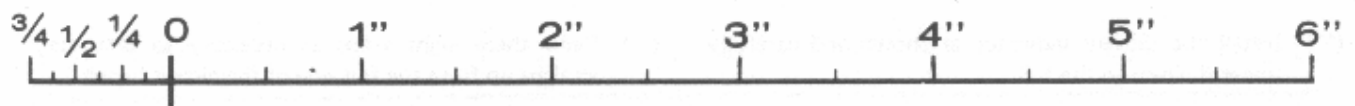


Detail 3-10E

Refer to Detail 3-10E for the following steps.

- () Mark each side of the circuit board 1/4" from the edge with the eight wires as shown in Part A.
- () Turn the scan circuit board so the foil side is up as shown. Note that the eight holes are near the cutout corner of the board. Hold the indicator circuit board so the display indicator is up, and the eight wires previously installed are in line with the holes in the edge of the scan circuit board.
- () Lower the indicator circuit board so each of the eight wires enters its matching hole in the scan circuit board. Press the indicator board down until it is 1/4" above the scan board, and the boards are parallel with each other.
- () Carefully bend the indicator circuit board upward, as shown, so the indicator is at a right angle to the scan circuit board. The 1/4" mark on the indicator circuit board should be even with the component side of the scan circuit board as shown.
- () Solder the eight wires to the scan circuit board. Then cut off the excess wire lengths on the component side of the scan board.
- () Carefully inspect both circuit boards and make sure there are no solder bridges between foils, that all connections are well soldered, and that all excess lead and wire lengths are cut as close to the foil as possible.

This completes the assembly of the scan circuit board; set it aside temporarily.



CHASSIS

PARTS LIST

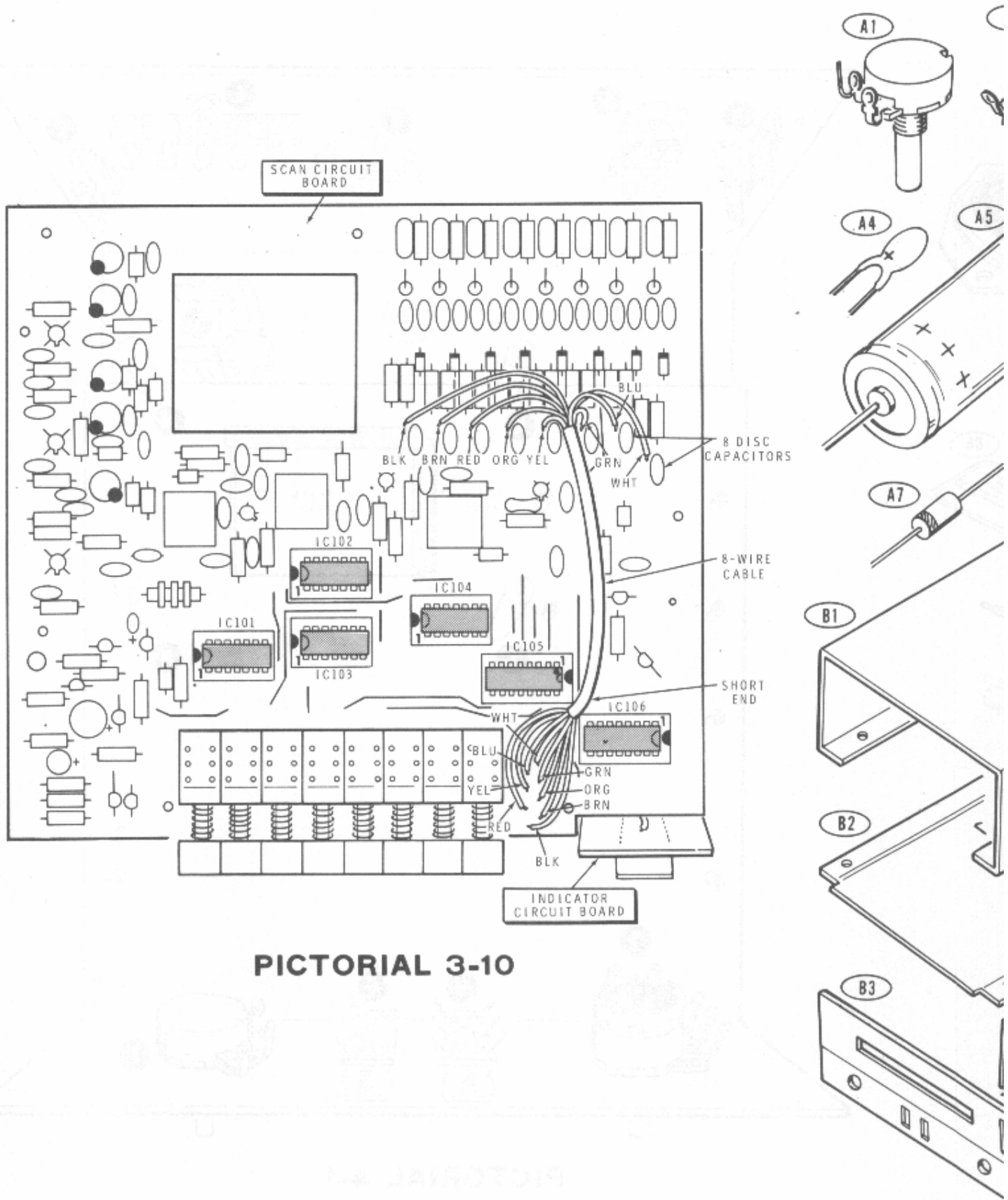
The parts remaining in the original packing carton after Packs #1, #2, and #3 have been removed are listed below. The Key numbers correspond to the numbers on the "Chassis Parts Pictorial" (fold-out from this page).

KEY PART No.	PARTS No.	DESCRIPTION	PRICE Each
CONTROLS-CAPACITORS-TRANSFORMER-DIODE			
A1	10-119	1 10 k Ω control	.55
A2	19-141	1 Control-switch	1.85
A3	21-111	1 15 pF disc capacitor	.10
A4	25-200	1 .68 μ F tantalum capacitor	.50
A5	25-154	1 2500 μ F electrolytic capacitor	1.35
A6	54-115	1 Power transformer	4.25
A7	57-65	4 1N4002 diode	.20

METAL PARTS

B1	90-577-1	1 Cabinet	5.00
B2	90-578-1	1 Bottom plate	4.85
B3	203-1444-1	1 Front panel	1.50
B4	204-1865-1	1 Gimbal bracket	2.40
B5	204-1866-1	1 Gimbal mount	1.70
B6	210-58	1 Bezel	2.25
B7	200-642-1	1 Chassis	7.90
B8	208-6	1 Capacitor clip	.10

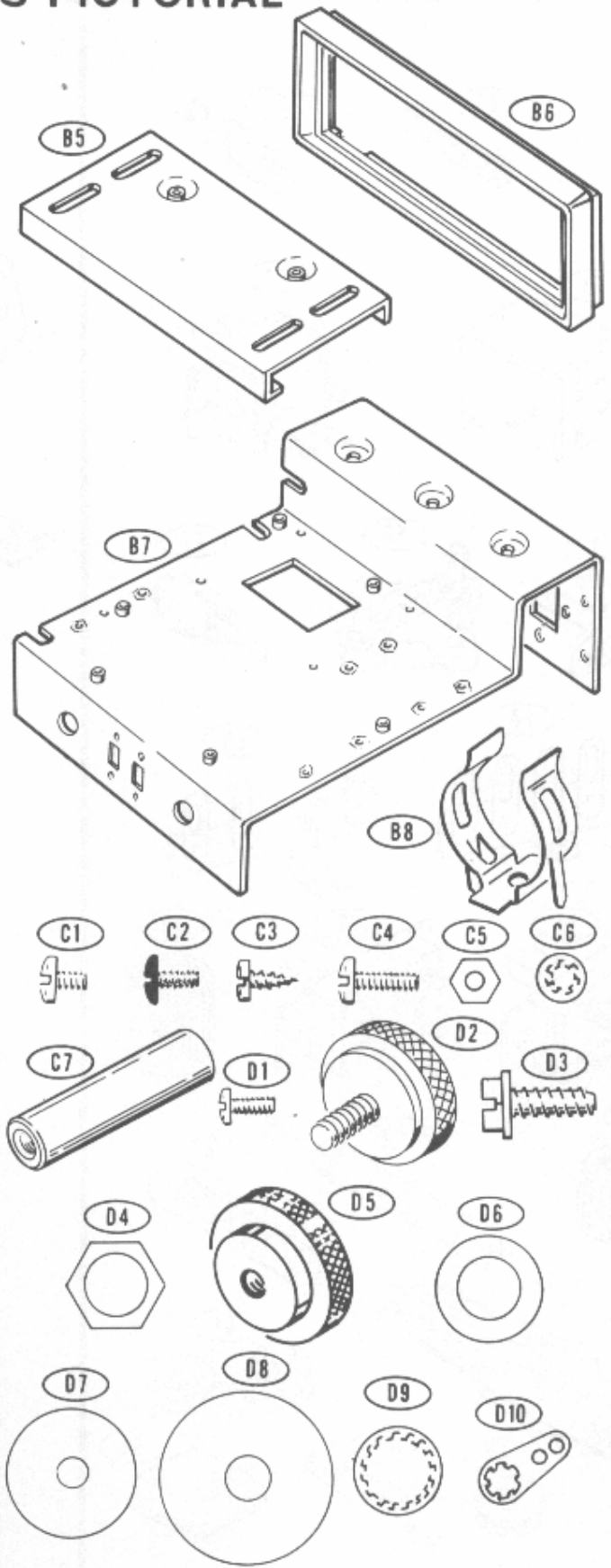
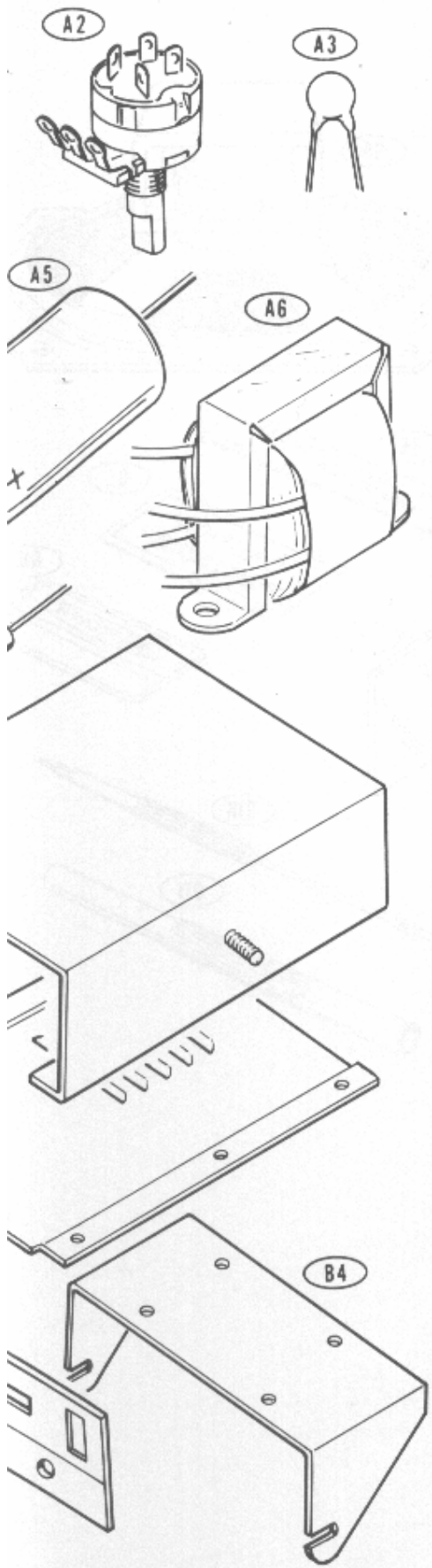
KEY PART No.	PARTS No.	PARTS Per Kit	DESCRIPTION	PRICE Each
HARDWARE				
#6 Hardware				
C1	250-138	6	6-32 x 3/16" screw	.05
C2	250-116	7	6-32 x 1/4" black screw	.05
C3	250-170	6	#6 x 1/4" sheet metal screw	.05
C4	250-357	2	6-32 x 3/8" black nylon screw	.05
C4	250-89	10	6-32 x 3/8" screw	.05
C5	252-3	11	6-32 nut	.05
C6	254-1	22	#6 lockwasher	.05
C7	255-60	4	6-32 x 1-1/8" spacer	.15
Other Hardware				
D1	250-285	19	4-40 x 1/4" screw	.05
D2	250-1147	2	10-32 thumbscrew	.40
D3	250-83	4	#10 x 1/2" sheet metal screw	.05
D4	252-7	5	Control nut	.05
D5	252-49	2	Thumbnut	.30
D6	253-10	2	Control flat washer	.05
D7	253-19	2	#10 flat washer	.05
D8	253-136	2	Nylon washer	.10
D9	254-5	2	Control lockwasher	.05
D10	259-2	2	#8 solder lug	.05



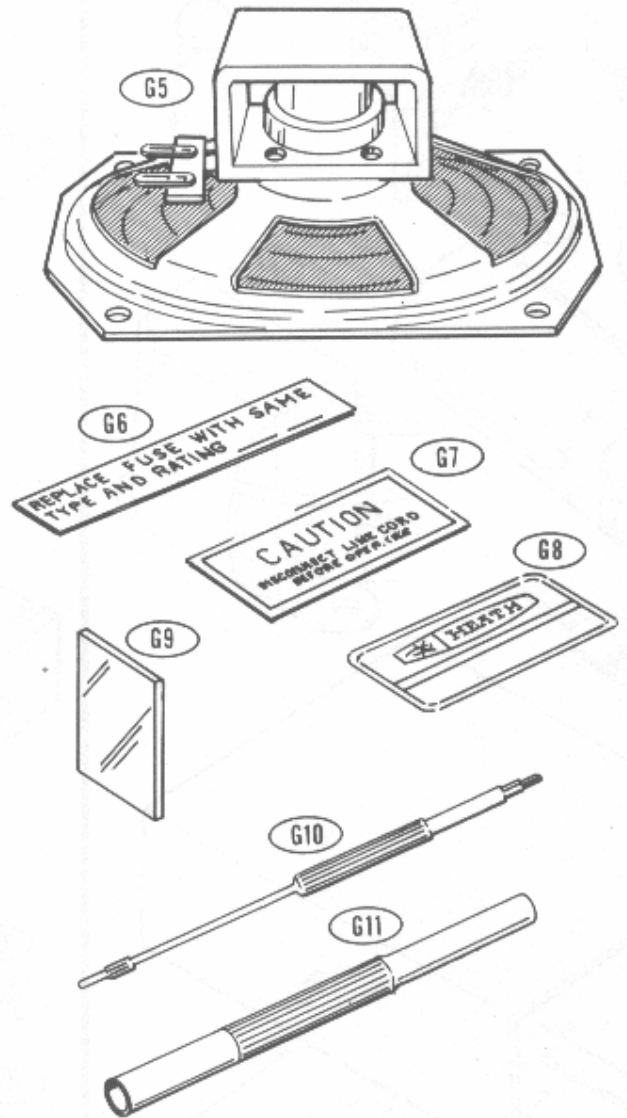
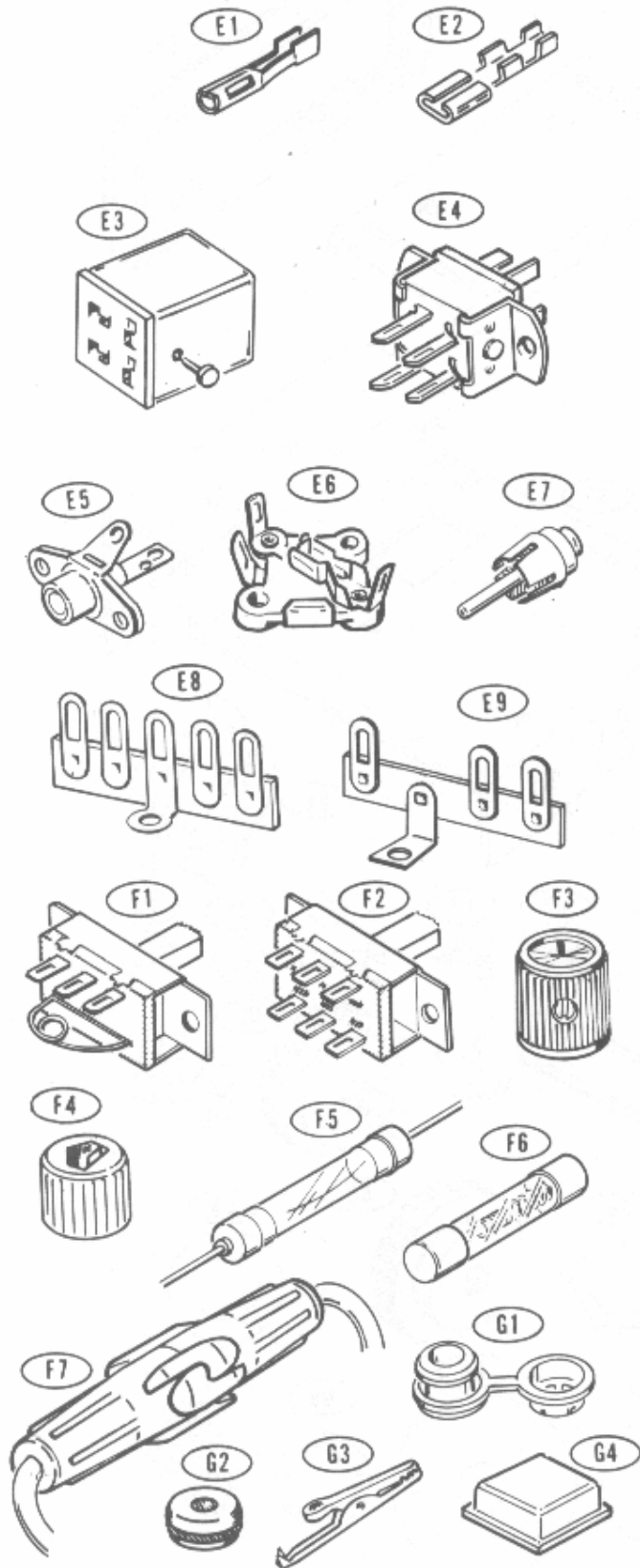
PICTORIAL 3-10

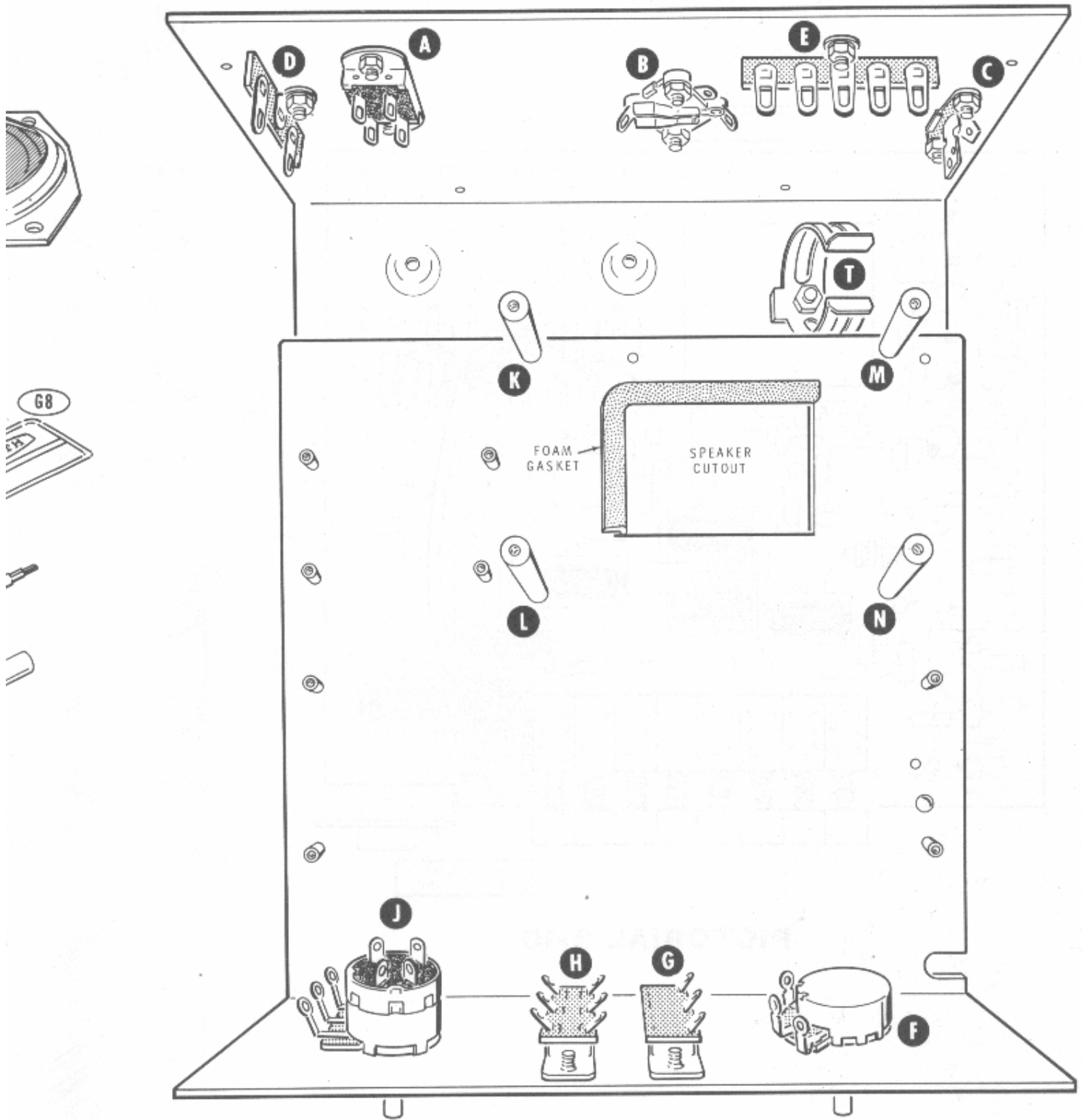
PICTORIAL 3-10

CHASSIS PARTS PICTORIAL



CHASSIS PARTS PICTORIAL (Cont'd.)





PICTORIAL 4-1

KEY PART No.	PARTS No.	DESCRIPTION	PRICE Each	KEY PART No.	PARTS No.	DESCRIPTION	PRICE Each
WIRE-CABLE-SLEEVING				Switches-Knobs-Fuses (cont'd.)			
340-1	1	Heavy bare wire	.05/ft	F3	462-159	1 Knob with setscrew	.30
343-12	1	1-wire shielded cable	.10/ft	F3	462-302	1 Knob	.35
344-2	1	Heavy black stranded wire	.05/ft	F4	455-50	1 Knob insert	.10
344-90	1	Small stranded black wire	.05/ft	F5	421-17	1 3/4 ampere (3/4 A) pigtail fuse	.15
344-92	1	Stranded red wire	.05/ft	F6	421-25	1 1-1/2 ampere slow-blow fuse	.30
344-93	1	Stranded orange wire	.05/ft	F7	423-10	1 Fuseholder assembly	.50
344-94	1	Stranded yellow wire	.05/ft	MISCELLANEOUS			
344-95	1	Stranded green wire	.05/ft		73-39	1 Foam gasket material	.10/ft
344-96	1	Stranded blue wire	.05/ft	G1	73-43	1 Plastic grommet	.10
346-2	1	Clear sleeving	.05/ft	G2	73-59	2 Rubber grommet	.10
346-3	1	Large black sleeving	.05/ft	G3	260-16	2 Alligator clip	.10
347-35	1	2-wire shielded cable	.10/ft	G4	261-29	5 Mounting foot	.05
346-19	1	Small sleeving	.05/ft	G5	401-139	1 Speaker	3.40
89-1	1	Line cord	.45	G6	390-362	1 Fuse label	.10
CONNECTORS-TERMINAL STRIPS-SOCKETS-PLUG				G7	390-926	1 Caution label	.15
E1	432-120	24 Female connector (1 extra included)	.10	G8	391-34	1 Blue and white label	
E2	432-137	2 Push-on connector	.10	G9	446-606	1 Readout window	.50
E3	432-759	2 4-pin socket	.70	G10	490-1	1 Alignment tool	.10
E4	432-760	1 4-pin plug	.50	G11	490-5	1 Nut starter	.10
E5	434-42	1 Phono socket	.10		171-7386	1 Alignment generator	
E6	434-231	1 Plastic phono socket	.40	NOTES:			
E7	438-4	2 Phono plug	.10	1.	Set aside the alignment generator parts. They will not be used until after the kit is assembled.		
E8	431-11	1 5-lug terminal strip	.10	2.	Refer to Page 72 for "Replacement Parts and Price Information."		
E9	431-43	1 3-lug terminal strip	.10				
SWITCHES-KNOBS-FUSES							
F1	60-77	1 Spring return switch	.75				
F2	60-78	1 Slide switch	.50				

STEP-BY-STEP ASSEMBLY

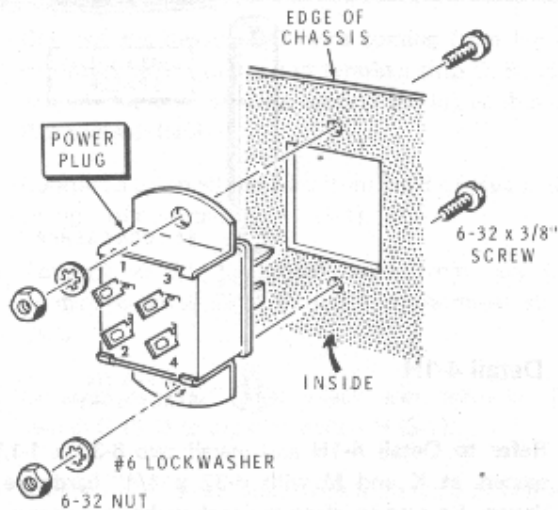
CHASSIS PARTS MOUNTING

Refer to Pictorial 4-1 for the following steps.

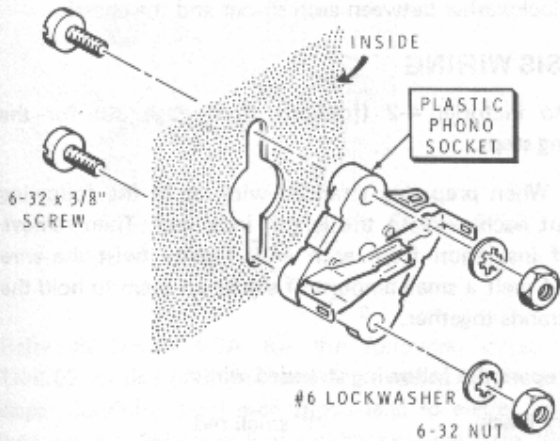
NOTE: Use the plastic nut starter to hold and start 6-32 and 4-40 nuts on screws. Also, when the nut starter is pressed firmly onto #6 and #4 lockwashers, they can be started with the nuts in difficult locations.

When hardware is called for, as in the next step, only the screw size will be given. For instance, if 6-32 x 3/8" hardware is called for, it means that a 6-32 x 3/8" screw, one or more #6 lockwashers, and a 6-32 nut should be used. The Pictorial or a Detail will show the proper number of lockwashers used.

() Refer to Detail 4-1A and install a power plug at A on the chassis rear apron with 6-32 x 3/8" hardware as shown. Be sure the horizontal lugs are nearest the edge of the chassis.



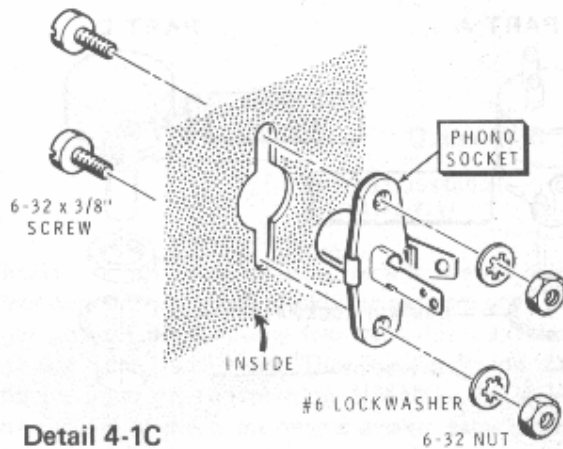
Detail 4-1A



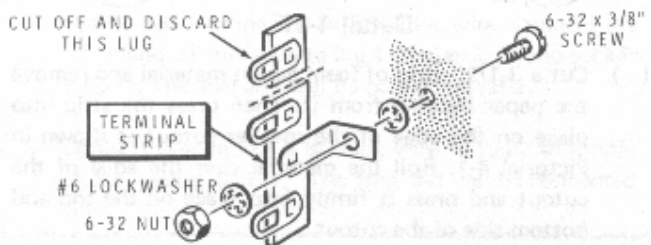
Detail 4-1B

() Loosely mount a plastic phono socket at B with 6-32 x 3/8" hardware as shown in Detail 4-1B. Then push a phono plug firmly into the socket to center it; then tighten the screws. Remove the phono plug. Be sure to position the plastic phono socket as shown in the Pictorial.

() Refer to Detail 4-1C and loosely mount a phono socket at C with 6-32 x 3/8" hardware. Push a phono plug firmly into the socket and tighten the screws. Remove the phono plug. Be sure to position the socket lugs as shown in the Pictorial.



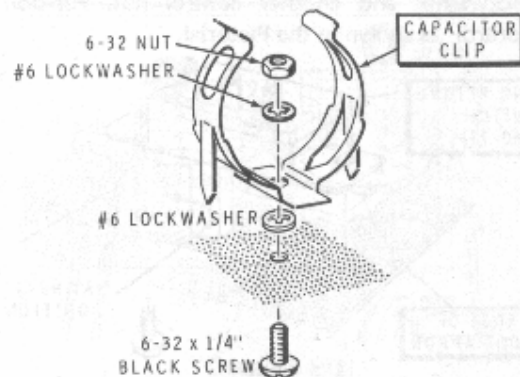
Detail 4-1C



Detail 4-1D

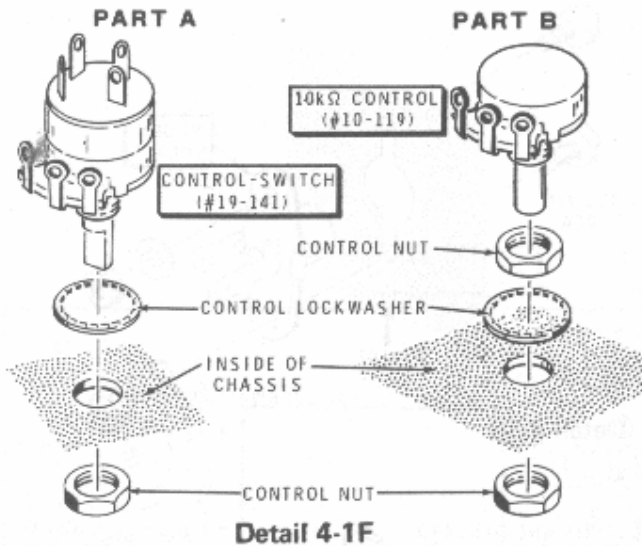
() Refer to Detail 4-1D and cut off the third lug from the 3-lug terminal strip. Install the terminal strip at D with 6-32 x 3/8" hardware. Position the terminal strip as shown in the Pictorial.

() In the same manner, mount a 5-lug terminal strip at E with 6-32 x 3/8" hardware.

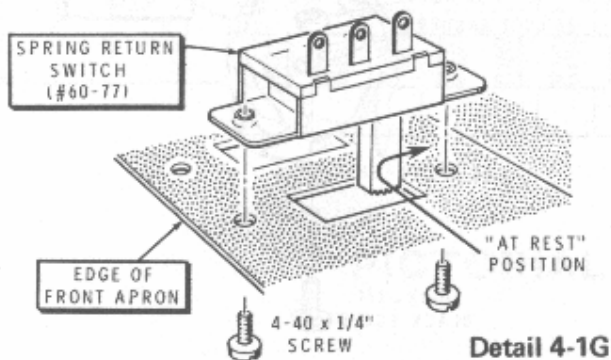


Detail 4-1E

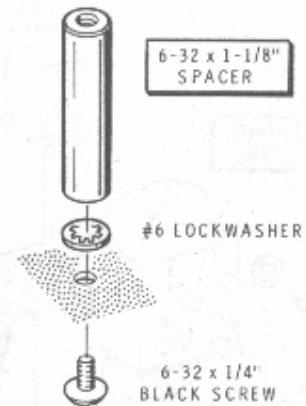
() Refer to Detail 4-1E and mount the capacitor clip at T with 6-32 x 1/4" hardware as shown. Position the clip as shown in the Pictorial.



- () Cut a 3-1/2" strip of foam gasket material and remove the paper backing from it. Then press the strip into place on the edge of the speaker cutout as shown in Pictorial 4-1. Roll the material over the edge of the cutout and press it firmly into place on the top and bottom side of the cutout.
- () Refer to Part A of Detail 4-1F and mount the control-switch (#19-141) at J. Position the control lugs as shown in Pictorial 4-1.
- () Refer to Part B of Detail 4-1F and locate a 10 kΩ control (#10-119). Turn a control nut onto the threads until it is snug.
- () Mount the 10 kΩ control at F with a control lockwasher and another control nut. Position the control as shown in the Pictorial.



- () Refer to Detail 4-1G and mount a spring return switch at G with 4-40 x 1/4" screws. Position the switch so its "at rest" toggle position is away from the edge of the front apron.
- () Similarly, install the slide switch at H with 4-40 x 1/4" screws.



- () Refer to Detail 4-1H and install two 6-32 x 1-1/8" spacers at K and M with 6-32 x 1/4" hardware as shown. Be sure to place the lockwasher between each spacer and the chassis.
- () Similarly, install two 6-32 x 1-1/8" spacers at L and N with 6-32 x 3/8" black nylon screws. Be sure to place a lockwasher between each spacer and the chassis.

CHASSIS WIRING

Refer to Pictorial 4-2 (fold-out from Page 39) for the following steps.

NOTE: When preparing stranded wire, as in the following step, cut each wire to the length indicated. Then remove 1/4" of insulation from each end. Tightly twist the wire ends and melt a small amount of solder on them to hold the small strands together.

- () Prepare the following stranded wires:

8" heavy black	9" small red
9" heavy black	1-1/2" small black
9" small red	2" small black

- () Connect one end of an 8" heavy black wire to lug 4 of control-switch J (S-1).
- () Connect one end of the 9" heavy black wire to lug 5 of switch J (S-1).
- () Cut three 3/4" lengths of clear sleeving.
- () Place a 3/4" length of sleeving onto each of the heavy black wires on control-switch J. Slide the sleeving all the way onto the lugs as shown.
- () Place another 3/4" length of clear sleeving onto the heavy black wire connected to lug 5 of control-switch J.
- () Connect the wire coming from lug 5 of control-switch J to lug 2 of plug A (S-1). Then slide the sleeving all the way onto lug 2.

- () Connect the heavy black wire coming from lug 4 of control-switch J to lug 2 of terminal strip D. Bend the end of this wire securely around the lug as shown in Pictorial 4-2 (NS).
- () Connect a 9" small red wire from lug 3 of plug A (S-1) to lug 7 of control-switch J (S-1).
- () Connect a 9" small red wire from lug 6 of control-switch J (S-1) to lug 1 of terminal strip E (NS).
- () Connect a 1-1/2" small black wire from lug 2 of switch G (S-1) to lug 6 of switch H (S-1).
- () Connect a 2" small black wire from lug 3 of control F (NS) to lug 3 of switch G (NS).

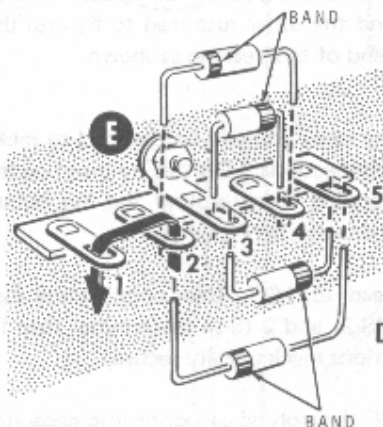


FEMALE CONNECTOR (#432-120)

Detail 4-2B

NOTE: If you plan to use a remote speaker with your Monitor, and want both speakers to be heard at all times, do not perform the following two steps. Instead, refer to the steps and the Detail under "Dual Speaker Option" below. If the next two steps are performed, the Monitor speaker will be disabled whenever the remote speaker cable is connected to the unit.

- () Refer to Detail 4-2B and install a female connector (#432-120) on one end of a 6" blue wire. Connect the other end of this wire to lug 1 of plastic phono socket B (S-1). The free end will be connected later.
- () Connect one end of a 6" blue wire to lug 3 of plastic phono socket B (S-1). The free end will be connected later.



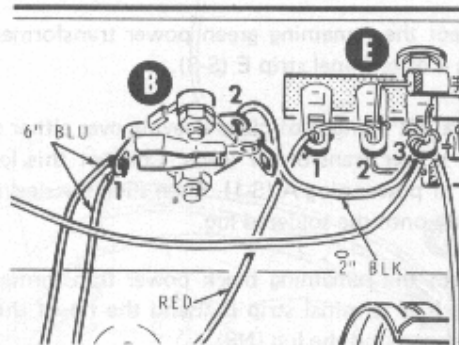
Detail 4-2A

Refer to Detail 4-2A for the following steps. NOTE: 1N4002 diodes (#57-65) will be installed in the next four steps. Carefully bend each diode lead to center the diode between the indicated lugs of the terminal strip. Wrap the leads around the lugs, cut off the excess lead lengths, and solder the leads as directed. Be sure to position the banded ends of all diodes as shown in the Detail.

- () Connect a 1N4002 diode between lugs 3 (NS) and 5 (NS) of terminal strip E.
- () Connect one lead of a 1N4002 diode to lug 5 of terminal strip E (NS). Pass the banded diode lead through lug 2 (NS), to lug 1 (NS) of terminal strip E.
- () Connect a 1N4002 diode between lugs 3 (NS) and 4 (NS) of terminal strip E.
- () Connect a 1N4002 diode between lugs 4 (NS) and 2 (NS) of terminal strip E.
- () Prepare the following small stranded wires:
 - 6" blue 5" black
 - 6" blue 4" black
 - 2" black

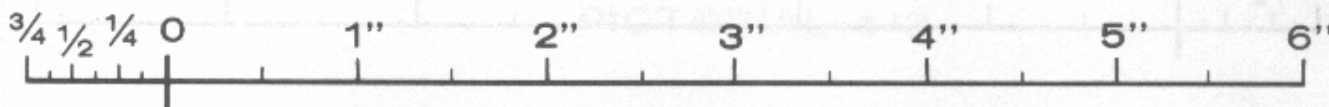
DUAL SPEAKER OPTION

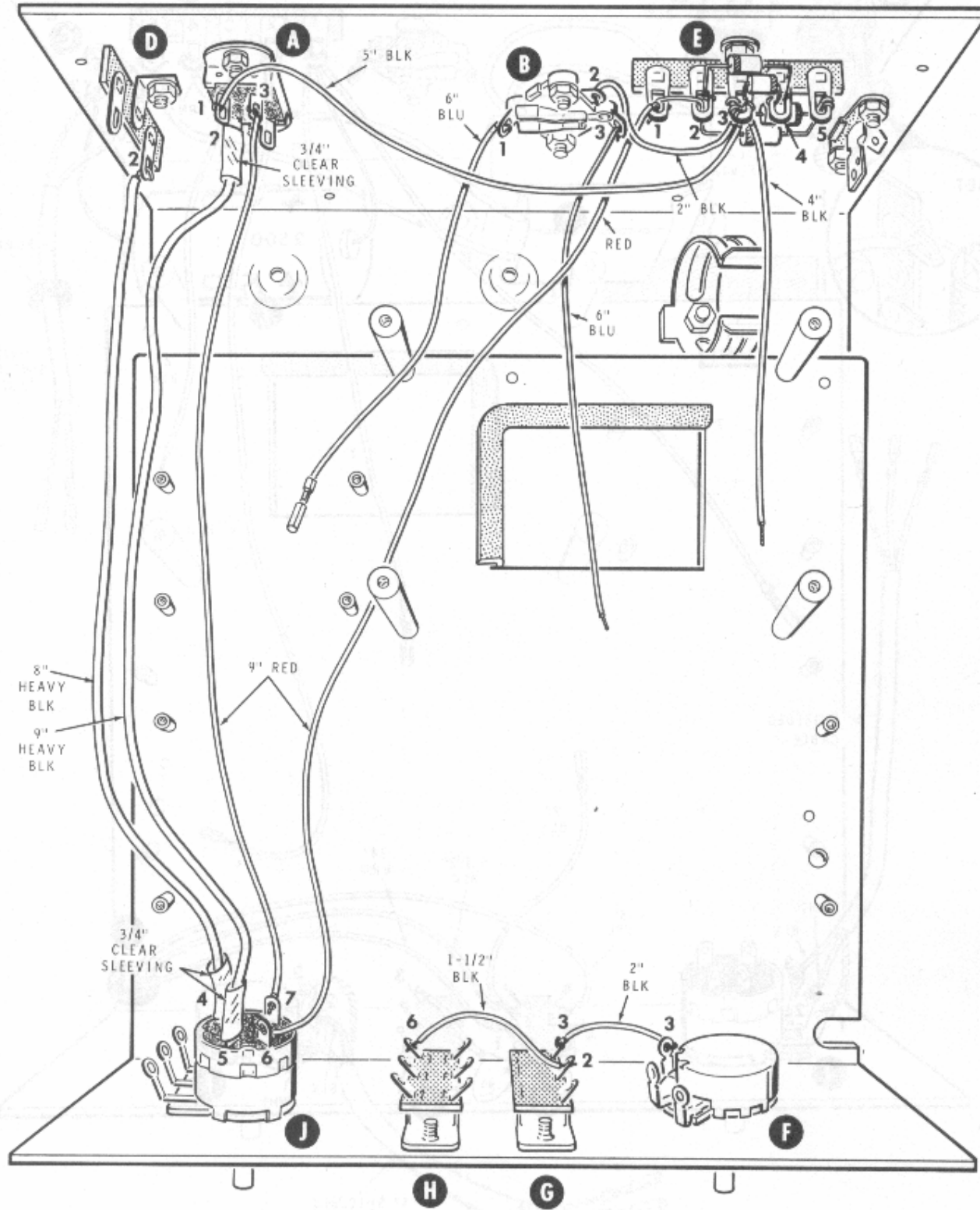
- () Refer to Detail 4-2B and install a female connector (#432-120) on one end of a 6" blue wire. Connect the other end of this wire to lug 1 of plastic phono socket B (NS). The free end will be connected later.
- () Refer to Detail 4-2C and connect one end of a 6" blue wire to lug 1 of phono socket B (S-2). The free end will be connected later.



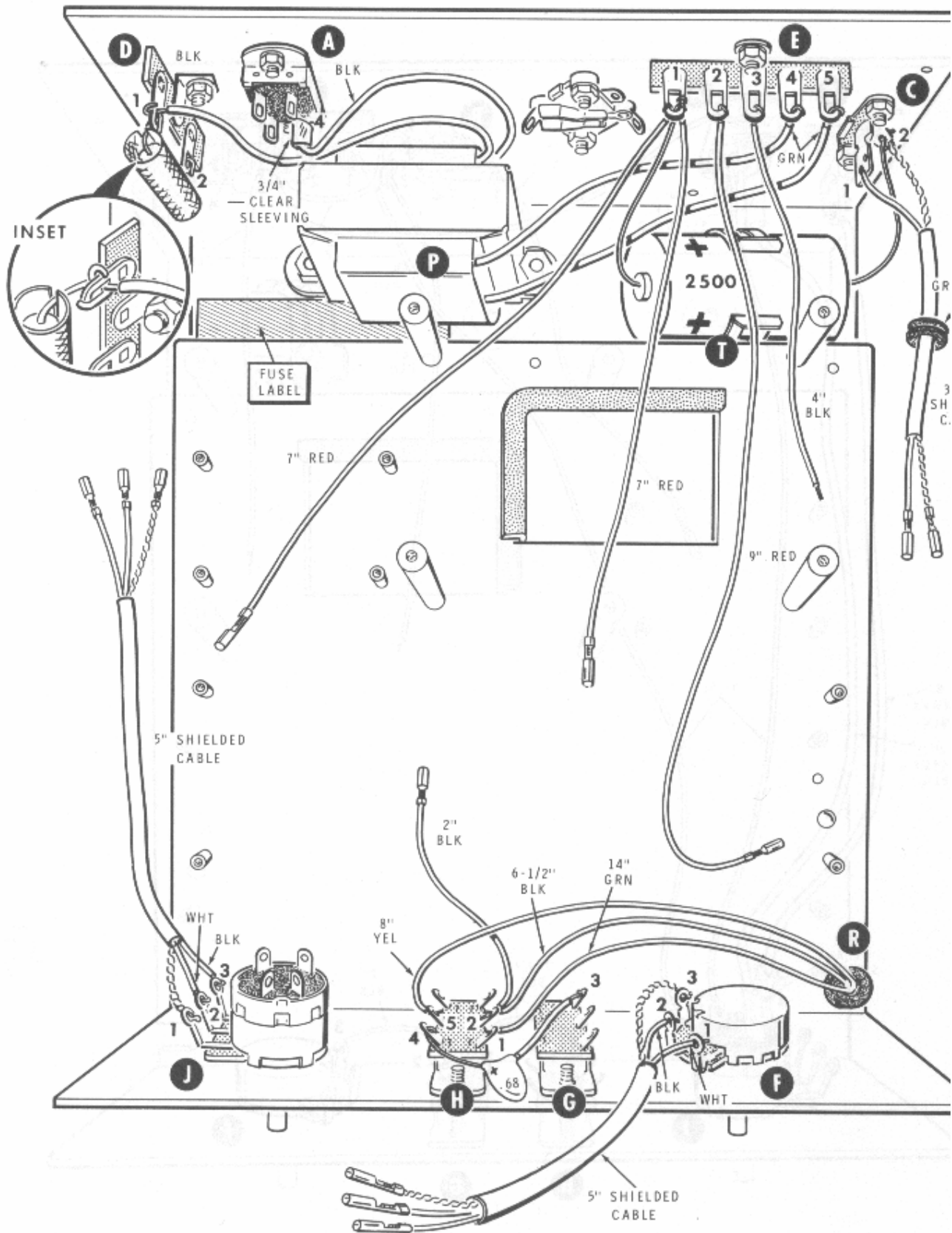
Detail 4-2C

- () Connect a 2" black wire from lug 2 of plastic phono socket B (S-1) to lug 3 of terminal strip E (NS).
- () Connect a 5" black wire from lug 1 of 4-pin plug A (S-1) to lug 3 of terminal strip E (NS).
- () Connect a 4" black wire to lug 3 of terminal strip E (S-5). The free end will be connected later.

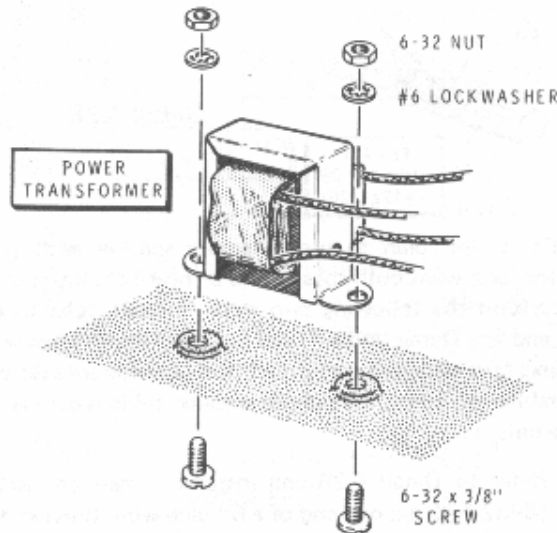




PICTORIAL A-3



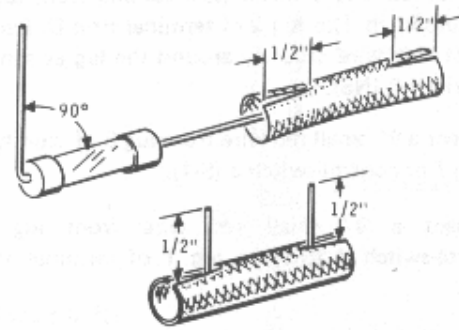
PICTORIAL 4-3



Detail 4-3A

Refer to Pictorial 4-3 for the following steps.

- () Locate the fuse label. Write the value and type of fuse for your kit (3/4 A, 3AG) in the blank space provided. Peel the paper backing from the fuse label, and press it into the lower rear of the chassis at the location shown.
- () Refer to Detail 4-3A and install the power transformer at P with 6-32 x 3/8" hardware. Position the transformer with the leads as shown in the Pictorial.
- () Connect either of the green power transformer leads to lug 5 of terminal strip E (S-3).
- () Connect the remaining green power transformer lead to lug 4 of terminal strip E (S-3).
- () Place a 3/4" length of clear sleeving over either of the black power transformer leads. Connect this lead to lug 4 of power plug A (S-1). Then slide the sleeving all the way onto the soldered lug.
- () Connect the remaining black power transformer lead to lug 1 of terminal strip D. Bend the tip of this lead securely around the lug (NS).
- () Refer to Detail 4-3B and cut 1/2" slits in the ends of the 2" length of black sleeving as shown.
- () Locate the 3/4-ampere pigtail fuse. Bend one lead 90 degrees to the body of the fuse. Then slide the fuse



Detail 4-3B

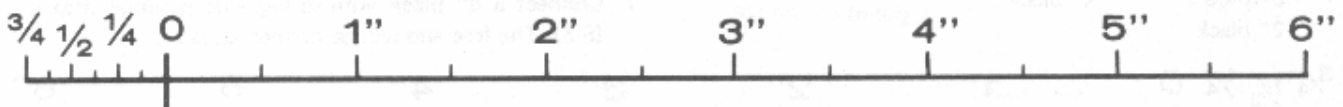
into the large black sleeving so the bent lead fits into the 1/2" slit. Bend the other fuse lead to fit into the slit on the other end of the sleeving as shown.

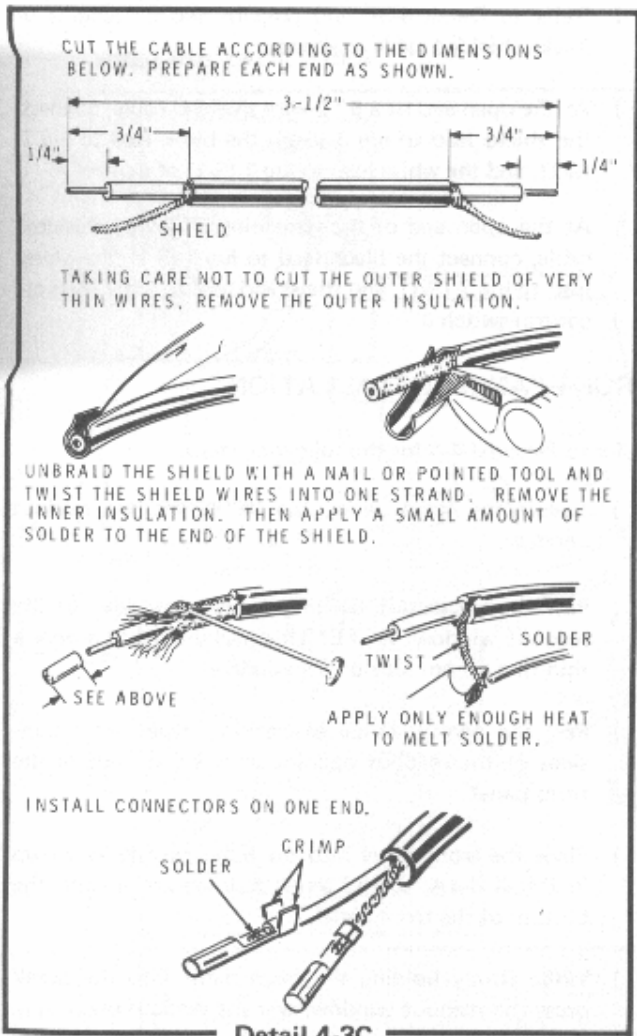
NOTE: In the following step, you will be directed to make "mechanically secure connections." Do this by inserting the leads through and wrapping them around the lug before soldering. See the inset drawing on Pictorial 4-3.

- () Cut each fuse lead to 1/2". Then connect the fuse between lugs 1 (S-2) and 2 (S-2) of terminal strip D. Make the connections mechanically secure.
- () Place the 2500 μ F electrolytic capacitor into capacitor clip T as shown in the Pictorial. Be sure the positive (+) end of the capacitor is toward the power transformer.
- () Connect the positive lead of the 2500 μ F capacitor to lug 1 of terminal strip E (NS). Connect the negative lead to lug 2 of phono socket C (NS).
- () Prepare one 9", and two 7" red stranded wires.
- () Install a female connector on one end of each of these wires.

NOTE: When one of the leads at a terminal passes through the lug and goes to some other point, as in the following step, it will be counted as two leads for solder steps — one entering and one leaving the connection.

- () Connect the end (without a connector) of the 9" red stranded wire to lug 2 of terminal strip E (S-4).
- () Connect the ends (without connectors) of two 7" red stranded wires to lug 1 of terminal strip E (S-5).





- () Refer to Detail 4-3C and prepare a 3-1/2" length of 1-wire shielded cable as shown.
- () Slide a rubber grommet onto the shielded cable.
- () At the end (without connectors) of the shielded cable, connect the center lead to lug 1 (S-1) and the shield lead to lug 2 (S-2) of phono socket C as shown in Pictorial 4-3.
- () Prepare the following small stranded wires:

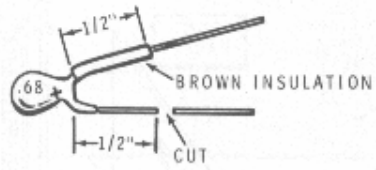
2" black	14" green
6-1/2" black	10" blue
8" yellow	7-1/2" orange
- () Refer to Detail 4-3D and install a female connector (#432-120) on one end of each of the following wires:

2" black wire	8" yellow wire
6-1/2" black wire	14" green wire



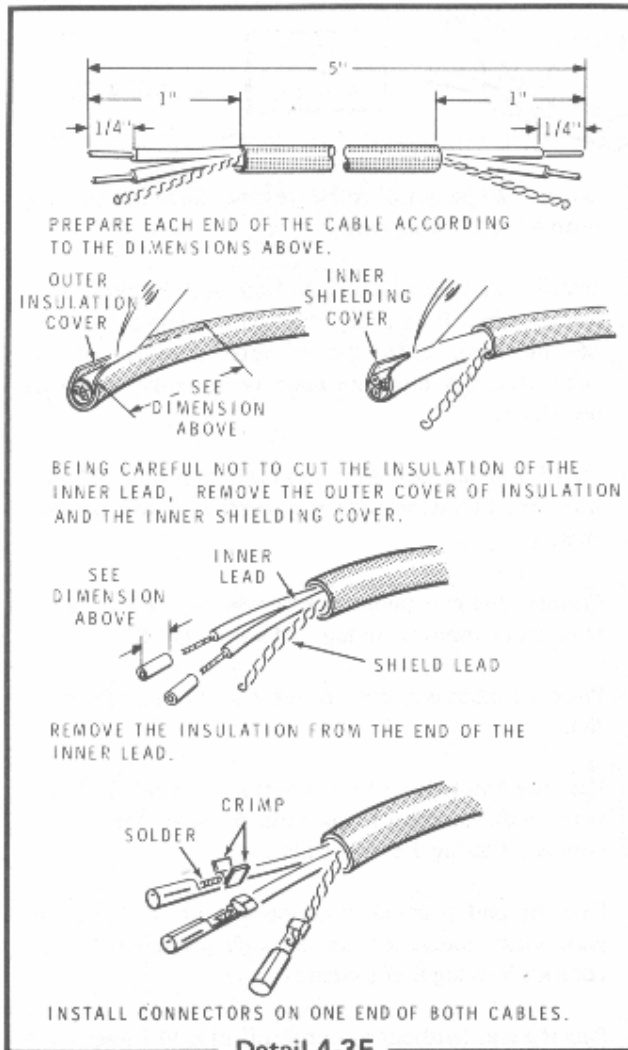
Detail 4-3D

- () Cut a 1/2" length of small sleeving. Slide this sleeving onto a 7-1/2" orange wire.
- () Install female connectors on both ends of the 7-1/2" orange wire. Then slide the small sleeving to one end of the wire, onto the crimped shoulder of the connector. Set this wire aside temporarily; it will be used later.
- () Install a female connector on both ends of a 10" blue wire. Set this wire aside temporarily; it will be used later.
- () Connect the end (without a connector) of a 2" black wire with connector to lug 2 of switch H (NS).
- () Place a rubber grommet in slot R as shown in Pictorial 4-3.
- () Pass the end (without a connector) of a 6-1/2" black wire with connector up through grommet R and connect it to lug 2 of switch H (S-2).
- () Pass the end (without a connector) of an 8" yellow wire with connector up through grommet R and connect it to lug 5 of switch H (S-1).
- () Pass the end (without a connector) of a 14" green wire with connector up through grommet R and connect it to lug 1 of switch H (S-1).



Detail 4-3E

- Refer to Detail 4-3E for the following steps.
- () Remove 1/2" of insulation from a brown wire. Slide this piece of insulation onto the negative (unmarked) lead of a .68 μ F tantalum capacitor.
 - () Cut the positive lead of the .68 μ F tantalum capacitor to 1/2".
 - () Connect the positive lead of this capacitor to lug 4 of switch H (S-1) and the negative lead to lug 3 of switch G (S-2). Position the capacitor away from the other switch lugs.



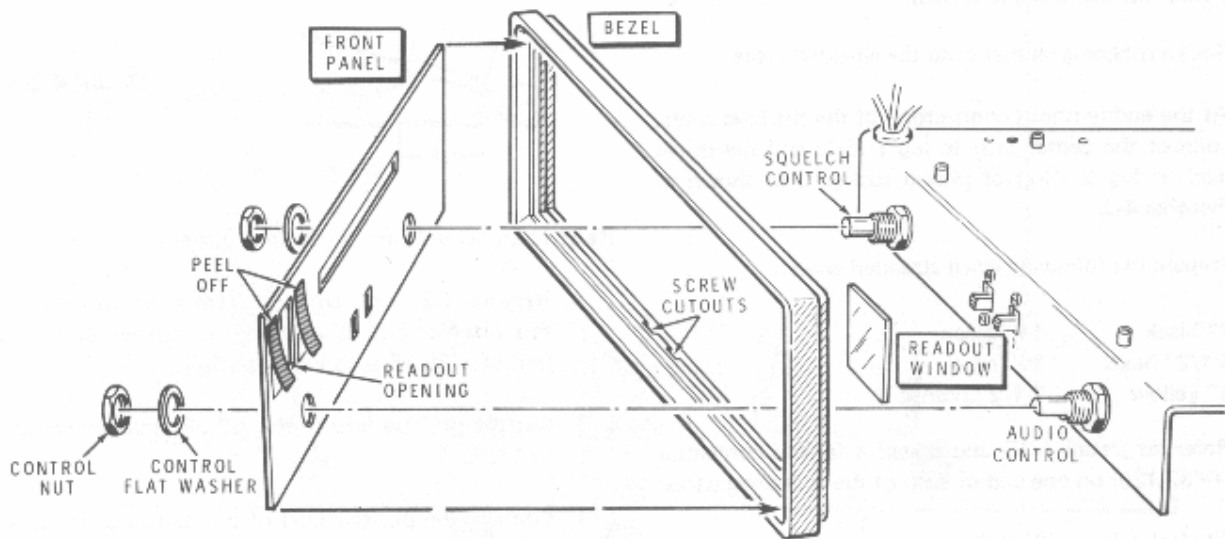
Detail 4-3F

- () Refer to Detail 4-3F and prepare two 5" lengths of 2-wire shielded cable as shown.
- () At the open end of a 5" 2-wire shielded cable, connect the shield lead to lug 3 (S-2), the black lead to lug 2 (S-1), and the white lead to lug 1 (S-1) of control F.
- () At the open end of the remaining 5" 2-wire shielded cable, connect the black lead to lug 3 (S-1), the white lead to lug 2 (S-1), and the shield lead to lug 1 (S-1) of control-switch J.

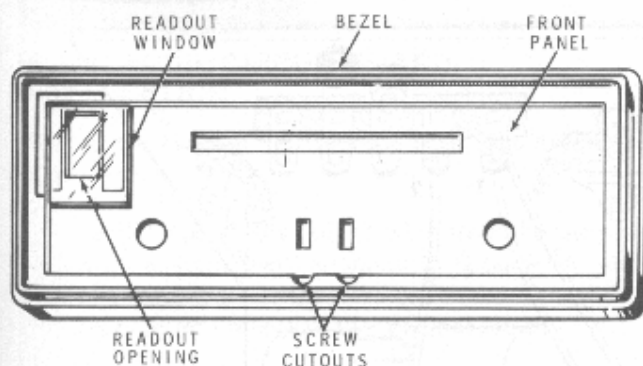
FRONT PANEL INSTALLATION

Refer to Pictorial 4-4 for the following steps.

- () Locate the front panel, the bezel, and the readout window.
- () Peel the protective backing from both sides of the readout window. NOTE: This backing may be only a thin film on one side of the window.
- () Peel the narrow strips of backing paper from both sides of the readout opening on the back side of the front panel.
- () Place the front panel into the bezel exactly as shown in Detail 4-4A, so the screw cutouts are toward the bottom of the front panel.
- () While firmly holding the front panel into the bezel, press the readout window over the readout opening in the front panel as shown. The two adhesive strips along the sides of the opening will hold the window in the proper position.



PICTORIAL 4-4



Detail 4-4A

- () Hold the front panel firmly into the bezel; then mount the front panel onto the Squelch control and the Audio control shafts. Secure the front panel with a control flat washer and a control nut on each of the two controls.

SCAN CIRCUIT BOARD MOUNTING

Refer to Pictorial 4-5 (fold-out from this page) for the following steps.

- () Position the chassis assembly on your work area as shown.
- () Cut a mounting foot into two equal pieces, 1/4" wide x 1/2" long. Discard one of these pieces.
- () Remove the paper backing from the remaining 1/2 mounting foot, and press the foot in place on the chassis (right rear) in the location shown.

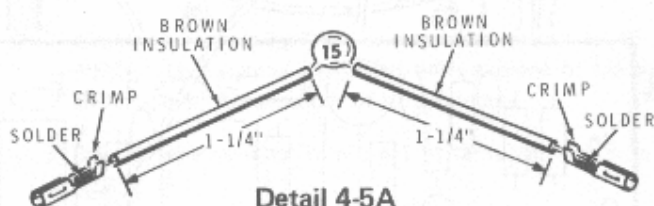
Position the green lead from grommet R across the chassis. Make sure all the other leads are out from under the circuit board area.

- () Carefully position the scan circuit board so the switch pushbuttons pass through the slot in the front panel. Then secure the scan circuit board to the chassis with seven 4-40 x 1/4" screws as shown.
- () Connect the green lead coming under the circuit board to the "Option" pin as shown.
- () Connect the black wire from grommet R to the "BLK" pin on the scan circuit board.
- () Connect the yellow wire from grommet R to the "YEL" on the scan circuit board.

- () Locate the 7-1/2" orange wire with connectors on both ends. Connect the end of this wire without sleeving to the "ORG" pin on the scan circuit board. Pass the free end of this wire through the speaker cutout in the circuit board and chassis; it will be connected later.

- () Temporarily turn the chassis over and locate one of the 7" red wires, with a connector, coming from lug 1 of terminal strip E. Pass this wire through the speaker cutout.

- () Once again turn the chassis over so the scan circuit board is on the top side. Connect the 7" red wire just passed through the speaker cutout to "Red" pin on the scan circuit board as shown.



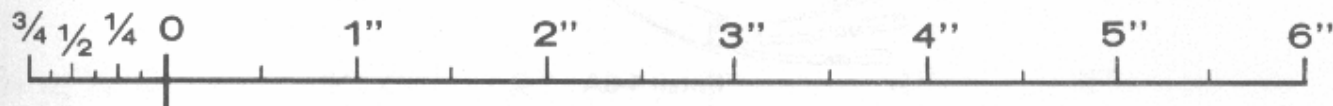
Detail 4-5A

- () Refer to Detail 4-5A and prepare a 15 pF disc capacitor as follows:

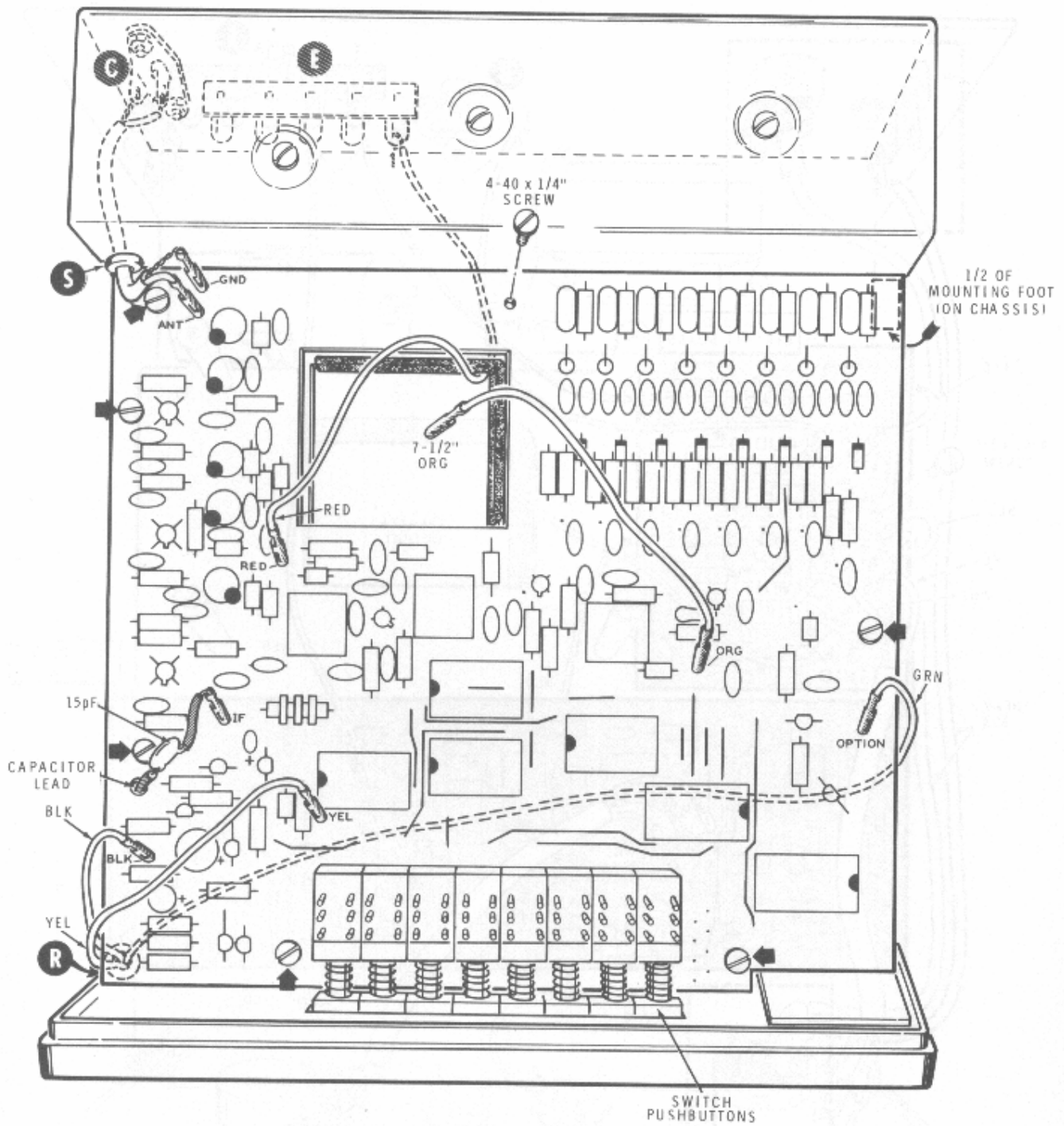
1. Remove the insulation from two 1-1/4" brown wires. Slide these pieces of insulation onto the capacitor leads.
2. Solder female connectors to each of the capacitor leads as shown.

- () Connect one of the female connectors on the capacitor lead to the "IF" pin on the scan circuit board. Then pass the other capacitor lead through the circuit board and chassis as shown in the Pictorial. This lead will be connected later.

- () Locate the shielded cable coming from phono socket C on the rear apron of the chassis. Press the grommet on this lead into slot S in the chassis. Then connect the shield lead to the "GND" pin and the center lead to the "ANT" pin on the left rear corner of the scan circuit board.



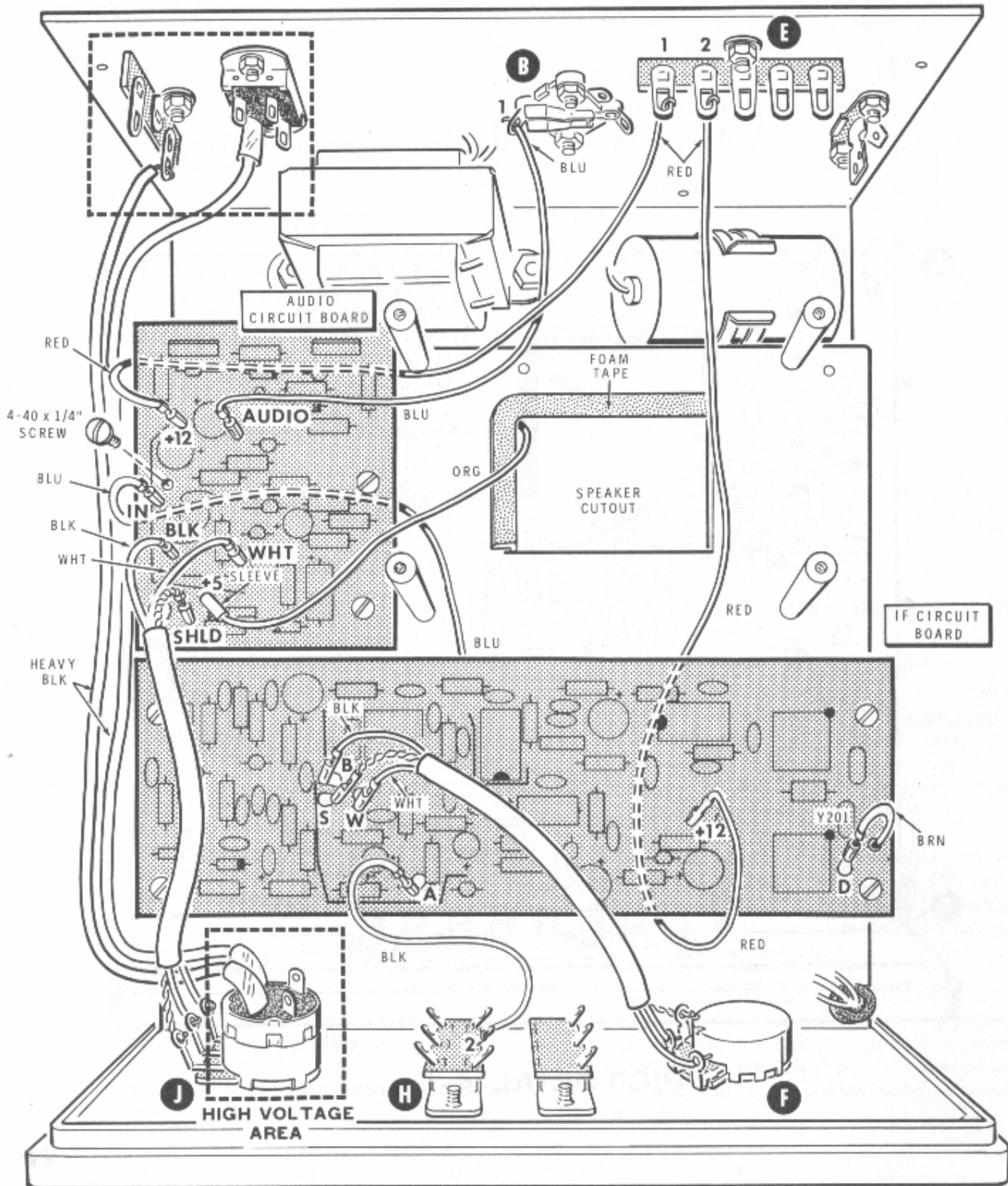
PICTORIAL 4-5



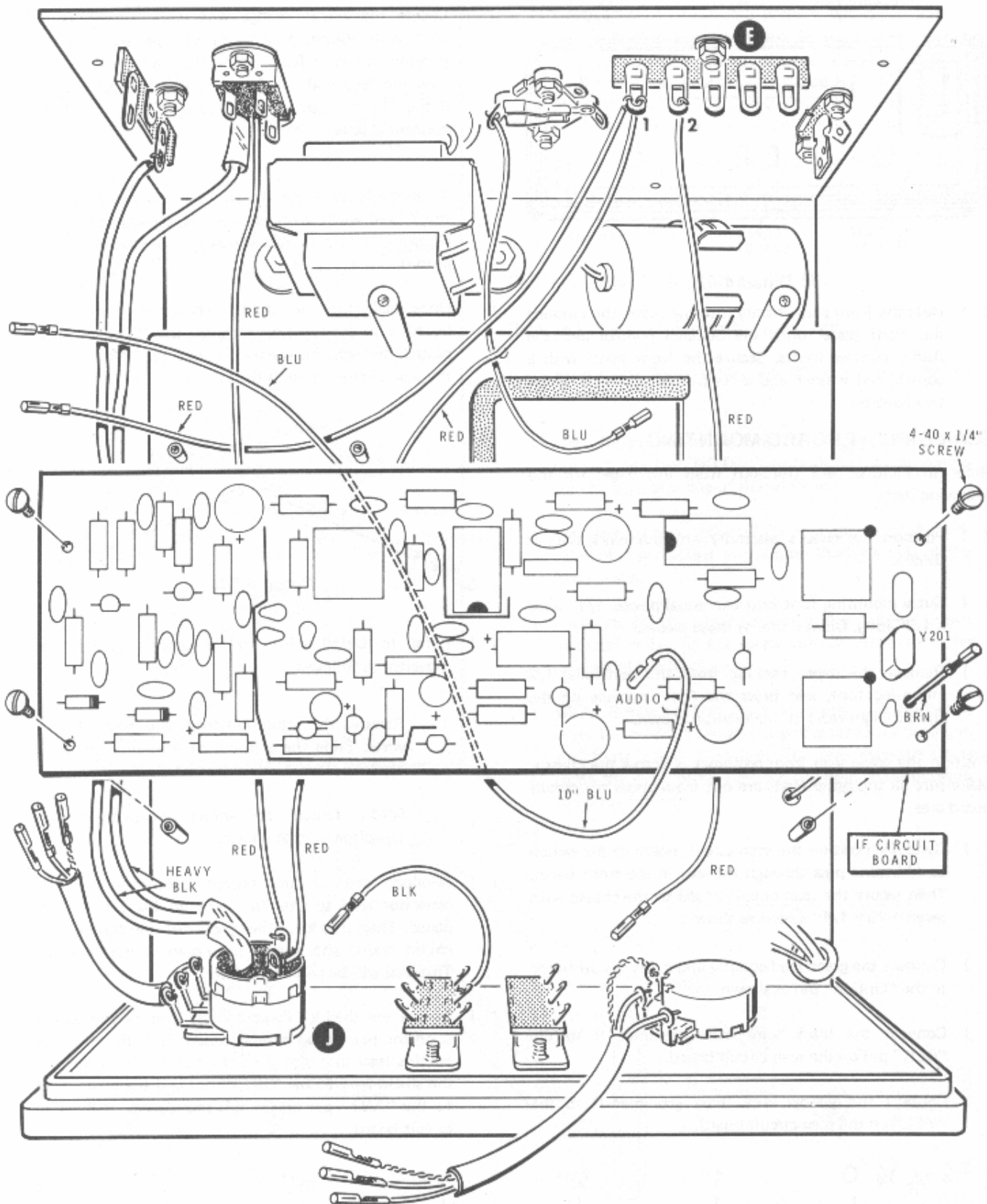
PICTORIAL 4-5

PICTORIAL 4-5

HIGH VOLTAGE AREA



PICTORIAL 4-6



Detail 4-6A



IF AND AUDIO CIRCUIT BOARD INSTALLATION

Refer to the Pictorial 4-6 (fold-out from Page 44) for the following steps.

- () Carefully position all of the wires from the rear panel and the front panel as shown in Detail 4-6A. Make sure the heavy black wires from switch J are sharply bent toward the edge of the chassis as shown.
- () Locate the previously prepared 10" blue wire with two female connectors. Plug this wire onto the "Audio" pin on the IF circuit board. Then fold the blue wire under the circuit board. Route this wire toward the middle left side of the chassis as the board is installed in the next step.
- () Set the IF circuit board down onto the mounting studs. As you perform this step, the brown lead with a connector will pass up through the hole in the board near crystal Y201. Secure the board to the chassis with four 4-40 x 1/4" screws. NOTE: Be sure the heavy black wires from switch J are not caught under the edge of the board.

Refer to the Pictorial and connect the wires to the IF circuit board as follows:

- () Red wire coming from lug 2 of terminal strip E to +12.
- () Brown wire near Y201 to D.
- () Black wire coming from lug 2 of switch H to A.

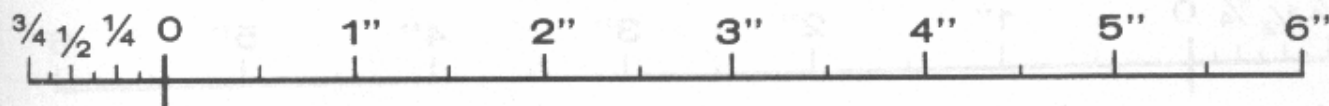
- () White cable wire coming from control F to W.
- () Black cable wire coming from control F to B.
- () Shield lead of the cable coming from control F to S.
- () Mount the audio circuit board to the chassis with 4-40 x 1/4" screws. Be sure the heavy black cables are routed along the outside edge of the chassis.

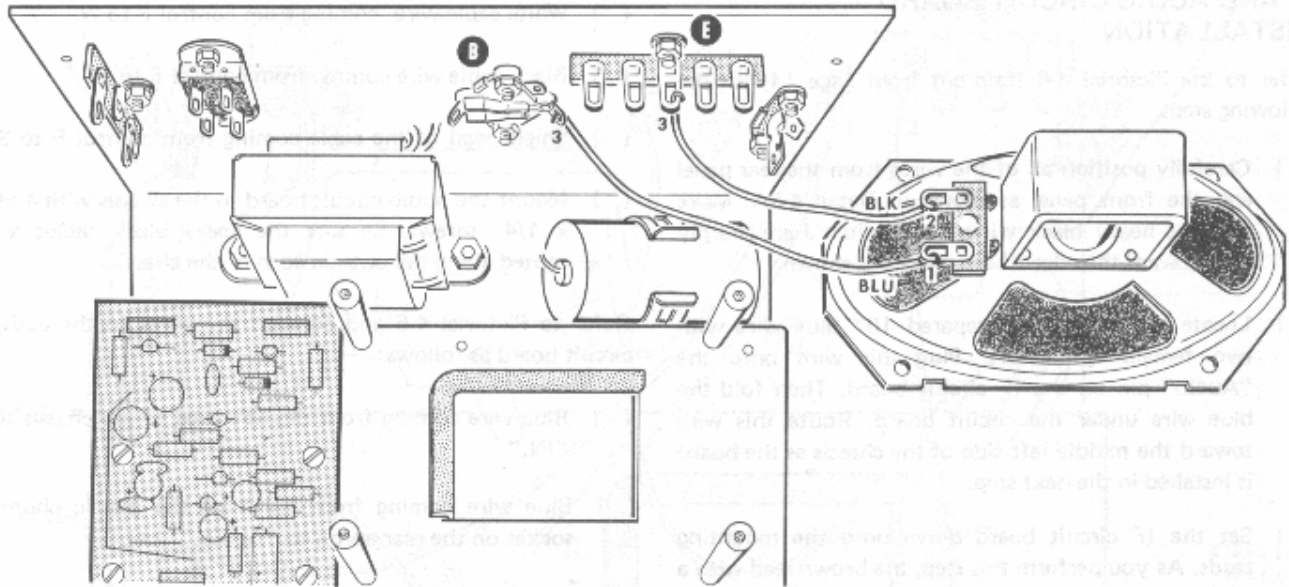
Refer to Pictorial 4-6 and connect the wires to the audio circuit board as follows:

- () Blue wire coming from the left edge of the chassis to "IN."
- () Blue wire coming from lug 1 of the plastic phono socket on the rear apron to "Audio."
- () Orange wire coming from the speaker cutout to +5. NOTE: This wire is identified with a piece of black sleeving over the shoulder of its connector.
- () 7" red wire coming from lug 1 of terminal strip E to +12.

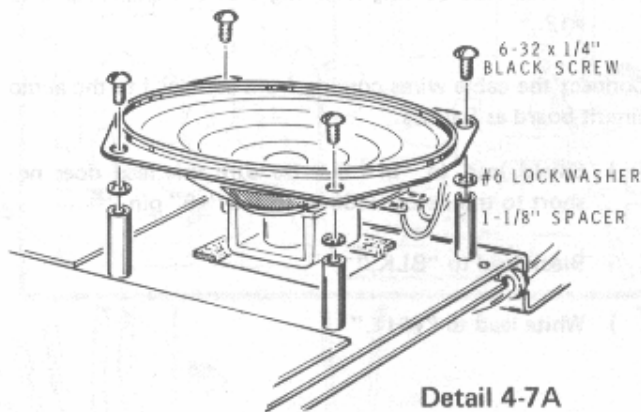
Connect the cable wires coming from control J to the audio circuit board as follows:

- () Shield lead to "SHLD." Be sure this lead does not short to transistor Q308 or to the "+5" pin.
- () Black lead to "BLK."
- () White lead to "WHT."





PICTORIAL 4-7



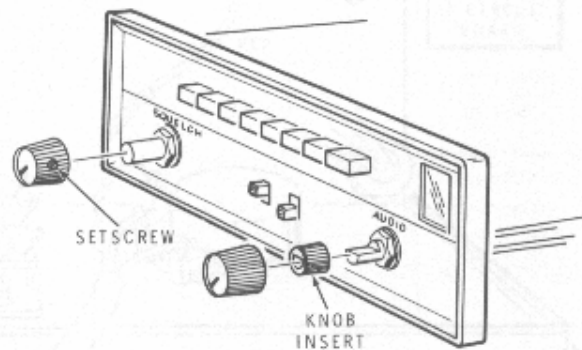
Detail 4-7A

- () Connect the black wire coming from lug 3 of terminal strip E to speaker lug 2 (S-1).
- () Refer to Detail 4-7A and mount the speaker on the four 1-1/8" spacers with 6-32 x 1/4" hardware, as shown. Be sure the #6 lockwashers are between the spacers and the speaker frame. Position the speaker so the solder lugs are toward the right side of the chassis. Position the red and orange wires through the speaker cutout in the area of the foam tape.

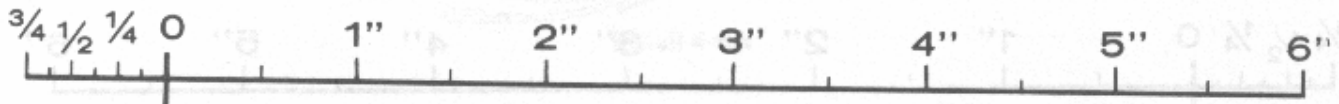
SPEAKER INSTALLATION

Refer to Pictorial 4-7 for the following steps.

- () Turn the speaker cone down, so the solder lugs are positioned toward the right side of the chassis as shown.
- () Connect the blue wire coming from lug 3 of plastic phono socket B to speaker lug 1 (S-1).



PICTORIAL 4-8

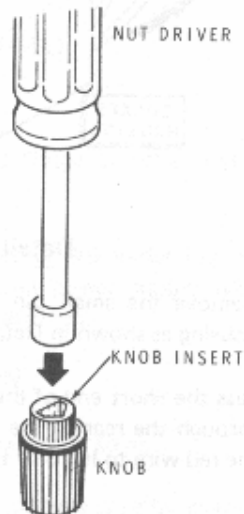


KNOB INSTALLATION

Refer to Pictorial 4-8 for the following steps.

- () Locate the knob with a setscrew.
- () Turn the Squelch control fully counterclockwise.
- () Place the knob with a setscrew onto the Squelch control shaft. Position the pointer at the 7 o'clock position as shown; then tighten the setscrew.
- () Place the knob insert onto the Audio control shaft. Then turn the control fully counterclockwise until the switch clicks to the Off position.
- () Lightly press the remaining knob onto the knob insert so the pointer is aligned with the OFF marking on the front panel.

Detail 4-8A



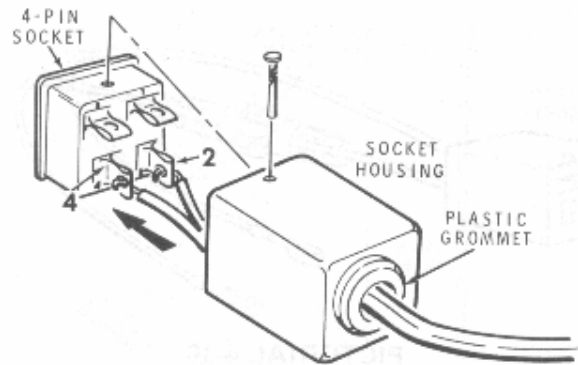
- () Refer to Detail 4-8A. Remove the knob and insert from the audio control shaft. Then press the insert into the knob with a nut driver or other suitable tool until the insert is fully seated.
- () Replace the knob onto the Audio control shaft.

POWER CABLE ASSEMBLY

AC Power Cable

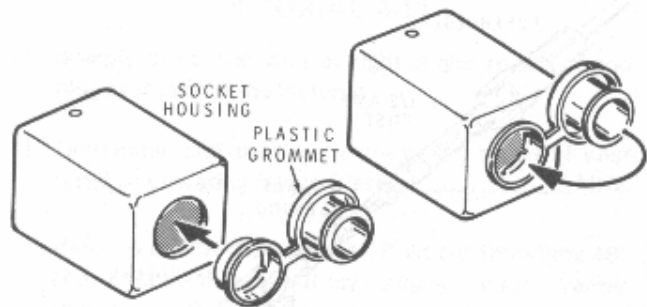
Refer to Pictorial 4-9 for the following steps.

- () Locate the AC line cord and a 4-pin socket.



PICTORIAL 4-9

- () Tightly twist the wire ends of the line cord and apply a small amount of solder to hold the small strands together. Cut the bare wire ends to 1/4".
- () Remove the small pin from the side of the socket housing as shown in the Pictorial.



Detail 4-9A

- () Refer to Detail 4-9A and place a plastic grommet in the hole in the rear of a socket housing as shown.
- () Pass the wire ends of the line cord through the hole in the back of the socket housing as shown in the Pictorial. Then connect one line cord wire to lug 4 (S-1) and the other line cord wire to lug 2 (S-1) of the 4-pin socket. Be sure each of the line cord wires is firmly wrapped around its socket lug before you apply solder.
- () Press the socket housing back onto the socket base so the side pin holes are aligned with one another.
- () Start the small side pin into its hole in the socket; then tap it firmly all the way down to the housing.

Set the AC power cable assembly aside temporarily.

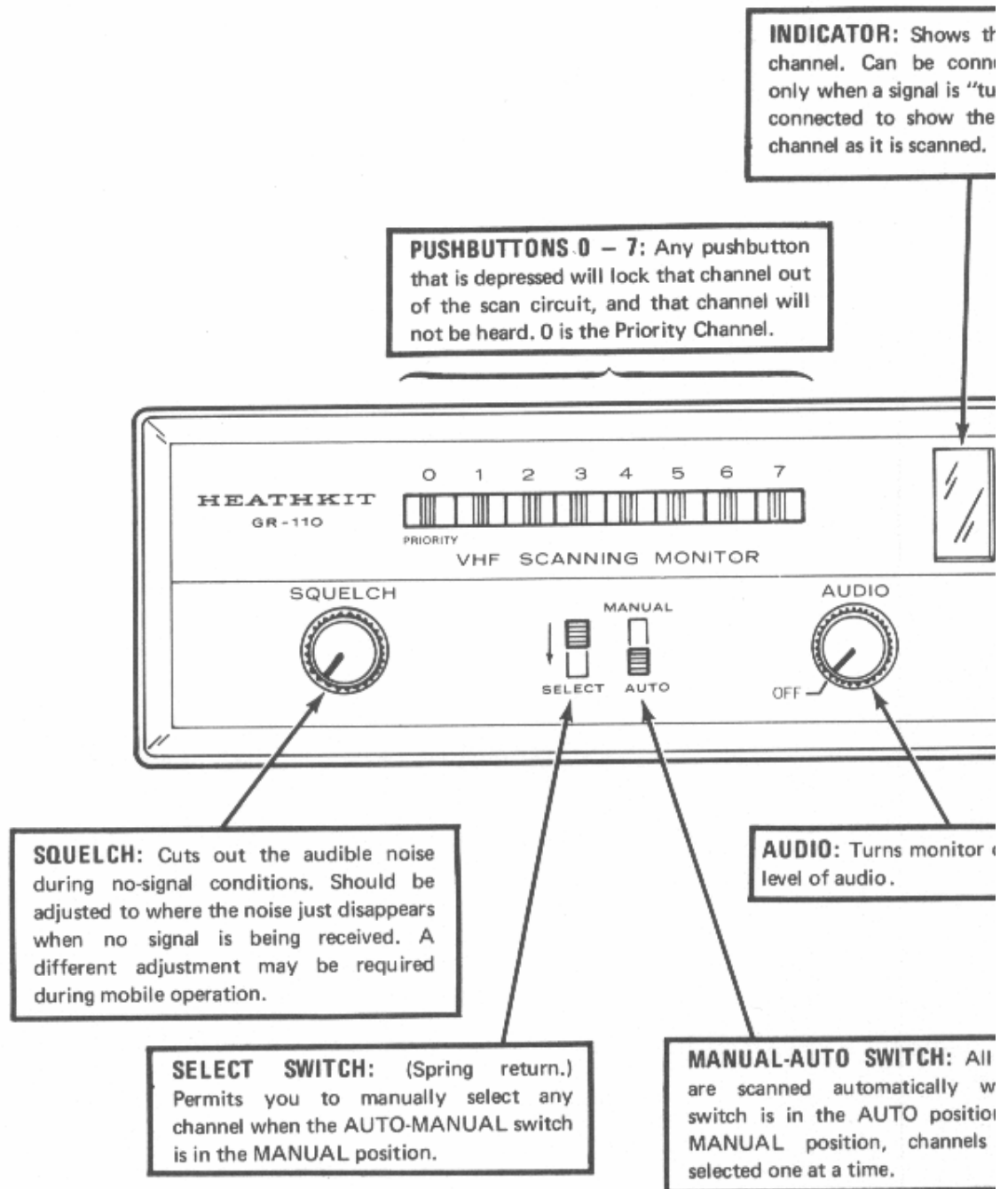
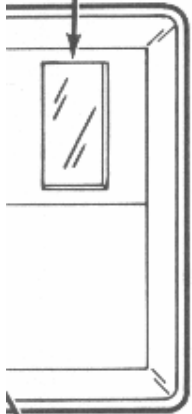


Figure 1

Shows the number of the
be connected to indicate
ignal is "tuned in;" or can be
show the number of each
; scanned.



monitor on and off. Adjusts

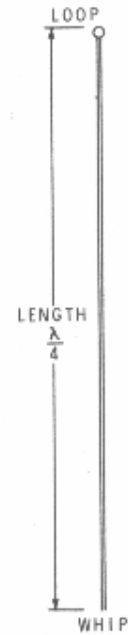
TCH: All channels
tically when this
D position. In the
channels can be

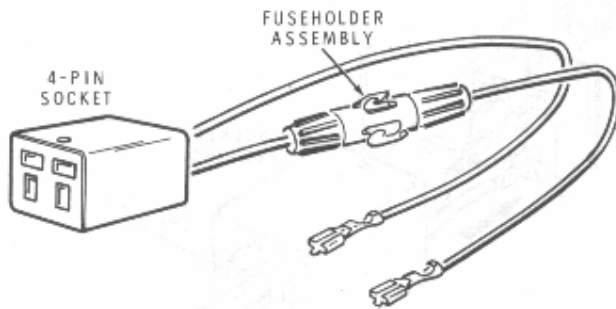
ANTENNA CHART

FREQUENCY IN MHz	LENGTH $\frac{\lambda}{4}$	FREQUENCY IN MHz	LENGTH $\frac{\lambda}{4}$
146	20-1/4"	162	18-1/4"
147	20-1/8"	163	18-1/8"
148	19-7/8"	164	18"
149	19-3/4"	165	17-7/8"
150	19-5/8"	166	17-3/4"
151	19-1/2"	167	17-5/8"
152	19-3/8"	168	17-1/2"
153	19-1/4"	169	17-1/2"
154	19-1/8"	170	17-3/8"
155	19"	171	17-1/4"
156	18-7/8"	172	17-1/8"
157	18-3/4"	173	17"
158	18-5/8"	174	17"
159	18-1/2"		
160	18-1/2"		
161	18-3/8"		

NOTE: $\frac{\lambda}{4} = \frac{1}{4} \times$ WAVELENGTH
(IN METERS)

ANTENNA CHART



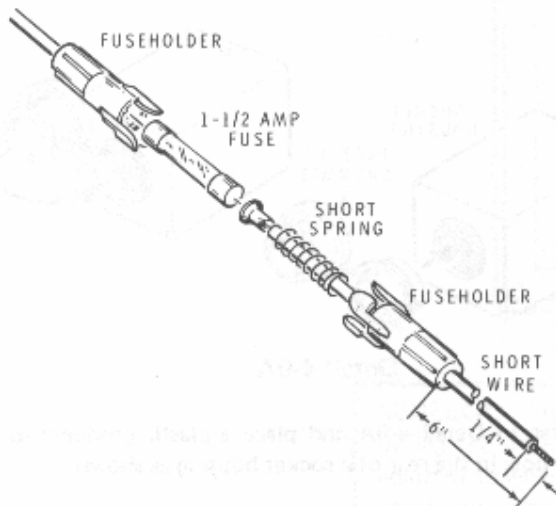


PICTORIAL 4-10

DC Power Cable

Refer to Pictorial 4-10 for the following steps.

- () Locate the fuseholder assembly, the 1-1/2 ampere slow-blow fuse, the heavy black stranded wire, and the remaining 4-pin socket.

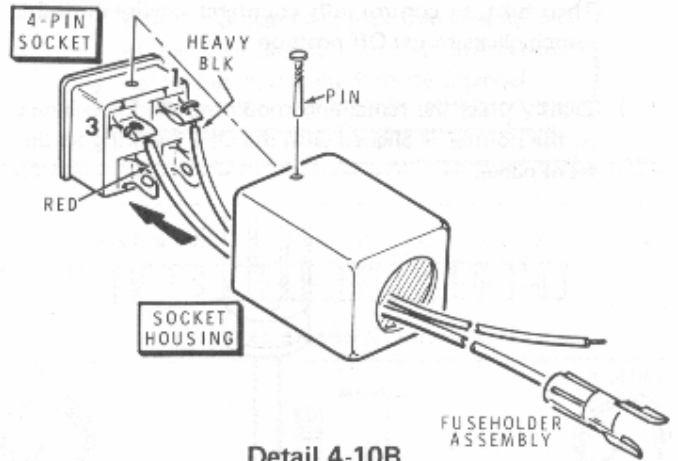


Detail 4-10A

Refer to Detail 4-10A for the following steps.

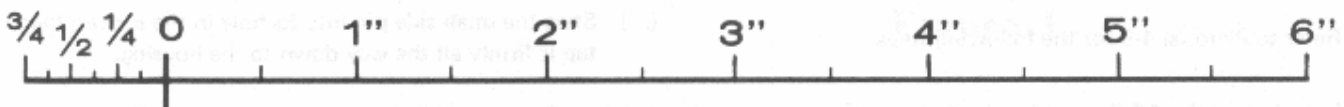
- () Open the fuseholder by twisting the two halves counterclockwise to each other.

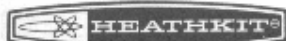
- () Cut the fuse wire 6" from one end as shown. Remove and discard the longer fuse spring if two are supplied.
- () Remove 1/4" of insulation from each of the wire ends. Then twist the wire ends tightly and apply a small amount of solder to hold the small strands together.
- () Reassemble the fuseholder assembly as shown: Place the short spring onto the short wire; then slide this wire into one half of the fuseholder. Install the 1-1/2 ampere slow-blow fuse into the holder and twist the two halves together in a clockwise direction.



Detail 4-10B

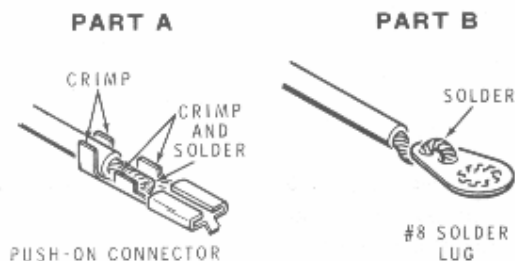
- () Remove the small pin from the side of the socket housing as shown in Detail 4-10B.
- () Pass the short end of the red fuseholder assembly wire through the rear of the socket housing. Then connect the red wire to lug 3 of the 4-pin socket (S-1).
- () Locate the heavy black stranded wire. Prepare both ends of this wire as previously described.
- () Pass one end of this wire through the rear of the socket housing and connect it to lug 1 of the 4-pin socket (S-1).
- () Press the socket housing back onto the socket base so the side pin holes are aligned with one another.





- () Start the small pin into its hole in the socket. Then tap it firmly all the way down to the housing.

NOTE: Two different types of DC power connectors are supplied with this kit, push-on connectors and #8 solder lugs. Which one you use will depend on the type of connection you wish to make in your car, boat, trailer, etc.



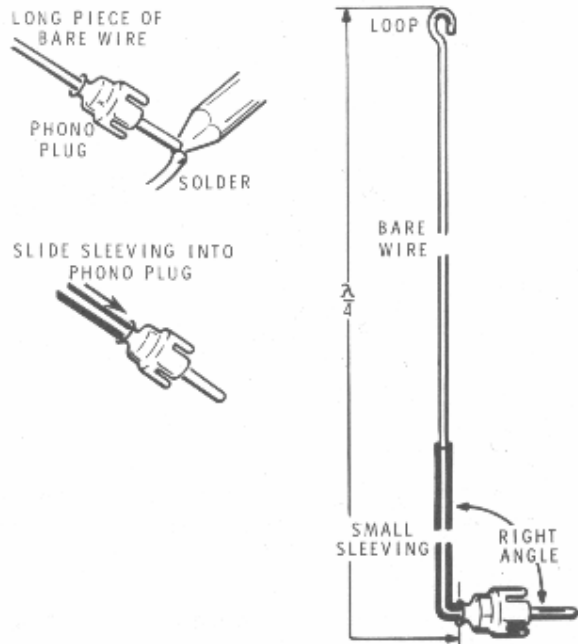
Detail 4-10C

- () Study Parts A and B of Detail 4-10C to determine which connector to use.
- () Install push-on connectors or #8 solder lugs on the ends of the black and red power supply wires, as shown in the appropriate drawing.

ANTENNA PREPARATION

Refer to Pictorial 4-11 for the following steps.

- () Straighten the long piece of bare wire by clamping it in a vise, or by grasping both ends with pliers, and then pulling on it until it is straight.
- () Place a phono plug on one end of this wire. Heat the tip of the phono plug with the soldering iron and flow solder into the tip as shown.
- () Place a 2" length of small sleeving over the wire. Then slide it all the way into the rear of the phono plug.



PICTORIAL 4-11

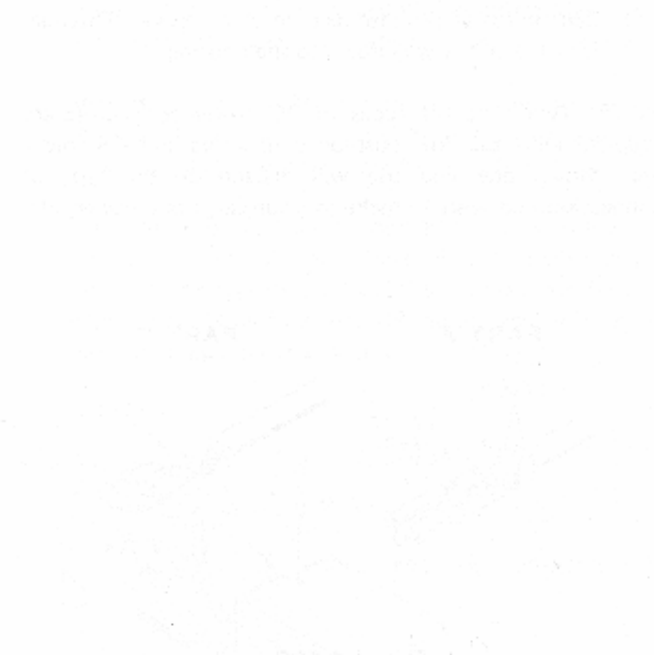
- () Sharply bend the wire at right angles to the phono plug as shown in the Pictorial.
- () Determine, and then mark down, the center of your range of operating frequencies: _____ MHz.
- () Refer to the "Antenna Chart" (fold-out from Page 48) and locate the frequency nearest your "center frequency." Carefully measure your antenna wire, and cut it to the length specified.
- () Twist a tiny loop into the free end of the antenna wire to prevent possible eye injury.
- () Set this antenna aside until it is called for later.

This completes the "Step-by-Step Assembly" of your kit. The Alignment Generator will be assembled later if you perform the "Alignment Without Instruments." Carefully inspect all connections for loose or unsoldered wires or leads. Remove any wire clippings or solder splashes. Then proceed with the "Tests and Alignment."



...the power supply section of the circuit. The components shown include a transformer, a bridge rectifier, and a filter capacitor. The transformer is connected to the AC input, and the bridge rectifier converts the AC to DC. The filter capacitor then smooths the DC output. The circuit is designed to provide a stable DC voltage for the rest of the system.

The power supply section is a critical part of the circuit, as it provides the necessary DC voltage for the other components. The transformer is the primary source of power, and the bridge rectifier and filter capacitor are essential for converting and smoothing the AC input. The circuit is designed to be efficient and reliable, ensuring that the DC output is stable and consistent.



...the control section of the circuit. The components shown include a microcontroller, various resistors, and capacitors. The microcontroller is the central component, responsible for processing the input signals and controlling the output. The resistors and capacitors are used for timing and signal conditioning. The circuit is designed to be compact and efficient, fitting into a small form factor.

The control section is the brain of the circuit, managing the overall operation. The microcontroller is programmed to perform specific tasks, and the resistors and capacitors help in fine-tuning the circuit's response. The circuit is designed to be robust and reliable, ensuring that it can handle the required load and maintain accurate control.

TESTS AND ALIGNMENT

NOTE: If you do not get the proper results in any of the following steps, turn the power off (if it is on) and refer to "In Case of Difficulty" on Page 65.

Refer to Figure 1 (fold-out from Page 48) for front panel control and switch information.

INITIAL TESTS

NOTE: An ohmmeter will be needed for these first few tests. These tests have been included so you can be sure your Monitor is wired properly before you turn it on. If you do not have an ohmmeter, disregard these steps and proceed to "Adjustments."

Do not plug this Monitor into a power source until you are instructed to do so.

- () Set the front panel controls as follows:

SQUELCH: Clockwise.

AUDIO: Clockwise until the switch clicks "on."

Pushbuttons 0-7: 0-button depressed; all others out.

MANUAL-AUTO: Auto.

- () Set the ohmmeter on a range to read low resistances, such as R x 10. Connect the negative lead to the chassis.
- () Refer to Figure 2 and place the positive ohmmeter probe on lug 3 of the power plug. This reading should be greater than 50 Ω .
- () Place one of the ohmmeter leads on pin 2 and the other on pin 4 of the power plug. The ohmmeter reading should be greater than 30 Ω .

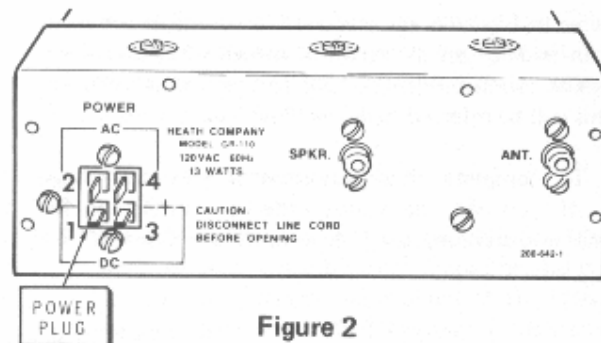


Figure 2

- () Switch the Power switch on the AUDIO control on and off. The ohmmeter reading should go to infinity and back to the reading of the previous steps.
- () Remove the ohmmeter leads from the power plug.
- () Turn the AUDIO control counterclockwise to the Power switch OFF position.
- () Connect the AC line cord assembly to the rear of the Monitor.
- () Place the ohmmeter leads onto the prongs of the line cord plug. You should read infinity on the meter.
- () Remove the ohmmeter from the line cord plug.

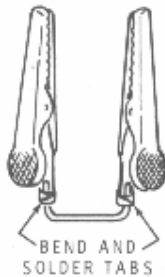
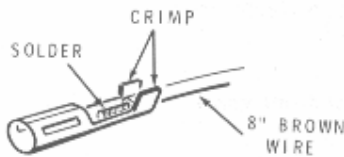


Figure 3

- () Refer to Figure 3 and connect a 1" length of bare wire to two alligator clips as shown. Bend this assembly into a U-shape.



FEMALE CONNECTOR (#432-120)

Figure 4

- () Refer to Figure 4 and remove 1/4" of insulation from both ends of an 8" length of brown wire. Connect a female connector (#432-120) to one end of this wire. This will be referred to as the "test lead."

NOTE: To complete these adjustments you must have crystals. If you still have not ordered crystals, or for additional information, see "How to Order Crystals" on Page 5.



Figure 5

- () Place a small tape "flag" on the long end of the alignment tool as shown in Figure 5. This will aid in counting the number of turns of the tool.

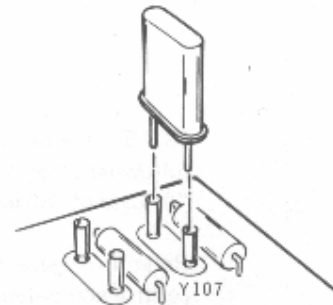


Figure 6

- () Refer to Figures 6 and 7 (fold-out from Page 57), and install the highest frequency crystal in the Y107 pins as shown.
- () Install the lowest frequency crystal in the Y101 pins.

NOTE: If you have purchased other crystals, they may be installed at this time in any of the crystal positions, Y102 through Y106. Do not install a crystal at Y100 until instructed to do so.

ALIGNMENT

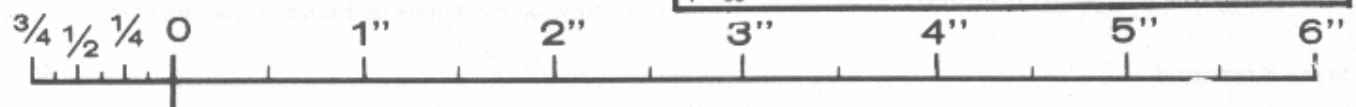
NOTE: The remaining instructions are divided into two sections: "Alignment Without Instruments" and "Alignment With Instruments." Choose one of the two sections and perform only the steps in that section.

ALIGNMENT WITHOUT INSTRUMENTS

- () Assemble the Alignment Generator Kit (set aside earlier). Use the instructions supplied with the kit. Then proceed with the following steps.

IF Alignment

Refer to Figure 7 (fold-out from Page 57) for the following steps:



NOTE: Do not plug this Monitor into a power source until you are instructed to do so.

- () Set the front panel controls as follows:
 SQUELCH: Clockwise.
 AUDIO: Counterclockwise to OFF.
 Pushbuttons 0-7: 0-button depressed; all others out.
 MANUAL-AUTO: AUTO.

WARNING: AC line voltage is present at various places (see "High Voltage Areas," Pictorial 4-6 on the fold-out from Page 44) in this unit whenever the line cord is plugged in. Be careful to avoid an electrical shock whenever this Monitor is plugged in.



- () Plug the AC line cord into a 120-volt AC wall receptacle. Do not plug in an antenna at this time.
- () Turn the monitor speaker-side-up.
- () Attach one of the alligator clips to each lead of resistor R200 to short across the resistor.
- () Turn the Power switch to the ON position.
- () Turn the SQUELCH control and the AUDIO control until you hear a noise in the speaker. Then turn the AUDIO control to a comfortable listening level.
- () Place the short end of the alignment tool in the slug of T202.
- () Adjust transformer T202 for a maximum noise from the speaker. When a peak is obtained, turn the alignment tool 1/2-turn clockwise. Then turn the AUDIO control counterclockwise to its OFF position.
- () Remove the alligator clip jumper from R200. Final adjustment of T202 will be made later.
- () Turn the Monitor speaker-side-down.
- () Turn the Monitor back on by turning the AUDIO control clockwise.
- () Turn the SQUELCH control until the audible sound disappears.
- () Place the MANUAL-AUTO slide switch in the MANUAL position.

This completes the "IF Alignment."

NOTE: When a station is being received or the Alignment Generator is connected, the following procedure must be followed to sequence the Monitor to another channel.

1. Push in the pushbutton that corresponds to the received channel.
2. Turn the SQUELCH control counterclockwise until the background noise disappears.
3. Sequence the Monitor to the desired channel by pressing the SELECT switch.
4. Return the depressed pushbutton to its out position.
5. Advance the SQUELCH control clockwise until the background noise is heard.

Oscillator Adjustments

- () Be sure the 0-channel pushbutton is in, and the remaining pushbuttons are out.
- () Manually sequence the Monitor to channel 7.
- () Make sure the green wire is on the OPTION pin.
- () Connect the female connector of the brown test lead to the GRN connector pin. Place the other end of this wire into the TP wire connector as shown in Figure 7.
- () Be sure the SQUELCH control is turned so the audible sound just disappears.

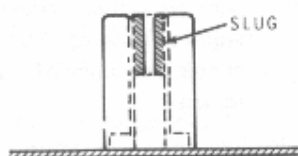


Figure 8

- () With the alignment tool, turn the slug in coil L107 counterclockwise until the top of the slug is level with the top of the housing, as shown in Figure 8.
- () While you watch the indicator light, turn the slug of coil L107 slowly clockwise until the indicator goes out, and then comes back on again. Stop. Then turn the slug counterclockwise until the light just goes out. Continue turning 1/8 turn and then remove the alignment tool from L107.
- () Remove the brown test lead.
- () Decide whether you want the indicator to light at all times, or only when a station transmits and is heard. To have the indicator illuminated at all times, place the green lead on the OPTION pin on the scan circuit board. To have the indicator illuminated only when a signal is received, place the green lead on the GRN pin.
- () Adjust coils L108 and L109 three full turns counterclockwise. Final adjustment of these coils will be performed later.

RF Alignment

- () Turn the AUDIO control counterclockwise to its OFF position.
- () Refer to Figure 7 (Top View) and connect the Alignment Generator to the ANT socket on the rear of your Monitor. Then connect the red wire to connector pin ORG and the coaxial cable to the case of transistor Q114. NOTE: Do not disconnect the orange wire from the ORG pin.

The coils in this Monitor were adjusted at the factory for a range of operating frequencies between 146 and 154 MHz, with a center frequency of 150.5 MHz. If your "center frequency" is at this same frequency, or within the 146 and 154 MHz range, disregard the next step. The "center frequency" of the crystals you have selected (including the priority channel crystal not installed yet) can be found by using the following example:

162.55 MHz	High crystal frequency.
<u>-155.37 MHz</u>	Subtract low crystal frequency.
2 7.18 MHz	Divide result by 2.
3.59 MHz	
<u>+155.37 MHz</u>	Add low crystal frequency.
158.96 MHz	
<u>-150.5 MHz</u>	Subtract this center frequency.
8.46 MHz	Amount center frequency must be adjusted upward to be at new center frequency of crystals selected.

- () Tune the following coils to adjust your center frequency upward. Turn all five coils approximately 1/4-turn clockwise for each 5 MHz you want to adjust the center frequency upward. Be sure to turn all the coils the same amount. NOTE: For the above example, you would turn all five coils approximately 3/8-turn clockwise.

L101 L104
L102 L105
L103

- () Turn the AUDIO control clockwise to its ON position.
- () Manually sequence the Monitor to the highest frequency channel. Be sure that channel's pushbutton is out and all others are in.

NOTES:

- Maximum quieting is indicated by minimum hiss from the speaker. As you perform the following steps, keep the Alignment Generator control adjusted so the Monitor starts to quiet (hiss level starts to diminish), but not so the Monitor is completely quiet. The proper setting is when a slight amount of hiss and crackling is heard. There will be no tone heard as there is no modulating signal.
- If it is difficult to hear a null in the noise, connect an AC voltmeter (that can read 0.5 VAC) across the speaker terminals. (Turn up the audio to increase the reading or turn up the Alignment Generator to decrease the reading.) Adjust for maximum quieting or minimum AC voltage across the speaker.
- Coils L108 and L109 tune very broadly. Find the center of the point where the noise just begins to peak as follows:

Using the alignment tool with the flag, turn the coil slug clockwise until the noise begins; note the position of the flag. Then turn the slug counterclockwise until the noise begins again; note the position of the flag. Then turn the slug clockwise to a point halfway between the previously noted positions of the flag.

- The following adjustments are critical. Follow them exactly.
 - () Adjust coils L101, L103, L105, and L109 for maximum quieting.
 - () Push in the highest frequency channel's pushbutton and release the lowest frequency channel's pushbutton.
 - () Manually sequence the Monitor to the lowest frequency channel.
 - () Adjust coils L102, L104, and L108 for maximum quieting. Make sure the SQUELCH control is fully clockwise.
- Repeat steps 1 through 4 until maximum quieting is obtained and little or no coil adjustment is needed when going from the high to the low channel.
- Turn the Alignment Generator control to full counterclockwise and the Audio control to full clockwise. Reperform steps 1 through 4 and decrease the Alignment Generator control, while you adjust the coils for maximum quieting.

This completes the "RF Alignment."

- () Turn the AUDIO control counterclockwise to the OFF position.
- () Disconnect the Alignment Generator from the Monitor and set the Generator aside.
- () Connect the antenna you prepared earlier, or an outside VHF antenna if available, to the ANT socket on the rear of the Monitor.
- () Turn the Monitor upside down.
- () Turn the AUDIO control clockwise to the ON position.
- () Manually select a channel that has a lot of activity and readjust coil T202, no more than one turn in either direction, for the best audio from the station heard. NOTE: If a VTVM is available, adjust coil T202 for maximum as in "Alignment with Instruments" on Page 55, right column, third step.

This completes the "Alignment Without Instruments."

NOTE: If you have selected a crystal for a priority channel, one that will exclude all others when that station transmits, install the crystal for that station in the following step.

- () Install the priority channel crystal in crystal pins Y100. This station will now be heard every time it transmits, unless the "0" pushbutton is depressed to exclude that channel.
- () Disconnect the Alignment Generator from the ANT socket and set it aside.
- () Disconnect the AC line cord.

This completes the "Tests and Adjustments." Proceed with the "Final Assembly."

ALIGNMENT WITH INSTRUMENTS

NOTE: In order to perform the following alignment steps, you should have these test instruments: An 11-megohm VTVM, or equivalent; an FM signal generator capable of covering the desired frequencies to be monitored, 10.7 MHz and modulated by a 5 kHz FM signal; and an AC VTVM.

IF Alignment

Refer to Figure 7 (fold-out from Page 57) for the following steps.

NOTE: Do not plug this Monitor into a power source until you are instructed to do so.

- () Set the front panel controls as follows:

SQUELCH: Clockwise.

AUDIO: Counterclockwise to OFF.

Pushbuttons 0-7: 0-button depressed; all others out.

MANUAL-AUTO: AUTO.

WARNING: AC line voltage is present at various places (see "High Voltage Areas," Pictorial 4-6 on the fold-out from Page 44) in this unit whenever the line cord is plugged in. Be careful to avoid an electrical shock whenever this Monitor is plugged in.

- () Plug the AC line cord into a 120-volt AC wall receptacle. Do not plug in an antenna at this time.
- () Connect the alligator clip jumper to each lead of resistor R200 as shown in Figure 7.
- () Turn the Power switch to the ON position.

- () Set the controls to the following positions:

Squelch control: Fully clockwise.

Audio control: To a comfortable listening level.

- () Adjust transformer T202 for maximum noise from the speaker. If measured, the DC voltage at pin 1 of IC202 should read half the indicated voltage on pin 13 of IC202.
- () Turn the AUDIO control counterclockwise to its OFF position.
- () Remove the alligator test clip assembly from resistor R200.
- () Turn the Monitor back on by turning the AUDIO control clockwise.

This completes the "IF Alignment."

Oscillator Alignment

- () Adjust the slug in coil L107 so it is level with the top of the coil form.
- () Connect the leads of an 11-megohm input VTVM, or equivalent, to chassis ground and to connector pin TP near coil L108.
- () Place the MANUAL-AUTO switch to MANUAL; then sequence the Monitor to the channel having the highest frequency crystal. Be sure the pushbutton for that channel is out.
- () Adjust coil L107 clockwise until a peak voltage is seen on the VTVM. Continue turning the slug until the voltage drops to zero. Now turn the slug counterclockwise until a voltage just reappears on the VTVM. Stop at this point; it will not be necessary to make this adjustment again, unless another crystal is installed in the Monitor whose frequency is higher than the highest channel crystal.

This completes the Oscillator Alignment.

RF Alignment

- () Connect the leads of an FM signal generator to the antenna of the Monitor. Set the output frequency of the signal generator to the frequency of the highest crystal in the Monitor. Turn the unmodulated output of the signal generator to zero.

NOTE: As you proceed with the following steps, frequently check the output frequency of your signal generator.

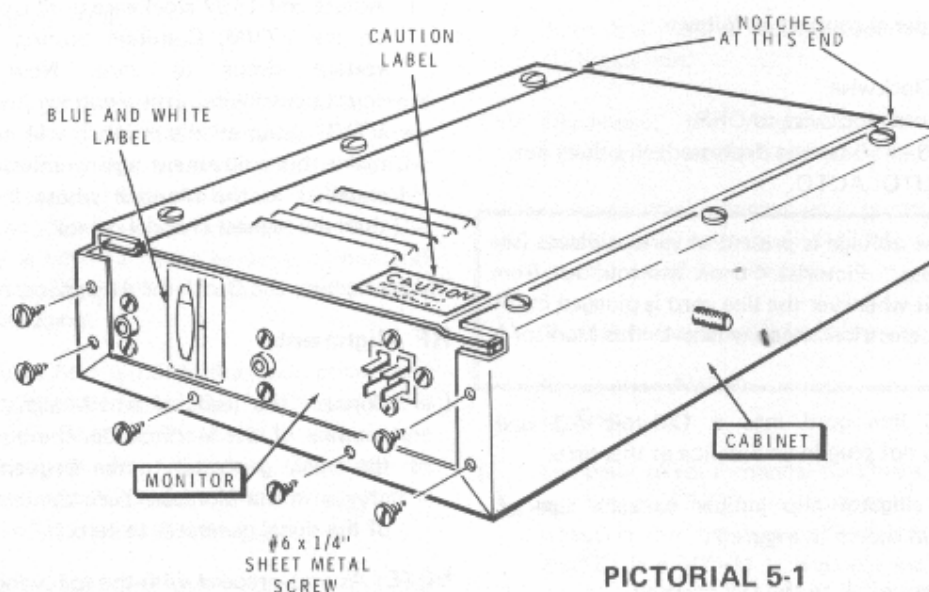
- () Connect the leads of an AC VTVM to the lugs of the speaker.
- () Adjust the Audio control for 1.5 volts on the AC VTVM.
- () Turn the signal generator output up to produce a minimum of noise, or a minimum voltage level at the Monitor output.
- () Adjust coils L108 and L109 for a minimum reading on the AC VTVM (minimum noise).
- () Adjust coils L101, L103, and L105 for a minimum reading on the AC VTVM. NOTE: If the adjustment on coil L105 is very broad, first detune L103 slightly and tune coil L105 for a minimum reading. Then retune coil L103 for a minimum reading.
- () Set the signal generator to the frequency of the lowest crystal installed in the Monitor. The output level should remain at .5 to 1 microvolt.
- () Sequence the Monitor to the channel with the lowest frequency crystal.
- () Adjust coils L102 and L104 for a minimum reading on the AC VTVM.
- () Adjust coil L101 (no more than 1/4 turn in either direction) for a minimum reading of the AC VTVM.
- () Once again, sequence the Monitor to the highest-frequency channel. Tune the signal generator to that frequency.
- () Adjust coils L103 and L105 for a minimum reading on the AC VTVM.
- () Alternately repeat the low and then the high frequency adjustments until the AC VTVM readings are the same.

This completes the "Alignment with Instruments."

NOTE: If you have selected a crystal for a priority channel, one that will exclude all others when that station transmits, install the crystal for that station in the following step.

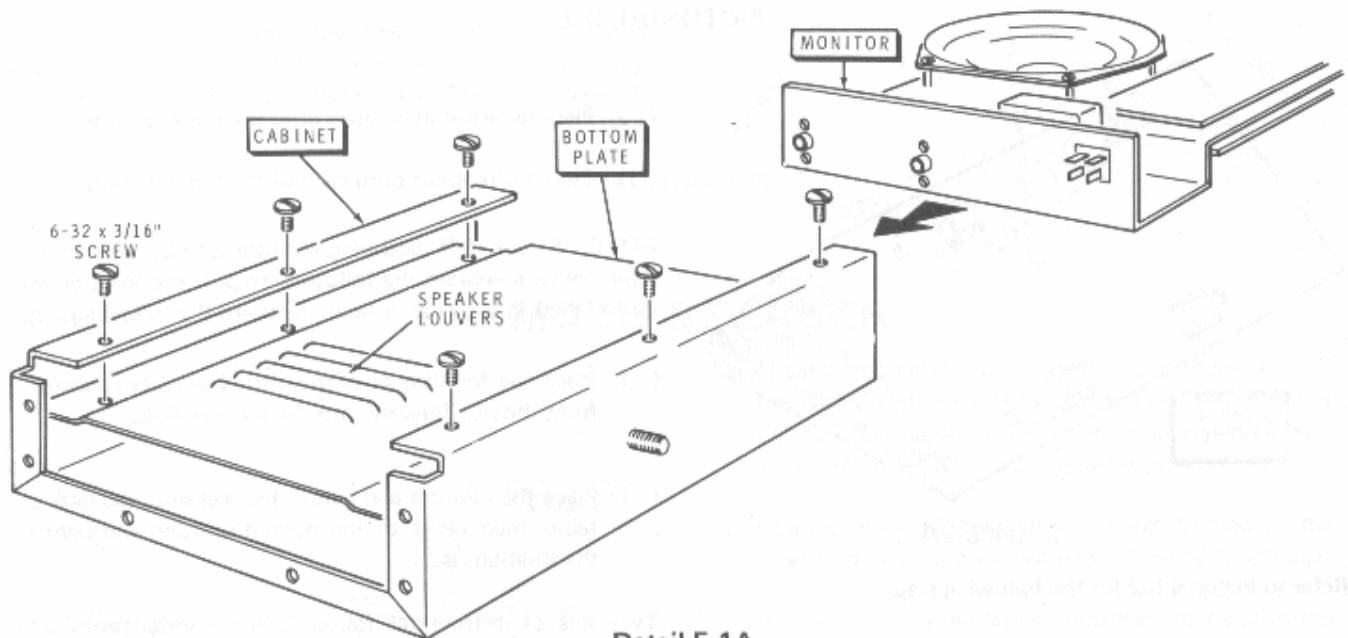
- () Install the priority channel crystal in crystal pins Y100. This station will now be heard every time it transmits, unless the "0" pushbutton is depressed to exclude that channel.
- () Disconnect the antenna from the ANT socket and set it aside.
- () Disconnect the AC line cord.

This completes the "Tests and Alignment." Proceed with the "Final Assembly."



PICTORIAL 5-1

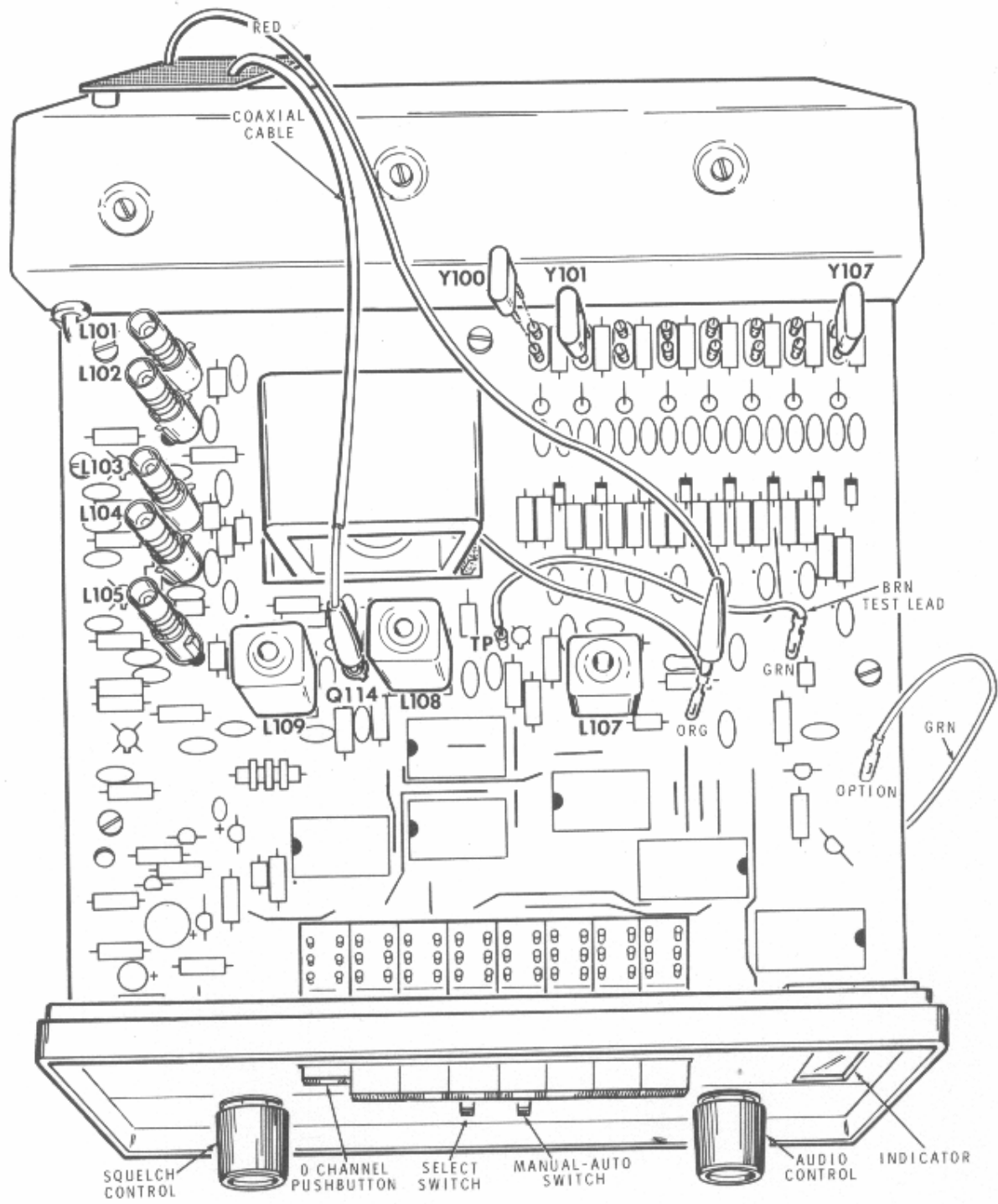
FINAL ASSEMBLY



Detail 5-1A

Refer to Pictorial 5-1 for the following steps.

- () Refer to Detail 5-1A and slide the bottom plate into the cabinet. Be sure the speaker louvers are toward the left rear as shown. Loosely secure the bottom plate to the cabinet with six 6-32 x 3/16" screws.
- () Slide the Monitor into the cabinet. Then secure the cabinet to the chassis with six #6 x 1/4" sheet metal screws as shown in the Pictorial.
- () Tighten the six bottom plate screws.
- () Remove the paper backing from the blue and white identification label. Then press the label onto the rear of the chassis in the location shown. NOTE: The Model Number and Production Series Number of your kit are shown on this label. Refer to these numbers in any communications with the Heath Company.
- () Remove the paper backing from the CAUTION label. Then press the label onto the underside of the bottom plate near the power socket, as shown.



TOP VIEW

Figure 7

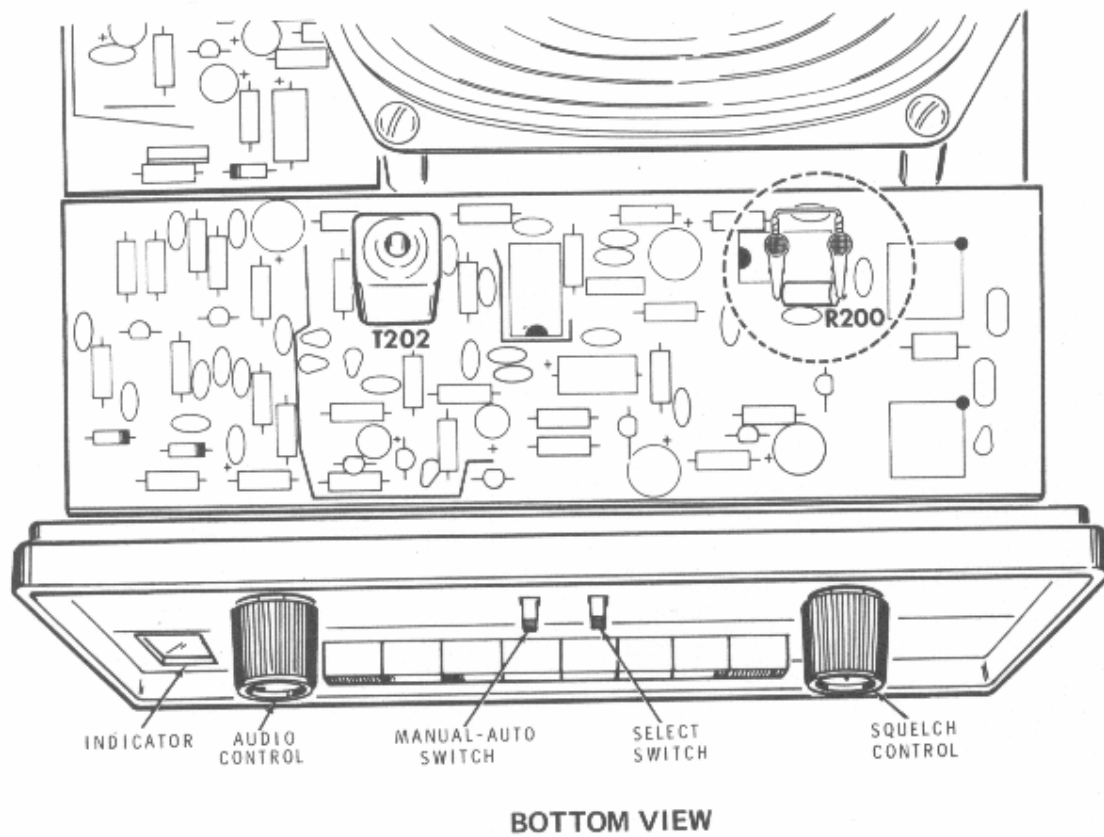
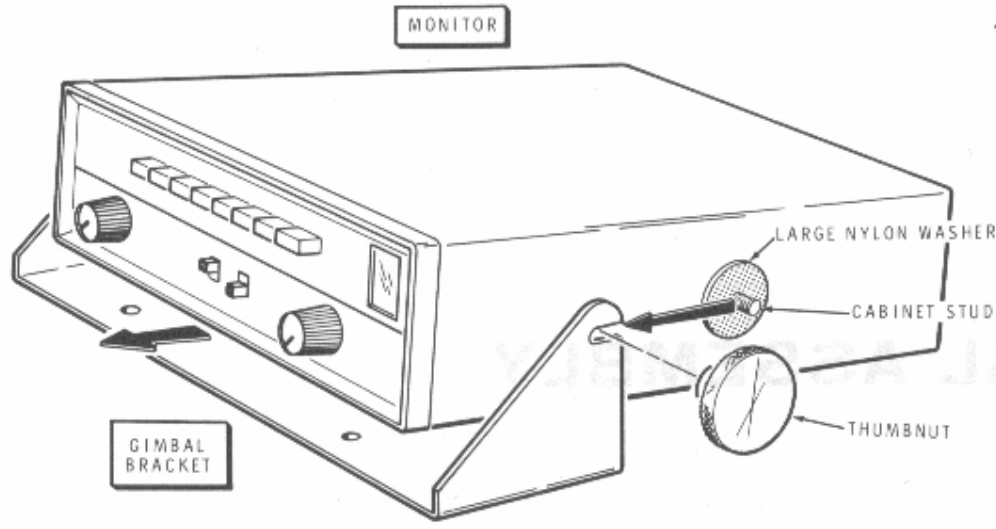
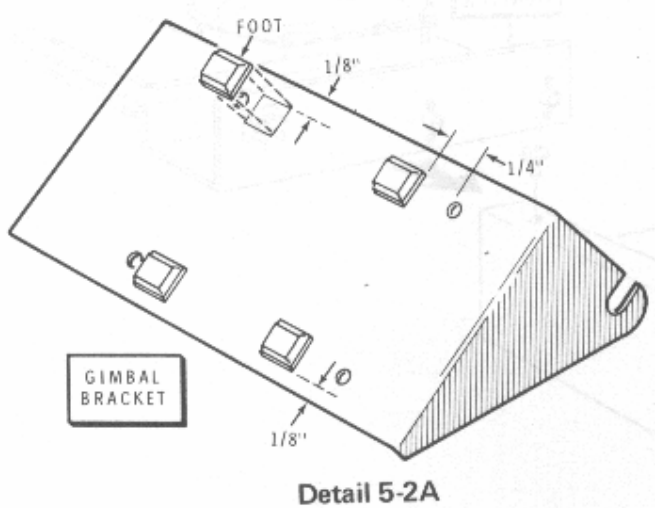


Figure 7



PICTORIAL 5-2



Detail 5-2A

Refer to Pictorial 5-2 for the following steps.

- () Refer to Detail 5-2A and turn the gimbal bracket upside down as shown. Then remove the paper backing from each of the feet and press them into place on the underside of the bracket as shown. Be sure to keep at least 1/4" distance between the sides of the feet and the screw holes.

- () Place large nylon washers onto the cabinet studs.
- () Start a thumbnut onto each of the cabinet studs.

NOTE: If your VHF Scanning Monitor is to be used only in your home, complete the following step. If the Monitor will be installed in your car or boat, disregard the following step.

- () Place the Monitor onto the gimbal bracket as shown, from the rear forward into the bracket slots.
- () Place the Monitor and gimbal bracket onto the desk or table; then tilt it to the desired position and tighten the thumbnuts.

Two sets of instructions follow: "Home Installation" and "Vehicle Installation." Use the instructions that will apply to you. If you intend to use your Monitor both in a vehicle and in your home (or office), perform the "Home Installation" steps first. Then disconnect the AC line cord and antenna, and remove the Monitor from the gimbal bracket, before you start the "Vehicle Installation" steps.

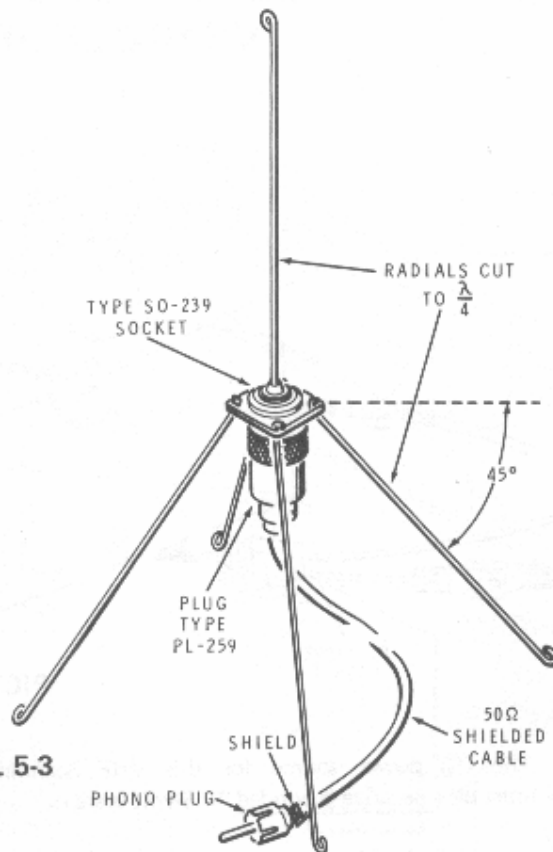
HOME INSTALLATION

- () Plug the AC line cord into the power socket on the rear panel.
- () Prepare an antenna for your VHF Scanning Monitor in one of the following three ways:



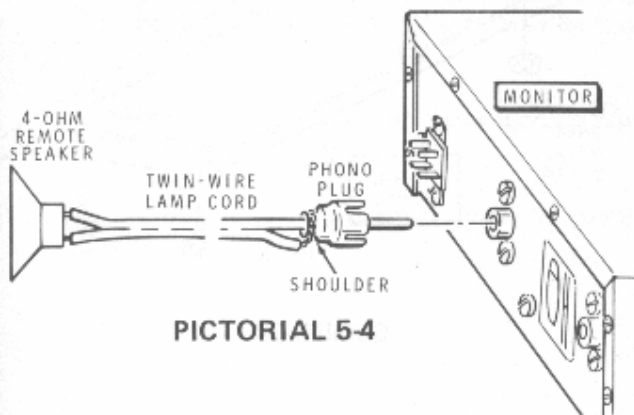
1. Use the wire antenna you built earlier.
 2. Refer to Pictorial 5-3 and construct a simple ground-plane antenna as shown. Cut each of the elements to correspond to the desired frequency (see the "Antenna Chart" on fold-out from Page 48). NOTE: Parts are not supplied in the kit for this assembly.
 3. Purchase one of the several types of commercial antennas that are available for use with your Monitor. If you purchase one of these antennas, follow the manufacturer's recommendations when you install it.
- () Plug the antenna lead (or the wire antenna) into the ANT socket on the rear of your Monitor.

This completes the "Home Installation." If you intend to install a remote speaker, refer to the step-by-step instructions. Otherwise, proceed to "Operation" on Page 63.



PICTORIAL 5-3

REMOTE SPEAKER



PICTORIAL 5-4

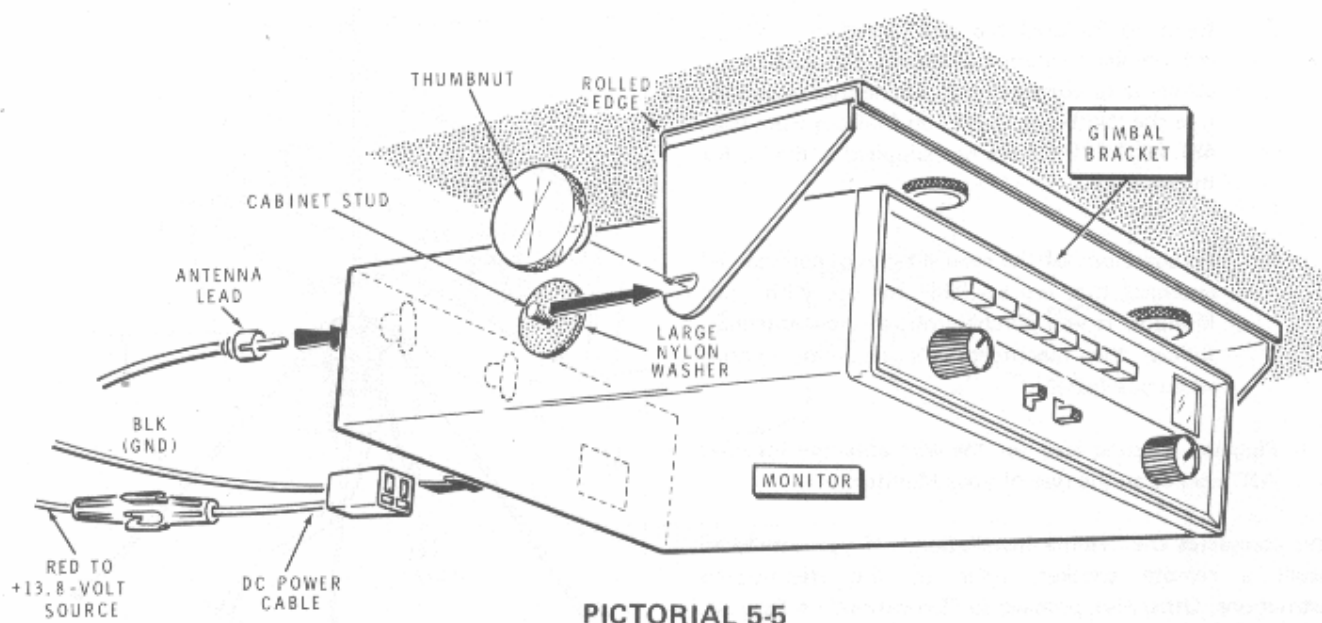
Refer to Pictorial 5-4 for the following steps.

If you wish to install a speaker at some distance from the usual Monitor location, obtain the necessary parts from a local electronic supply store. You will need a 4-ohm speaker and the necessary length of 2-conductor wire (standard twin-wire lamp cord will do). You may use either the second phono plug supplied with your kit or, if necessary, purchase another phono plug. Use twin-wire lamp cord for the following steps.

- () Prepare one end of the lamp cord by removing 1/4" of insulation from each of the wires. Twist the wire ends tightly. Then apply a small amount of solder to each wire end to hold the small strands together.
- () Connect each of the prepared wires to one of the speaker lugs as shown. Solder both wires to the lugs.
- () Remove 3/4" of insulation from the other end of the twin-wire lamp cord. Twist the wire ends and apply a small amount of solder to hold the small strands together.
- () Push one wire end into the phono socket. Hold the soldering iron to the tip of the phono plug and flow a small amount of solder into the opening in the tip.
- () Wrap the remaining wire end around the shoulder of the phono plug and solder it in place.
- () Place the remote speaker in the desired location and run the speaker wires to the Monitor. Plug the phono plug into the SPKR socket on the rear panel.

This completes the installation of the remote speaker.

VEHICLE INSTALLATION



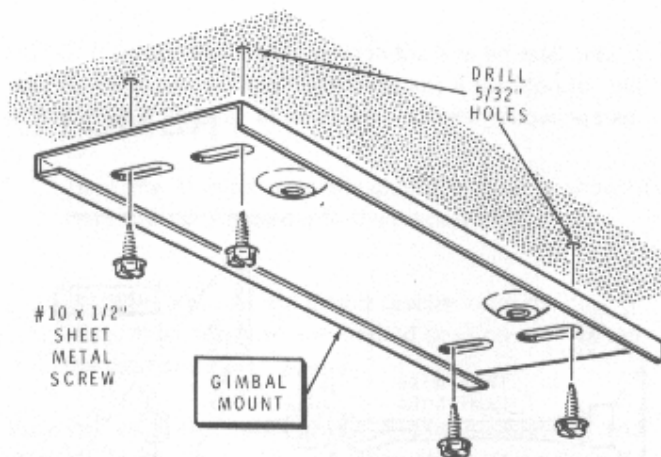
PICTORIAL 5-5

NOTE: The DC power source for this VHF Scanning Monitor must be a negative-grounded 13.8-volt system.

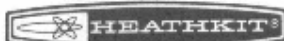
Before you install the Monitor in your vehicle, check your state and local government regulations on the use of this Monitor to monitor official frequencies.

Refer to Pictorial 5-5 for the following steps.

- () Select a suitable location for this unit in your vehicle (for instance, under the instrument panel). Then locate a positive 13.8-volt source, such as a terminal post on the rear of the ignition switch or a lug in the vehicle fuseholder assembly.
- () Connect the red lead of the DC socket assembly to the 13.8-volt source.
- () Connect the ground (black) lead of the DC socket assembly to a suitable location on the chassis of the vehicle.



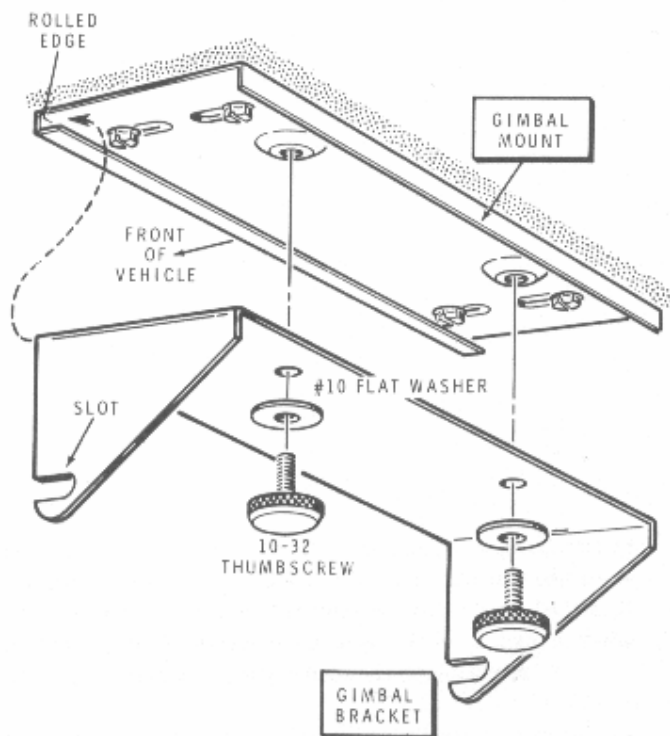
Detail 5-5A



- () Refer to Detail 5-5A and position the gimbal mount in the location chosen. Mark the locations of the four mounting holes to be drilled in the panel.
- () Drill four 5/32" holes for the gimbal mount.
- () Position the gimbal mount on the vehicle so the rolled edge is toward the front of the vehicle as shown in the Pictorial.
- () Install the gimbal mount with four #10 x 1/2" sheet metal screws.
- () Refer to Detail 5-5B and place the gimbal bracket into the gimbal mount with the slots in the bracket on the same side as the rolled edge of the mount. You will have to tilt the gimbal bracket slightly because of the feet on the bracket.
- () Secure the gimbal bracket to the gimbal mount with two #10 flat washers and two 10-32 thumbscrews as shown.

NOTE: Before installing the Monitor in your vehicle, you may wish to purchase a suitable commercial antenna, or to install a "splitter" (two-set coupler) in your existing antenna lead. Follow the instructions for antenna installation on your vehicle supplied by the manufacturer. If you have an antenna that is imbedded in your windshield, you should use a separate antenna with the VHF Scanning Monitor for best results.

- () Plug the antenna lead into the ANT socket on the rear panel.
- () Plug the DC power cable assembly into the power socket on the rear panel.



Detail 5-5B

- () Place the cabinet studs into the gimbal bracket slots. Pull the Monitor toward you slightly; then tighten the thumbnuts securely. Be sure the large nylon washers are between the cabinet and the gimbal bracket.

This completes the "Vehicle Installation." Proceed to "Operation" on Page 63.

[The following text is extremely faint and illegible due to low contrast and scan quality. It appears to be a technical manual page containing multiple paragraphs of text.]

OPERATION

Refer to Figure 1 (fold-out from Page 48) for a brief description of how to operate each of the controls.

AUTOMATIC SCAN

Learn the automatic operation of your VHF Scanning Monitor by performing the following steps. After you get familiar with the Monitor, you will be able to change the sequence of these steps to suit your individual needs.

NOTE: Perform the following steps while no station signal is being received.

1. Place the MANUAL/AUTO switch in the AUTO position.
2. Be sure all of the PUSHBUTTONS are in the out position.
3. Set the SQUELCH control fully clockwise.
4. Set the AUDIO control for a comfortable listening level.
5. Adjust the SQUELCH control counterclockwise until the audible sound just disappears. The front panel controls are now adjusted and Monitor is ready for normal operation.

The Display Indicator will show the channel numbers. If you connected the green wire to the "OPTION" pin (in the "Adjustments," Page 52), the Indicator will show the

number of each channel as it is scanned. If you connected this green wire to the "GRN" pin, the Indicator will show only the number of a station that is transmitting. NOTE: If the Display Indicator seems to be erratic in its scan, turn the SQUELCH control slightly more counterclockwise.

The Monitor will continue to sweep all the frequencies for which you have crystals. It will automatically stop on any one of them as soon as it receives a signal. The Monitor will remain locked on that signal as it is being received. As soon as the signal stops, and after a slight delay, the Monitor will again begin to scan all the available frequencies. The delay is so replies on the same frequency may be heard.

If the Monitor receives a signal on Channel 0 (the priority channel) at any time, it will immediately lock onto that signal until the transmission stops. The scan circuit will then return to a normal search operation. If the priority signal overrides a regular channel, the scan circuit will return to that channel, pause, and then resume scanning from that point.

If, while you are listening to a signal, you wish to hold that channel for a period of time, place the MANUAL/AUTO switch in the MANUAL (up) position. The Monitor is then locked onto that channel until the switch is returned to the AUTO position. It will only change stations when a priority signal is detected or when the Monitor is manually sequenced from the chosen channel. The Monitor must be squelched when manually sequencing. If a station has halted scan sequencing, it must be locked out with its associated pushbutton before you resume manual selection.

If you wish to pass over any specific channel at any time, you can "lock it out" by depressing the appropriate pushbutton. The scan circuit will then pass over the "locked out" frequency until the pushbutton is released.

MANUAL MODE

To operate your VHF Scanning Monitor in the Manual mode, place the MANUAL/AUTO switch in the MANUAL position. Then set the remaining controls as described in steps 2 through 5 under "Automatic Scan."

To select a specific channel, operate the spring-loaded SELECT switch until you have sequenced the Monitor to the desired channel. Note that occasionally a channel may be skipped. Be sure the unit is properly squelched.

If a priority signal (Channel 0) overrides the manually-selected channel, the scan circuit will automatically return to the manually-selected channel when the priority signal is ended. The circuit will remain locked to that channel until the Monitor is again manually sequenced to another channel. You can "lock out" any channel by depressing the pushbutton for that channel.

To return to automatic scanning, place the MANUAL/AUTO switch in the AUTO position.

OPERATION

AUTOMATIC SCAN

Place the MANUAL/AUTO switch in the AUTO position. Then set the remaining controls as described in steps 2 through 5 under "Automatic Scan."

NOTE: To return to the following state while in the AUTO position, push the MANUAL/AUTO switch.

1. Place the MANUAL/AUTO switch in the AUTO position.

2. Push all of the PUSHBUTTONS on to the out position.

3. Set the SQUELCH control knob clockwise.

4. Set the AUDIO control for a comfortable listening level.

5. Adjust the SQUELCH control knob until you hear the audible sound first disappear. The front panel controls are now adjusted and Monitor is ready for normal operation.

The Digital Indicator will show the channel number. If you connected the green wire to the "OFFLOW" pin on the Adjustment Panel (A), the indicator will show the

number of each channel as it is received. If you connected the green wire to the "ORBIT" pin, the indicator will show only the number of a station that is received. The Digital Indicator will be zeroed out when the SQUELCH control tightly locks out the channel.

The Monitor will continue to search for the programmed channels until you have operated it. It will automatically stop when one of them is heard as it receives a signal. The channel will remain locked on that signal as it is being received. As the signal strength fades, a slight delay will occur before the Monitor again begins to scan. All the available frequencies will be scanned in order of their frequency until a program

If the Monitor receives a signal on Channel 0 (Priority Channel) at any time, it will immediately scan that channel until the transmission ends. The next channel will then return to a normal search operation. If the channel search overrides a signal channel, the scan circuit will return to that channel, pause, and then resume scanning until the next

If, while you are listening to a signal, you wish to scan the channel for a period of time, place the MANUAL/AUTO switch in the MANUAL position. The Monitor will be locked into that channel until the switch is returned to the AUTO position. It will only change to the next available signal is detected or when the Monitor's receiver is sequenced from the chosen channel. The Monitor will be sequenced when manually sequenced. If a station has been sequenced, it must be locked out with its respective pushbutton before you resume normal scanning.

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 77 for the physical location of parts on the circuit board.

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 that they are soldered as described in the "Soldering" section of the "Kit Builders Guide." Be sure there are no solder bridges.
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.
4. Check that each of the IC's are properly installed in their sockets, and the pins are not bent out or under the IC. Also be sure the IC's are installed in their correct positions.
5. 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 k Ω (red-red-orange) resistor where a 3300 Ω (orange-orange-red) resistor should have been installed.
6. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.
7. Look between each circuit board and the chassis to be sure all leads have been cut off.
8. 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 Schematic Diagram (fold-out from Page 85). Read the "Precautions for Troubleshooting" before making any measurements. NOTE: All voltage readings were taken with a high impedance voltmeter. Voltages may vary as much as $\pm 20\%$.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Service" section of the "Kit Builders Guide" and to the "Factory Repair Service" information on Page 72 of this Manual. Your Warranty is located inside the front cover of the Manual.

PRECAUTIONS FOR TROUBLESHOOTING

1. Be cautious when testing IC and transistor circuits. Although they have almost unlimited life when used properly, they are much more vulnerable to damage from 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 IC's, transistors, or diodes.

TROUBLESHOOTING CHARTS

The following chart lists the "Condition" and the "Possible Cause" of a large number of malfunctions. If a particular part or parts are mentioned (transistor Q111, for example, or resistor R206) 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: If an IC is suggested as a problem area, additional charts are listed on Pages 68 through 71 to enable you to thoroughly check the scan circuit IC's.

CONDITION	POSSIBLE CAUSE
No sound, no visible sign of operation.	<ol style="list-style-type: none"> 1. Fuse F1 if you are using 120 VAC. 2. Fuse in 12 VDC supply. 3. Power plug or socket; check for wiring errors. 4. Power switch S-1; check for wiring errors. 5. Speaker or speaker jack.
No sound, Display Indicator appears to scan properly.	<ol style="list-style-type: none"> 1. Audio and squelch (shielded) cables incorrectly connected. 2. Squelch control incorrectly wired. 3. External SPKR jack incorrectly wired. 4. Spare phono plug left plugged into SPKR jack. 5. No B+ voltage to audio circuit board. Check "+12" pin (red lead) with VTVM.
No hum from audio amplifier. (NOTE: Lift the white wire from the audio circuit board connector. Then touch the WHT pin on the circuit board with a screwdriver blade. If you hear a loud hum, the audio amplifier section is OK.)	<ol style="list-style-type: none"> 1. Faulty connection or component on audio circuit board.
No hum heard when you touch pin 14 of IC202.	<ol style="list-style-type: none"> 1. IC202. 2. Transistor Q201.
No hum when you touch pin 4 of IC202.	<ol style="list-style-type: none"> 1. IC202 incorrectly installed. 2. Solder bridge on foil leads to IC202. 3. Incorrect IC installed at IC202. 4. Defective. IC202.

CONDITION.	POSSIBLE CAUSE
Audible distortion.	<ol style="list-style-type: none"> 1. Crystal defective. 2. Crystal filter misaligned. 3. Defective quadrature coil.
No hum when you touch pin 4 of IC201.	<ol style="list-style-type: none"> 1. IC201 incorrectly installed. 2. Incorrect IC installed at IC201. 3. Solder bridged on foil leads to IC201. 4. Defective IC201.
Low Sensitivity.	<ol style="list-style-type: none"> 1. Incorrect voltages at S (source) leads of Q101, Q102, or Q103; check each for correct installation. 2. RF coils L101-L105 interchanged, incorrectly installed, or misaligned.
Crystal oscillator not working (less than 1 VDC on scan circuit board TP. Correct pushbutton <u>out</u>).	<ol style="list-style-type: none"> 1. Defective crystal. 2. 8-wire cable incorrectly installed. 3. L107 and L109 interchanged. 4. Diode associated with selected channel. 5. Solder bridge in circuit. 6. IC105. 7. Pushbutton switch.
Monitor does not scan automatically.	<ol style="list-style-type: none"> 1. SQUELCH control not properly set. 2. Incorrect voltage at pin A on IF circuit board (+2 VDC or greater on collector of transistor Q205).
No +5 VDC at ORG wire connection on scan circuit board.	<ol style="list-style-type: none"> 1. Jumper wire on audio circuit board in wrong place or missing. 2. Regulator transistor Q308. 3. Regulator diode D303. 4. IC's incorrectly installed. 5. Transistors Q108, Q109, Q110, or Q111. 6. Solder bridges across scan circuit IC's.

CONDITION	POSSIBLE CAUSE
One or more Display Indicator segments not lighting. (Check by manually scanning through all channels.)	<ol style="list-style-type: none"> 1. Less than +4 VDC at IC106 pin 16. 2. Defective Display Indicator. This can be determined by, one at a time, grounding each jumper wire between the indicator circuit board and the scan circuit board except the power source. Each segment should light as its jumper is grounded. 3. Open foil leads or solder bridges at IC's on scan circuit board.
Unit scans but will not lock on transmitting station.	<ol style="list-style-type: none"> 1. Associated crystal pushbutton is <u>in</u> (locking out reception). 2. Interchanged black and yellow wires on scan circuit board. 3. Incorrect wiring to Manual/Auto switch. 4. Transistor Q111. 5. Defective crystal.

SCAN CIRCUIT IC CHARTS

The following charts show the correct readings on each IC pin under certain conditions. To properly use the charts, some preliminary instructions are necessary:

1. Place the green wire on the scan circuit board OPTION pin.
2. Place the female end of the brown test wire on the scan circuit board GRN pin.
3. Place the MANUAL/AUTO switch in the MANUAL position.
4. Manually scan to the desired channel, 0 through 7.
5. Check the pins on the IC with the end of the test wire. The key for the chart is as follows:

0 = a segment or segments of the indicator are illuminated.

5 = any illuminated segment or segments of the Display Indicator will go out.

⊗ = a segment or segments of the Display Indicator are illuminated when the MANUAL switch is activated.

NOTE: If you do not obtain the correct indication in any of the following tests, proceed as follows:

1. Apply the "Visual Tests" to the IC where you get the incorrect indication.
2. Also apply the "Visual Tests" at the other end (or ends) of any foil that connects to that IC.
3. If you have an electronic background, locate the point on the Schematic where you get the wrong indication. Then read the "Circuit Description" and apply appropriate troubleshooting techniques in that area.

If you use a VTVM to measure the voltages at these integrated circuit pins, the voltage values will be as follows:

- 0 = 0 volts DC.
- 5 = +5 volts DC.

When the tests are completed, disconnect the brown test wire from the GRN pin.

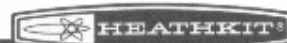
NOTE: In the "DO NOT CHECK" areas on these charts, no significant readings will be obtained.

IC101

CHAN- NEL	IC PIN															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	DO NOT CHECK	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
1		0	0	0	0	5	0	0	0	0	0	0	5	0	0	0
2		0	0	0	0	5	0	0	0	5	0	0	0	0	0	0
3		0	0	0	0	5	0	0	0	5	0	0	5	0	0	0
4		0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
5		0	0	0	0	5	0	0	0	0	0	0	5	0	0	0
6		0	0	0	0	5	0	0	0	5	0	0	0	0	0	0
7		0	0	0	0	5	0	0	0	5	0	0	5	0	0	0

IC102

CHAN- NEL	IC PIN															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	0	5	0	5	5	5	5	5	0	5	5	5	5	5		
1	0	5	0	5	5	5	5	0	5	5	5	5	DO NOT CHECK			
2	0	5	5	5	5	0	5	5	0	5	5	5				
3	0	5	5	5	5	0	5	0	5	5	5	5				
4	0	5	0	5	5	5	5	5	0	5	5	5				
5	0	5	0	5	5	5	5	0	5	5	5	5				
6	0	5	5	5	5	0	5	5	0	5	5	5				
7	0	5	5	5	5	0	5	0	5	5	5	5				



FACTORY REPAIR SERVICE

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

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

If it is not convenient to deliver your kit to a Heathkit Electronic Center, please ship it to the factory at Benton Harbor, Michigan and observe the following shipping instructions:

Prepare a letter in duplicate, containing the following information:

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

Attach the envelope containing one copy of this letter directly to the unit before packaging, so that we do not overlook this important information. Send the second copy of the letter by separate mail to Heath Company, Attention: Service Department, Benton Harbor, Michigan 49022.

Check the equipment to see that all parts and screws are in place. Then, wrap the equipment in heavy paper. Place the equipment in a strong carton, and put at least THREE INCHES of resilient packing material (shredded paper, excelsior, etc.) on all sides, between the equipment and the carton. Seal the carton with gummed paper tape, and tie it with a strong cord. Ship it by prepaid express, United Parcel Service, or insured parcel post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

REPLACEMENT PARTS AND PRICE INFORMATION

To order Replacement Parts: Use the Parts Order Form furnished with this kit. If one is not available, see "Replacement Parts" in the "Kit Builders Guide."

The prices in the Parts Lists apply only on purchases from the Heath Company where shipment is to a U.S.A.

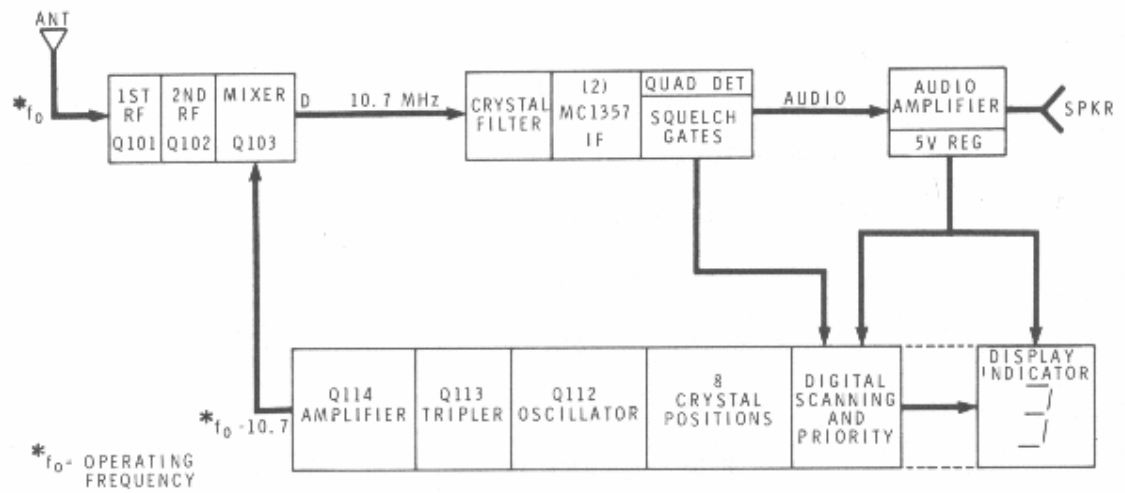
destination. Add 10% (minimum 25 cents) to the price when ordering from a Heathkit Electronic Center to cover local sales tax, postage, and handling. Outside the U.S.A., parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties, and rates of exchange.

SPECIFICATIONS

Frequency Range	146 to 174 MHz.
Scanning Range	Any 9 MHz segment of frequency range.
Sensitivity	Less than 1 μ V for 20 dB of quieting.
Usable Sensitivity	Less than 0.5 μ V.
Adjacent Channel Rejection	-40 dB (\pm 30 kHz spacing).
Intermediate Frequency (IF)	10.7 MHz, crystal filter.
IF Rejection	Greater than -80 dB.
Image Rejection	Greater than -40 dB.
Modulation Acceptance	\pm 7.5 kHz maximum.
Antenna Input Impedance	50 ohms.
Scan Rate	Approximately 17 channels per second.
Audio Output	2 watts into a 4-ohm load, with less than 10% distortion.
Solid-State Devices	30 transistors, 8 integrated circuits, 17 diodes.
Readout Device	3015A, 7-segment indicator tube.
Power Requirements	
Alternating Current	120 volts, 50/60 Hz; 13 watts.
Direct Current	13.8 volts. Squelched .275 amperes. Unsquelched with full audio, 0.8 amperes.
Overall Dimensions	8-1/4" wide x 3" high x 9-3/4" deep.
Net Weight	5-1/2 lbs.

The Heath Company reserves the right to discontinue instruments and to change specifications at any time

without incurring any obligation to incorporate new features in instruments previously sold.



BLOCK DIAGRAM

CIRCUIT DESCRIPTION

Refer to the "Schematic Diagram" (fold-out from Page 85) and to the "Block Diagram" (fold-out from Page 74) while reading 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:

- 0-99 Parts mounted on the chassis.
- 100-199 Parts mounted on the scan circuit board.
- 200-299 Parts mounted on the IF circuit board.
- 300-399 Parts mounted on the audio circuit board.

RF CIRCUIT

RF amplifier field-effect transistors (FET's) Q101 and Q102 amplify the incoming signal at the received frequency. Coils L101 through L105 are in tank circuits, tuned to the incoming signals.

The output from transistor Q102 is coupled to gate G_1 of mixer transistor Q103. Gate G_2 receives a signal from the crystal oscillator circuit that is 10.7 MHz lower in frequency than the incoming signal. The 10.7 MHz IF output of transistor Q103 is capacitively coupled through capacitor C3 to the input of the IF circuit.

IF CIRCUIT

The signal from the RF amplifier circuit is coupled through monolithic crystal filters Y201 and Y202. These filters and their matching coils, L201 and T201, help shape the filter bandpass, eliminating frequencies other than the 10.7 MHz IF.

After amplification through integrated circuit (IC) 201, the signal is again filtered by ceramic filter Y203. Here the IF signal bandpass is shaped to give more attenuation to out-of-band signals.

From Y203 the signal is coupled through limiting amplifier IC202. In addition to amplifying the IF signal, IC202 is also the demodulator, or quadrature detector. Coil T202 is part of the associated circuit of IC202 and forms a phase shift network for the quadrature detector.

The output at pin 1 of IC202 is routed into two paths. One path capacitively couples the audio signal to the base of preamplifier-squelch gate transistor Q201.

The second path of the amplified IF signal is routed through the squelch circuit. The purpose of this circuit is to cut off the receiver output when no signal is coming through the units circuits. After passing through Squelch control R2, the noise is amplified by transistors Q202 and Q203, rectified in a voltage doubler circuit, and then filtered. The resultant DC voltage is then amplified by transistor Q204, filtered, and then coupled to transistor Q205.

In Q205 the signal is once again amplified and inverted. The output of transistor Q205 operates transistor gate Q206, which in turn operates audio squelch-gate transistor Q201. Also, the output from transistor Q205 acts as a switch for the scanning circuits.

SCAN CIRCUITS

The squelch gate signal from transistor Q205 is coupled to the base of transistor Q111. This transistor acts as a control switch, starting and stopping the action of scan oscillator transistors Q108 and Q109. A delay is generated in the circuitry of transistor Q110. When a received signal stops, a delay of approximately 4 seconds duration begins. After this delay time, scan oscillator transistors Q108 and Q109 start to search for other signals being transmitted.

When a signal has the Monitor locked on any channel other than priority Channel "0," the priority oscillator will cause a pulsing noise in the audio signal. This occurs when the priority channel is being scanned for the presence of a signal.

Priority Oscillator Operation

When integrated circuit IC101 has stopped counting and is locked on a channel, the priority oscillator, consisting of transistors Q106 and Q107, will pulse an input of each gate in IC102 and IC103 to ground. This causes the outputs of three input nand gates to go "low." IC104 then inverts these signals to a "high" (Logic 1) and couples these signals to the inputs of IC105 and IC106. When all their inputs are "high," (Logic 1), an indication of "0" will be presented by decoder drivers IC105 and IC106.

This sequence occurs approximately every 4 seconds, and has a duration of 20 milliseconds. During this time the "0" Channel crystal oscillates. If a signal is detected, the scan circuit will lock on the transmitted signal by using the squelch voltage to trigger pin 4 of IC103, the input of a 3-input nand gate. A voltage is coupled from the "0" output through an inverter to produce a "high" on pin 4 of IC103. This insures that the Monitor will stay locked on the priority channel when a priority signal is detected.

Crystal Oscillator Operation

The crystal oscillator is basically a Colpitts oscillator with a 1/4-wave impedance transforming network in series with the crystal and the base of transistor Q112. The associated diodes form an RF path between the crystal and the transistor, and are normally biased "off." When a ground is placed at the series resistor by IC105, the associated diode will conduct and place the crystal in the circuit. Transistor Q113 is a frequency tripler. The output of coil L108 is rich in third harmonics, which are amplified by transistor Q114. This signal is then coupled to G₂ of mixer transistor Q103.

AUDIO AMPLIFIER

The audio signal from the IF circuit board is routed through a de-emphasis network, consisting of C302, C303, and R301. The purpose of this circuit is to filter high frequencies from the audio signal before they are heard in the speaker. The signal is fed to Audio control R1, which is adjusted to provide a comfortable listening level at the speaker.

From control R1, the signal is coupled to the base of transistor Q301, part of a differential amplifier. The differential amplifier also consists of transistor Q302 and common-emitter resistor R306. The result of this common connection is to combine the input and feedback signals.

The signal at the collector of Q301 is coupled to the base of constant-current voltage amplifier transistor Q303. From the emitter of Q303, the signal is coupled to the base of transistor Q304 and through diode D301 to the base of Q305. The constant voltage drop across diode D301 provides a bias voltage for the driver and output stages. This voltage is applied across the two base-to-emitter junctions that are connected in parallel with diode D302 and transistors Q304 and Q305 as shown in Figure 9 (fold-out from Page 74).

Resistor R308 drops the voltage enough to keep these three junction transistors biased ON at all times. Diode D302 limits the amount of voltage that will develop across R308, thereby limiting the amount of current developed in the output stages.

Driver transistors Q304 and Q305, and output transistors Q306 and Q307 form a quasi-complementary output circuit. In this circuit, a positive-going signal applied to the base of transistor Q304 causes the transistor to conduct. This, in turn, causes transistor Q306 to conduct, increasing the current flowing through the speaker voice coil. Negative-going signals cause Q305 and Q307 to conduct, decreasing the current through the speaker voice coil. This alternate increase and decrease of current through the speaker coil converts the electrical energy to audible signals.

Since the input and output signals are in phase, they tend to be coupled back to the input of the circuit. Resistor R316 and capacitor C308 at the output are for parasitic suppression and eliminate this feedback tendency.

POWER SUPPLY

The power supply consists of a dual-input power source. It provides for both a 13.8-volt DC or a 120-volt AC power source.

When a 13.8-volt DC source is used, the power is routed through On-Off switch S1 to the top of filter capacitor C1. From this point it is sent to all circuits requiring a B+ supply of 13.8 to 17.5 volts.

When a 120-volt AC power source is utilized, power is routed through On-Off switch S1, through fuse F1 to the primary winding of power transformer T1. T1 steps the voltage down to 17.5 volts AC in the secondary winding. Bridge rectifier diodes D1 through D4 convert this AC voltage to DC. It is then filtered by capacitor C1 and routed to the various B+ points on the circuit boards.

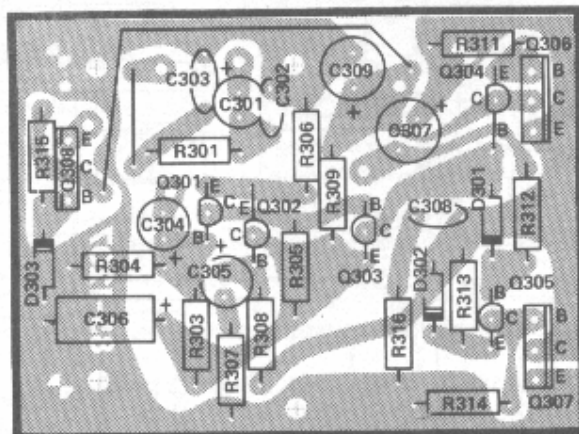
The 5-volt power for the scan circuits is regulated by transistor Q308 on the audio circuit board and its associated circuits.

The 13.8-volt power supply is regulated by the action of a regulator-capacitance multiplier on the IF circuit board, transistor Q207 and its associated components. The purpose of this regulator is mainly to keep the output of the IF circuits at a constant level.

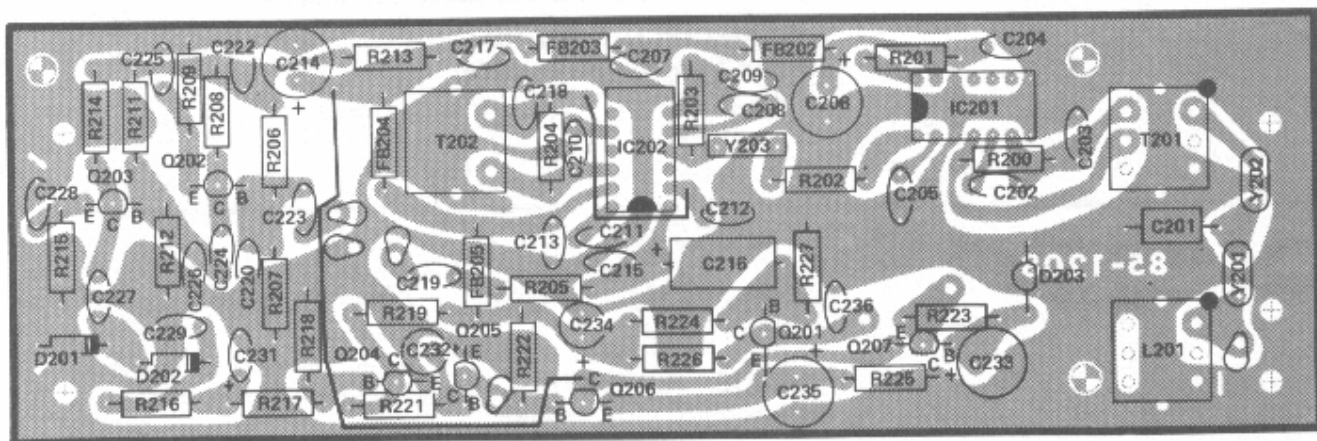
CIRCUIT BOARD X-RAY VIEWS

NOTE: To determine the value (22 k Ω , .01 μ F, etc.) of one of these parts, you may proceed to either of the following ways.

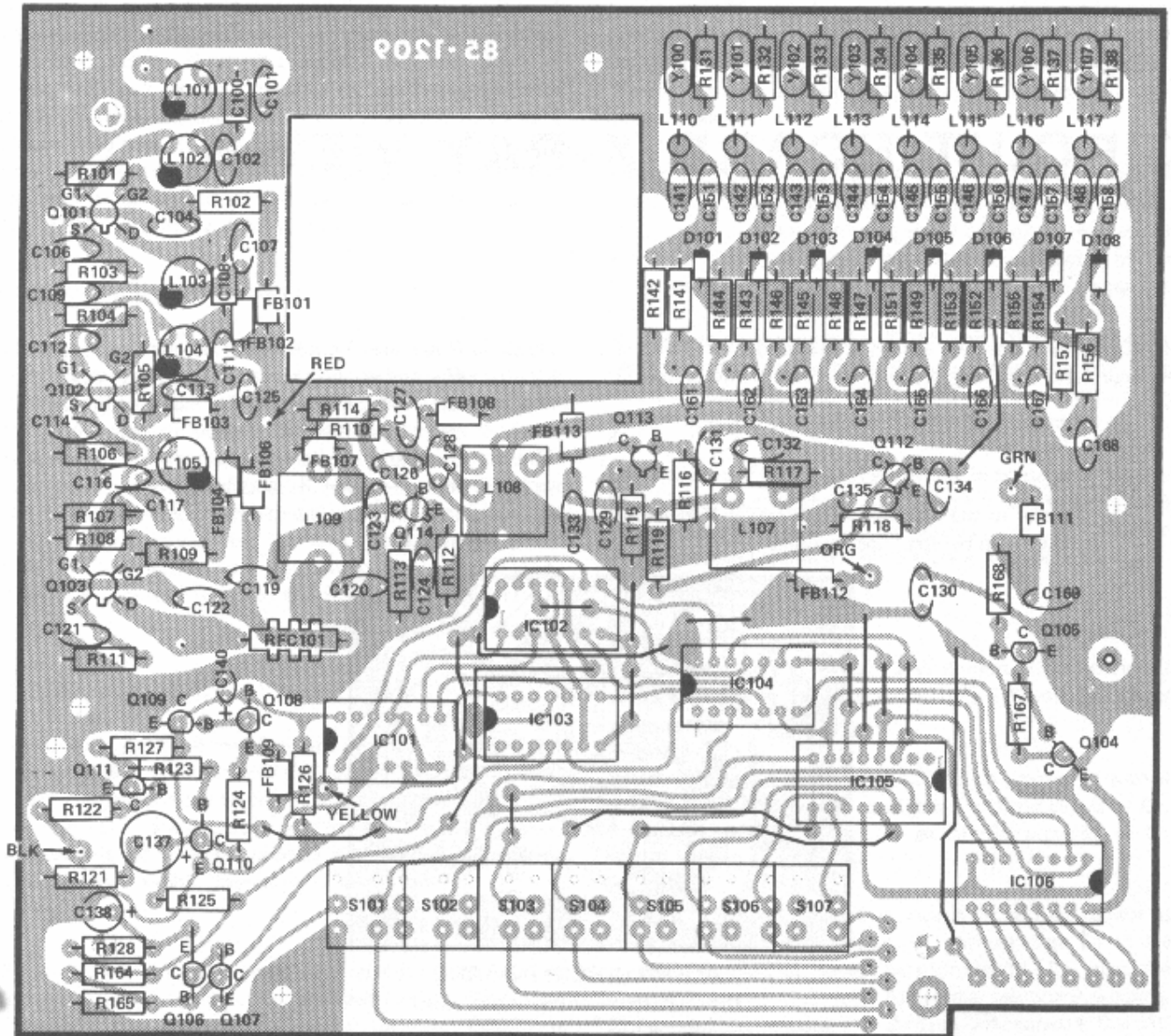
1. Refer to the place where the part is installed in the "Step-by-Step" instructions.
2. Note the identification number of the part (R-number, C-number, etc.). Then locate the same identification number next to the part on the "Schematic." The value, or description, of the part should be near this number. For integrated circuits and transistors, refer to the IC-Transistor identification chart on Pages 83 through 85.



AUDIO CIRCUIT BOARD
(Shown from component side)



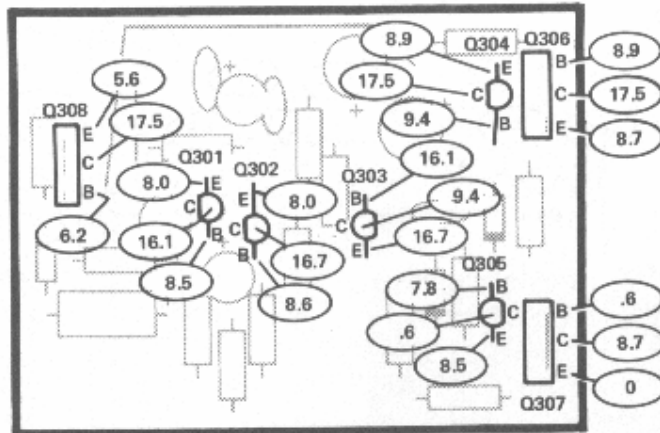
IF CIRCUIT BOARD
(Shown from component side)



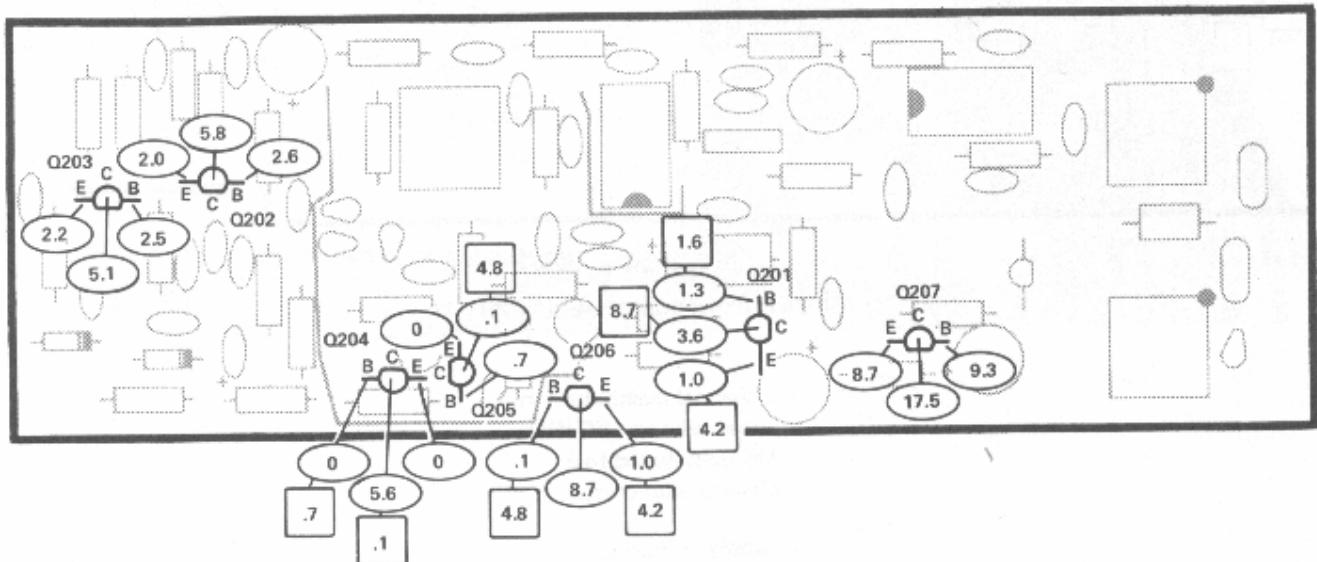
SCAN CIRCUIT BOARD
(Shown from component side)

CIRCUIT BOARD VOLTAGE CHARTS

NOTE: Voltage readings may vary $\pm 20\%$.



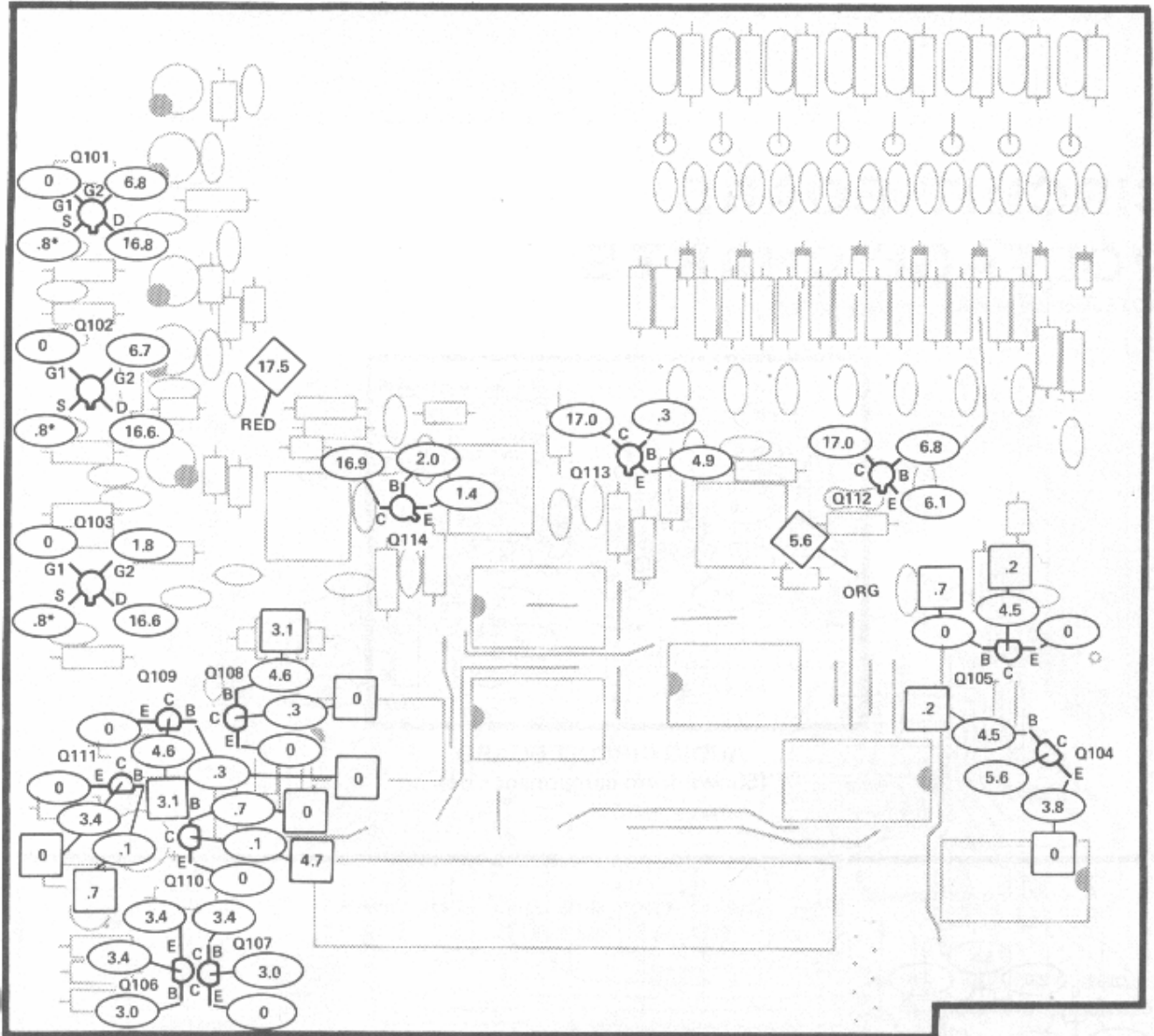
AUDIO CIRCUIT BOARD
(Shown from component side)



IF CIRCUIT BOARD
(Shown from component side)




= Voltage taken with Squelch Control fully counterclockwise.

= Voltage taken with Squelch Control fully clockwise.

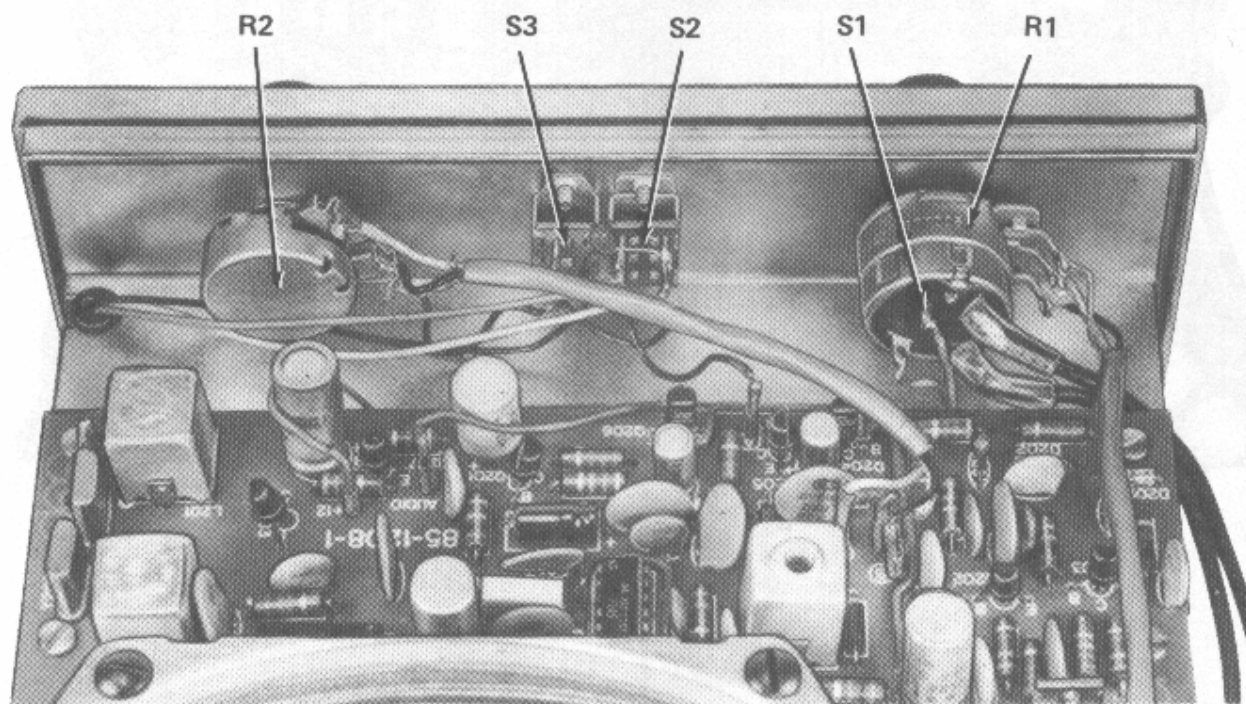


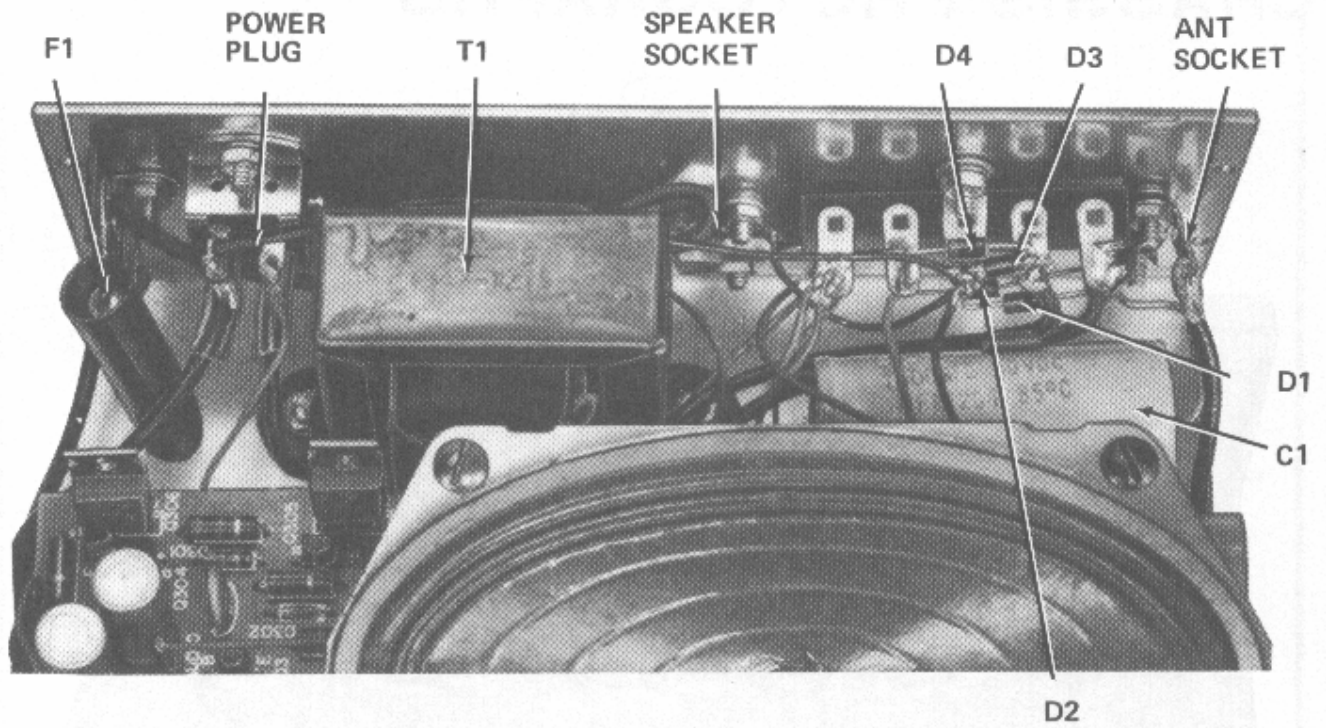
*MAY VARY BETWEEN
.8 and 1.8.

SCAN CIRCUIT BOARD
(Shown from component side)

-  = 0 channel pushbutton in.
Green wire on OPTION
Manually tuned to a
channel with crystal.
-  = Supply voltages.
-  = Squelch fully counterclockwise.
Green wire on GRN.
Automatic scan mode.

CHASSIS PHOTOGRAPHS





TRANSISTOR- INTEGRATED CIRCUIT CHART

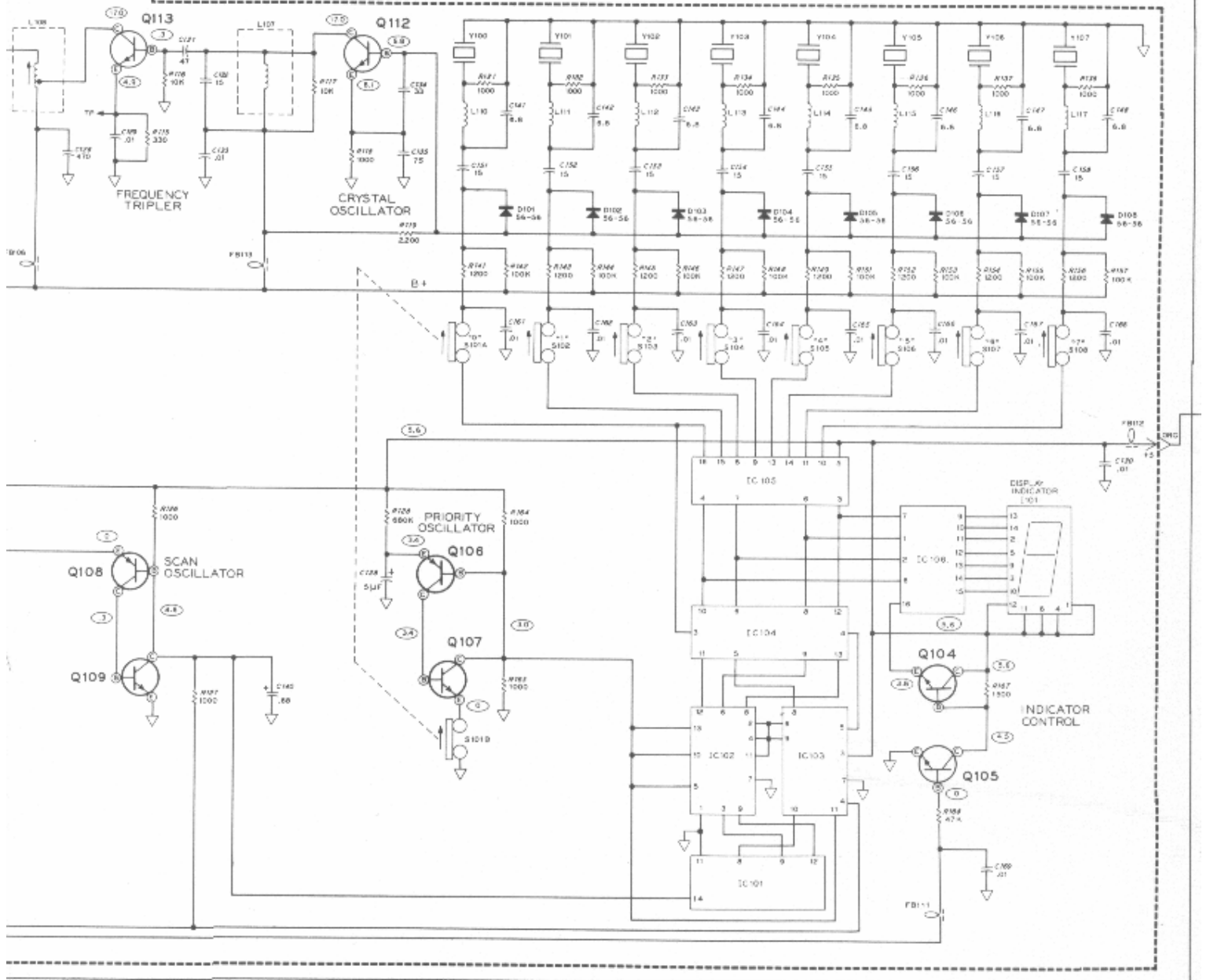
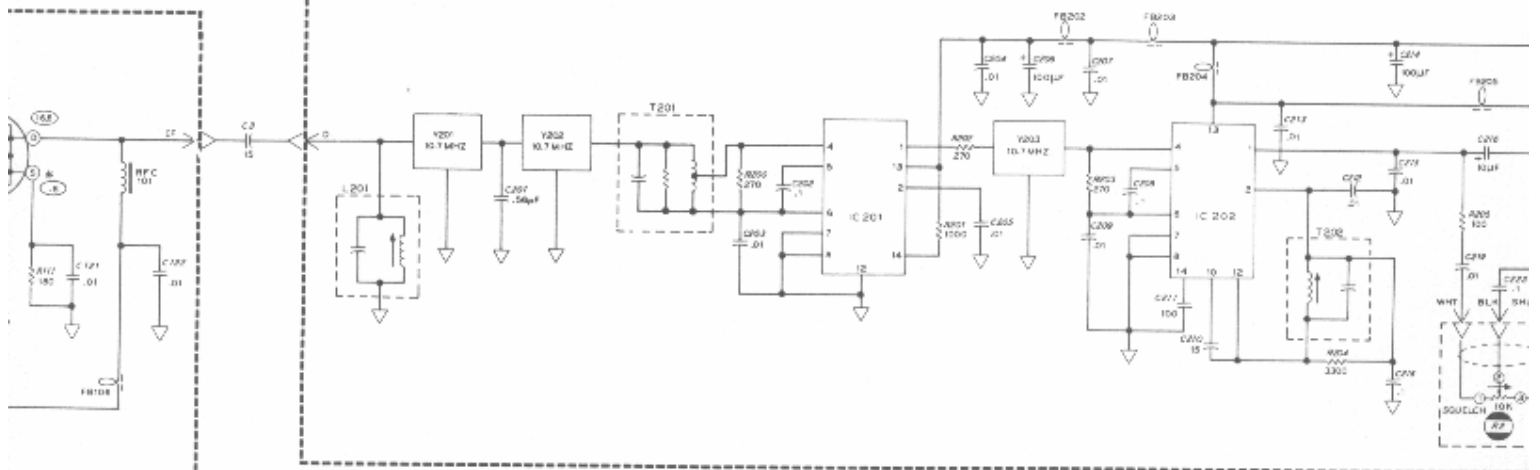
COMPONENT	HEATH PART NUMBER	INTEGRATED CIRCUIT (TOP VIEW)
IC101	443-7	<p>Diagram of IC101 (443-7) showing a 14-pin DIP package. Inputs: 14 (A), 13 (NC), 12 (A), 11 (D), 10 (GND), 9 (B), 8 (C). Outputs: 1 (BD), 2 (R₀₁₁), 3 (R₀₂₁), 4 (NC), 5 (V_{CC}), 6 (R₄₁₁), 7 (R₄₂). Internal components include three J-K flip-flops (J, K, CP) and two NAND gates.</p>
IC102, IC103	443-12	<p>Diagram of IC102, IC103 (443-12) showing a 14-pin DIP package. Inputs: 14 (V_{CC}), 13 (3C), 12 (1Y), 11 (3C), 10 (3B), 9 (3A), 8 (3Y). Outputs: 1 (1A), 2 (1B), 3 (2A), 4 (2B), 5 (2C), 6 (2Y), 7 (GND). Internal components include two NAND gates and two inverters.</p>
IC104	443-18	<p>Diagram of IC104 (443-18) showing a 14-pin DIP package. Inputs: 14 (V_{CC}), 13 (6A), 12 (6Y), 11 (3A), 10 (3Y), 9 (6A), 8 (6Y). Outputs: 1 (1A), 2 (1Y), 3 (2A), 4 (2Y), 5 (3A), 6 (3Y), 7 (GND). Internal components include three inverters.</p>
IC105	443-35	<p>Diagram of IC105 (443-35) showing a 16-pin DIP package. Inputs: 16 (GND), 15, 14, 13, 12, 11, 10, 9. Outputs: 1 (1), 2 (2), 3 (3), 4 (4), 5 (5), 6 (6), 7 (7), 8 (8). Internal component: BCD-TO-DECIMAL DECODER/DRIVER.</p>

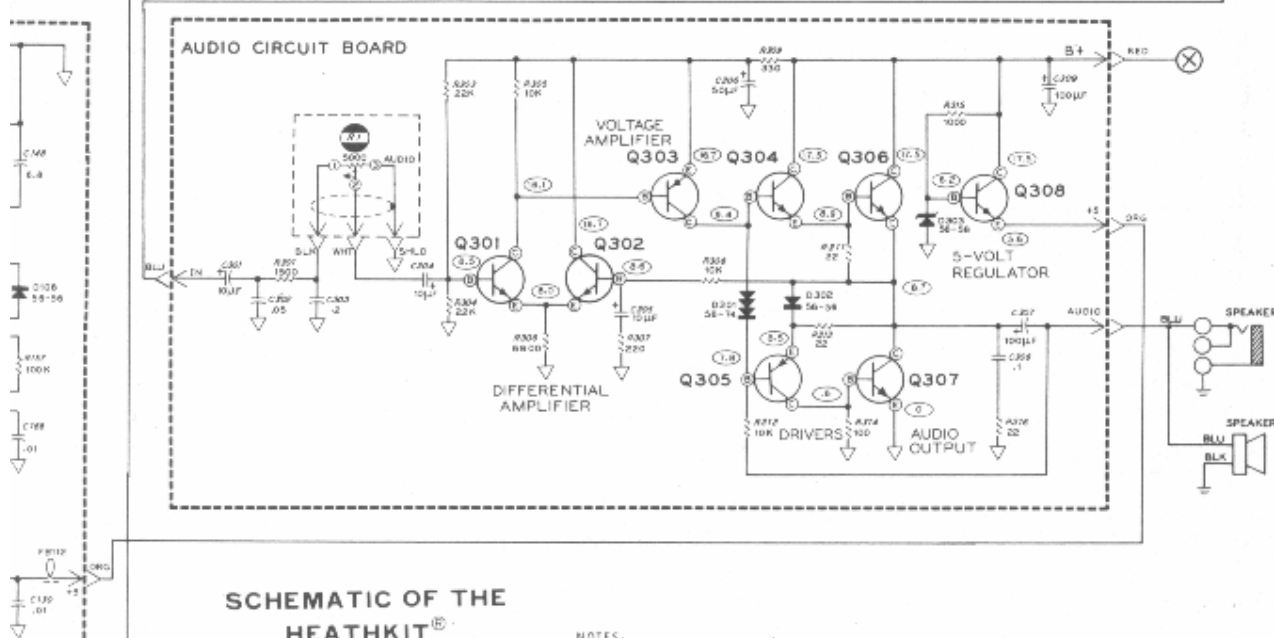
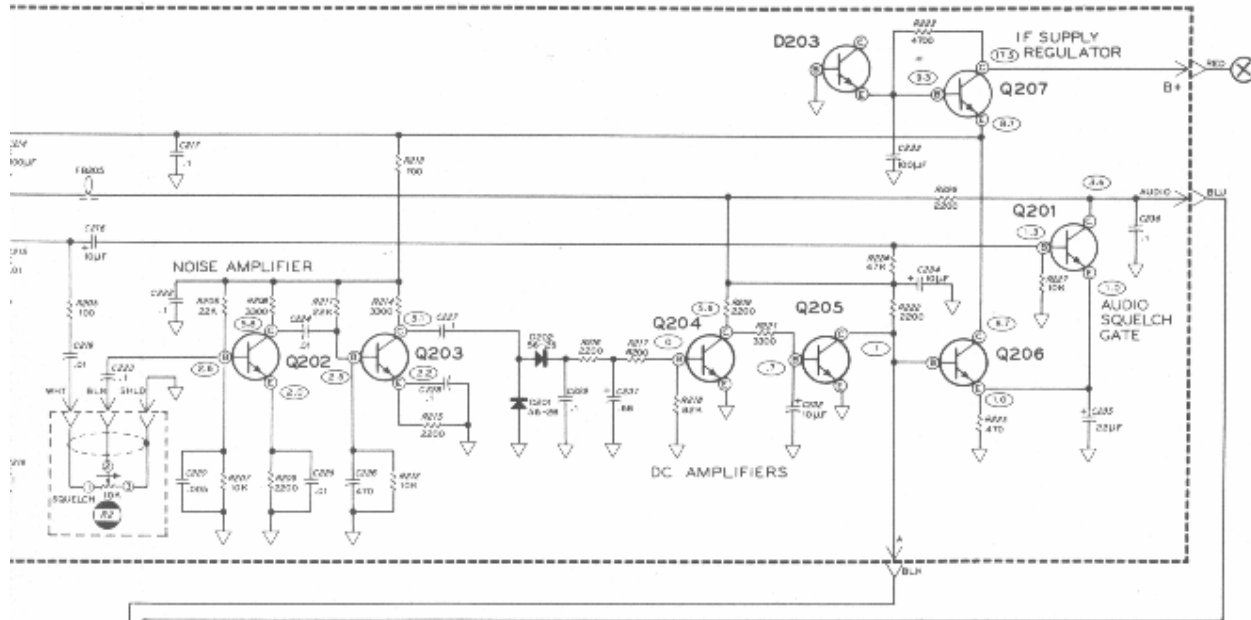
COMPONENT	HEATH PART NUMBER	INTEGRATED CIRCUIT (TOP VIEW)
IC106	443-36	<p>Diagram showing the pinout for IC106 (443-36). The chip has 16 pins. Pin 16 is VCC and pin 8 is GND. Pins 1-7 are inputs: 1 (B), 2 (C), 3 (LAMP TEST), 4 (RB), 5 (RB), 6 (D), 7 (A). Pins 9-15 are outputs: 9 (f), 10 (e), 11 (d), 12 (c), 13 (b), 14 (a), 15 (g).</p>
IC201, IC202	442-28	<p>Diagram showing the internal circuit for IC201 and IC202 (442-28). The circuit is a complex multi-stage logic circuit involving several transistors, diodes, and resistors. Key components include resistors of 1k, 2k, 500, 4k, 7k, 500, 10, 200, 2.5k, 2.5k, 5k, 5k, 8.8k, 200, 200, 200, 200, and 5k. The circuit is connected to pins 7, 10, 11, 13, 14, and 15.</p>

TRANSISTORS

COMPONENT	HEATH PART NUMBER	CASE DIAGRAM
Q104, Q105, Q107, Q109, Q110, Q111, Q115, Q201, Q202, Q203, Q204, Q205, Q206, Q207, Q301, Q302, Q304	417-91	
Q106, Q108, Q303, Q305	417-201	
Q112, Q113, Q114	417-154	
Q101, Q102, Q103	417-274	
Q306, Q307, Q308	417-175	

IF CIRCUIT BOARD





SCHEMATIC OF THE HEATHKIT® MODEL GR-110 VHF SCANNING MONITOR

NOTES:

1. RESISTOR AND CAPACITOR NUMBERS ARE IN THE FOLLOWING GROUPS:

0-99	PARTS ON CHASSIS
100-199	PARTS ON THE SCAN CIRCUIT BOARD
200-299	PARTS ON THE IF CIRCUIT BOARD
300-399	PARTS ON THE AUDIO CIRCUIT BOARD

2. THIS SYMBOL AROUND A PART NUMBER MEANS THAT THIS COMPONENT IS MOUNTED ON THE CHASSIS, THOUGH ITS LOCATION ON THE SCHEMATIC SUGGESTS ANOTHER LOCATION.

3. ALL RESISTORS ARE 1/2 WATT. RESISTOR VALUES ARE IN OHMS; K = 1000.

4. CAPACITORS LESS THAN 1 ARE IN μ F (MICROFARADS); ALL OTHER CAPACITORS ARE IN pF (PICOFARADS) UNLESS OTHERWISE MARKED.

5. THIS SYMBOL INDICATES A POSITIVE DC VOLTAGE MEASUREMENT TAKEN WITH AN 11 MEGOHM VTVM, FROM THE POINT INDICATED TO CHASSIS GROUND. SQUELCH CONTROL FULL CLOCKWISE. REFER TO THE VOLTAGE CHARTS ON PAGES 79 AND 80 FOR MEASUREMENTS UNDER OTHER CONDITIONS. VOLTAGES MAY VARY $\pm 20\%$.

6. VOLTAGES MARKED WITH AN ASTERISK (*) MAY VARY BETWEEN .6 AND 1.8 VOLTS.

7. THIS SYMBOL INDICATES A COMMON B+ CONNECTION.

8. THIS SYMBOL INDICATES A CIRCUIT BOARD GROUND.

9. THIS SYMBOL INDICATES A CHASSIS GROUND.

10. THIS SYMBOL INDICATES A CIRCUIT BOARD GROUND THROUGH A SHIELD LEAD.

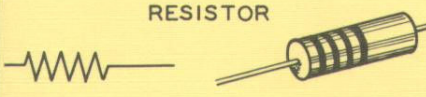

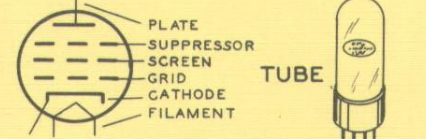

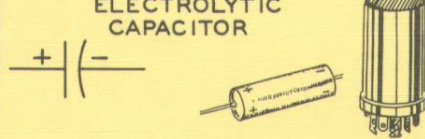





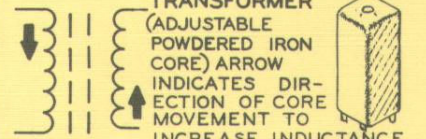
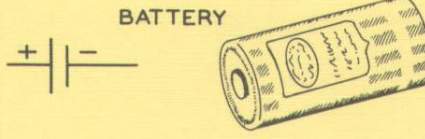
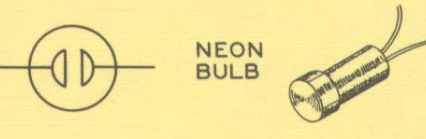
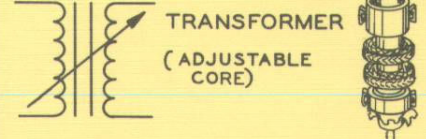

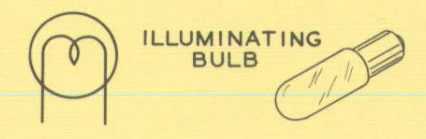
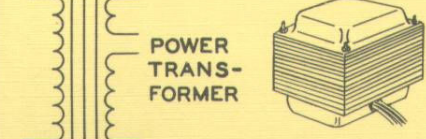

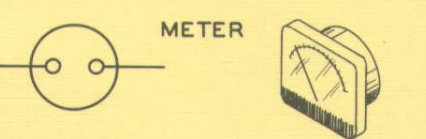
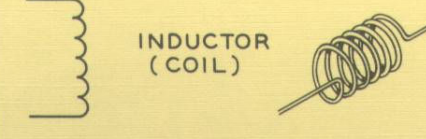

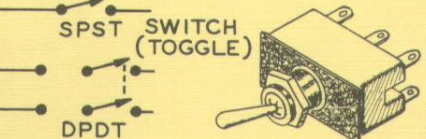
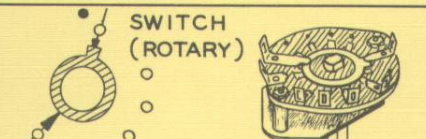
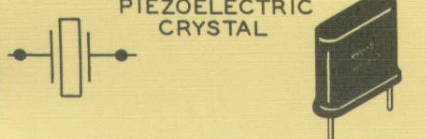
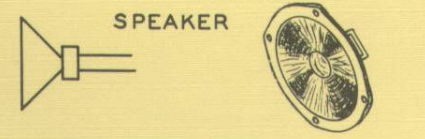
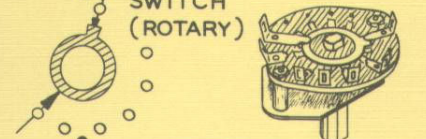


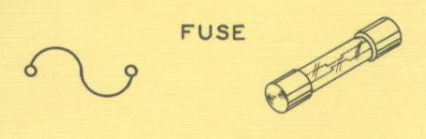






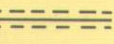
11. ARROWS AT CONTROLS INDICATE CLOCKWISE ROTATION, VIEWED FROM THE SHAFT END OF THE CONTROL.

12. REFER TO THE CHASSIS PHOTOGRAPHS AND CIRCUIT BOARD X-RAY VIEWS FOR THE PHYSICAL LOCATION OF PARTS.

TYPICAL COMPONENT TYPES

This chart is a guide to commonly used types of electronic components. The symbols and related illustrations

should prove helpful in identifying most parts and reading the schematic diagrams.

<p style="text-align: center;">RESISTOR</p> 	<p style="text-align: center;">CAPACITOR</p> 	<p style="text-align: center;">TUBE</p> 
<p style="text-align: center;">POTENTIOMETER (CONTROL)</p> 	<p style="text-align: center;">ELECTROLYTIC CAPACITOR</p> 	<p style="text-align: center;">PNP TRANSISTOR</p>  <p style="text-align: center;">NPN TRANSISTOR</p> 
<p style="text-align: center;">TRANSFORMER (IRON CORE)</p> 	<p style="text-align: center;">VARIABLE CAPACITOR</p> 	<p style="text-align: center;">RECTIFIER (DIODE)</p> 
<p style="text-align: center;">TRANSFORMER (ADJUSTABLE POWDERED IRON CORE) ARROW INDICATES DIRECTION OF CORE MOVEMENT TO INCREASE INDUCTANCE</p> 	<p style="text-align: center;">BATTERY</p> 	<p style="text-align: center;">NEON BULB</p> 
<p style="text-align: center;">TRANSFORMER (ADJUSTABLE CORE)</p> 	<p style="text-align: center;">PHONO JACK</p> 	<p style="text-align: center;">ILLUMINATING BULB</p> 
<p style="text-align: center;">POWER TRANSFORMER</p> 	<p style="text-align: center;">PHONE JACK</p> 	<p style="text-align: center;">METER</p> 
<p style="text-align: center;">INDUCTOR (COIL)</p> 	<p style="text-align: center;">RECEPTACLE</p> 	<p style="text-align: center;">SPST SWITCH (TOGGLE)</p>  <p style="text-align: center;">DPDT</p> 
<p style="text-align: center;">PIEZOELECTRIC CRYSTAL</p> 	<p style="text-align: center;">SPEAKER</p> 	<p style="text-align: center;">SWITCH (ROTARY)</p> 
<p style="text-align: center;">BINDING POST</p> 	<p style="text-align: center;">MICROPHONE</p> 	<p style="text-align: center;">FUSE</p> 
<p style="text-align: center;">ANTENNA</p> <p style="text-align: center;">GENERAL  LOOP </p>	<p style="text-align: center;">EARTH GROUND</p>  <p style="text-align: center;">CHASSIS GROUND</p> 	<p style="text-align: center;">CONDUCTORS</p> <p style="text-align: center;">NOT CONNECTED  CONNECTED  SHIELDED </p>

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LITHO IN U.S.A.

July 12, 1973

IMPORTANT NOTICE

A recent engineering change has been made to improve your VHF Scanning Monitor. Therefore, please put the two resistors with this notice in with the loose parts in the shipping carton (Pack 3). Note that two 15 k Ω (brown-green-orange) resistors will be left over when the kit is assembled.

Also mark the following changes in your Manual.

Page 21 – Under "Resistors."

Change:	1-21	2	15 k Ω (brown-green-orange)	.10
To:	<u>1-24</u>	2	<u>33 kΩ (orange-orange-orange)</u>	.10

Page 26 – Left column. Change both the first and fifth steps as follows:

From:	()	15 k Ω (brown-green-orange).
To:	()	33 k Ω (orange-orange-orange).

Page 85 – Refer to the upper left corner of the Schematic. Under Q101 and Q102, change R102 and R105 from 15K to 33K.

Thank you,

HEATH COMPANY

GR-110/595-1469-01
591-1253

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HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022
PHONE 616-983-3961 TWX 616-983-3897

June 6, 1973

IMPORTANT NOTICE

Please make the following change in your Manual before you start to assemble your VHF Scanning Monitor.

Page 19 – Right column. Change the second step to read:

- () 22 μ F vertical electrolytic.
Disregard the "100" printed on the circuit board.

Thank you,

HEATH COMPANY

GR-110/595-1469-01
591-1232

