

MODEL **SW-717 Shortwave Receiver**

# **HEATHKIT<sup>®</sup>**

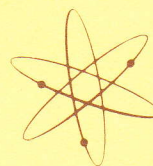
## **ASSEMBLY MANUAL**

Model SW-717 Shortwave Receiver

HEATH COMPANY • BENTON HARBOR, MICHIGAN



PRICE \$2.00



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595-1293-04

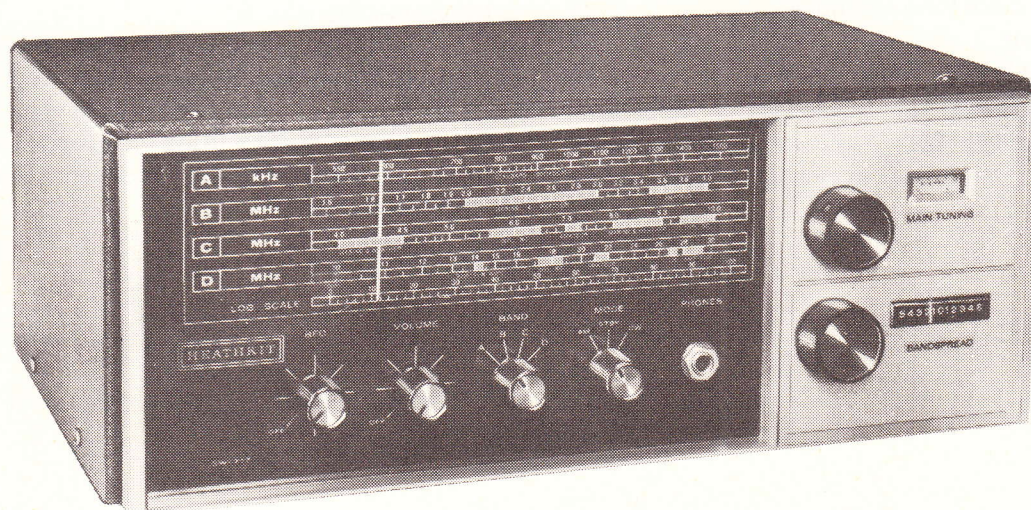
MIKE O'GRADY



Assembly and Operation  
of the



SHORTWAVE RECEIVER  
MODEL SW-717



HEATH COMPANY  
BENTON HARBOR, MICHIGAN 49022

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# INTRODUCTION

The Heathkit Model SW-717 Shortwave Receiver is designed to receive both the standard broadcast and the short wave bands. The receiver tunes from 550 kHz to 30 MHz in four overlapping bands.

The Receiver features electrical bandspread for all four bands, a relative signal strength meter, a BFO control, an automatic noise limiter, and a headphone jack. There is also a built-in rod antenna for the broadcast band and provisions for connecting an external antenna for shortwave reception.

Solid-state circuitry is used throughout. Most of the components are mounted on a printed circuit board both for ease of assembly and for reliability. The built-in power supply is transformer operated from either 120 Vac or 240 Vac and uses four silicon diodes in a full-wave bridge circuit.

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



# CIRCUIT BOARD

## PARTS LIST

Remove the bag marked Pack #1 from the shipping carton and empty its contents on your work table. Check each part against the following list. The numbers in the "Key No." column refer to the numbers in the Parts Pictorial (fold-out from Page 11). To avoid intermixing parts, any part packed in an individual envelope with a part number on it should be placed back in its envelope after it is identified until that part is called for in a step.

After the above parts bag has been removed from the shipping carton, the remaining parts will be considered to be part of the Final Pack.

To order replacement parts, refer to the "Price Each" column and use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to the "Replacement Parts" inside the rear cover of the Manual.

| KEY PART                                           |            | PARTS PRICE    |             | DESCRIPTION                         |
|----------------------------------------------------|------------|----------------|-------------|-------------------------------------|
| <u>No.</u>                                         | <u>No.</u> | <u>Per Kit</u> | <u>Each</u> |                                     |
| RESISTORS (1/2-watt, 10%, unless otherwise marked) |            |                |             |                                     |
| 1                                                  | 1-143      | 2              | .15         | 2.7 $\Omega$ , 5% (red-violet-gold) |
| 1                                                  | 1-49       | 1              | .15         | 22 $\Omega$ (red-red-black)         |
| 1                                                  | 1-3        | 4              | .15         | 100 $\Omega$ (brown-black-brown)    |
| 1                                                  | 1-6        | 1              | .15         | 470 $\Omega$ (yellow-violet-brown)  |
| 1                                                  | 1-7        | 2              | .15         | 680 $\Omega$ (blue-gray-brown)      |
| 1                                                  | 1-9        | 2              | .15         | 1000 $\Omega$ (brown-black-red)     |
| 1                                                  | 1-13       | 2              | .15         | 2700 $\Omega$ (red-violet-red)      |
| 1                                                  | 1-14       | 2              | .15         | 3300 $\Omega$ (orange-orange-red)   |
| 1                                                  | 1-19       | 1              | .15         | 6800 $\Omega$ (blue-gray-red)       |
| 1                                                  | 1-20       | 2              | .15         | 10 k $\Omega$ (brown-black-orange)  |

| KEY PART            |            | PARTS PRICE    |             | DESCRIPTION                   |
|---------------------|------------|----------------|-------------|-------------------------------|
| <u>No.</u>          | <u>No.</u> | <u>Per Kit</u> | <u>Each</u> |                               |
| Resistors (cont'd.) |            |                |             |                               |
| 1                   | 1-21       | 1              | .15         | 15 kΩ (brown-green-orange)    |
| 1                   | 1-22       | 1              | .15         | 22 kΩ (red-red-orange)        |
| 1                   | 1-23       | 1              | .15         | 27 kΩ (red-violet-orange)     |
| 1                   | 1-24       | 2              | .15         | 33 kΩ (orange-orange-orange)  |
| 1                   | 1-60       | 2              | .15         | 68 kΩ (blue-gray-orange)      |
| 1                   | 1-102      | 1              | .15         | 82 kΩ (gray-red-orange)       |
| 1                   | 1-26       | 2              | .15         | 100 kΩ (brown-black-yellow)   |
| 1                   | 1-27       | 1              | .15         | 150 kΩ (brown-green-yellow)   |
| 1                   | 1-31       | 2              | .15         | 330 kΩ (orange-orange-yellow) |
| 1                   | 1-33       | 1              | .15         | 470 kΩ (yellow-violet-yellow) |



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

**CAPACITORS****Disc**

|   |        |   |     |             |
|---|--------|---|-----|-------------|
| 2 | 21-149 | 1 | .15 | 2.7 pF      |
| 2 | 21-60  | 1 | .15 | 18 pF       |
| 2 | 21-5   | 1 | .15 | 20 pF       |
| 2 | 21-9   | 2 | .15 | 100 pF      |
| 2 | 21-23  | 2 | .15 | 420 pF      |
| 2 | 21-16  | 3 | .15 | .01 $\mu$ F |
| 2 | 21-143 | 4 | .30 | .05 $\mu$ F |
| 2 | 21-95  | 4 | .25 | .1 $\mu$ F  |

**Mica**

|   |        |   |     |        |
|---|--------|---|-----|--------|
| 3 | 20-116 | 1 | .45 | 400 pF |
|---|--------|---|-----|--------|

**Electrolytic\***

|   |        |   |     |                       |
|---|--------|---|-----|-----------------------|
| 4 | 25-54  | 3 | .30 | 10 $\mu$ F, 15 volts  |
| 5 | 25-i46 | 1 | .70 | 100 $\mu$ F, 30 volts |
| 5 | 25-131 | 1 | .85 | 250 $\mu$ F, 25 volts |

\*May be marked MFD instead of  $\mu$ F.**Polystyrene**

|   |      |   |     |         |
|---|------|---|-----|---------|
| 6 | 29-5 | 1 | .15 | 1000 pF |
| 6 | 29-3 | 1 | .25 | 2700 pF |

**Trimmer**

|   |       |   |     |           |
|---|-------|---|-----|-----------|
| 7 | 31-54 | 2 | .55 | 4-40 pF   |
| 7 | 31-56 | 2 | .45 | 1.5-20 pF |

**CONTROL**

|   |        |   |      |               |
|---|--------|---|------|---------------|
| 8 | 10-241 | 1 | 1.00 | 10 k $\Omega$ |
|---|--------|---|------|---------------|

**INDUCTORS**

|    |         |   |      |                                                  |
|----|---------|---|------|--------------------------------------------------|
| 9  | 40-487  | 2 | 1.00 | 300 $\mu$ H peaking coil<br>(orange-black-brown) |
| 10 | 40-1024 | 1 | 1.00 | L1 (band A oscillator)                           |
| 10 | 40-1025 | 1 | 1.00 | L2 (band B oscillator)                           |
| 10 | 40-1026 | 1 | 1.00 | L3 (band C oscillator)                           |
| 10 | 40-1027 | 1 | 1.00 | L4 (band D oscillator)                           |
| 10 | 40-1028 | 1 | 1.00 | L5 (band B antenna)                              |
| 10 | 40-1029 | 1 | 1.00 | L6 (band C antenna)                              |
| 10 | 40-1030 | 1 | 1.00 | L7 (band D antenna)                              |

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

**DIODES-FILTERS**

|    |         |   |     |                                       |
|----|---------|---|-----|---------------------------------------|
| 11 | 56-26   | 1 | .40 | 1N191 (brown-white-brown) diode       |
| 12 | 56-61   | 1 | .95 | 1 mA, 1.3 V stabistor<br>(GE STB 620) |
| 13 | 404-399 | 3 | .60 | Ceramic filter                        |

**TRANSISTORS**

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

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

|         |   |      |         |
|---------|---|------|---------|
| 417-91  | 2 | .85  | 2N5232A |
| 417-224 | 1 | 1.40 | MPSU05  |
| 417-225 | 1 | 1.60 | MPSU55  |
| 417-118 | 1 | .40  | 2N3393  |
| 417-169 | 1 | 1.50 | MPF105  |
| 417-201 | 1 | .50  | X29A829 |
| 417-222 | 1 | 1.00 | 2N5308  |
| 417-240 | 1 | 2.40 | 40673   |

**PARTS FROM THE FINAL PACK**

|           |   |        |                                           |
|-----------|---|--------|-------------------------------------------|
| 85-452-3  | 1 | 2.05   | Circuit board                             |
| 344-56    | 1 | .05/ft | Blue hookup wire                          |
| 14 391-34 | 1 | .15    | Identification label                      |
| 15 490-5  | 1 | .15    | Nut starter                               |
| 597-260   | 1 |        | Parts Order Form                          |
| 597-308   | 1 |        | Kit Builders Guide                        |
|           | 1 | 2.00   | Manual (See front cover for part number.) |

Solder (Additional 3' rolls of solder, #331-6, can be ordered for .25 cents each.)

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



## 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.

Use 1/2-watt resistors unless directed otherwise in a step. Resistors are designated by the color code and the resistance value. The symbol  $\Omega$  means ohms, and K or  $k\Omega$  indicates 1,000 ohms. Capacitors are designated by their value and type. The symbol  $\mu F$  means microfarad, and pF means picofarad. 1  $\mu F$  is equal to 1,000,000 pF.

Before you install a disc capacitor, remove from its leads any excess body coating material which would protrude through the circuit board and prevent soldering the leads to the foil.

Be very careful not to cover unused holes with solder or bridge solder between foils during the assembly of the circuit board. Use a soldering iron that is rated at 15 to 25 watts. Its tip should be no wider than 1/16" at its widest dimension; a pyramid or chisel-shaped tip is best. This type of soldering iron will make the kit easier to assemble, with less chance of solder bridges occurring. Solder a part, or group of parts, only when instructed to do so.



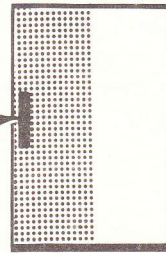
# START



NOTE: Only part of the circuit board is shown in each of the following Pictorials. An identification drawing at the top of each Pictorial shows the area of the circuit board to be assembled.

Position the circuit board with the part number as shown in the identification drawing. Then complete each step on Pictorials 1 through 7.

PART  
NUMBER



IDENTIFICATION  
DRAWING

(✓) 68 k $\Omega$  (blue-gray-orange).

(✓) 1000  $\Omega$  (brown-black-red).

(✓) 10 k $\Omega$  (brown-black-orange).

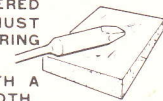
(✓) 27 k $\Omega$  (red-violet-orange).

(✓) 3300  $\Omega$  (orange-orange-red).

(✓) 150 k $\Omega$  (brown-green-yellow).

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

WIPE IT OFTEN WITH A  
DAMP SPONGE OR CLOTH.



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

(✓) 100  $\Omega$  (brown-black-brown).

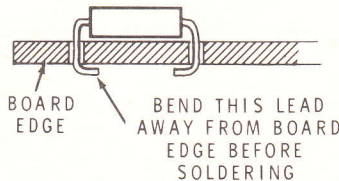
(✓) 82 k $\Omega$  (gray-red-orange).

(✓) 22  $\Omega$  (red-red-black).

(✓) 100 k $\Omega$  (brown-black-yellow).

(✓) 330 k $\Omega$  (orange-orange-yellow).

(✓) 3300  $\Omega$  (orange-orange-red).



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

# CONTINUE



(✓) 2700  $\Omega$  (red-violet-red).

(✓) 2.7  $\Omega$  (red-violet-gold).

(✓) 10 k $\Omega$  (brown-black-orange).

( ) 6800  $\Omega$  (blue-gray-red).

(✓) 100  $\Omega$  (brown-black-brown).

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

(✓) 1000  $\Omega$  (brown-black-red).

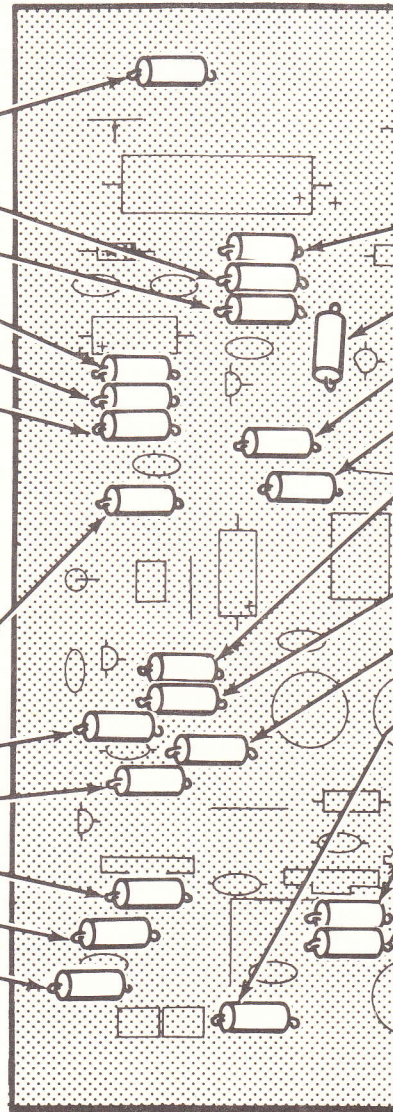
(✓) 33 k $\Omega$  (orange-orange-orange).

(✓) 68 k $\Omega$  (blue-gray-orange).

(✓) 330 k $\Omega$  (orange-orange-yellow).

(✓) 33 k $\Omega$  (orange-orange-orange).

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



PICTORIAL 1

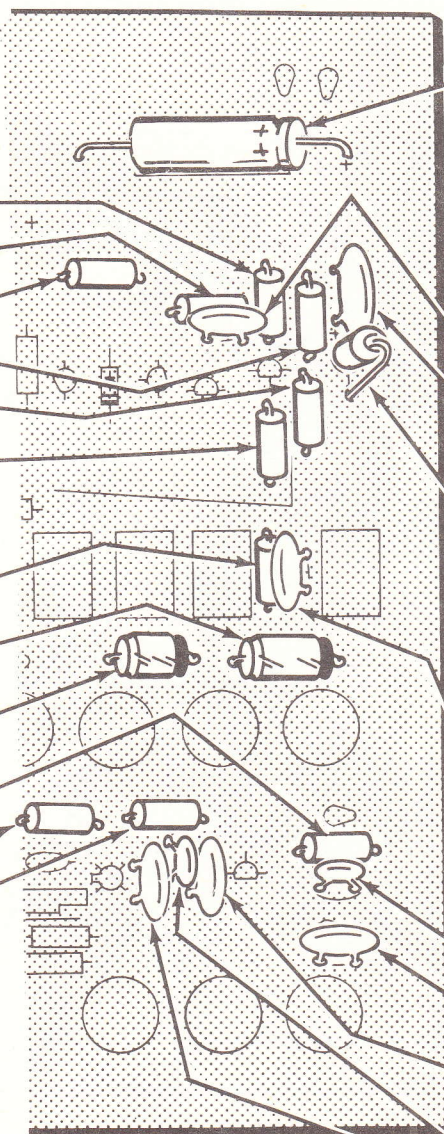


PART  
NUMBER

IDENTIFICATION  
DRAWING

START

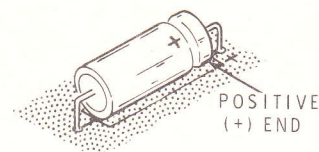
- (✓) 680  $\Omega$  (blue-gray-brown).
- (✓) 680  $\Omega$  (blue-gray-brown).
- (✓) 2.7  $\Omega$  (red-violet-gold).
- (✓) 22 k $\Omega$  (red-red-orange).
- (✓) 15 k $\Omega$  (brown-green-orange).
- (✓) 2700  $\Omega$  (red-violet-red).
- ( ) Solder all leads to the foil and cut off excess lead lengths.
- (✓) 100  $\Omega$  (brown-black-brown).
- (✓) 2700 pF polystyrene. Note the position of the banded or colored end.
- (✓) 1000 pF polystyrene. Note the banded or colored end.
- (✓) 470 k $\Omega$  (yellow-violet-yellow).
- (✓) 100  $\Omega$  (brown-black-brown).
- (✓) 100 k $\Omega$  (brown-black-yellow).
- ( ) Solder all leads to the foil and cut off excess lead lengths.



PICTORIAL 2

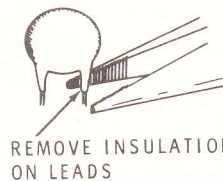
CONTINUE

NOTE: When you install electrolytic capacitors, always match the positive (+) marked end of the capacitor with the positive (+) mark on the circuit board.

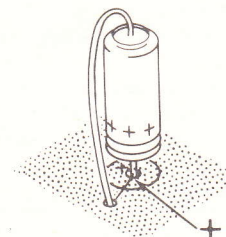


- ( ) 250  $\mu$ F electrolytic.

NOTE: Before you install each disc capacitor, use pliers to remove any lead coating which would extend through the circuit board and prevent a good solder connection.



- (✓) .1  $\mu$ F disc.
- (✓) .05  $\mu$ F disc.
- (✓) Solder all leads to the foil and cut off excess lead lengths.
- (✓) 10  $\mu$ F electrolytic. Mount vertically. Solder each lead to the foil.



- (✓) .1  $\mu$ F disc.
- (✓) 420 pF disc.
- (✓) 18 pF disc.
- (✓) .1  $\mu$ F disc.
- (✓) 2.7 pF disc.
- (✓) 100 pF disc.
- (✓) Solder all leads to the foil and cut off excess lead lengths.

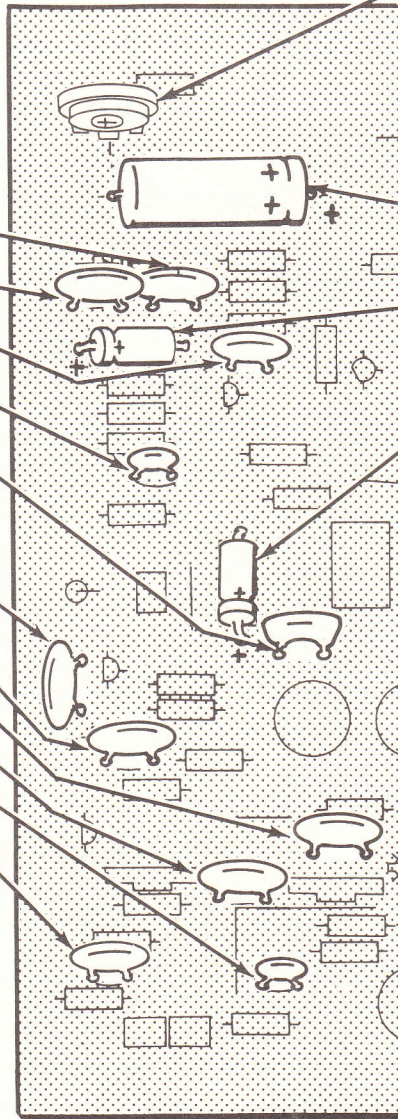


PART  
NUMBERIDENTIFICATION  
DRAWING

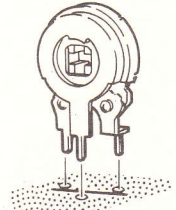
CONTINUE

START

- ( ) .05  $\mu$ F disc.
- ( ) .05  $\mu$ F disc.
- ( ) .1  $\mu$ F disc.
- ( ) 20 pF disc.
- ( ) 400 pF mica.
- ( ) Solder all leads to the foil and cut off excess lead lengths.
- ( ) .05  $\mu$ F disc.
- ( ) .01  $\mu$ F disc.
- ( ) .01  $\mu$ F disc.
- ( ) .01  $\mu$ F disc.
- ( ) 420 pF disc.
- ( ) 100 pF disc.
- ( ) Solder all leads to the foil and cut off excess lead lengths.



- ( ) 10 k $\Omega$  control (#10-241). Solder each lug to the foil.



- ( ) 100  $\mu$ F electrolytic. Match the + marks.
- ( ) 10  $\mu$ F electrolytic. Match the + marks.
- ( ) 10  $\mu$ F electrolytic. Match the + marks.
- ( ) Solder all leads to the foil and cut off excess lead lengths.

PICTORIAL 3

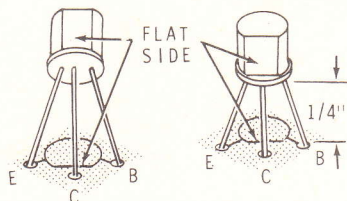


START

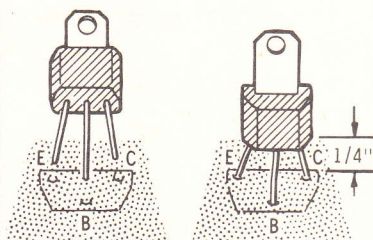


NOTE: Install transistors in the manner shown. Line up the flat or wide space of the transistor with the outline on the circuit board. Identify the transistor leads from the drawings and insert each lead into its proper hole. Push the transistor down to within 1/4" of the circuit board. Then solder each lead to the foil and cut off the excess lead lengths.

- ( ) 2N3393 transistor (#417-118) at Q6.

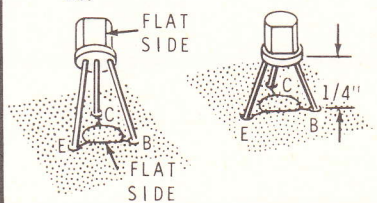


- ( ) MPSU05 transistor (#417-224) at Q8. Bend the B (middle) lead forward. Match the shape of the transistor body to the outline on the circuit board.

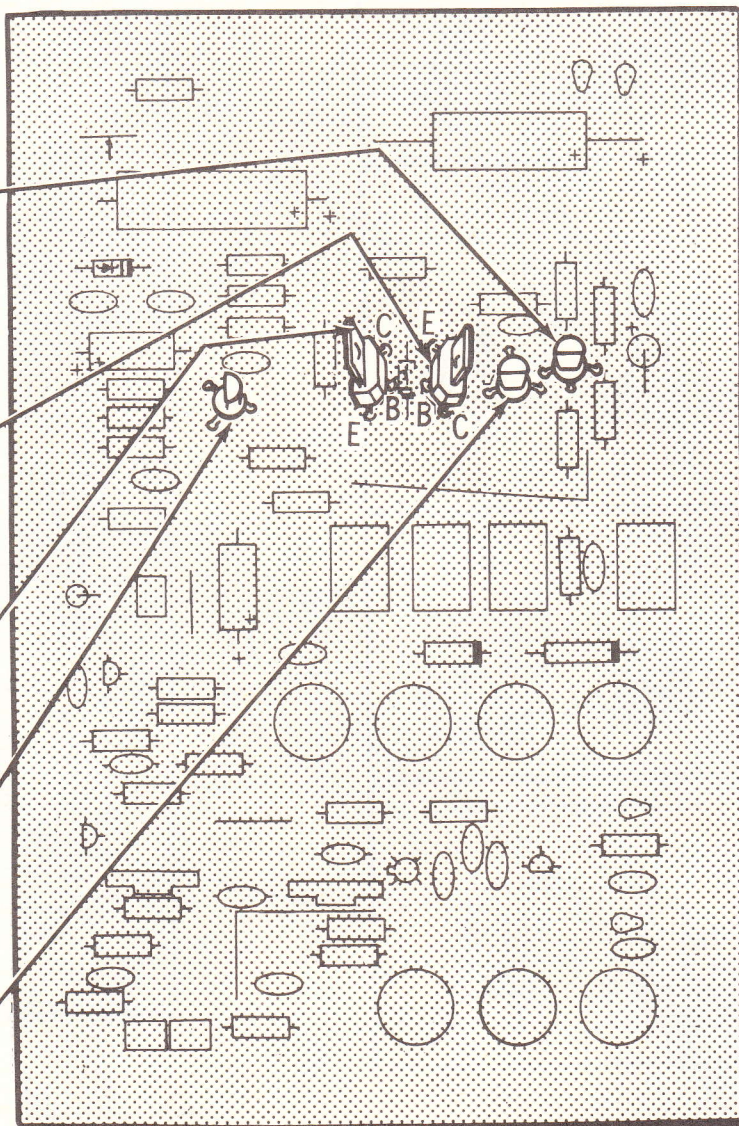


- ( ) MPSU55 transistor (#417-225) at Q9.

- ( ) 2N5232A transistor (#417-91) at Q5.



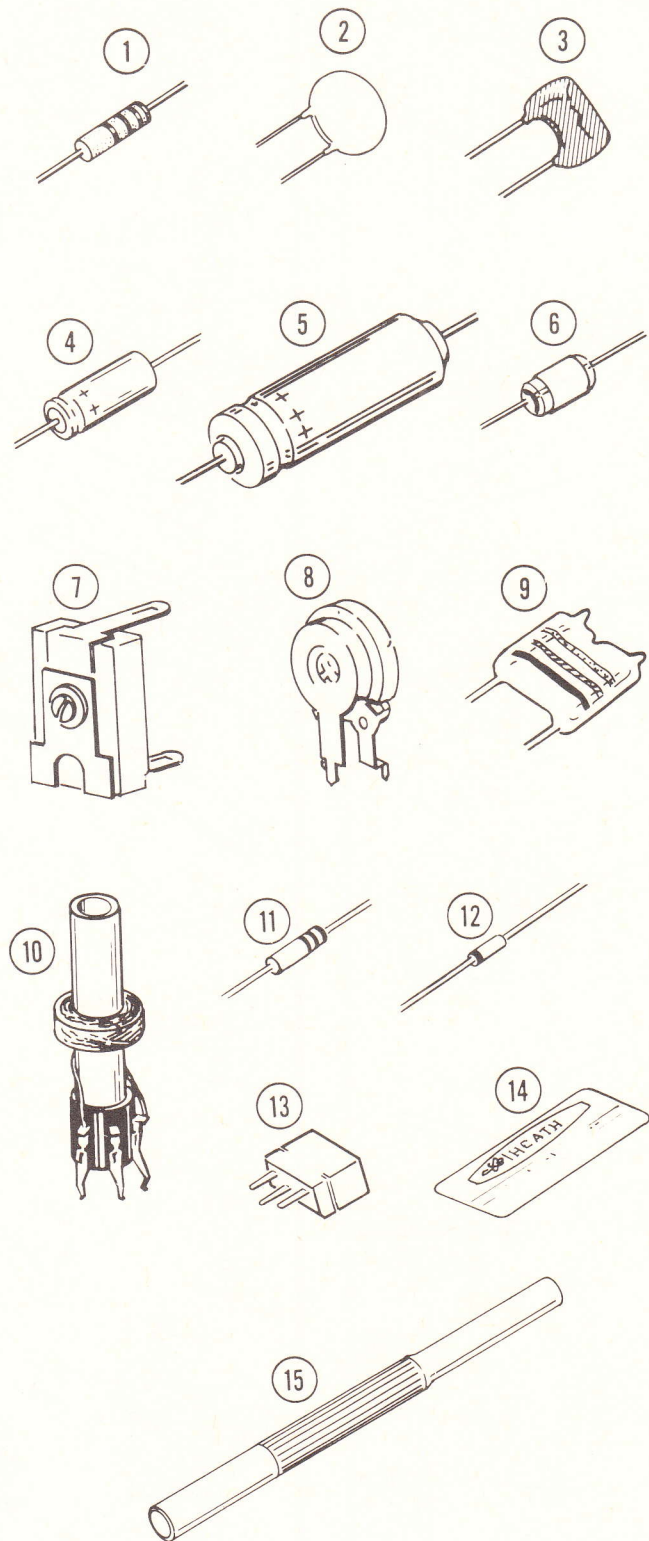
- ( ) X29A829 transistor (#417-201) at Q7.



PICTORIAL 4



# CIRCUIT BOARD PARTS PICTORIAL

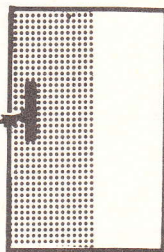




START



PART  
NUMBER



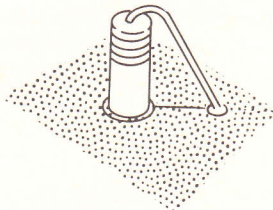
IDENTIFICATION  
DRAWING

NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES THE CATHODE END OF THE DIODE IS MARKED WITH A BAND OR BANDS. ALWAYS POSITION THIS END AS SHOWN IN THE PICTORIAL.



( ) 1N191 diode (brown-white-brown).

( ) 470  $\Omega$  (yellow-violet-brown). Install this resistor vertically.



( ) Remove all of the insulation from a 3/4" and a 1" length of blue hookup wire.

( ) 3/4" bare wire. Bend the ends down to fit the holes.

( ) 1" bare wire.

( ) 300  $\mu$ H peaking coil (#40-487, orange-black-brown).

( ) Remove 1/4" of insulation from each end of a 1-7/8" blue hookup wire. Bend down each end as before, and install the wire.

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

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

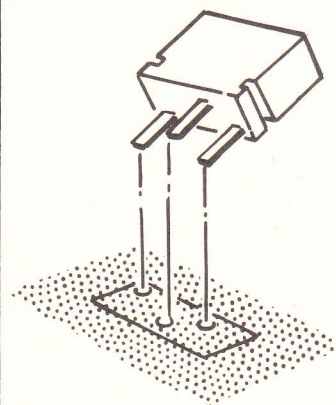
WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



CONTINUE



( ) Ceramic filter at FL3. Solder the leads to the foil.



( ) 300  $\mu$ H peaking coil (#40-487, orange-black-brown). Solder the leads to the foil.

( ) Ceramic filter. Solder the leads to the foil.

( ) Ceramic filter. Solder the leads to the foil.

PICTORIAL 6

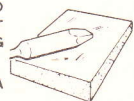


# START



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

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES. THE CATHODE END OF THE DIODE IS MARKED WITH A BAND OR BANDS. ALWAYS POSITION THIS END AS SHOWN IN THE PICTORIAL.



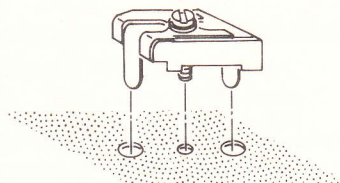
( ) Stabister (#56-61) at D2. Note the position of the banded end.

( ) Remove 1/4" of insulation from each end of a 2-1/4" blue hookup wire. Then install the wire.

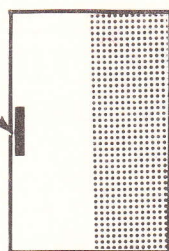
( ) Solder all leads to the foil and cut off excess lead lengths.

NOTE: In the following steps, position each trimmer capacitor so its upper leaf (immediately under the adjusting screw washer) is positioned as shown in the Pictorial. Then, on the bottom of the circuit board, bend the lugs apart to hold the trimmers in place. As each component is installed, solder its lugs to the foil. DO NOT solder the trimmer adjustment screws.

( ) 4-40 pF trimmer (#31-54). Solder ONLY the two long lugs to the foil. DO NOT solder the end of the adjustment screw.



PART NUMBER



IDENTIFICATION DRAWING

# CONTINUE

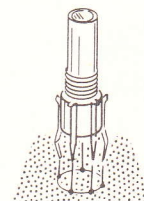


( ) 1.5-20 pF trimmer (#31-56).

( ) 4-40 pF trimmer (#31-54).

( ) 1.5-20 pF trimmer (#31-56).

( ) Coil #40-1027 coil at L4. Solder the leads of each coil as it is installed.



( ) Coil #40-1026 at L3.

( ) Coil #40-1025 at L2.

( ) Coil #40-1024 at L1.

( ) Coil #40-1030 at L7.

( ) Coil #40-1029 at L6.

( ) Coil #40-1028 at L5.

( ) Check the circuit board carefully for unsoldered connections and solder bridges between foils.

Lay the circuit board aside. It will be installed later.

NOTE: The remaining blue hookup wire will be used in the "Chassis" section.

PICTORIAL 7

# FINISH



# CHASSIS

## PARTS LIST

Check each of the remaining parts against the following list. Remember to replace parts back in their individual envelopes until required for a step. Chassis Parts Pictorial fold-out from Page 12.

| KEY PART<br>No.             | KEY PART<br>No. | PARTS<br>Per Kit | PRICE<br>Each | DESCRIPTION                               | KEY PART<br>No.                     | KEY PART<br>No. | PARTS<br>Per Kit | PRICE<br>Each | DESCRIPTION                              |
|-----------------------------|-----------------|------------------|---------------|-------------------------------------------|-------------------------------------|-----------------|------------------|---------------|------------------------------------------|
| <b>RESISTORS (1/2-Watt)</b> |                 |                  |               |                                           | <b>Transistors-Diodes (cont'd.)</b> |                 |                  |               |                                          |
| A1                          | 1-45            | 1                | .15           | 220 $\Omega$ (red-red-brown)              | A10                                 | 57-65           | 4                | .30           | 1N4002 silicon diode                     |
| A1                          | 1-48            | 1                | .15           | 390 $\Omega$ (orange-white-brown)         | A11                                 | 56-26           | 2                | .40           | 1N191 (brown-white-brown) diode          |
| <b>CAPACITORS</b>           |                 |                  |               |                                           | A12                                 | 417-118         | 2                | .40           | 2N3393 transistor                        |
| <b>Disc</b>                 |                 |                  |               |                                           | <b>SWITCHES</b>                     |                 |                  |               |                                          |
|                             | 21-5            | 1                | .15           | 20 pF                                     | A13                                 | 60-1            | 1                | .30           | SPST slide                               |
| <b>Electrolytic</b>         |                 |                  |               |                                           | A14                                 | 63-190          | 1                | 3.10          | 3-position rotary                        |
| A2                          | 25-54           | 2                | .30           | 10 $\mu$ F, 15 volts                      | A15                                 | 63-587          | 1                | 4.15          | 4-position, 2-wafer, rotary              |
| A3                          | 25-138          | 1                | 3.40          | 1000/1000 $\mu$ F, 25 volts, dual section | <b>RUBBER-PLASTIC PARTS</b>         |                 |                  |               |                                          |
| A4                          | 25-157          | 1                | .85           | 500 $\mu$ F, 15 volts                     | B1                                  | 73-1            | 1                | .15           | 1/4" grommet                             |
| <b>Other Capacitors</b>     |                 |                  |               |                                           | B2                                  | 73-3            | 1                | .15           | 3/8" grommet                             |
| A5                          | 26-88           | 1                | 5.20          | 5.9 pF variable                           | B3                                  | 73-4            | 5                | .15           | 3/16" grommet                            |
| A6                          | 26-81           | 1                | 6.15          | 323/356 pF dual section variable          | B4                                  | 73-92           | 2                | .25           | White vinyl gasket (adhesive, 5" x 3/4") |
| A7                          | 31-11           | 1                | .95           | 30/30 pF dual trimmer                     | B5                                  | 75-71           | 1                | .15           | Strain relief                            |
| <b>CONTROLS</b>             |                 |                  |               |                                           | B6                                  | 75-167          | 2                | .15           | Nylon insert                             |
| A8                          | 10-320          | 1                | 1.60          | 1 megohm                                  | B7                                  | 203-759         | 1                | 5.45          | Front panel                              |
| A9                          | 19-95           | 1                | 1.60          | 10 k $\Omega$ , with switch               | B8                                  | 207-18          | 2                | .15           | Cable clamp                              |
| <b>TRANSISTORS-DIODES</b>   |                 |                  |               |                                           | B9                                  | 261-17          | 2                | .05           | Large plastic foot                       |
| A10                         | 56-19           | 1                | 1.50          | 9.1 volt, 25 mA, zener diode              | B10                                 | 261-42          | 2                | .10           | Small plastic foot                       |
|                             |                 |                  |               |                                           | B11                                 | 490-1           | 1                | .15           | Alignment tool                           |



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

**WIRE-SLEEVING**

|        |   |        |                                 |
|--------|---|--------|---------------------------------|
| 89023  | 1 | 1.25   | Line cord                       |
| 343-12 | 1 | .10/ft | Single conductor shielded cable |
| 344-21 | 1 | .05/ft | Red stranded wire               |
| 344-50 | 1 | .05/ft | Black hookup wire               |
| 344-54 | 1 | .05/ft | Yellow hookup wire              |
| 344-55 | 1 | .05/ft | Green hookup wire               |
| 344-59 | 1 | .05/ft | White hookup wire               |
| 345-1  | 1 | .10/ft | Metal braid                     |
| 347-35 | 1 | .10/ft | Two-conductor shielded cable    |

**TERMINAL STRIPS**

|    |        |   |     |                   |
|----|--------|---|-----|-------------------|
| C1 | 431-6  | 1 | .15 | 2-lug, screw type |
| C2 | 431-11 | 1 | .15 | 5-lug             |
| C3 | 431-45 | 2 | .15 | 6-lug             |

**DIAL PARTS-SHAFTS-BUSHINGS**

|     |          |   |     |                            |
|-----|----------|---|-----|----------------------------|
| C4  | 100-1036 | 1 | .60 | Small metal pulley         |
|     | 100-1037 | 1 | .60 | Large metal pulley         |
| C5  | 258-1    | 1 | .05 | Main tuning spring         |
| C6  | 258-103  | 1 | .25 | Bandsread tuning spring    |
|     | 100-707  | 1 | .15 | 36" dial cord assembly     |
|     | 100-1063 | 1 | .30 | 17-3/8" dial cord assembly |
| C7  | 453-211  | 1 | .40 | Shaft                      |
| C8  | 455-13   | 1 | .20 | Brass bushing              |
| C9  | 463-30   | 1 | .55 | Main tuning pointer        |
| C10 | 463-57   | 1 | .65 | Bandsread tuning pointer   |
| C11 | 466-25   | 2 | .40 | Pulley                     |

**SHEET METAL PARTS**

|    |           |   |      |              |
|----|-----------|---|------|--------------|
| D1 | 90-520-1  | 1 | 5.85 | Cover        |
| D2 | 200-603   | 1 | 3.85 | Chassis      |
| D3 | 203-778-1 | 1 | 1.90 | Subpanel     |
| D4 | 205-829   | 1 | 2.40 | Bottom plate |

**HARDWARE****#4 Hardware**

|    |         |   |     |                                |
|----|---------|---|-----|--------------------------------|
| E1 | 250-273 | 1 | .05 | 4-40 x 3/8" screw              |
| E2 | 250-248 | 1 | .05 | 4-40 x 1/2" self-tapping screw |
| E3 | 250-382 | 1 | .10 | 4-40 x 3/4" black nylon screw  |
| E4 | 252-15  | 1 | .05 | 4-40 nut                       |

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

**#6 Hardware**

|     |         |    |     |                              |
|-----|---------|----|-----|------------------------------|
| F1  | 250-208 | 1  | .05 | 6-32 x 1/8" screw            |
| F2  | 250-162 | 2  | .05 | 6-32 x 1/2" screw            |
| F3  | 250-89  | 23 | .05 | 6-32 x 3/8" screw            |
| F4  | 250-381 | 4  | .05 | 6-32 x 3/8" black screw      |
| F5  | 250-569 | 2  | .15 | 6-32 x 3/4" black screw      |
| F6  | 250-365 | 9  | .05 | #6 x 1/4" sheet metal screw  |
| F7  | 250-8   | 4  | .05 | #6 x 3/8" sheet metal screw  |
| F8  | 250-298 | 2  | .05 | #6 x 3/4" self-tapping screw |
| F9  | 252-3   | 15 | .05 | 6-32 nut                     |
| F10 | 252-22  | 4  | .05 | #6 Speed Nut*                |
| F11 | 252-118 | 3  | .35 | 6-32 x 1/4" press-in nut     |
| F12 | 254-6   | 23 | .05 | #6 lockwasher                |
| F13 | 259-1   | 9  | .05 | #6 solder lug                |

**Other Hardware**

|     |        |   |     |                       |
|-----|--------|---|-----|-----------------------|
| G1  | 250-16 | 6 | .05 | 8-32 x 3/16" setscrew |
| G2  | 250-22 | 2 | .10 | 8-32 x 7/16" setscrew |
| G3  | 252-7  | 6 | .05 | Control nut           |
| G4  | 253-10 | 5 | .05 | Control flat washer   |
| G5  | 253-11 | 2 | .05 | E-ring washer         |
| G6  | 254-5  | 4 | .05 | Control lockwasher    |
| G7  | 255-2  | 7 | .05 | 3/16" long spacer     |
| G8  | 255-3  | 2 | .05 | 3/8" long spacer      |
| G9  | 255-63 | 1 | .25 | 2" long spacer        |
| G10 | 259-10 | 1 | .05 | Control solder lug    |
| G11 | 259-24 | 1 | .05 | #8 plain solder lug   |
| G12 | 432-66 | 2 | .15 | Push-on connector     |

**MISCELLANEOUS**

|    |           |   |      |                         |
|----|-----------|---|------|-------------------------|
| H1 | 40-1089   | 1 | 1.45 | Rod antenna             |
| H2 | 54-96-24  | 1 | 5.40 | Power transformer       |
|    | 74-29     | 1 | .15  | Double-adhesive tape    |
|    | 75-90     | 1 | .15  | Gray insulating paper   |
| H3 | 203-779-3 | 1 | .75  | Rear panel              |
|    | 390-362   | 1 | .15  | Fuse replacement label  |
|    | 401-148   | 1 | 4.55 | Loudspeaker             |
|    | 407-116   | 1 | 5.00 | Meter                   |
| H4 | 412-17    | 1 | .20  | #53 pilot lamp          |
| H5 | 412-58    | 1 | .55  | #1813 pilot lamp        |
| H6 | 421-17    | 1 | .40  | .75 ampere pigtail fuse |
| H7 | 434-171   | 2 | .20  | Pilot lamp socket       |
| H8 | 436-19    | 1 | .60  | Phone jack              |
| H9 | 462-140   | 2 | .50  | Large knob              |
|    | 462-159   | 4 | .55  | Small knob              |

\*Registered Trademark, Tinnerman Company



## STEP-BY-STEP ASSEMBLY

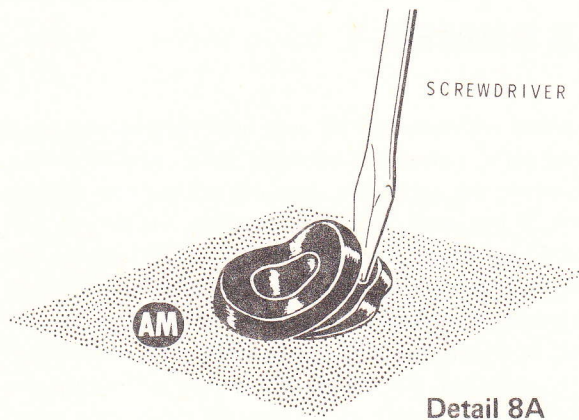
The illustrations in this section of the Manual are called Pictorials and Details. Pictorials show the overall operation for a group of assembly steps. Details are used to illustrate a single step. When you are directed to refer to a certain Pictorial "for the following steps," continue using that Pictorial until you are referred to another Pictorial for another group of steps.

As the drawings in the Manual may be slightly distorted to show all the parts clearly, look at the Chassis Photos (Page 67) from time to time to see the actual positions of wires and components.

Lockwashers and nuts will be used with most screws when mounting parts, unless the assembly steps state otherwise. Consequently, the applicable steps will call out only the size and type of hardware used. For example, the phrase "Use 6-32 x 1/4" hardware" means to use 6-32 x 1/4" screws, one or more #6 lockwashers, and 6-32 nuts. Refer to the Details for the proper installation of hardware. Be sure to position each part 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.

When a step directs you to "connect" an insulated wire, first prepare its ends by removing 1/4" of insulation.



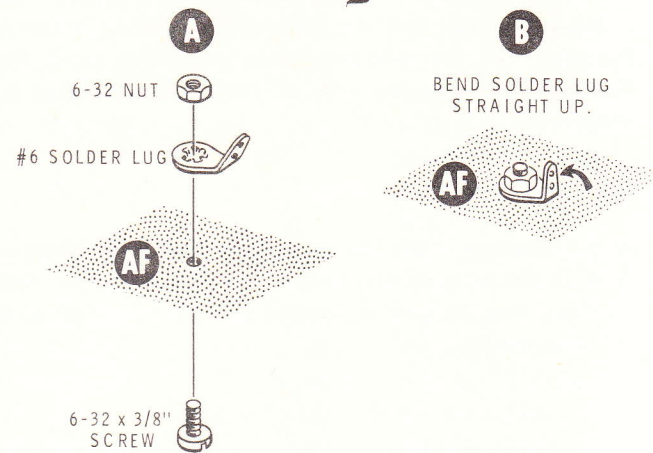


### CHASSIS PARTS MOUNTING

Refer to Pictorial 8 (fold-out from Page 25) for the following steps.

- ( ) Refer to Detail 8A and install a 3/8" grommet in the chassis at AM.
- ( ) In a similar manner, install a 1/4" grommet in the side of the chassis at AZ.
- ( ) Install 3/16" grommets at AN, AP, AR, AX, and AY.
- ( ) Temporarily push the piece of gray insulating paper (2-3/4" x 2-3/4") into the corner of the chassis so it touches both the chassis side and the front chassis apron, as shown in the Pictorial.
- ( ) Mount the 5.9 pF variable capacitor at G on the front chassis apron. Use 6-32 x 3/8" screws through grommets AX and AY. Tighten only until the screw heads are snug against the grommets. Make sure that no part of this capacitor touches the chassis.

- ( ) Bend the capacitor terminal away from the chassis side as shown.
- ( ) Remove the piece of gray insulating paper. Save the paper for use later.

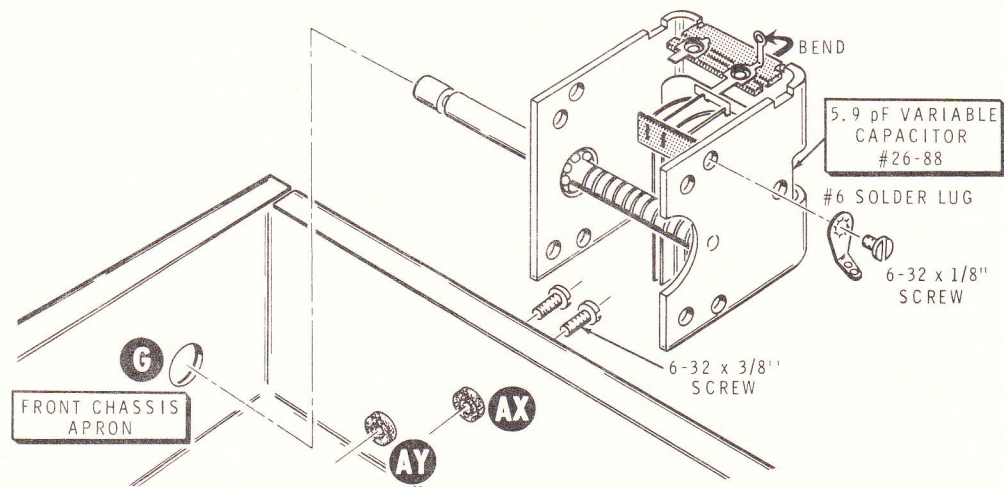


Detail 8B

NOTE: A plastic nut starter has been provided with this kit. Use it to hold and start nuts on screws. See Page 3 of the "Kit Builders Guide" for more information.

Refer to Detail 8B for the following steps.

- ( ) Refer to Part A of the Detail and mount a #6 solder lug on the under side of the chassis at AF. Use a 6-32 x 3/8" screw and a 6-32 nut. Position the solder lug as shown.
- ( ) Refer to Part B of the Detail and bend the solder lug straight up from the chassis.

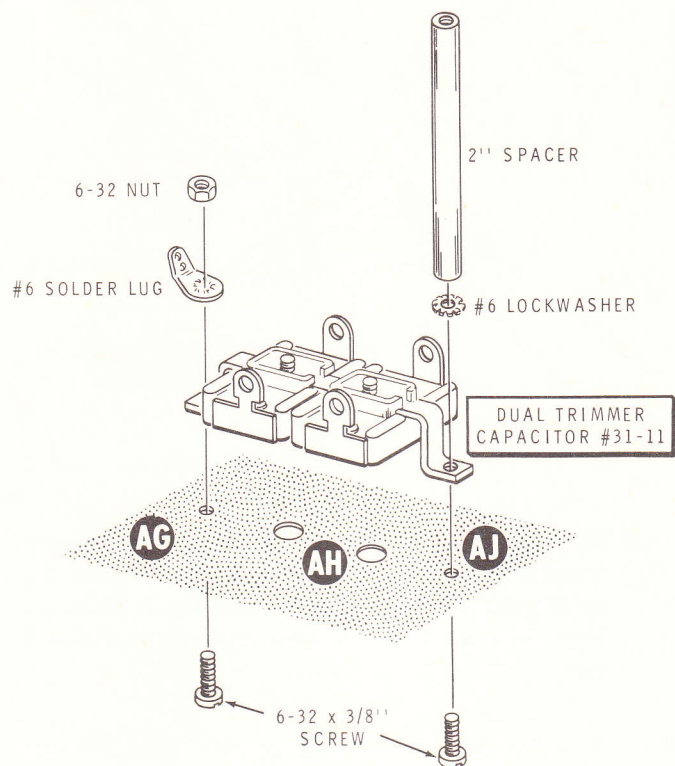


Detail 8C

NOTE: To avoid damage, keep the plates of the variable capacitors fully meshed while you assemble the Receiver.

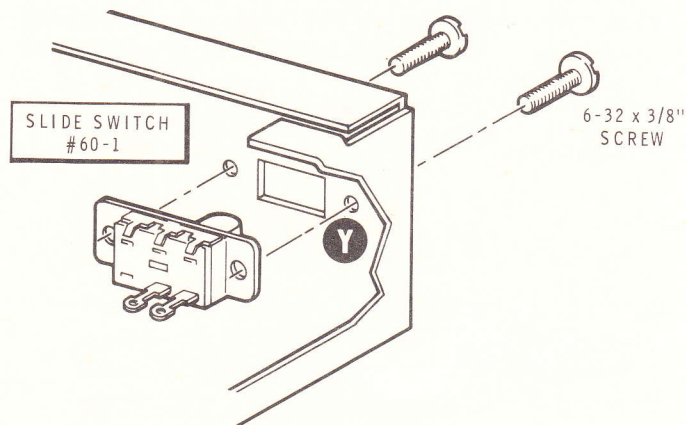
Refer to Detail 8C for the next three steps.

- ( ) Mount a #6 solder lug on the rear frame of a 5.9 pF variable capacitor (#26-88). Use a 6-32 x 1/8" screw.



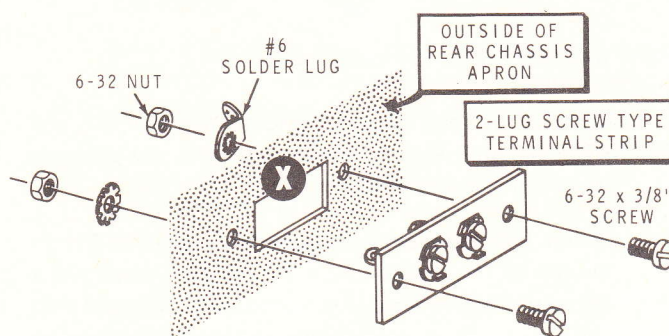
Detail 8D

- ( ) Refer to Detail 8D and mount the dual trimmer capacitor on the chassis at AH. Use a 6-32 x 3/8" screw, a #6 solder lug, and a 6-32 nut at AG. Use a 6-32 x 3/8" screw, a #6 lockwasher, and the 2" long spacer at AJ.



Detail 8E

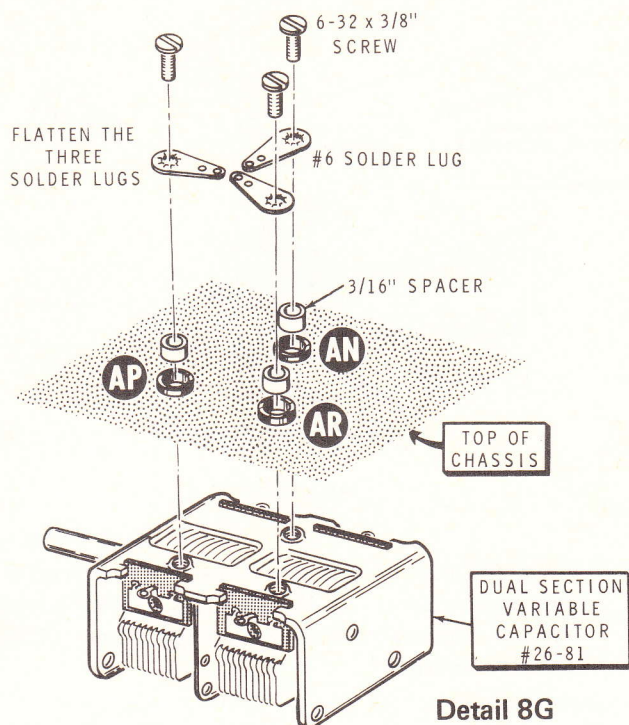
- ( ) Refer to Detail 8E and mount the slide switch on the rear chassis apron at Y. Use 6-32 x 3/8" screws. Position the switch lugs toward the corner of the chassis as shown.



Detail 8F

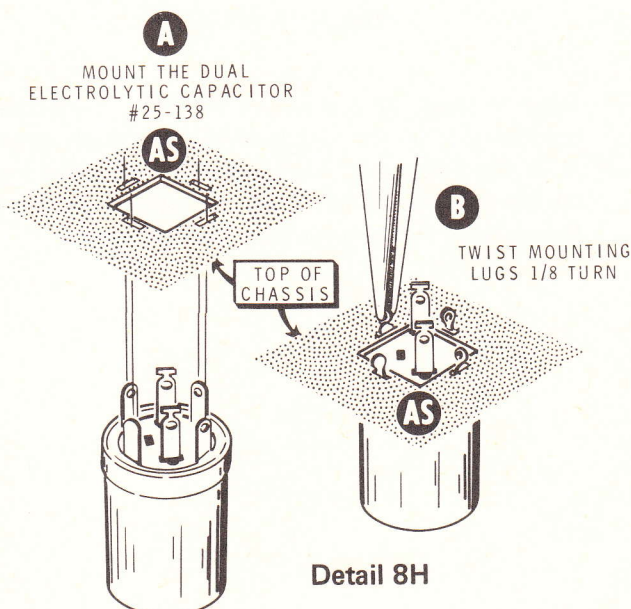
- ( ) Refer to Detail 8F and mount the 2-lug, screw-type terminal strip on the outside of the rear chassis apron at X. Use 6-32 x 3/8" hardware with a #6 solder lug on one screw as shown. Point the solder lug toward the center of the chassis as shown in the Pictorial.



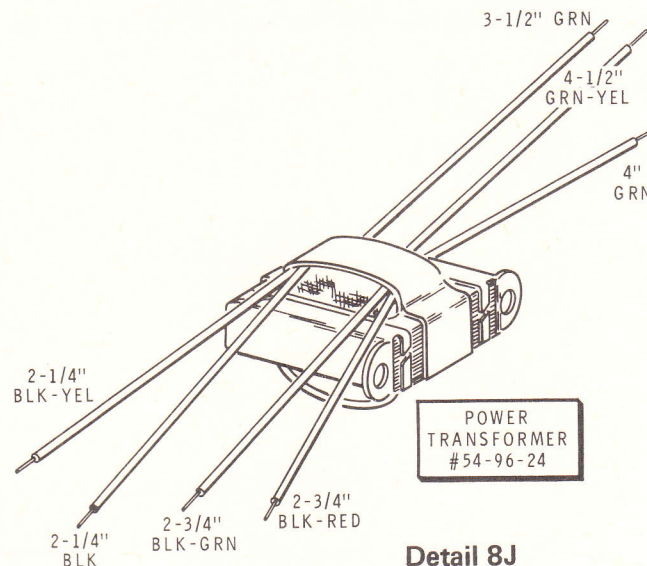


Refer to Detail 8G for the following steps:

- ( ) Force 3/16" long spacers into grommets AN, AP, and AR. The outer ends of the spacers must not protrude beyond the grommet faces.
- ( ) Mount the dual section variable capacitor (#26-81) on the top of the chassis. Use a 6-32 x 3/8" screw and a #6 solder lug at each of grommets AN, AP, and AR. Flatten the three solder lugs and position them so their ends come together at the midpoint of the three grommets.

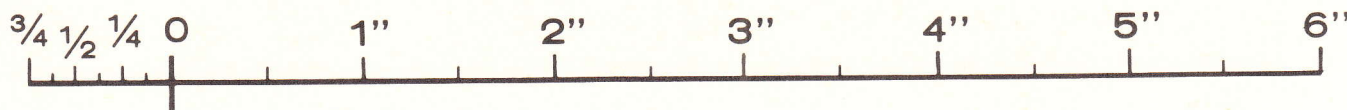
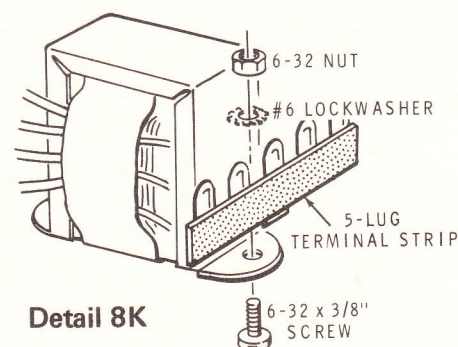


- ( ) Refer to Detail 8H and mount the dual electrolytic capacitor on the top of the chassis at AS with the ■ mark on the capacitor positioned as shown in the Pictorial. Hold the capacitor snugly against the chassis and use pliers to twist each of the four mounting lugs about 1/8 of a complete turn.

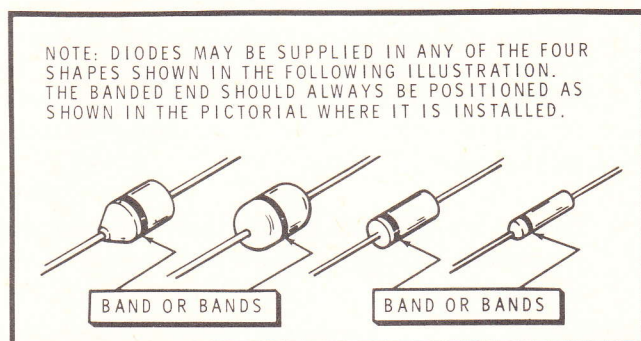


- ( ) Refer to Detail 8J and cut the leads of the power transformer to the lengths shown. Measure from the point where the leads leave the transformer windings. Then remove 1/4" of insulation from the end of each lead.
- ( ) If it has not been done previously, twist the fine strands of each transformer lead and melt a small amount of solder on each lead. This will make soldering the connections easier, and it will avoid the possibility of "stray" strands causing a short circuit.

NOTE: The 5-lug terminal strip will be pre-wired outside of the chassis before it is permanently mounted. Be sure that you position the parts and wires as shown and that you do not obstruct access to the screw which holds the terminal strip to the transformer.

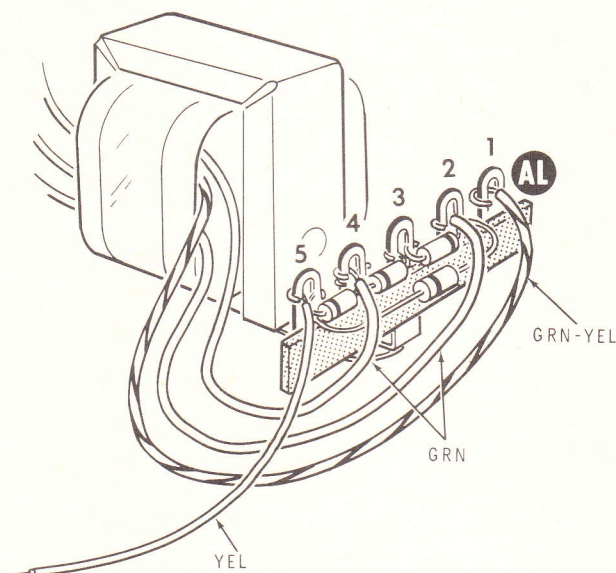


- ( ) Refer to Detail 8K and turn the power transformer so its leads are toward you. Then temporarily mount the 5-lug terminal strip on the right hand transformer mounting foot. Use 6-32 x 3/8" hardware.



Detail 8L

Refer to Detail 8L to identify diode leads.



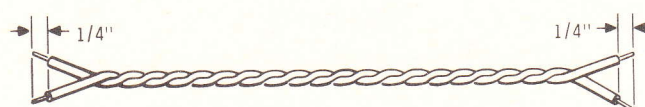
Detail 8M

Refer to Detail 8M and connect four 1N4002 diodes (#57-65) to the 5-lug terminal strip as follows:

- ( ) The lead at the banded end of a diode to lug 2 (NS) and the other lead to lug 3 (NS).
- ( ) The lead at the banded end of a diode to lug 4 (NS) and the other lead to lug 3 (S-2).
- ( ) The lead at the banded end of a diode to lug 5 (NS) and the other lead to lug 4 (NS).
- ( ) The lead at the banded end of a diode to lug 5 (NS) and the other lead to lug 2 (NS).

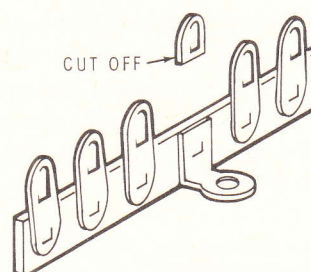
Route the green and green-yellow wires from the transformer as shown in Detail 8M and connect them to the 5-lug terminal strip as follows:

- ( ) Green-yellow to lug 1 (NS).
- ( ) Longer green to lug 2 (NS).
- ( ) Shorter green to lug 4 (NS).
- ( ) Connect one end of a 3-1/4" yellow hookup wire to lug 5 of the terminal strip (S-3). The other end of this wire will be connected later.



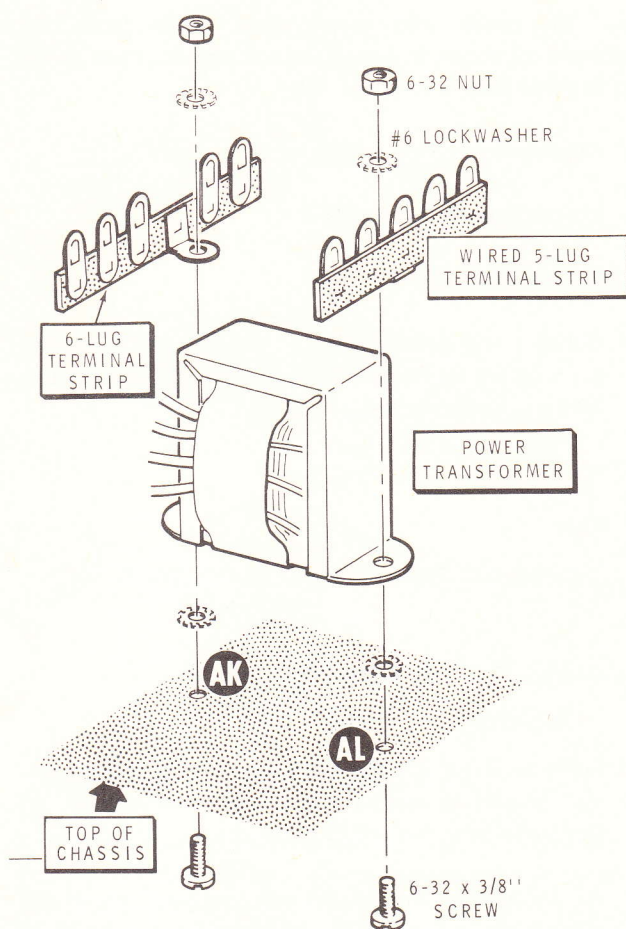
Detail 8N

- ( ) Refer to Detail 8N and form a twisted pair from two 12" lengths of green hookup wire. Remove 1/4" of insulation from the end of each wire.
- ( ) At one end of the twisted pair, connect one of the green wires to lug 1 (NS) and the other green wire to lug 2 (S-4) of the terminal strip.
- ( ) Prepare two 22" green wires and form a twisted pair.
- ( ) At one end of the twisted pair, connect one wire to lug 1 (S-3) and the other wire to lug 4 (S-4) of the terminal strip.
- ( ) Remove the 6-32 hardware from the terminal strip and transformer.
- ( ) Refer to Detail 8P and cut off the solder lug portion of the mounting foot on the 6-lug terminal strip.



Detail 8P



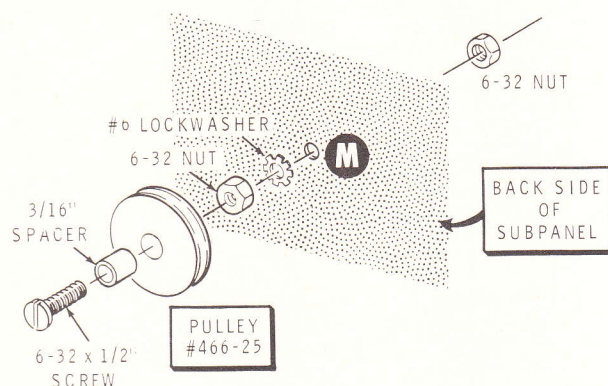


Detail 8Q

NOTE: The 5-lug terminal strip in the following step is the one pre-wired earlier. For clarity, Detail 8Q does not show the prewiring.

- ( ) Refer to Detail 8Q and mount the power transformer on the bottom of the chassis. Use 6-32 x 3/8" hardware. Place the 6-lug terminal strip at AK and the pre-wired 5-lug terminal strip at AL. Be sure to position the mounting foot of each terminal strip as shown. Use lockwashers under each transformer mounting foot as shown.
- ( ) Insert the ends of both green twisted pairs through grommet AM and pull the pairs up through the grommet to the top of the chassis. Do not pull the pairs so tight that there is any strain on the connections to the terminal strip. The loose ends of these pairs will be connected later.
- ( ) From the gray insulating paper, cut off a strip 1" wide to form a piece 1" x 2-3/4". Save the remaining paper for use later.

- ( ) At 1-1/8" from one end of the strip, notch out the insulating paper so it will fit snugly around the transformer mounting foot at AK and be centered under the terminal strip as shown in Pictorial 8.
- ( ) Remove the white protective backing from the gray insulating paper and (keeping the adhesive off the chassis as much as possible) slide the strip under the terminal strip with the adhesive side down. Then press the paper onto the chassis.
- ( ) Remove the protective backing paper from the fuse replacement label and press the adhesive side of the label against the chassis as shown in Pictorial 8.
- ( ) Temporarily set the chassis aside.

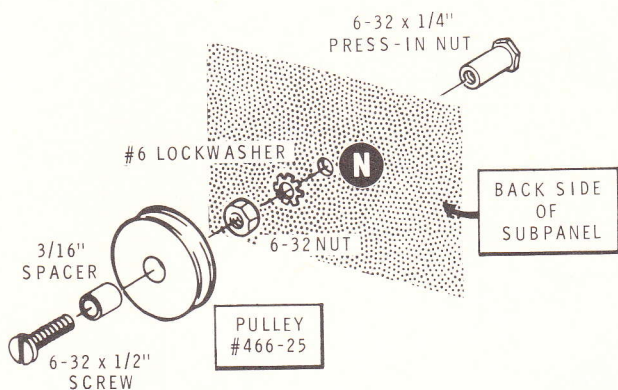


Detail 9A

## SUBPANEL ASSEMBLY

Refer to Pictorial 9 (fold-out from Page 25) for the following steps.

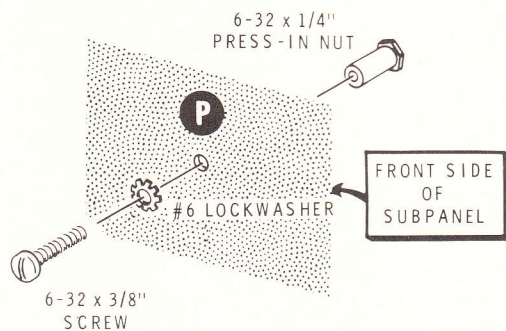
- ( ) Refer to Detail 9A and mount a white pulley on the subpanel at M as follows:
  1. Insert a 3/16" long spacer and a 6-32 x 1/2" screw into the pulley.
  2. Place a 6-32 nut on the screw and tighten it until it just touches the spacer.
  3. Place a #6 lockwasher on the screw.
  4. Place the screw of the pulley assembly into hole M on the back (unpainted) side of the subpanel and secure it with a 6-32 nut on the front of the subpanel. Tighten this nut securely.
  5. Make sure the pulley still turns easily on the spacer.



Detail 9B

( ) Refer to Detail 9B and mount a pulley and spacer assembly on the back side of the subpanel at N as follows:

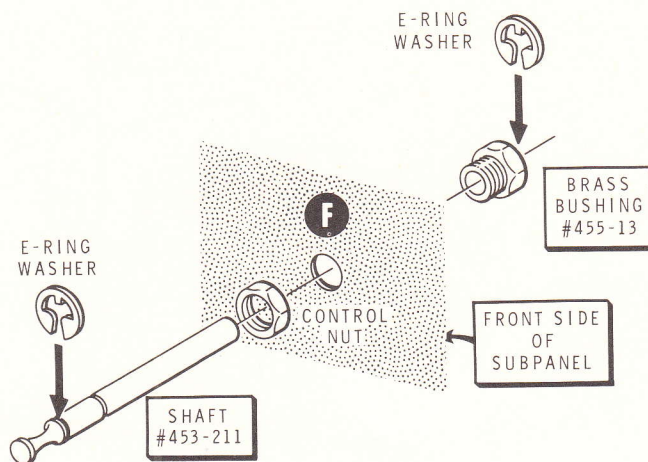
1. Insert a 3/16" long spacer and a 6-32 x 1/2" screw into a white pulley.
2. Place a 6-32 nut on the screw and tighten it until it just touches the spacer.
3. Place a #6 lockwasher on the screw.
4. Place the screw of the pulley assembly into hole N from the back of the subpanel and secure it with a 6-32 x 1/4" press-in nut on the front of the panel. Make sure the hex end of the nut is away from the panel.



Detail 9C

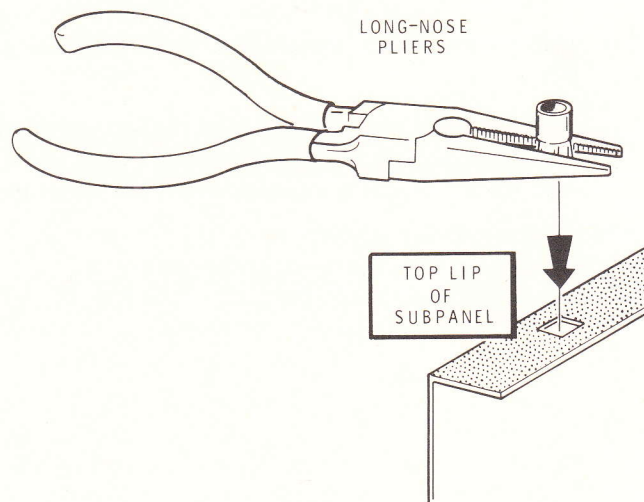
- ( ) Refer to Detail 9C and mount a 6-32 x 1/4" press-in nut on the front of the subpanel at P. Use 6-32 x 3/8" hardware.
- ( ) Similarly, mount another press-in nut on the front of the subpanel at S.

Refer to Detail 9D for the next two steps.



Detail 9D

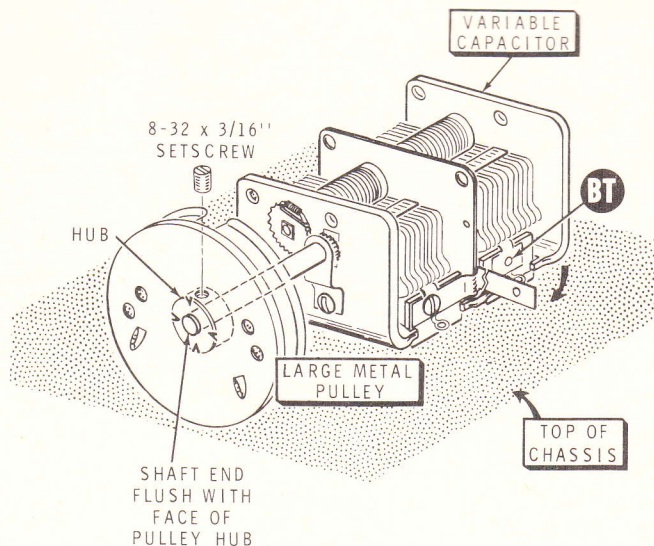
- ( ) Mount a brass bushing on the front of the subpanel at F. Use a control nut.
- ( ) Place an E-ring washer in the shaft groove near the shaft end. Then place the shaft in the bushing so that the other groove is visible at the front of the bushing. Place an E-ring washer in this groove.
- ( ) Refer to Detail 9E and use long-nose pliers to compress the two skirts on a nylon insert. Then press the insert into the opening at BP in the subpanel until the round portion of the insert is against the panel lip.



Detail 9E

- ( ) Similarly, insert another nylon insert into the subpanel at BR.





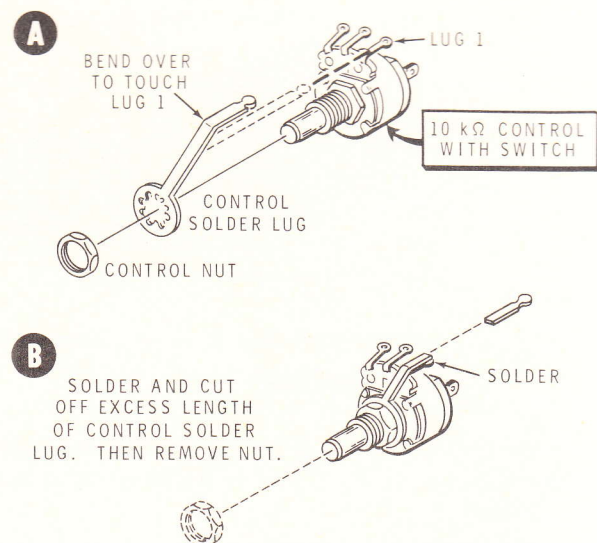
PICTORIAL 10

## CIRCUIT BOARD AND PANEL MOUNTING

Refer to Pictorial 10 for the following steps.

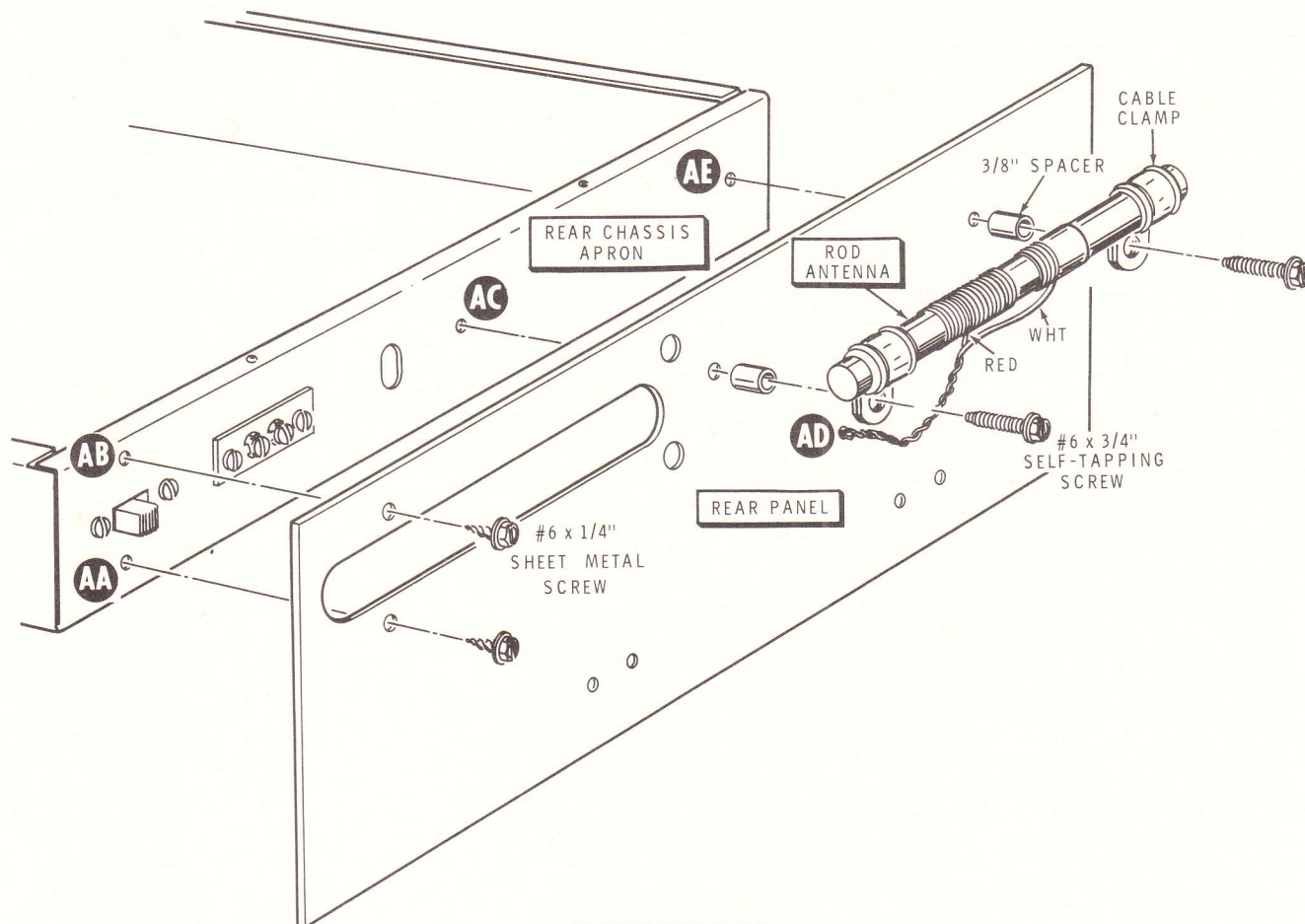
- ( ) Start an 8-32 x 3/16" setscrew into the tapped hole in the hub of the large metal pulley.
- ( ) Push the large metal pulley onto the variable capacitor shaft until the end of the shaft is flush with the face of the pulley hub. Be sure the open face of the pulley is toward the capacitor. Then tighten the setscrew.
- ( ) Remove and discard the screw from the capacitor at BT.
- ( ) Bend the metal tab out away from the rear section of the capacitor as shown. Cut the tab off and discard it. Also discard the mica insulator which was under the tab.

Refer to Pictorial 11 (fold-out from Page 25) for the following steps.



Detail 11A

- ( ) Refer to Detail 11A and mount the control solder lug on the 10 kΩ control with switch (#19-95). Align the control solder lug with lug 1 of the control, and retain it in position with a control nut.
- ( ) Form the control solder lug so it touches lug 1 of the control (S-1) as shown in Detail 11A. Cut off the excess length of the control solder lug. Then remove and set the control nut aside. This assembly will be used later.
- ( ) Mount the subpanel on the front of the chassis. Secure it with the phone jack, a control lockwasher, a control flat washer, and a control nut at E and with the 1 megohm control, a control lockwasher, a control flat washer, and a control nut at A. Tighten the nuts only finger tight.
- ( ) Similarly, install a 3-position rotary switch at D.
- ( ) Install the 10 kΩ control with switch at B. Use a control flat washer and a control nut. Tighten the nuts finger tight only.



PICTORIAL 12

NOTE: The rod antenna furnished may vary in appearance from the one shown.

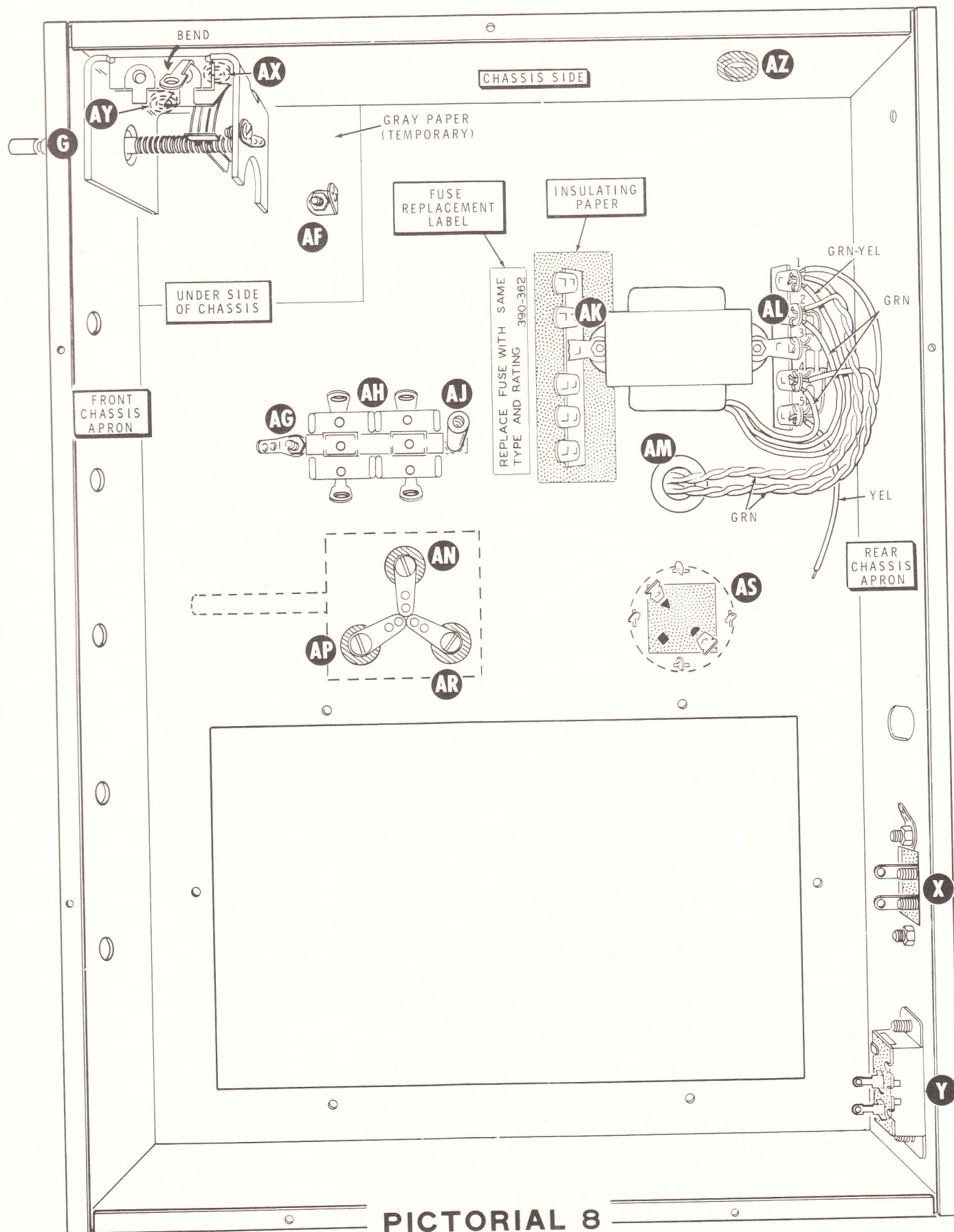
Refer to Pictorial 12 for the following steps.

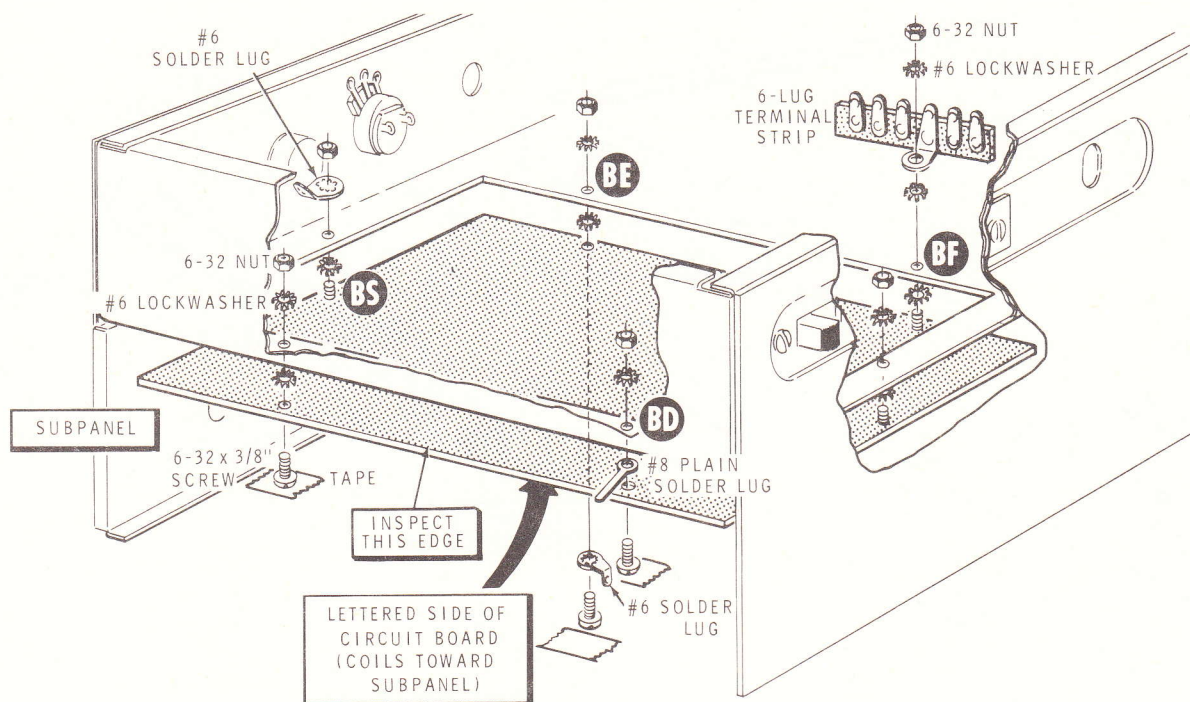
- ( ) Place two cable clamps on the rod antenna. Simultaneously mount the rod antenna on the rear panel and the rear panel on the rear chassis apron. Use a 3/8" long spacer and a #6 x 3/4" self-tapping screw at AC and at AE. Be sure to position the red lead of

the antenna toward hole AD in the rear panel as shown in the Pictorial. Do not overtighten these screws.

- ( ) Install #6 x 1/4" sheet metal screws through the rear panel into the rear chassis apron at AA and AB.
- ( ) Bring the white antenna lead over to the point where the red lead leaves the antenna rod. Then twist the red and the white antenna leads together and push them through hole AD in the rear panel.







PICTORIAL 13

Refer to Pictorial 13 for the following steps.

- ( ) Cut a 1" length of double-adhesive tape from the 1-foot length furnished. Lay this piece aside for use later.

NOTE: When the circuit board is mounted, lockwashers must be installed between the chassis and the foil side of the circuit board. This assures a good ground between the circuit board and the chassis. This operation can be simplified if you place a 1-1/2" piece of tape over each screw head after the screws are placed in the holes from the lettered side of the circuit board. The tape will hold the screws in place until lockwashers and nuts are installed. The tape furnished has adhesive with a protective covering on each side. Remove the covering from one side only when you tape the screw heads.

- ( ) Cut six 1-1/2" lengths of tape.

NOTE: In the following step, after you raise the circuit board into place but before you install the hardware to hold it, carefully inspect the circuit board along its lower edge (as shown in the Pictorial) to make sure that no soldered connections contact the chassis edge. If they do, remelt the solder and clip the leads as necessary to allow the circuit board to lie flat against the chassis. Failure to do this may result in a cracked circuit board.

- ( ) Mount the circuit board on the chassis. (Position the board as shown in Pictorial 14.) Use 6-32 x 3/8" hardware. Tape the screw heads into place with the 1-1/2" pieces of tape. On the lettered side of the circuit board, place a #6 solder lug under the screw head at BE. At BD place a #8 plain solder lug on the screw instead of a lockwasher. Then raise the circuit board into place and secure the screws with lockwashers and nuts. Do not place nuts or lockwashers on the screws at BF or BS. Tighten the nuts finger tight only.
- ( ) Install a 6-lug terminal strip on circuit board mounting screw BF. Position the mounting foot as shown. Note the lockwashers used.
- ( ) Place a #6 solder lug and a 6-32 nut on the screw at BS. Be sure to position the solder lug as shown.
- ( ) Remove the tape from the screw heads, position each solder lug as shown in the Pictorials, and tighten each mounting screw securely so the lockwashers will bite into the circuit board foil to form a good connection to the chassis.

## CHASSIS WIRING

Refer to Pictorial 14 for the following steps.

NOTE: The metal braid furnished is actually flattened tubular braid; the end can be opened up by inserting the tip of a knife blade.



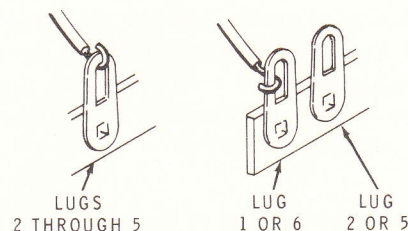
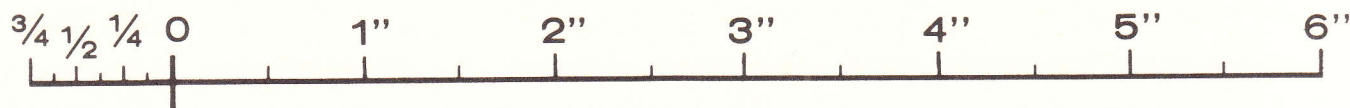
- ( ) Use the point of a pen knife to open up one end of a 2" length of metal braid. Slide this end over the capacitor mounting lug at AU (S-1). Route the braid under the terminal strip BF to point BA on the circuit board (S-1). Solder the braid directly to the foil. Make sure this braid does not touch any metal on the terminal strip.
- ( ) Use the point of a pen knife to open up one end of a 3" length of metal braid. Slide the braid over the capacitor mounting lug at AT (S-1). Solder the other end of the braid to the three solder lugs AN, AP, and AR.
- ( ) Use the point of a pen knife to open up one end of a 1-3/4" length of metal braid. Slide the braid over lug 2 of terminal strip X on the rear chassis apron (S-1). Solder the other end of the braid directly to the circuit board foil at BB.
- ( ) Open up both ends of a 1-1/4" length of metal braid with a knife point. Slide one end of the braid onto solder lug AF (S-1), and the other end over the solder lug on the rear of variable capacitor G (S-1).



Detail 14A

- ( ) Refer to Detail 14A and form a twisted pair from two 11" lengths of red stranded wire. Remove 1/4" of insulation from the end of each wire. Twist the fine strands together, and melt a small amount of solder on the ends of each wire.
- ( ) Refer to Detail 14B and, at one end of the twisted pair, connect one wire to lug 4 (S-1) and the other wire to lug 5 (S-1) of control B.
- ( ) At the other end of the twisted pair, connect one wire to lug 1 (NS) and the other wire to lug 2 (NS) of terminal strip AK. Route these wires as shown.

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

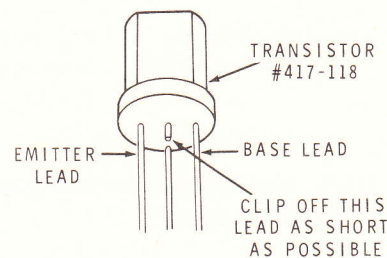


Detail 14B

If this receiver will be used in Canada, these instructions for wiring terminal strip AK must be followed to comply with Canadian standards.

So the clearance between lugs will not be reduced, all leads to lugs 2 through 5 must be wrapped at the top of the solder lug. Connections to lugs 1 and 6 may be wrapped around the side away from lugs 2 or 5.

- ( ) Cut a 2-1/4" length of yellow hookup wire and remove all the insulation. Save the insulation for use later.
- ( ) Push the end of the hookup wire through lug 1 (S-2) to lug 2 (S-1) of dual trimmer capacitor AH. Connect the other end of the wire to solder lug AG (S-1).
- ( ) Connect a 220  $\Omega$  (red-red-brown) resistor from lug 1 (NS) to lug 2 (NS) of terminal strip BF.



Detail 14C

- ( ) Refer to Detail 14C and prepare two 2N3393 (#417-118) transistors as shown.
- ( ) Position one of these transistors with the flat side toward the chassis. Connect the emitter lead to lug 3 (NS) and the base lead to lug 4 (NS) of terminal strip BF.

- ( ) Cut two 3/8" lengths of insulation from the yellow length laid aside earlier. Place one 3/8" length on each lead of the other transistor. Position the transistor with the flat side away from the chassis. Connect the base lead to lug 3 (S-2) and the emitter lead to lug 5 (NS) of terminal strip BF.
- ( ) Connect the banded end of the zener diode (#56-19) to lug 2 (NS) and the other end to lug 4 (NS) of terminal strip BF.

NOTE: When you connect a wire to the circuit board in the following steps, do not insert more than 1/8" of the wire into the circuit board hole.

- ( ) Connect a 17-1/2" length of green hookup wire from lug 3 of phone jack E (S-1) to hole B on the circuit board (S-1). Route the wire as shown in Pictorial 14.

Refer to Pictorial 15 (fold-out from Page 31) for the following steps.

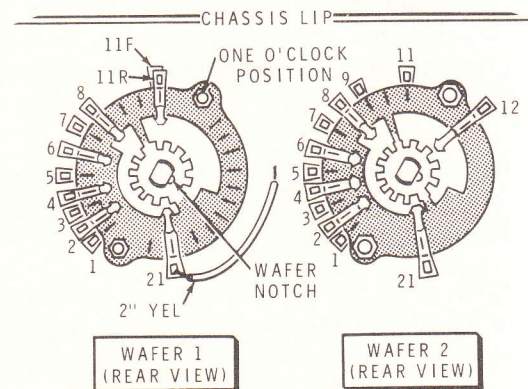
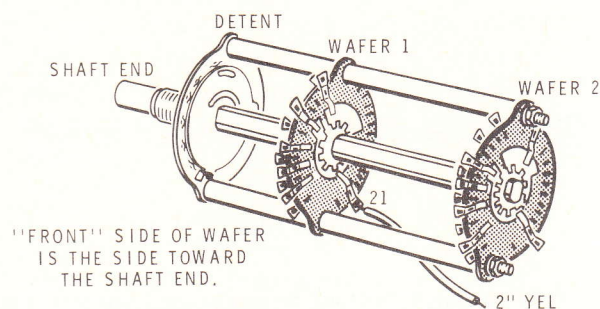
NOTE: To "prepare" a hookup wire, cut it to length and then remove 1/4" of insulation from each end. Be careful not to nick the wire when you cut the insulation.

- ( ) Prepare the following lengths of blue hookup wire:

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

- ( ) Connect a 1-1/4" blue hookup wire from lug 4 (S-3) to lug 6 (NS) of terminal strip BF.
- ( ) Connect a 1-1/2" blue hookup wire from L on the circuit board (S-1) to lug 1 of terminal strip BF (NS).
- ( ) Connect a 2" blue hookup wire from lug 1 of terminal strip BF (S-3) to lug 2 of capacitor AS (NS).
- ( ) Connect a 1-3/4" blue hookup wire from lug 5 of terminal strip BF (NS) to lug 1 of capacitor AS (NS).

- ( ) Connect a 3" blue hookup wire from lug 5 of terminal strip BF (S-3) to hole HH on the circuit board (S-1).
- ( ) Connect a 4-1/2" blue hookup wire from lug 2 of terminal strip BF (NS) to hole V on the circuit board (S-1).
- ( ) Cut each lead of the 500  $\mu$ F electrolytic capacitor to a length of 3/4".
- ( ) Connect the lead at the positive (+) end of the 500  $\mu$ F electrolytic capacitor to lug 2 (S-4) and the other lead to lug 6 (S-2) of terminal strip BF. Make sure the body of this capacitor does not touch the leads of any component mounted on the terminal strip.
- ( ) Connect the 390  $\Omega$  (orange-white-brown) resistor from lug 1 (NS) to lug 2 (S-2) of capacitor AS.
- ( ) Connect the end of the 3-1/4" yellow wire coming from lug 5 of terminal strip AL to lug 1 of capacitor AS (S-3).



PICTORIAL 16





Refer to Pictorial 16 for the arrangement of the 2-wafer rotary switch wafers and the numbering of the switch lugs. Observe that each space is numbered, even though a lug is not installed. Excepting lug 11 and lug 21, all odd numbered lugs are on the front side of the wafer (side toward the shaft end). Lug 11 of wafer #1 has solder lugs on both sides of the wafer. The lug on the front side of the wafer is "11F" and the lug on the rear side is lug "11R."

- ( ) Prepare a 2" yellow hookup wire.
- ( ) Refer to Pictorial 16 and connect one end of the hookup wire to lug 21 of wafer #1 of the 2-wafer rotary switch (S-1). The other end will be connected later.

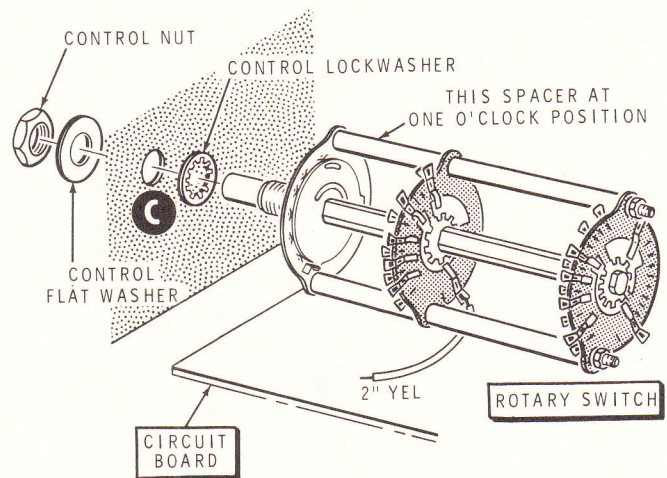
Refer to Pictorial 17 for the following steps.

- ( ) Refer to Detail 17A and temporarily install the 2-wafer rotary switch at C on the front chassis apron in the position shown. Use a control flat washer, a control lockwasher, and a control nut. Before you install the switch, position the hookup wire from wafer #1 so its free end will be over the circuit board. Be sure to position the spacers between lugs 11 and 12 at the one o'clock position.

**CAUTION:** When you solder wires to the switch wafers in the following steps, be sure you do not use so much solder that it flows into the switch contacts.

- ( ) Prepare the following lengths of yellow hookup wire:

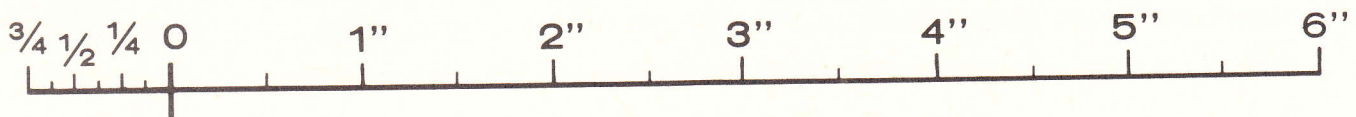
1-3/4"  
2-1/2"  
3-1/2"



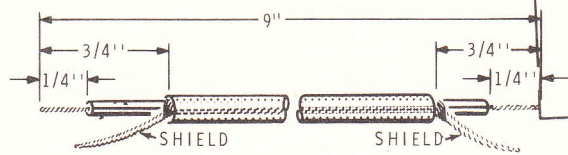
**Detail 17A**

Wire the lugs on the front of wafer #1 of switch C as follows:

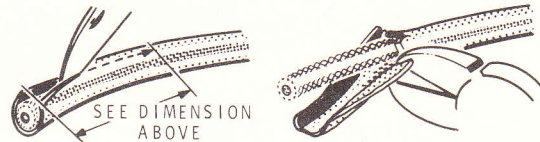
- ( ) Connect a 1-3/4" yellow hookup wire from lug 3 (S-1) to hole DD on the circuit board (S-1).
- ( ) Connect a 2-1/2" yellow hookup wire from lug 5 (S-1) to point EE on the circuit board (S-1).
- ( ) Connect a 3-1/2" yellow hookup wire from lug 7 (S-1) to point FF on the circuit board (S-1).



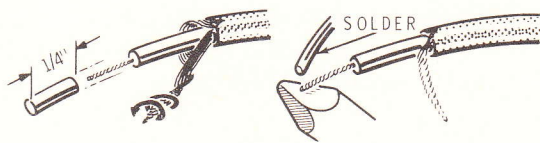
CUT THE CABLE ACCORDING TO THE DIMENSIONS BELOW. PREPARE EACH END AS SHOWN.



TAKING CARE NOT TO CUT THE OUTER SHIELD OF VERY THIN WIRES, REMOVE THE OUTER INSULATION.



COMB OUT THE SHIELD WIRES AND TWIST THEM INTO ONE STRAND. REMOVE THE INNER INSULATION. THEN APPLY A SMALL AMOUNT OF SOLDER TO THE END OF THE INNER LEAD.



**Detail 17B**

- ( ) Refer to Detail 17B and prepare two 9" single conductor shielded cables. Comb out the shield wires to expose the center conductor, and twist the shield wires tightly together as shown. Melt a small amount of solder on the ends of the twisted center conductors.
- ( ) Cut off the shield wires at one end of one of the shielded cables. Connect the center conductor at this end to lug 1 of bandswitch wafer #1 (S-1). Pass the other end of this cable under switch C and under the blue wire from lug 2 of terminal strip BF. Connect the center conductor to lug 1 (S-1) and the shield wires to the braid on lug 2 (S-1) of terminal strip X.
- ( ) Cut a 4-3/4" length of yellow hookup wire. Remove 1/4" of insulation from one end and 2-1/4" of insulation from the other end.
- ( ) Push the 2-1/4" bare end of the hookup wire through lug 12 of wafer #2 of switch C (NS), and through lug 11R (S-2) to lug 11F (NS) of switch wafer #1. The other end of this wire will be connected later.

Refer to Pictorial 18 for the following steps.

- ( ) Prepare the following lengths of yellow hookup wire:

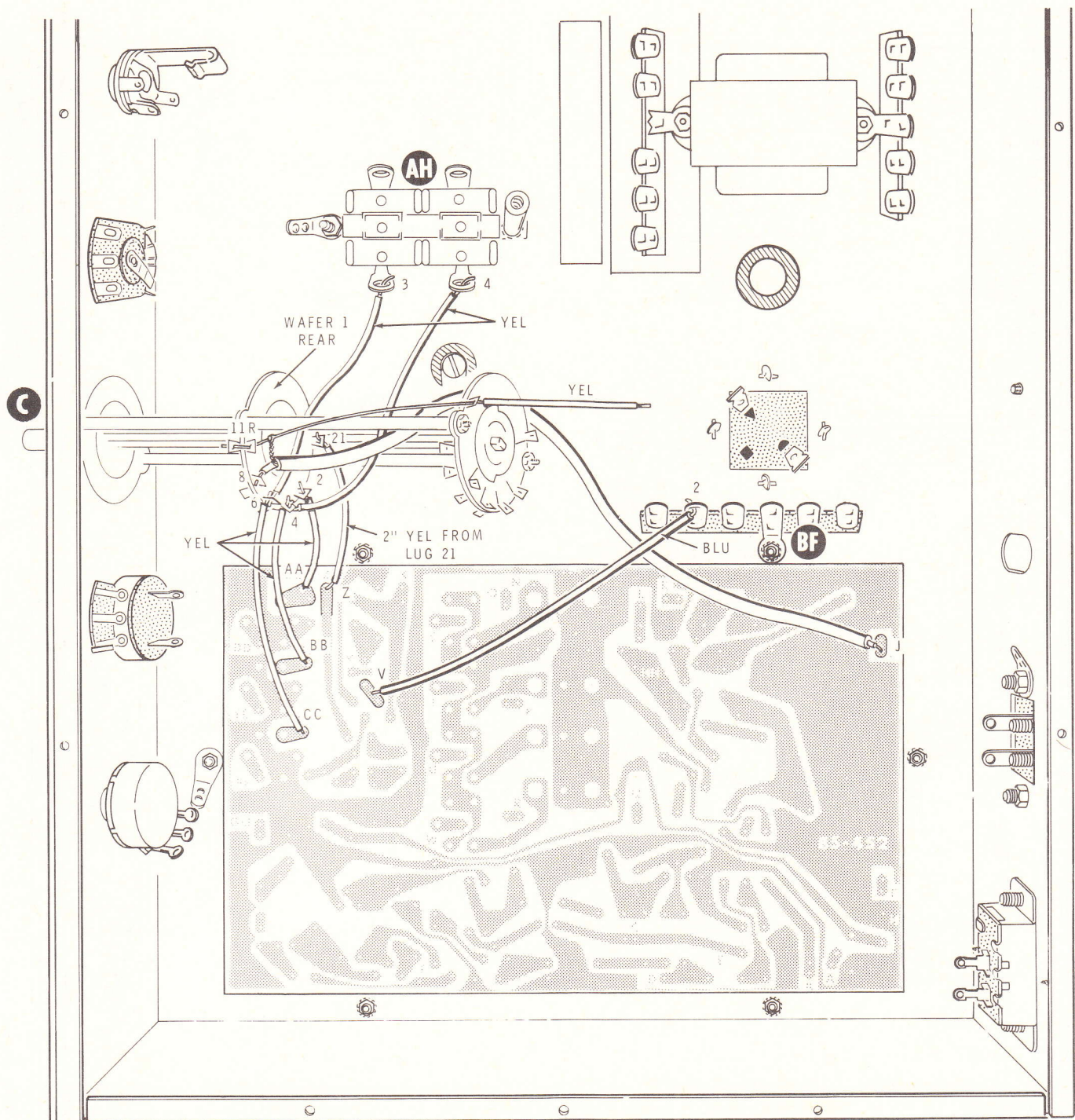
1-1/4"  
2"  
3"  
3-1/2"  
3-1/4"

Wire the lugs on the rear of wafer #1 of switch C as follows:

- ( ) Connect the yellow hookup wire coming from lug 21 to hole Z on the circuit board (S-1).
- ( ) Connect the 1-1/4" hookup wire from lug 2 (S-1) to hole AA on the circuit board (S-1).
- ( ) Connect the 2" hookup wire from lug 4 (NS) to hole BB on the circuit board (S-1).
- ( ) Connect the 3" hookup wire from lug 6 (NS) to hole CC on the circuit board (S-1).
- ( ) Connect the 3-1/2" hookup wire to lug 4 (S-2). Pass the other end of this wire under the switch shaft and connect it to lug 4 of dual trimmer AH (S-1).
- ( ) Connect the 3-1/4" hookup wire to lug 6 (S-2). Pass the other end of this wire under the switch shaft and connect it to lug 3 of dual trimmer AH (S-1).
- ( ) At one end of the remaining 9" single conductor shielded cable, connect the center conductor to lug 8 (S-1). Wrap the shield wires around the bare wire going to lug 11R (S-1).
- ( ) At the free end of the shielded cable in the preceding step, cut off the shield wires only. Then pass this end over the switch shaft and under the long blue wire coming from lug 2 of terminal strip BF. Connect the center conductor to hole J in the circuit board (S-1).







PICTORIAL 18

Refer to Pictorial 19 for the following steps.

- ( ) Prepare the following lengths of yellow hookup wire:

|        |        |
|--------|--------|
| 2"     | 2-1/4" |
| 2-1/4" | 3-1/4" |
| 1-1/2" | 4-1/4" |

- ( ) Connect one end of a 2" yellow hookup wire to hole X on the circuit board (S-1). Position the wire between the switch and the chassis. The free end will be connected later.

Wire the lugs on the front of wafer #2 of switch C as follows:

- ( ) Connect a 2-1/4" hookup wire from lug 1 (S-1) to hole Y on the circuit board (S-1).
- ( ) Connect the 1-1/2" hookup wire from lug 3 (S-1) to the remaining hole in foil S on the circuit board (S-1).
- ( ) Connect a 2-1/4" hookup wire from lug 5 (S-1) to the remaining hole in foil T on the circuit board (S-1).
- ( ) Connect the 3-1/4" hookup wire from lug 7 (S-1) to the remaining hole in foil U on the circuit board (S-1).
- ( ) Connect the 4-1/4" hookup wire from lug 9 (S-1) to the remaining hole in foil W on the circuit board (S-1).
- ( ) Connect the lead at the positive (+) end of a 10  $\mu$ F electrolytic capacitor to lug 11 (S-1). Connect the other lead of the capacitor to lug 12 on the rear of wafer #2 (S-3).

Refer to Pictorial 20 for the following steps.

- ( ) Prepare the following lengths of yellow hookup wire:

|        |    |
|--------|----|
| 1-1/4" | 4" |
| 1-1/2" | 7" |
| 2-3/4" |    |

Wire the lugs on the rear of wafer #2 of switch C as follows:

- ( ) Connect the 1-1/4" hookup wire from lug 2 (S-1) to hole N on the circuit board (S-1).

- ( ) Connect the 1-1/2" hookup wire from lug 4 (S-1) to hole O on the circuit board (S-1).

- ( ) Connect the 2-3/4" hookup wire from lug 6 (S-1) to hole P on the circuit board (S-1).

- ( ) Connect the 4" hookup wire from lug 8 (S-1) to hole R on the circuit board (S-1).

- ( ) Connect the hookup wire coming from hole X on the circuit board to lug 21 (NS).

- ( ) Connect the 7" hookup wire from lug 21 (S-2) to the terminal lug on variable capacitor G (S-1).

- ( ) Inspect the connections at lug 21 carefully to make sure there is NO contact between them and the three adjacent solder lugs.

- ( ) Connect the hookup wire coming from lug 12 of wafer #2 of switch C to hole M on the circuit board (S-1). The letter M may be partially obscured by the edge of the chassis.

Refer to Pictorial 21 for the following steps.

- ( ) Bend the solder lug at BS and lug 1 of control A so they touch each other. It may be necessary to reposition the control.

- ( ) Connect a 20 pF disc capacitor from lug 2 (NS) to lug 1 (NS) of control A.

- ( ) Connect a 1-1/4" yellow hookup wire from lug 2 of control A (S-2) to hole GG in the circuit board (S-1).

- ( ) Refer to Detail 21A (on Page 32) and prepare a 5" length of shielded cable as shown.

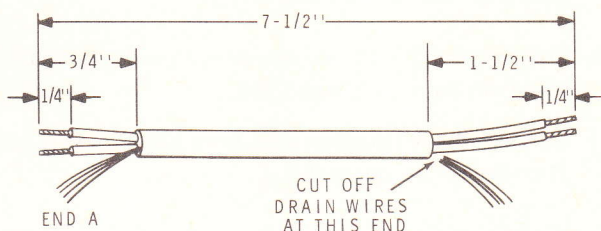
- ( ) Connect end A of the cable to control A as follows:  
Shield lead through lug 1 to solder lug BS.  
Solder the connections.  
Inner lead to lug 3 (S-1).

- ( ) Connect the free cable end to circuit board hole C (S-1).

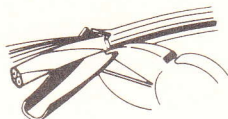




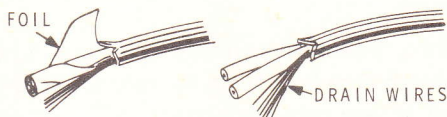
CUT THE CABLE ACCORDING TO THE DIMENSIONS BELOW. PREPARE EACH END AS SHOWN.



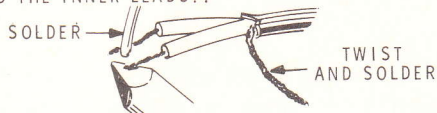
TAKING CARE NOT TO CUT THE OUTER DRAIN (VERY THIN) WIRES, REMOVE THE OUTER INSULATION.



PEEL OFF AND REMOVE THE FOIL AND STRAIGHTEN OUT THE DRAIN WIRES.



REMOVE 1/4" OF INSULATION FROM EACH INNER WIRE. TWIST THE DRAIN WIRES TOGETHER. APPLY SMALL AMOUNTS OF SOLDER TO THE END OF THE DRAIN WIRES AND THE INNER LEADS.



### Detail 21A

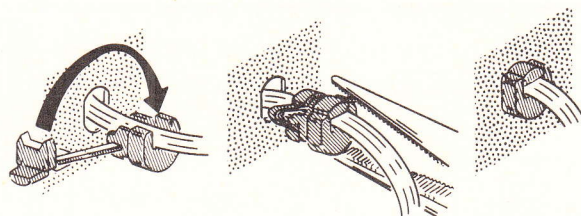
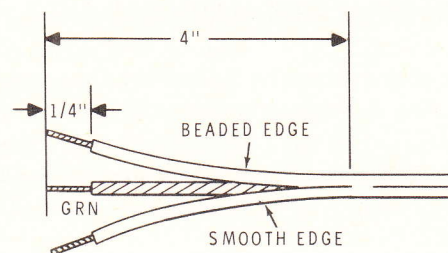
Refer to Pictorial 21 (fold-out from Page 32) for the following steps.

- ( ) Refer to Detail 21A and prepare a 7-1/2" length of two-conductor shielded cable. CAUTION: When you remove the insulation from the ends of the two inner wires, be very sure you do not pull the wire out of the cable. Grip the wire firmly before removing the insulation.
- ( ) At the ends of each wire, twist the fine strands together and melt a small amount of solder on each. Also melt a small amount of solder on the ends of the twisted drain wires.

- ( ) At end A (3/4" end) connect the clear wire to lug 3 (S-1), the black wire to lug 2 (S-1), and the drain wires to lug 1 (S-1) of control B. Make sure the control solder lug remains soldered.
- ( ) At the other end of the cable, connect the black wire to hole K (S-1) and the clear wire to hole BC (S-1) on the circuit board. BC is not marked on the circuit board.
- ( ) Prepare a 16" black hookup wire.
- ( ) Connect one end of the black hookup wire to lug 1 of switch D (S-1). Connect the other end of this wire to hole G on the circuit board (S-1). Position the wire under the chassis lip.
- ( ) Prepare a 15" blue and a 15" black hookup wire. Then form a twisted pair from these two wires.
- ( ) At one end of this twisted pair, connect the blue wire to lug 3 (S-1) and the black wire to lug 2 (NS) of switch D.
- ( ) At the other end of the twisted pair, connect the black wire to hole F (S-1) and the blue wire to hole D (S-1) on the circuit board. Position the twisted pair under the chassis lip.
- ( ) Cut each lead of a 10  $\mu$ F electrolytic capacitor to 3/4". Connect the lead at the positive (+) end of the capacitor to lug 2 of switch D (S-2). Connect the other lead to lug 11F of wafer #1 of switch C (S-2).
- ( ) Prepare a 24" white hookup wire and a 24" blue hookup wire. Then form a twisted pair from these two wires.
- ( ) At one end only of the twisted pair, cut off and discard 2" of white wire. Remove 1/4" of insulation from the cut end.
- ( ) Pass this end of the twisted pair under the metal braid coming from terminal strip X. Then connect the white wire to hole A (S-1) and the blue wire to hole Q (S-1) on the circuit board.



- ( ) Position the twisted pair into the corner of the chassis and push the free ends through grommet AZ.
- ( ) Cut the lead at the banded end of a 1N191 diode (#56-26, brown-white-brown) to 1/2" and the other lead to 3/4". Connect the lead at the banded end to hole H on the circuit board (S-1). Connect the other lead to lug 1 of switch Y (S-1).
- ( ) Prepare a 2-3/4" black hookup wire. Connect one end to hole E on the circuit board (S-1) and the other end to lug 2 of switch Y (S-1).
- ( ) Prepare an 18-1/2" white and an 18-1/2" black hookup wire. Then form a twisted pair from these two wires.
- ( ) At one end of the twisted pair, connect the black wire to lug 1 (S-1) and the white wire to lug 2 (S-1) of jack E.
- ( ) Position the twisted pair as shown, and push the free ends out through grommet AZ.



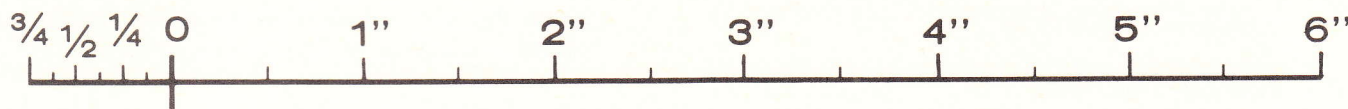
PLACE THE LINE CORD IN THE SLOT. SQUEEZE THE TWO SEGMENTS TOGETHER. INSERT THE REAR HALF INTO THE CHASSIS.

### Detail 21B

Note that one edge of the line cord is smooth and the other edge is beaded.

Connect the line cord conductors as follows:

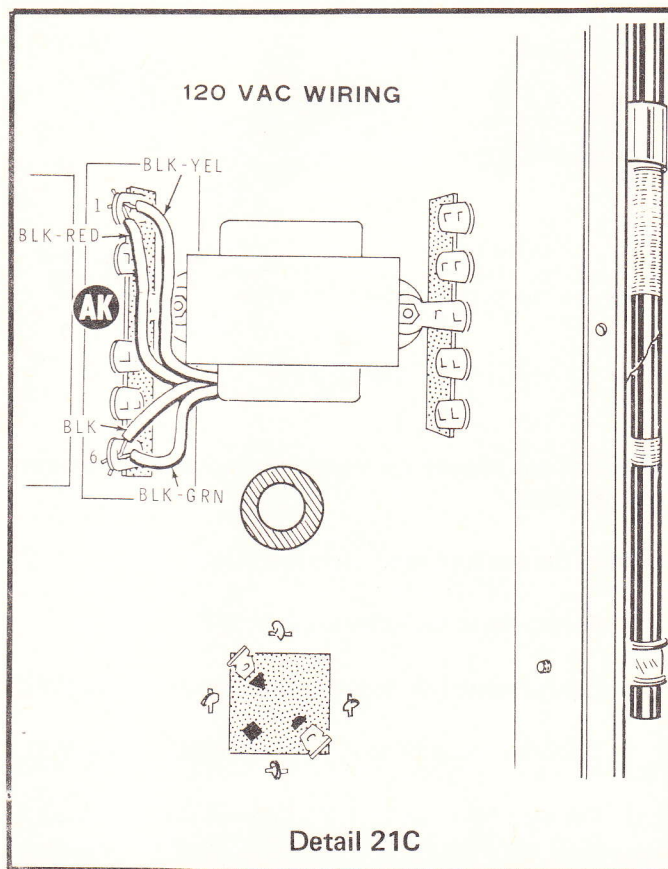
- ( ) Separate the line cord conductors for a distance no greater than 4".
- ( ) If not already done, remove 1/4" of insulation from the end of each conductor and melt a small amount of solder on each.
- ( ) Place the strain relief on the line cord 6" from the end. Insert the free end of the line cord into hole U from the outside of the chassis. Use pliers to compress the strain relief and insert it into hole U in the rear chassis apron.
- ( ) Green wire to the solder lug at X (S-1).
- ( ) Beaded conductor to lug 6 of terminal strip AK (NS).
- ( ) Smooth conductor to lug 5 of terminal strip AK (NS).
- ( ) Cut each fuse lead to 1/2". Connect one lead to lug 2 (S-2) and the other lead to lug 5 (S-2) of terminal strip AK.





## TRANSFORMER PRIMARY WIRING

Two sets of line voltage wiring instructions are given, one for 120 Vac line voltage and the other for 240 Vac line voltage. In the U.S.A., 120 Vac is most often used, while in foreign countries 240 Vac is more common. USE ONLY THE INSTRUCTIONS THAT AGREE WITH THE LINE VOLTAGE IN YOUR AREA.



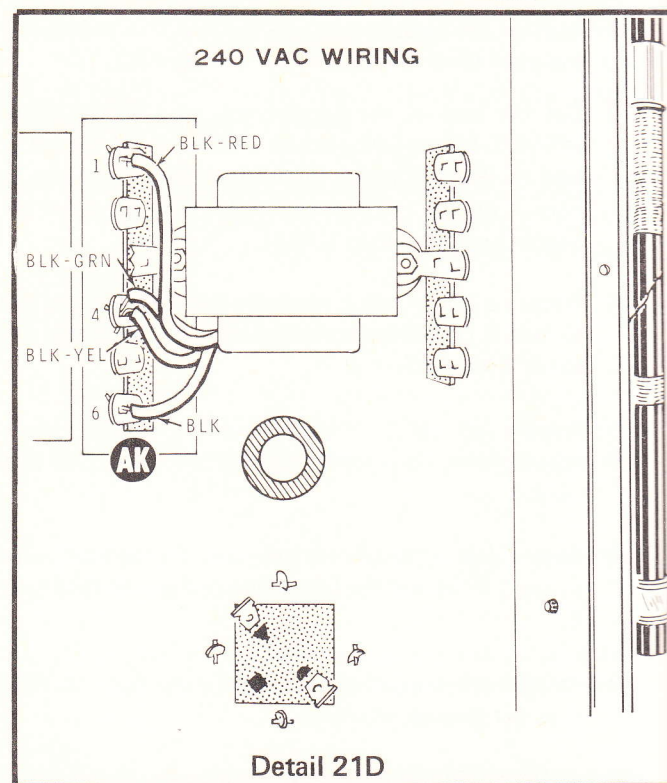
### 120 Vac Wiring

Refer to Detail 21C and connect the wires coming from the transformer to terminal strip AK as follows:

- ( ) Black to lug 6 (NS).
- ( ) Black-green to lug 6 (S-3).
- ( ) Black-red to lug 1 (NS).
- ( ) Black-yellow to lug 1 (S-3).

### 240 Vac Wiring

Refer to Detail 21D and connect the wires coming from the transformer to terminal strip AK as follows:

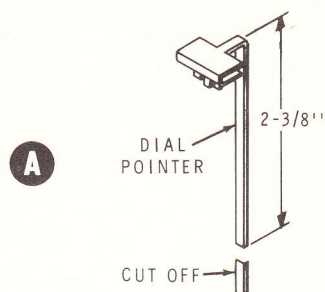


- ( ) Black to lug 6 (S-2).
- ( ) Black-red to lug 1 (S-2).
- ( ) Black-green to lug 4 (NS).
- ( ) Black-yellow to lug 4 (S-2).

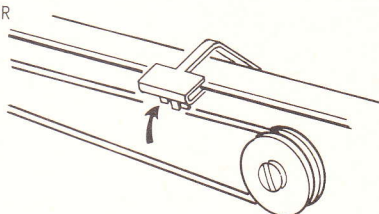
## CHASSIS TOP ASSEMBLY

Refer to Pictorial 22 (fold-out from Page 39) for the following steps.

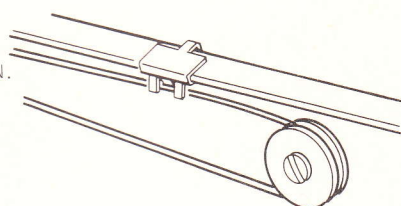
- ( ) Open the plates of the tuning capacitor by rotating its shaft pulley.
- ( ) String the 36" dial cord on the tuning capacitor pulley. String the dial cord according to the numbers on the Pictorial. Be sure to use the main tuning spring (#258-1), the longer of the two springs furnished.
- ( ) Loosen the setscrew in the tuning capacitor pulley, and hold the pulley in place with one hand. Then close the plates of the tuning capacitor and retighten the setscrew.
- ( ) Rotate shaft F with your fingers to make sure the capacitor plates open and close properly.



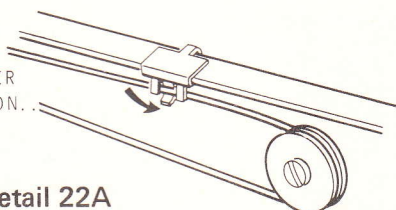
**B**  
SLIDE THE DIAL POINTER  
ONTO THE LIP OF THE  
SUBPANEL



**C**  
POSITION THE DIAL  
CORD BETWEEN THE  
THREE TABS AS SHOWN.



**D**  
BEND THE OUTER TABS  
TOWARD THE PANEL TO  
LOCK THE DIAL POINTER  
AND CORD IN POSITION.



**Detail 22A**

Refer to Detail 22A for the following steps.

- ( ) Cut the main tuning pointer to a length of 2-3/8".
- ( ) Place the main tuning pointer on the lip of the subpanel, between the two pulleys. Make sure it slides easily along the subpanel lip.

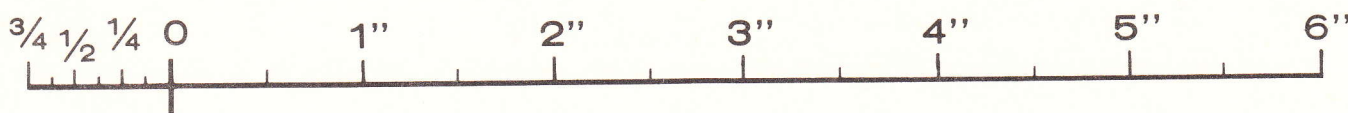
- ( ) With the main tuning capacitor closed, position the main tuning pointer opposite the front circuit board mounting screw.
- ( ) Position the dial cord between the three tongues of the tuning pointer. Carefully adjust the pointer so it is parallel with the subpanel when viewed from the side.
- ( ) Rotate the shaft with your fingers and make sure the pointer moves freely as the tuning capacitor opens and closes. If the pointer slips on the dial cord, bend the two outer tongues of the pointer toward the subpanel as necessary to grip the dial cord.

Refer to Pictorial 23 (fold-out from Page 39) for the following steps.

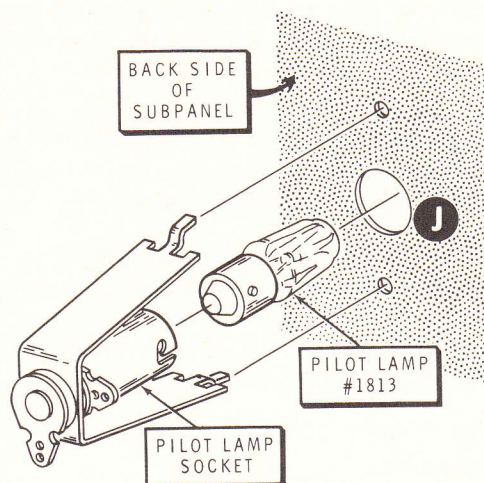
- ( ) Open the end of a 1" length of metal braid and slide the braid over solder lug BE (S-1).
- ( ) Solder the other end of the braid directly to the shield between the tuning capacitor sections at BG. Make sure the braid does not touch lug 2 of the tuning capacitor.
- ( ) Connect one end of a 1-1/2" yellow wire to hole D on the circuit board (S-1), and connect the other end of the wire to lug 2 of the tuning capacitor (S-1).
- ( ) Connect one end of a 1-3/4" yellow wire to hole C on the circuit board (S-1), and connect the other end to lug 1 of the tuning capacitor (S-1).

**NOTE:** The blue and white identification label shows the Model Number of your kit. Refer to these numbers in any communications with the Heath Company.

- ( ) Install the identification label in the location shown in the Pictorial. Carefully peel away the backing paper. Then press the label into position. You will avoid smearing the numbers on the label if you will put the piece of waxed backing paper on top of the label and then rub on it instead of directly on the label.

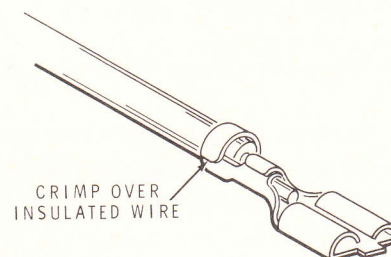
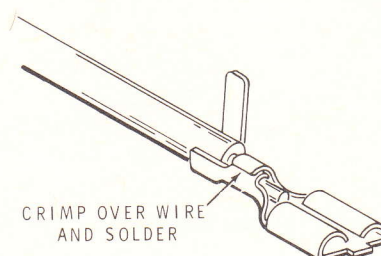
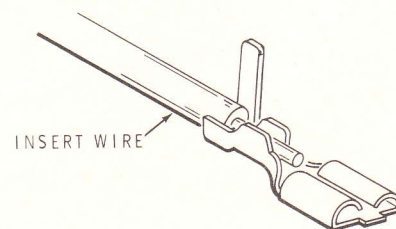
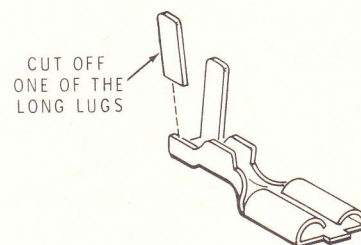




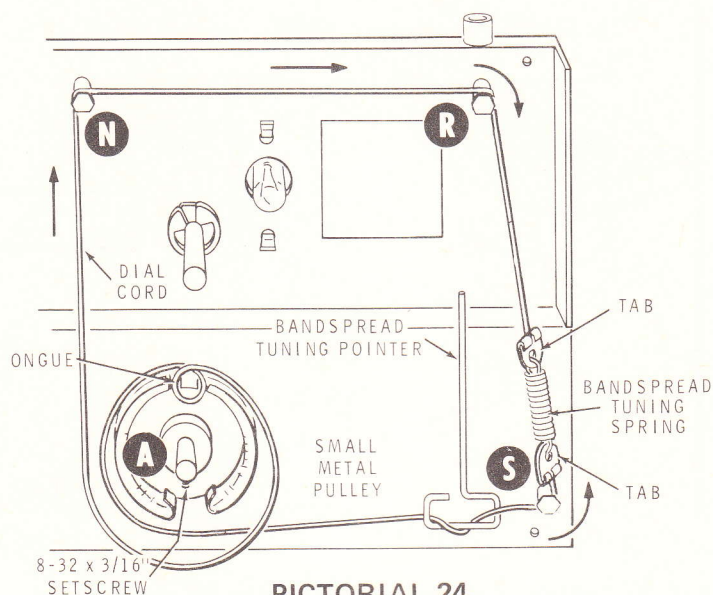


Detail 23A

- ( ) Connect the white antenna lead to hole B on the circuit board (S-1).
  - ( ) Connect the red antenna lead to hole A on the circuit board (S-1).
  - ( ) Refer to Detail 23B and connect a push-on connector to each wire at the end of the black and white twisted pair.
- ( ) Refer to Detail 23A and install the #1813 pilot lamp in a pilot lamp socket. Then squeeze the two arms of the socket together and insert the formed ends into the two small holes near J from the rear side of the subpanel.
  - ( ) Similarly, install the #53 pilot lamp in the remaining socket, and mount the socket at H.
  - ( ) At the end of the shorter green twisted pair coming from grommet AM, connect either wire to one of the pilot lamp socket lugs at J (S-1) and the other wire to the remaining lug (S-1).
  - ( ) Position the other green twisted pair around two edges of the circuit board and secure it at BD by wrapping the plain solder lug around the wires.
  - ( ) At the end of the twisted pair, connect either wire to one lug on pilot lamp socket H (S-1) and the remaining wire to the other lug (S-1).
  - ( ) Shorten the white antenna lead coming from hole AD in the rear panel until it is 1/4" shorter than the red antenna lead. Then remove 1/4" of insulation from the end of the lead.



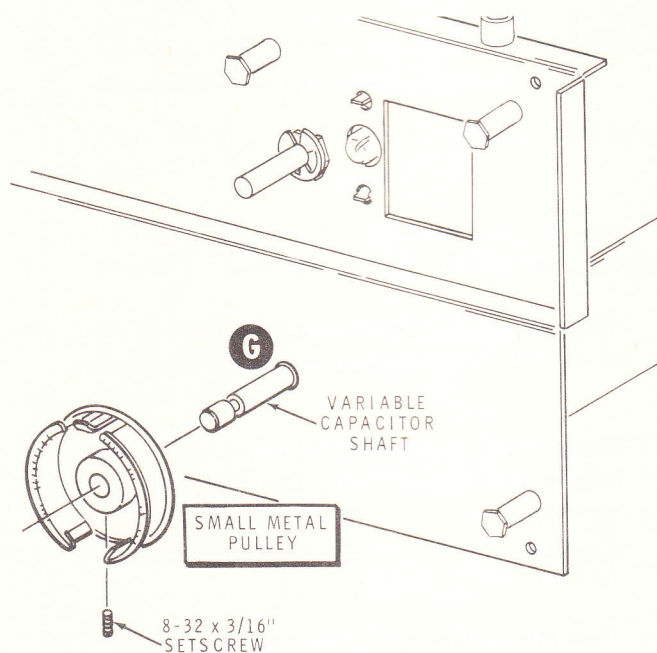
Detail 23B



PICTORIAL 24

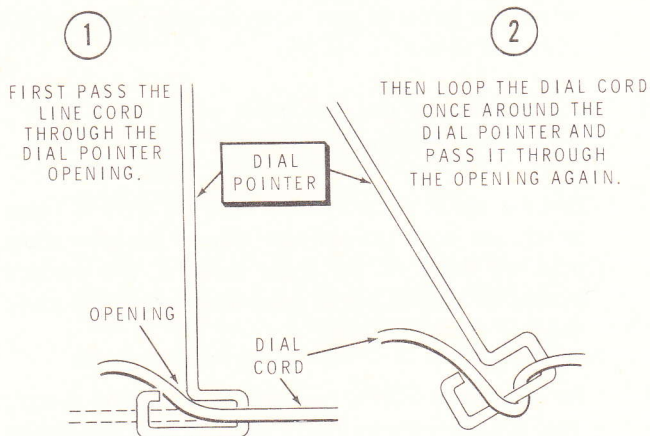
Refer to Pictorial 24 for the following steps.

- ( ) Rotate the variable capacitor clockwise as far as possible.
- ( ) Start an 8-32 x 3/16" setscrew into the tapped hole in the hub of the small metal pulley.



Detail 24A

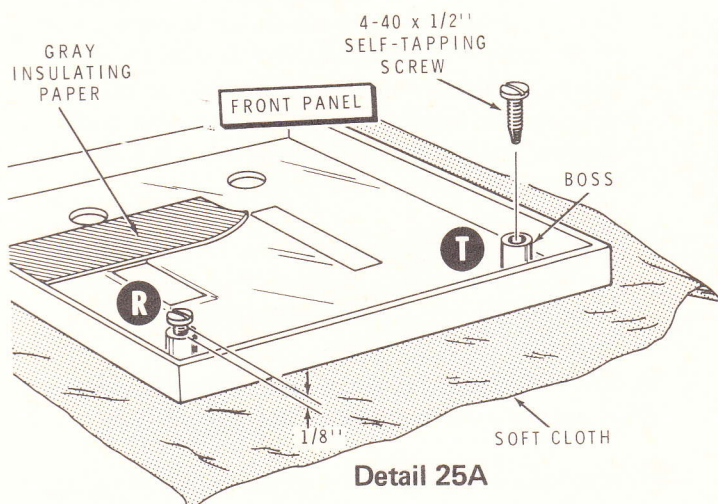
- ( ) Refer to Detail 24A and place the small metal pulley on the shaft of variable capacitor G with the closed face of the pulley toward the subpanel and the open space in the rim of the pulley at the six o'clock position. Position the pulley so its hub just clears the subpanel, and tighten the setscrew.
- ( ) Refer to Pictorial 24 and wind the 17-3/8" dial cord once around the pulley tongue so that the tab at one end of the dial cord is positioned at S as shown.
- ( ) Wind the other end of the dial cord 3/4 turn clockwise around the pulley and then up and over N and R.
- ( ) Attach the end loops of the bandspread tuning spring to the two dial cord tabs.
- ( ) Turn the shaft of the bandspread tuning capacitor through its range with your fingers. The two dial cord tabs should just touch R and S at each end of the range. If necessary, loosen the setscrew in the pulley and rotate the pulley to adjust the travel of the dial cord tabs.
- ( ) Refer to Detail 24B and install the bandspread tuning pointer on the dial cord. Then slide the pointer to the left on the dial cord until the edge of the pointer is 1/8" from the edge of the pulley.



Detail 24B

NOTE: If the pointer does not stand up straight, it is because the dial cord is twisted. Slide the pointer back and forth along the dial cord several times until the position is corrected.





Detail 25A

## FRONT PANEL MOUNTING

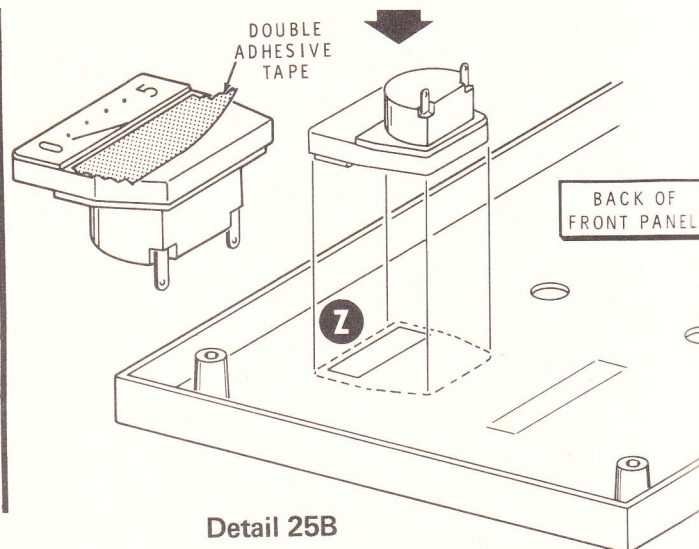
Refer to Pictorial 25 for the following steps.

Refer to Detail 25A for the following three steps.

- ( ) Place the front panel face down on a soft cloth on your workbench so the hollow bosses at T and R are facing upward. Tap threads in each of the two bosses by turning the 4-40 x 1/2" self-tapping screw into each boss until there is just 1/8" between the underside of the screw head and the end of the boss. Use force on the screwdriver, turn slowly, and do not permit the screw to lean in any direction. Remove the screw and save it for use later.
- ( ) Cut a piece of gray insulating paper 1" x 2-3/4". Discard the remaining paper.
- ( ) Remove the white protective covering from the gray paper, and press the adhesive side of the gray paper onto the back of the front panel in the position shown. Be careful not to cover any part of the panel holes.
- ( ) Refer to Detail 25B, remove the protective coating from one side only of the 1" length of double-adhesive tape laid aside earlier, and press this side against the front of the meter just below the projection for the meter scale.

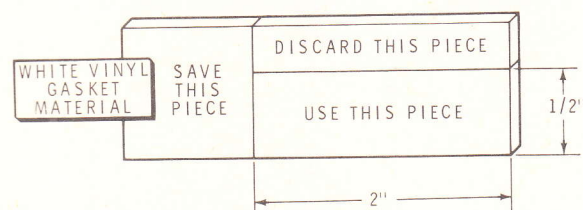
**NOTE:** In the following step, be sure the meter scale is right side up before permitting the adhesive tape to touch the back of the panel.

- ( ) Remove the protective coating from the front of the tape on the meter. Then, from the back of the panel place the meter scale projection into the rectangular opening at Z on the front panel. Press the meter firmly into place.



Detail 25B

- ( ) Carefully bend the two solder lugs on the meter so they point straight out from the meter body as shown.
- ( ) Refer to Detail 25C and cut a piece of white vinyl gasket 2" long by 1/2" wide from one of the two pieces furnished. Save the indicated portion of the gasket for use later.



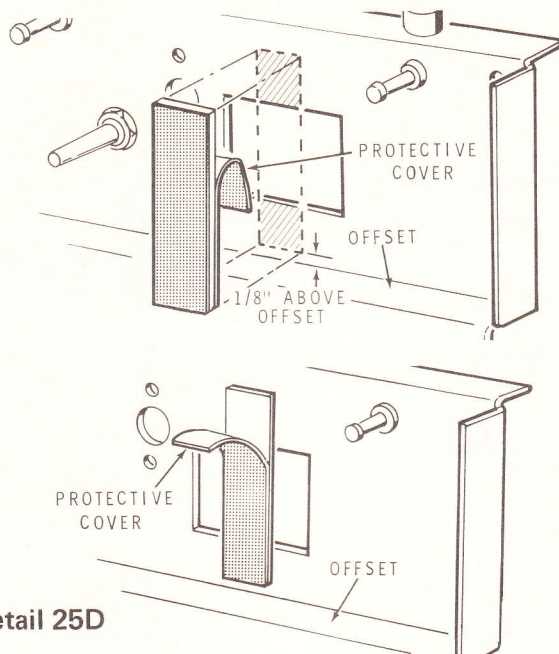
Detail 25C

Refer to Detail 25D for the next two steps.

- ( ) Remove the protective covering from one side only of the 2" x 1/2" vinyl gasket cut in the preceding step.
- ( ) Position the adhesive side of the gasket on the painted side of the subpanel so the strip is exactly centered over the square meter hole and one end is 1/8" above the offset, or step, of the subpanel. Rub the gasket material firmly into place.
- ( ) Carefully remove the protective covering from the upper side of the gasket.

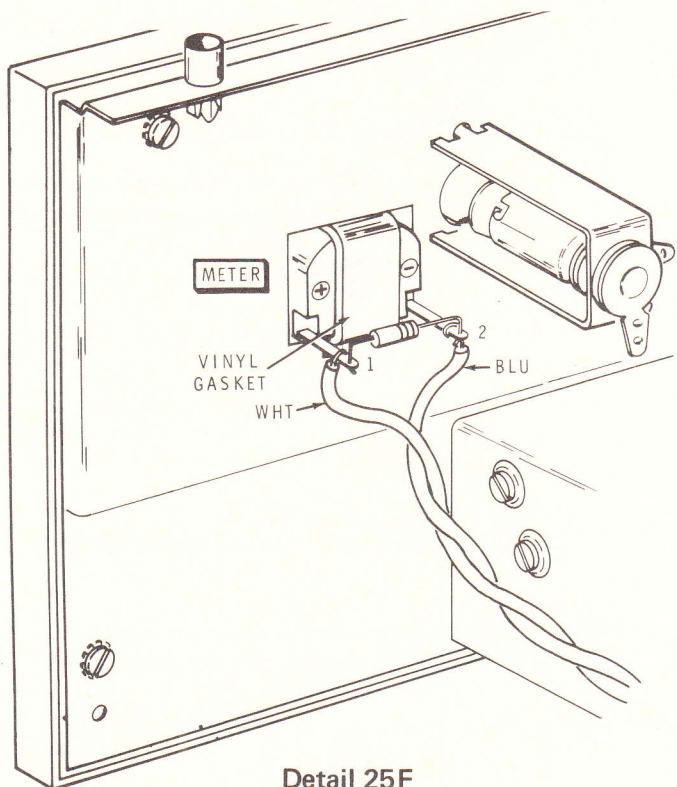
**CAUTION:** As you mount the front panel in the following step, make sure it is properly aligned with the subpanel so the back of the meter will be aligned with the meter mounting hole in the subpanel before the meter touches the vinyl gasket. See Pictorial 25.





Detail 25D

- ( ) Remove control nuts and washers from the subpanel. Then mount the front panel on the subpanel. Be sure the back of the meter is properly aligned with the cutout in the subpanel. Use a 4-40 x 3/4" black nylon screw, a 3/16" aluminum spacer, and a 4-40 nut at L. From the back of the panel, use a 4-40 x 1/2" self-tapping screw and a 3/16" aluminum spacer at R. Use a 4-40 x 3/8" screw at T. CAUTION: Be sure the screw at T is not longer than 3/8", or the panel may be damaged when the screw is tightened.
- ( ) Place control washers and control nuts on the bushings at A, B, C, D, and E.
- ( ) Check the front panel control nuts to make sure they are tight.
- ( ) Keep the tuning capacitor plates closed and adjust the main tuning pointer so it coincides with the left end markings of the frequency scale.
- ( ) Refer to the inset drawing on Pictorial 25 and start an 8-32 x 7/16" setscrew into each of the large knobs as shown.
- ( ) In the same manner, start an 8-32 x 3/16" setscrew into each of the four small knobs.
- ( ) Mount large knobs on the main tuning and bandspread knobs and tighten the setscrews.
- ( ) Turn the shafts at A, B, and C fully counterclockwise. Turn the shaft at D to its center position.

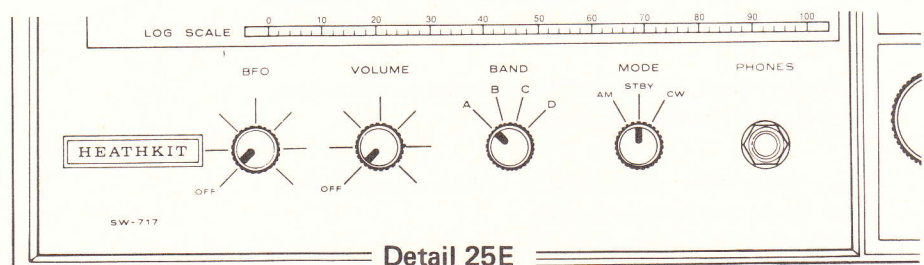


Detail 25F

- ( ) Refer to Detail 25E and mount four small knobs with the index marks positioned as shown. Tighten the setscrews.

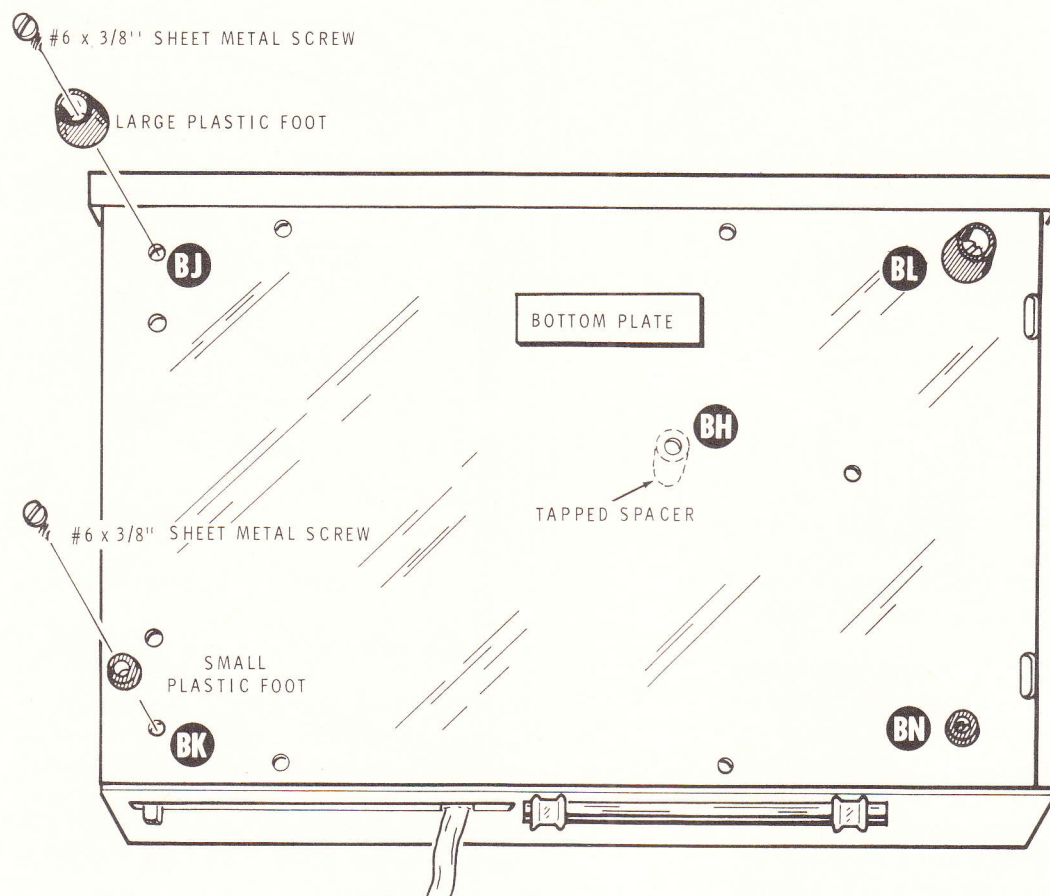
Refer to Detail 25F for the next two steps.

- ( ) Cut the leads of a 1N191 (#56-26, brown-white-brown) diode to 3/8". Connect the lead at the banded end of the diode to lug 2 (NS) and the other lead to lug 1 (NS) of the meter.
- ( ) At the end of the blue and white twisted pair, connect the blue wire to lug 2 (S-2) and the white wire to lug 1 (S-2) of the meter. Carefully wrap each wire around a meter lug (before soldering) to make the connection.
- ( ) Remove the meter shorting wire from the meter. This is a very fine wire which may be hard to see. It connects the two meter terminals to prevent damage from handling.



Detail 25E

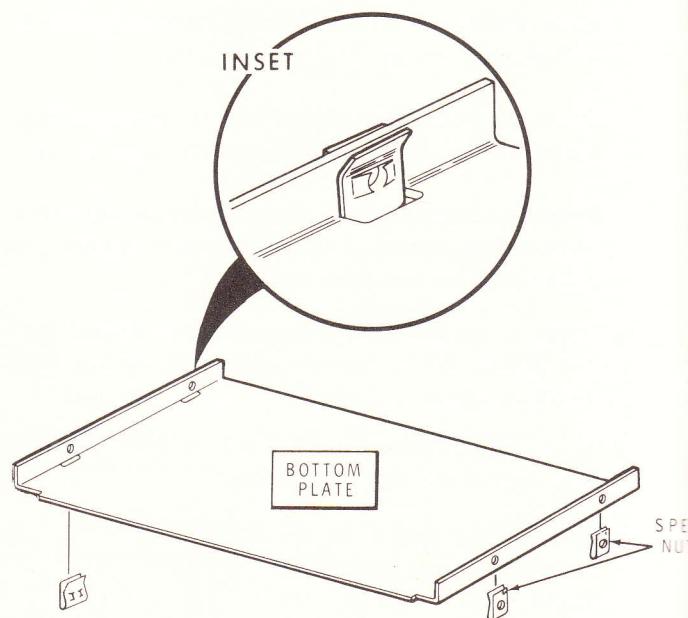




Detail 25G

Refer to Detail 25G for the following steps.

- ( ) Hold the bottom plate against the bottom of the Receiver so that the hole near the center of the bottom plate matches the hole in the 2" tapped spacer at AJ. Mark this hole BH on the bottom plate.
- ( ) Install the two large plastic mounting feet at BJ and BL. Use #6 x 3/8" sheet metal screws.
- ( ) Install the two small plastic feet at BK and BN. Use #6 x 3/8" sheet metal screws.
- ( ) Refer to Detail 25H and mount a Speed Nut in each of the four slots in the bottom plate. Note that the curved portion of each Speed Nut enters the slot with the straight portion against the outside of the bottom plate lip. See the inset drawing.
- ( ) Visually check all connections to make sure that each connection has been soldered.
- ( ) Lay the bottom plate aside. It will be mounted after the Initial Tests are performed.



Detail 25H

# INITIAL TESTS

If you have a VOM (volt-ohm-milliammeter) or a VTVM (vacuum tube voltmeter), refer to Figure 1 (fold-out from Page 40) and perform the resistance and voltage tests which follow. These are to insure that there are no short circuits in the power supply, and that the correct voltage is present. If you do not observe the proper meter readings when you make the checks, turn to the "In Case of Difficulty" section.

If you do not have the meters, proceed directly to the "Alignment" section.

## RESISTANCE CHECK

- ( ) Set your ohmmeter on its R x 10 scale. Clip the common (negative) lead of the ohmmeter to the chassis and the positive lead to lug 1 of terminal strip BF. The resistance reading should be not less than 150  $\Omega$ . If you do not obtain this minimum reading, DO NOT connect the Receiver to the electric outlet until the difficulty is corrected.
- ( ) Disconnect the ohmmeter.

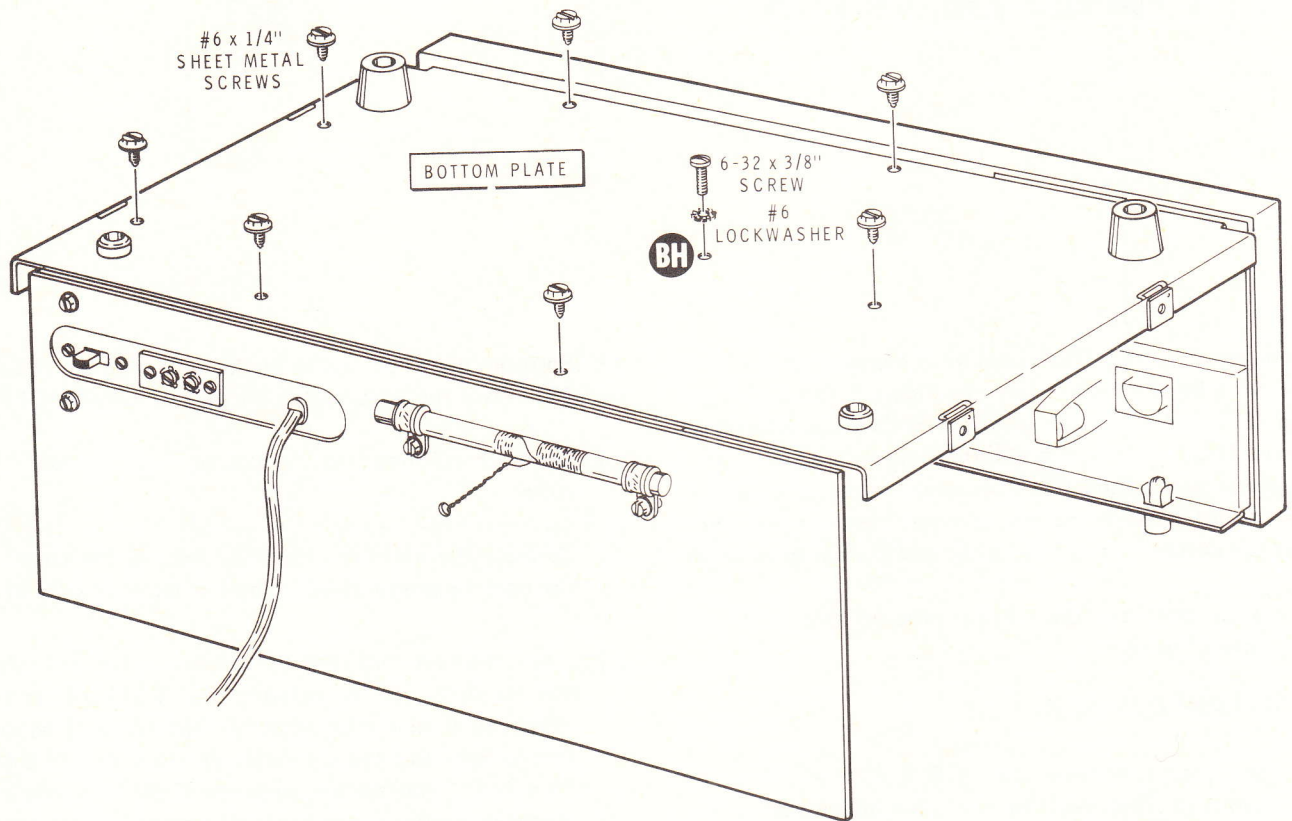
## VOLTAGE CHECK

- ( ) With the Receiver off, temporarily push the two connectors on the black and white twisted pair onto the two speaker lugs.

- ( ) Position the knob index marks according to Detail 25E. Place the ANL switch on the rear panel at OFF.
- ( ) Set your voltmeter to the proper range to read 15 volts.
- ( ) Connect the voltmeter common lead to the chassis. Connect the positive lead to lug 1 of terminal strip BF.
- ( ) Insert the line cord into the electric outlet and turn the Receiver on by rotating the VOLUME knob clockwise until a click is heard. The two dial lamps should light and the voltmeter should indicate 8 to 13 volts. If you see any evidence of short circuits or overheated components (such as wisps of smoke), turn the Receiver off immediately and turn to the "In Case of Difficulty" section.
- ( ) Disconnect the voltmeter.
- ( ) Turn the VOLUME control so the index mark is at the 12 o'clock position. Then touch the exposed lead of C22, the 10  $\mu$ F electrolytic capacitor mounted vertically on the circuit board. A hum should be heard. This indicates the audio stages are working.
- ( ) Turn the Receiver off and disconnect the speaker leads and the line cords.



- ( ) Refer to Pictorial 26 and mount the prepared bottom plate on the bottom of the chassis. Use a 6-32 x 3/8" screw and #6 lockwasher at BH and use #6 x 1/4" sheet metal screws at the other 7 holes.



PICTORIAL 26

# ALIGNMENT

Before you start to align the Receiver, allow it to operate for approximately 5 minutes. If any evidence of overheating is observed during this time, turn the Receiver off and refer to the "In Case of Difficulty" section of this Manual.

For best results, the Receiver should be aligned with test instruments. A VTVM (vacuum tube voltmeter) and a modulated rf (radio frequency) signal generator (that operates at least from .5 to 30 MHz) are required for this procedure, described under "Alignment With Instruments" following. If these instruments are not available, perform the steps under "Alignment Without Instruments."

Refer to Figure 2 (fold-out from Page 40) for the location of the coils and trimmer capacitors used in the alignment instructions.

A plastic alignment tool is provided to align the coils. This is done by inserting the tip of the alignment tool into the coil core, and then rotating the tool for the desired indication on the VTVM.

## SIGNAL METER ADJUSTMENT

- ( ) Turn the Receiver on.
- ( ) Refer to Figure 2 and, while viewing the Receiver from the front panel, insert a small screwdriver blade (approximately 1/8" wide) into hole AW in the rear panel and into the R25 control on the circuit board.
- ( ) Turn the control fully clockwise, as viewed from the front panel. The signal meter (Inset drawing #2) should deflect to the right. This indicates the meter circuit is working.

- ( ) Push the connections on the black and white twisted pair onto the two loudspeaker connecting lugs.
- ( ) Tune the Receiver to a point where no signal can be heard, and adjust the control in a counterclockwise direction until the meter needle rests over the left-hand dot and points to 0 on the meter scale.

NOTE: Protective circuitry in the radio prevents damage to the meter by strong signals.

- ( ) Turn the Receiver off.

## ALIGNMENT WITH INSTRUMENTS

- ( ) Position the Receiver right side up. The loudspeaker should be connected.
- ( ) Preset the front panel controls as follows:  
VOLUME: Off                      MODE: CW  
BAND: D                              BFO: Off  
BANDSPREAD: 0
- ( ) Be sure the ANL switch on the rear panel is OFF.
- ( ) Connect the line cord to the electric outlet and turn the VOLUME control clockwise to the 3 o'clock position. Adjust this control as desired during the alignment.
- ( ) Connect the signal generator leads to the terminal strip on the rear panel of the Receiver. Connect the center conductor to the ANT terminal and the shield conductor to the GND terminal.



- ( ) Set your VTVM to read ac volts on its lowest scale. Then connect the VTVM leads to the loudspeaker terminals. Connect the probe of the VTVM to the white wire and the common (ground) lead of the VTVM to the black wire.
  - ( ) Turn on the signal generator and the VTVM. Then allow 5 minutes to elapse before you start the alignment steps.
- Align the Receiver by performing the steps in the "Alignment With Instruments Chart." The following numbered paragraphs explain the first step in the chart and will serve as an example of how to perform the other steps:
1. Set the Receiver BAND SWITCH at D.
  2. Set the signal generator at 11 MHz. Adjust it to the minimum useable signal level. Be sure to turn on the modulation of the signal generator.
  3. Set the MAIN TUNING of the Receiver so the pointer is at 11 MHz.
  4. Refer to Figure 2 and identify L4 and L7. Then use the alignment tool and adjust L4 for the loudest signal (highest VTVM reading). If you do not hear the signal generator at the first setting, tune the Receiver to each side of the 11 MHz setting and find the generator signal. Then turn the coil core in the direction which will move the signal to the 11 MHz position on the tuning scale.
  5. Adjust L7 for maximum signal as heard on the loudspeaker and seen on the VTVM scale. Note that small changes in signal strength are more easily detected by the meter than by your ear.
  6. Perform each step in the chart carefully.
  7. Repeat the steps as necessary. Then disconnect and shut off the VTVM and the signal generator.

ALIGNMENT CHART

|     | BAND SWITCH | SIGNAL GENERATOR | MAIN TUNING INDICATOR | ADJUST   |
|-----|-------------|------------------|-----------------------|----------|
| ( ) | D           | 11 MHz           | 11MHz                 | L4, L7   |
| ( ) | D           | 26 MHz           | 26 MHz                | C35, C39 |
| ( ) | C           | 4.5 MHz          | 4.5 MHz               | L3, L6   |
| ( ) | C           | 9.5 MHz          | 9.5 MHz               | C34, C37 |
| ( ) | B           | 1.6 MHz          | 1.6 MHz               | L2, L5   |
| ( ) | B           | 3.6 MHz          | 3.6 MHz               | C33, C36 |
| ( ) | A           | 600 kHz          | 600 kHz               | L1       |
| ( ) | A           | 1400 kHz         | 1400 kHz              | C32      |

## ALIGNMENT WITHOUT INSTRUMENTS

- ( ) Refer to Figure 2 (fold-out from Page 40) and turn all trimmer capacitors clockwise until they are just snug. Then turn each one counterclockwise the following number of turns:

| Trimmer | Turns<br>Counterclockwise |
|---------|---------------------------|
| C32     | 3/8                       |
| C33     | 1/4                       |
| C34     | 1/4                       |
| C35     | 1/4                       |
| C36     | 1/8                       |
| C37     | 1/8                       |
| C39     | 1/4                       |

- ( ) Push the ANL switch (on the rear panel) to OFF.

- ( ) Preset the front panel controls as follows:

|                    |              |
|--------------------|--------------|
| VOLUME:            | Off          |
| BAND:              | A            |
| MODE:              | AM           |
| BFO:               | Off          |
| BANDSPREAD TUNING: | 0 (centered) |
| MAIN TUNING:       | 550          |

- ( ) Temporarily push the connectors on the black and white twisted pair onto the two speaker lugs.
- ( ) Plug in the Receiver, turn it on, and tune in a radio station of known frequency near the low end of band A.
- ( ) Refer to Inset Drawing #1 and insert the shorter end of the alignment tool into the core of L1. Adjust the core until the main tuning indicator shows the correct frequency of the station on the tuning scale.

- ( ) Tune in a station of known frequency near the high end of Band A. Adjust C32 until the station is received properly when the main tuning indicator shows the station's correct frequency. As there will be some interaction, repeat the adjustment of L1 and C32 until the frequencies of both stations are correctly shown.

NOTE: The tuning indicator will be nearly correct on the other three bands, but adjustment to a station of known frequency is preferable.

In the United States, Federal Bureau of Standards station WWV at Ft. Collins, Colorado transmits on frequencies of 2.5, 5, 10, 15, 20, and 25 MHz. It can be identified by announcements periodically. At other times it transmits a variety of tones, often with a pulse each second.

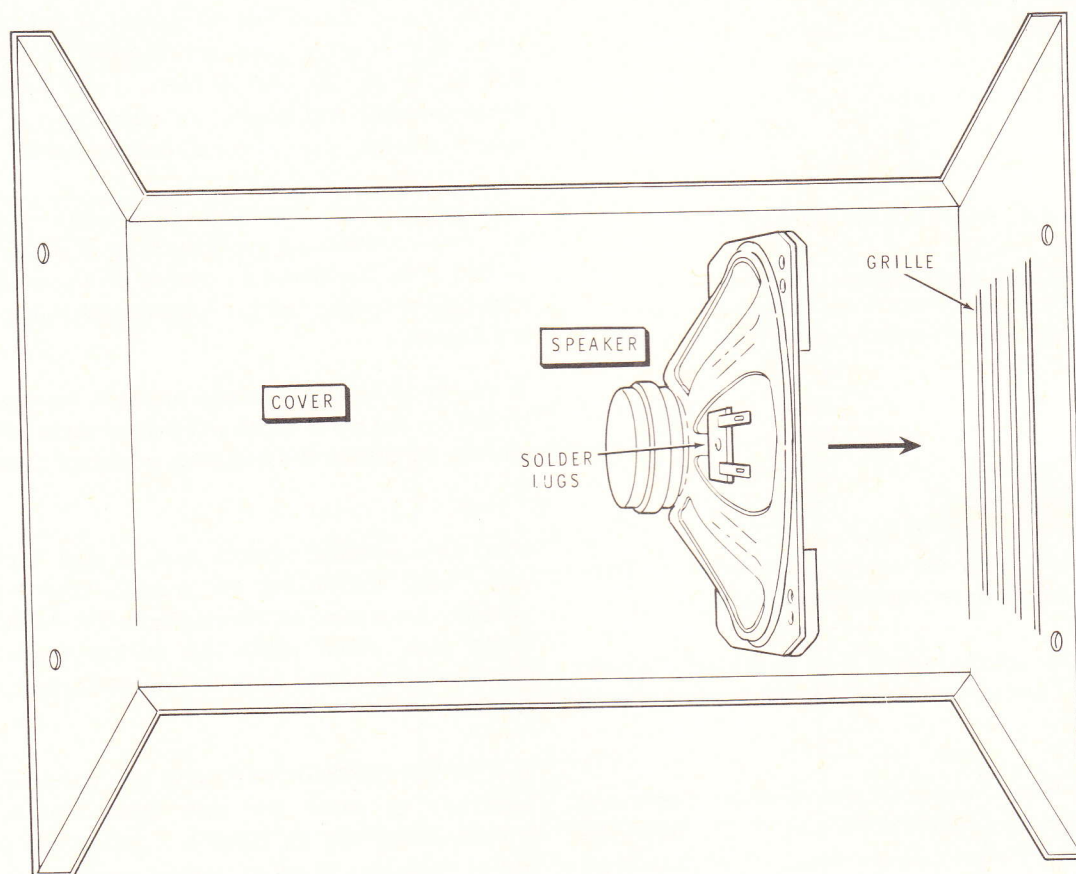
In Canada, the Dominion Observatory station CHU transmits continuously on frequencies of 3.330, 7.335 and 14.670 MHz. Transmissions consist of a pulse each second with time and station announcements each minute in French and English.

If you know an amateur radio operator, he may be able to transmit a test signal which will enable you to calibrate your receiver on at least one frequency in each of bands B, C, and D.

Shortwave broadcast stations may be used for calibration when their frequencies are known. Your local library probably has a copy of "World Radio TV Handbook" (or a similar publication) which lists station frequencies. This handbook is available from the Heath Company as Model GDP-315.

The "Alignment Chart" on Page 46 tells you which coils and capacitors to adjust for each band. Utilize the same principles described for Band A — adjust coils for the low end of the band and adjust trimmer capacitors for the high end of the band.





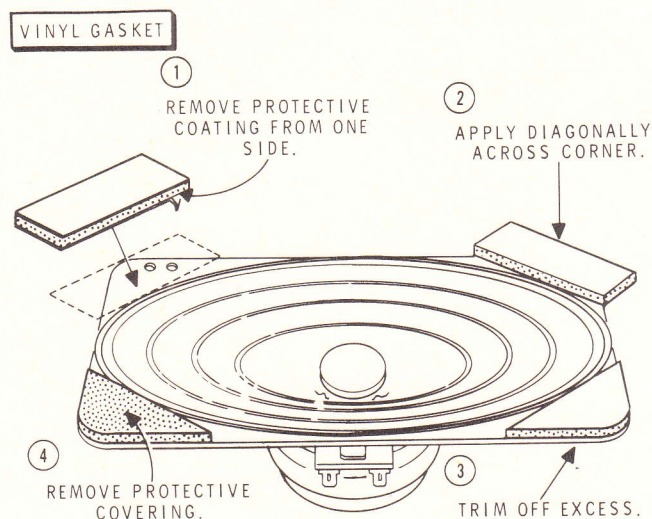
PICTORIAL 27

# FINAL ASSEMBLY

Refer to Pictorial 27 for the following steps.

- ( ) Cut the remaining 5" piece of white vinyl gasket into three equal lengths. As the fourth length, use the piece of gasket which was saved when you mounted the meter.
- ( ) Refer to Detail 27A and remove the protective covering from one side of a piece of the vinyl gasket. Then apply this adhesive side diagonally across a corner of the front side of the speaker frame. Press it firmly into place.
- ( ) Similarly, apply the other three pieces of vinyl gasket to the other three corners of the speaker.
- ( ) Use scissors to trim off that portion of the gasket material extending beyond the speaker frame.
- ( ) Remove the protective covering from the four pieces of vinyl gasket.

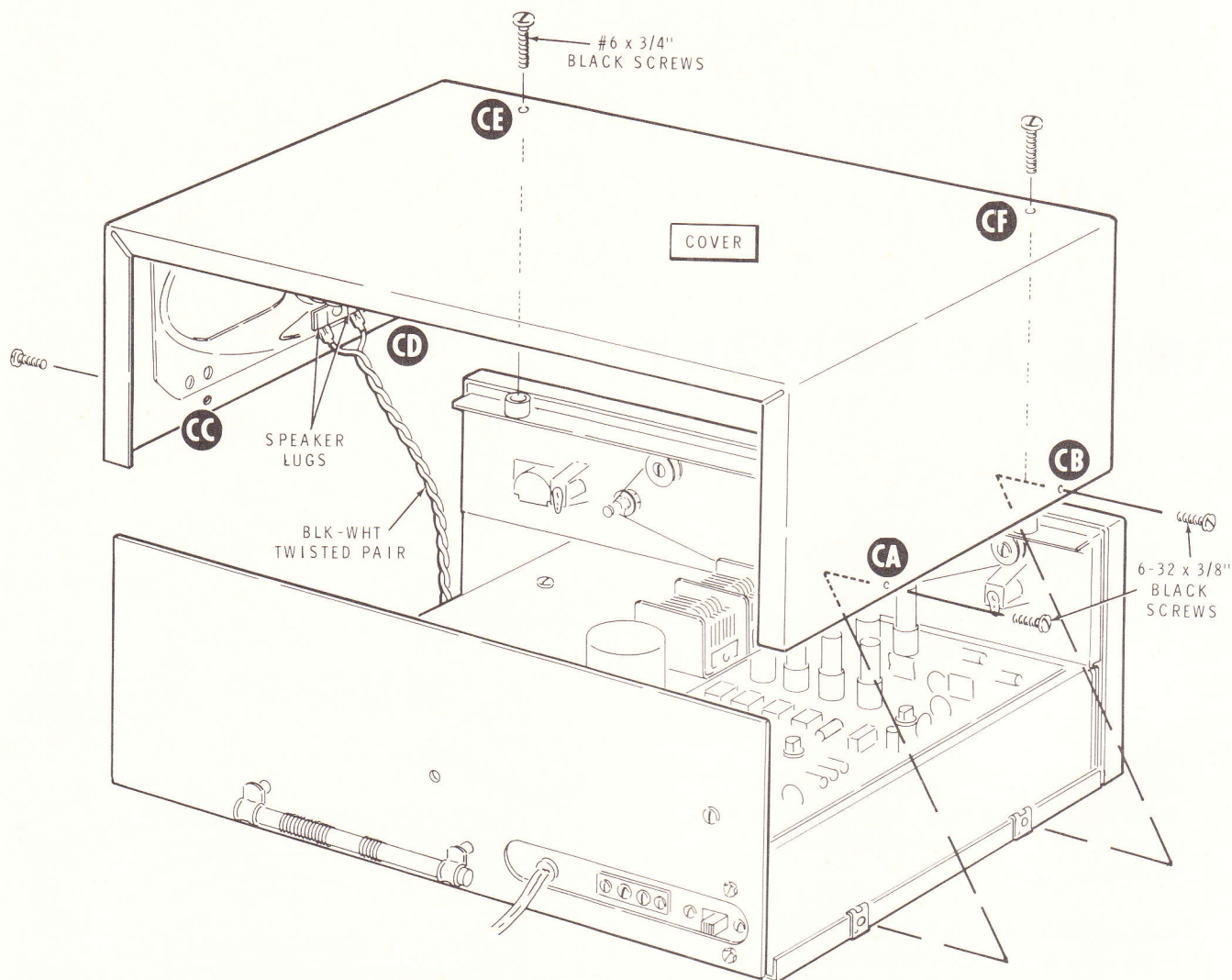
NOTE: The double-sided adhesive vinyl gasket material used to mount the speaker provides a very secure, yet resilient, speaker mounting. However, be sure the speaker is positioned correctly before you permit the adhesive to touch the cover.



Detail 27A

- ( ) Position the speaker so its solder lugs are toward the lower edge of the cover, and press the speaker into place back of the grille.





PICTORIAL 28

- ( ) Refer to Pictorial 28, place the cover assembly beside the chassis, and push the two connectors on the black and white twisted pair onto the two speaker lugs.
- ( ) Place the cover down over the chassis and panel assembly.
- ( ) Secure the cover with 6-32 x 3/8" black screws at holes CA, CB, CC, and CD.
- ( ) Insert #6 x 3/4" black screws into holes CE and CF in the top of the cover.

NOTE: This completes the assembly of the Receiver. Turn to the "Installation" section.

# INSTALLATION

## ELECTRIC SERVICE CONSIDERATIONS

The Receiver will operate on either 120 Vac or 240 Vac, but it must be wired specifically for the voltage to be used. Full instructions are included in "Step-by-Step Assembly."

## ANTENNA INSTALLATION

The Receiver must have an antenna connected for proper shortwave reception. The built-in antenna is for broadcast reception only.

For general broadcast and shortwave listening, a long-wire outside antenna is suggested. A typical long-wire antenna installation is shown in Figure 3. The length of the antenna wire may be from 50 to 100 feet long. The lead-in wire should be attached and soldered to one end of the antenna. The other end of the lead-in wire is connected to the ANT terminal on the rear of the Receiver.

Generally, the higher the antenna the better the reception. A tree or pole may be used as one support and your house as the other support. Insulators must be used at each end of the antenna to separate the antenna wire from the support wire.

The GND terminal on the rear of the Receiver should be grounded to a water pipe or to a 6 or 8 foot long ground rod driven into the earth.

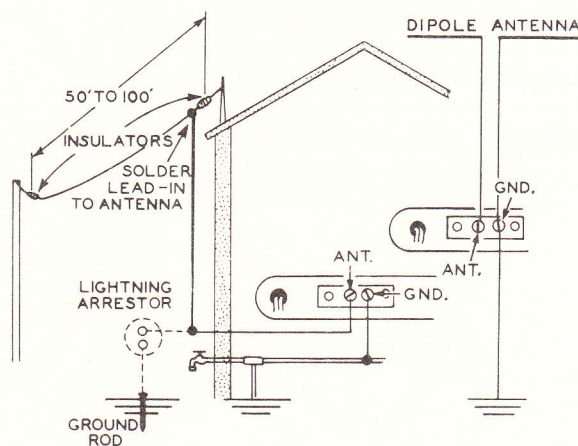


Figure 3

A dipole antenna may be used for optimum reception on the shortwave band. This type of antenna is directional and is designed to receive a narrow band of the shortwave frequencies. It is suggested you check an ARRL Handbook\* or an Antenna Handbook for the proper dipole antenna length needed for the shortwave frequencies of interest.

The two lead-in wires from a dipole antenna should be connected to the ANT and GND terminals on the rear of the Receiver.

\* Available from Heath Company as Model HDP-293.



# OPERATION

Before attempting to use the Receiver, carefully read the explanation of each control. Figure 4 (fold-out from Page 52) illustrates the front panel and describes the control functions. Figure 5 illustrates the rear panel.

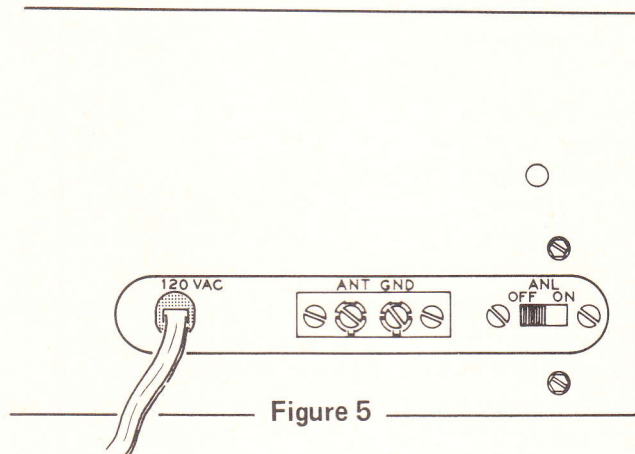


Figure 5

## CONTROLS

**VOLUME** - Turns the Receiver on or off and controls the sound from the speaker or headphones.

**BFO** - Required for the reception of CW or SSB (single sideband) signals. Turn the control clockwise until the signals are received as desired.

**MODE** - Selects AM, STBY, or CW (including SSB) modes of reception. In the AM position the AVC voltage is on; in the CW position the AVC voltage is off. In the STBY position the Receiver is kept warmed up and ready for instant use but it is kept muted.

**BAND** - Selects one of four bands: A, B, C, or D.

**MAIN TUNING** - Tunes the Receiver to the desired station.

**BANDSPREAD** - Provides fine tuning for the MAIN TUNING capacitor to help separate the incoming signals from each other when they are near the same frequency. This capacitor is normally left in the "0" position as its position affects the main dial calibration.

## AM OPERATION

The BFO control should be in the fully counterclockwise position. Turn the MODE switch to AM and advance the VOLUME control for sufficient volume. Set the BAND switch to the desired band and tune in a station with the MAIN TUNING control.

Turn the BANDSPREAD control until the desired station is clearest.

When listening to weak stations, slowly adjust the BFO control for the loudest and clearest reception.

## CW-SSB OPERATION

Turn the BFO control 3/4 turn clockwise. Turn the MODE switch to CW and set the BAND switch to one of the shortwave bands, B, C, or D.

With the MAIN TUNING control, tune in a CW station. Adjust the BFO control as follows: Turn the control fully clockwise and then slowly counterclockwise until the clearest tone is produced. The frequency of this tone may be varied either with the MAIN TUNING or the BANDSPREAD capacitor. Some experimentation will be necessary to find the best position for the BFO control.

When tuning SSB signals, tune to the SSB station and then alternate between the BANDSPREAD and BFO controls for the clearest reception.

### AUTOMATIC NOISE LIMITER (ANL)

If you experience impulse type noise, such as automobile ignition radiations, move the (ANL) switch on the rear panel to ON.

### LOCATION

If the Receiver is used on band A (which uses the built-in antenna) in a house which has aluminum siding, or in a steel

framed building, you may find the signals attenuated to some degree. Placing the Receiver near a window in the direction from which reception is desired may improve reception.

### TUNING SCALE

A scale for each of the four bands appears on the front panel as shown in Figure 4. Each scale is calibrated in frequency. Scale A frequencies are in kilohertz (thousands of cycles per second). The other three scales are calibrated in megahertz (millions of cycles per second). A "log scale" is also provided for convenience in recording the pointer setting of stations for future reference.

## RECEPTION GUIDE

| <u>BAND</u> | <u>FREQUENCY</u> | <u>TIME</u>                | <u>ZONE</u>                                       |
|-------------|------------------|----------------------------|---------------------------------------------------|
| B           | 2.0 MHz          | All day                    | Marine and Weather                                |
| B           | 3.5 MHz          | All day                    | Local (Amateur)                                   |
| C           | 6 MHz            | Evening                    | Latin America and Europe                          |
| C           | 7 MHz            | Evening                    | Europe                                            |
| C           | 7 MHz            | Late afternoon,<br>Evening | Europe                                            |
| C           | 7 MHz            | Morning                    | United States (Amateur)                           |
| C           | 9 MHz            | Morning                    | Asia and Australia                                |
| C           | 9 MHz            | Afternoon                  | Europe and Africa                                 |
| C           | 9 MHz            | Evening                    | Europe and Latin America                          |
| D           | 11 MHz           | Morning                    | Asia and Australia                                |
| D           | 11 MHz           | Evening                    | Latin America                                     |
| D           | 14 MHz           | Late morning,<br>Afternoon | United States, Foreign, (Amateur)                 |
| D           | 15 MHz           | Late morning,<br>Afternoon | Europe and North America                          |
| D           | 15 MHz           | Evening                    | North and Latin America                           |
| D           | 17 MHz           | Afternoon                  | Europe                                            |
| D           | 17 MHz           | All day                    | United States                                     |
| D           | 17 MHz           | Evening                    | South America                                     |
| D           | 20 MHz           | Afternoon                  | Europe                                            |
| D           | 20 MHz           | All day                    | United States                                     |
| D           | 20 MHz           | Evening                    | South America                                     |
| D           | 27 MHz           | All day                    | Local (Citizen's Band)                            |
| D           | 28 MHz           | Morning                    | Europe                                            |
| D           | 28 MHz           | All day                    | Central America, United States (Amateur),<br>Asia |
| D           | 28 MHz           | Evening                    | Asia                                              |

These reception conditions prevail in the spring and fall of the year. They are also subject to varying atmospheric conditions, sun spot activities, and to some extent, weather conditions. In the winter, reception generally will be best on the lower frequency bands. In summer, reception will be better on higher frequency bands.



# IN CASE OF DIFFICULTY

This section of the Manual is divided into the "Visual Tests" and the "Troubleshooting Chart." The Visual Tests are directed primarily toward troubles that occur right after assembly.

## 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 builder.
2. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the "Kit Builders Guide."
3. Check to be sure that all components are in their proper locations.
4. Check the values of the parts. Be sure that the proper part has been wired into the circuit, as shown in the

pictorial diagrams and as called out in the wiring instructions.

5. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring.
6. Check to make sure there are no "solder bridges" on the circuit board. These are caused by solder which has flowed unintentionally from one foil to another causing an improper connection. To remove a "bridge", melt the solder and brush it off the board with a wire brush or a rag.
7. If, after careful checks, the trouble is still not located and a voltmeter is available, check voltage readings against those shown on the Schematic Diagram. NOTE: All voltage readings were taken with a high impedance vacuum tube voltmeter. Voltages may vary as much as 20%.
8. A review of the "Circuit Description" will prove helpful in indicating where to look for trouble.

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