

# HAMTRONICS® RPA-30 UHF REPEATER POWER AMPLIFIER ASSEMBLY, OPERATION, & MAINTENANCE INSTRUCTIONS

## CONSTRUCTION.

a. Set heatsink on bench, oriented as in figure 1. Note where PA transistor is to be mounted to two adjacent holes. Align the pc board with the heatsink, matching the cut-out for the transistor and the pc board mounting holes with the holes on the heatsink. *Note that the heatsink is used for several products; so there will be extra holes to the left of the pc board which are not used in this model.*

b. Temporarily remove the pc board, and lay it on a box or hold it in a vise horizontally with the etched side of the board up. Using a sharp pick or any other convenient tool, pick up eyelets and place them in the small holes on the board. The heads of the eyelets must rest flat against the foil on the etched side of the board. Then, using a small amount of solder, solder the heads of the eyelets to the foil. The eyelets connect the pc board front and rear ground planes together at critical locations. Be sure all small holes are thus connected through. If you lose

an eyelet, bus wire can be used.

c. Turn the pc board over, and solder the other side of the eyelets to the ground plane. Be sure all are soldered, and check to make sure none have slipped back through the other side. If so, heat eyelet flange on top side of board until solder on both sides melts, and push eyelet gently back in place. Note that it is especially important that the 8 eyelets under the emitter leads of Q1 are properly seated and that no solder blobs protrude above eyelet heads. This is to prevent stress on transistor leads when it is later installed.

d. Set two #8 flat washers over each of the 3 enclosure holes used to mount the pc board (not the 2 transistor holes). *The two washers provide the proper thickness for the pc board spacing needed for the transistor; so be sure to use the ones supplied to prevent damage to the transistor.* Set the pc board in place, and secure with three each 6-32 x 3/8 inch thread cutting screws. The screws go through the

pc board and spacer washers and thread into the aluminum heatsink. *Be careful not to over tighten the screws and strip the threads.*

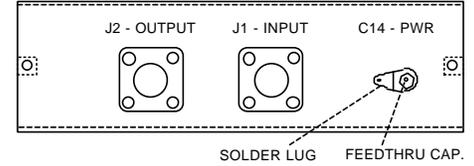


Figure 2. Outside View of End Plate.

e. Locate the power transistor, and note that the collector lead is the narrow one (see component location diagram). The collector lead should face the right-hand side (toward connectors). Apply a small amount of heatsink compound to the bottom surface of the transistor, and set it in place through the cutout in the board.

f. Secure the transistor with two 4-40 x 5/8 inch screws inserted through the transistor flange into the heatsink. Use lockwashers and nuts on the fin side of the heatsink. Align the transistor with the board before tightening screws.

g. There are two end plates: one has holes for connectors. Each end plate has two clearance holes for attachment to the heatsink and two Pem nuts which allow the cover to be secured. Position the end plate with holes for connectors as shown, and attach to heatsink with two 4-40 x 3/8 inch screws through the heatsink and two 4-40 nuts on the flange of the end plate. In like manner, attach the end plate without connector holes on the other end of the heatsink. Before tightening screws, align the end plates carefully with the edges of the heatsink so the cover later fits neatly.

h. The cover is secured to the chassis with four angle brackets, which are threaded on both sides but have slightly different dimensions on the two sides. It is important to install them correctly. These angle brackets should be fastened to the inside of the chassis as shown in the diagram, using 4-40 screws. The leg with the **shorter** dimension from the bend to the hole goes over the screw,

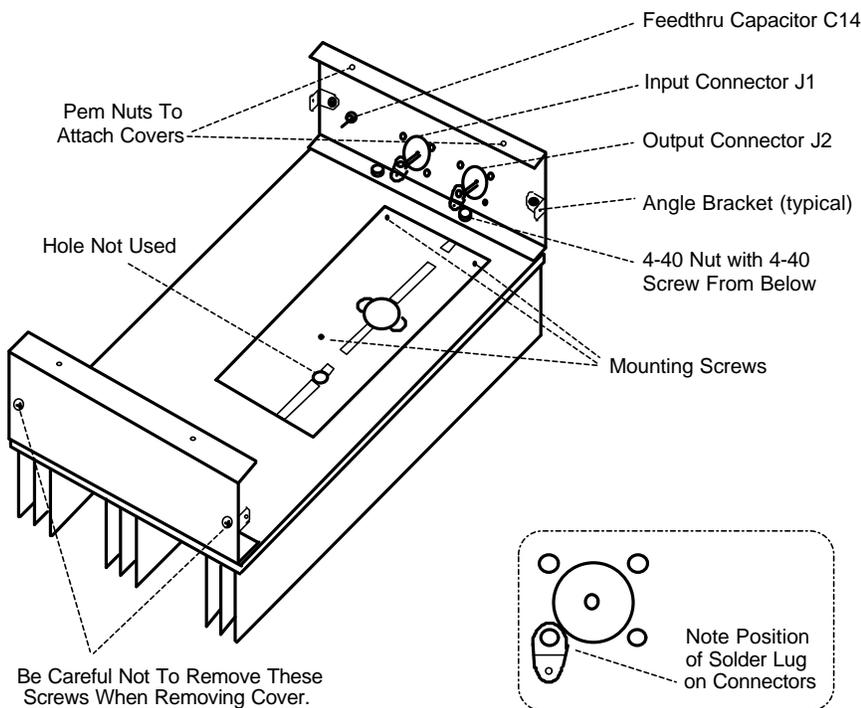


Figure 1. Bottom View of Heatsink and End Plates

leaving the side with the longer dimension for the cover screws to engage. Before tightening the screws, carefully align the angle nuts flush with the edge of the chassis. After the angle brackets are installed, you can set the cover over the heat-sink/end plate assembly and see if any minor adjustments are necessary to make the cover screw holes line up with the angle brackets. It may be necessary to temporarily loosen the screws holding the end plates to the heatsink to realign the end plates farther apart or closer together.

i. Install feedthru capacitor C14 from the outside of the end plate as shown in figure 2. Insert the capacitor through a #8 ground lug, through the outside of the end plate, and secure with a #8 lockwasher and nut on the inside. Tighten the nut on the inside of the assembly with a 1/4-inch nut driver. *Be careful not to break the ceramic by putting force on capacitor leads, and be careful not to over tighten nut.*

j. Attach two SO-239 or 'N' connectors to the outside of the end plate, using three 4-40 x 1/4 inch screws with nuts and one 4-40 x 3/8 inch screw with a ground lug and nut for each connector. The ground lugs should be positioned as shown in the inset in figure 1 so that they are as close as practical to the center lug of the connectors.

*Refer to the pc board component location diagram in the rear of the manual for the following assembly operations.*

k. Solder the six transistor leads to the pc board. It is important to solder the entire surface of each lead and use enough solder to form a bond under the leads.

l. Install the metal clad mica capacitors in the exact positions shown. The flat side with the value markings should be up. Bend the tabs down so they just touch the board with the case flat against the board. Hold each capacitor in place and solder the tab to the board. Then, solder each side of the metal case to the ground plane. C3-C6 should be over the emitter leads, as close to the body of the transistor as possible. C7 should have its tab bent up slightly. It acts as a free-standing terminal

above the board. Its tab does not connect to the board, just the case.

m. Solder the mylar and disc capacitors and the electrolytic capacitor (C9-C11) in place as shown. The .01uF capacitor may be marked "103". The mylar capacitor is red. Observe polarity of electrolytic capacitor. C11 is connected from the tab of C7 to ground.

n. Cut a brass strap 3/16 x 1 inch (approx.), and solder it down to complete the stripline from the base of Q1 to the hole under the position of C2 on the diagram. (This pc board was originally designed for another PA which had a driver transistor which is not used in this model.)

o. Bend the tabs of variable mica capacitor C12 as shown, and solder it in the exact position shown, on a diagonal from the center contact of J2 to the end of the collector stripline. Its leads are bent out away from the capacitor to reach.

p. Prepare the three piston capacitors by cutting off the two narrow lugs from the bottom of the main body of each capacitor. On C1 and C2, bend the narrow lugs at the end of the rotor straps over at a 90-degree angle away from the capacitor.

q. Set C2 in place on the board as shown and tack solder in place. It will be necessary to bend the rotor strap out away from the capacitor body at an angle to straddle the large hole in the board. The capacitor itself can be installed on a slight angle, and the strap will be at an angle. Tack solder the lugs at the bottom of the main body of the capacitor first and then the rotor strap.

r. Likewise, set C1 in place and solder to the board with the two lugs at the bottom of the body of the capacitor soldered to the stripline, and the rotor strap soldered to the ground plane.

s. Refer to the detail drawing to the right of C13 in the component location drawing. Note that the rotor strap must be bent up at an angle away from the body of the capacitor. The excess should be trimmed off. Install C13 on the board with the lugs at the bottom of the body soldered to the ground plane next to the mounting screw, and the rotor strap, routed as directly as possible, laying

on top of the lug from C12 above the connector pin. Tack solder thoroughly.

t. Wind coil L1 as shown in the diagram from #18 bus wire supplied. It is 1/4 inch inside diameter; so it can be formed around a 1/4 inch drill bit or other rod. L1 has three turns barely spaced. Solder L1 leads from the tab of C7 to the stripline in the position shown. The bottom of the coil should be just above the board.

u. Ferrite chokes Z1 and Z2 are 6-hole balun cores with 1-1/2 turns of #22 bus wire threaded through the holes in the manner shown in the diagram. The turns go only through the holes, not around the outside of the core, except at the ends. Cut a 3-inch length of wire. Feed it through a hole with about 1/2 inch protruding, and hold this short end. Then, thread the long end through the adjacent hole and pull tight. Thread through a third hole as shown until 1/1-2 turns are complete. (Three holes are not used.) Tack solder the leads of the balun chokes to the board in the positions shown. One end of Z2 is soldered to the tab of C7.

v. Solder Z1 in place, with short leads, from the base of Q1 to ground, positioned as shown.

w. Strip and solder short length of hookup wire from B+ land area on pc board to feedthru capacitor C14.

x. Cut an 8 inch length of miniature coax. Strip it and solder to input of board and uhf receptacle J1. Keep stripped lead lengths to no more than 1/4 inch to avoid losses. The center lead at the pc board must be connected at the very end of the stripline as shown.

y. Solder a short, direct piece of 3/16 inch wide brass strap from the ground lug on J2 to the pc board ground plane directly below J2, as shown in the diagram. Keep the strap as short and direct as possible for low inductance.

z. Cut the leads of a 10pf disc capacitor to about 1/8 inch. Carefully tack solder this capacitor to the front side of piston capacitor C2 as shown in the parts location diagram.

aa. Check to be sure all parts have been installed. Check for potential short circuits and other

workmanship problems. Double check circuit to schematic diagram.

## ALIGNMENT

**CAUTION:** Do not screw rotor screws of piston capacitors down so far that they touch the pc board under the body of the capacitor. Doing so would cause a short circuit and possibly cause damage. The screw bottoms out when the top of the screw protrudes less than about 1/4 inch from the top of the capacitor.

a. Preset the variable capacitors as follows:

- Mica capacitor C12: 1 turn from full clockwise.
- Piston capacitor C1: 5/16 inch of screw exposed.
- Piston capacitor C2: 3/16 inch of screw exposed.
- Piston capacitor C13: 1/2 inch of screw exposed.

b. Connect J1 to repeater output or other source of 10 Watts drive. Connect J2 through power meter to a good uhf 50 ohm dummy load.

c. Connect regulated +13.6Vdc power source to feedthru capacitor C14 and power supply ground to adjacent ground lug. (If your power supply has adjustable voltage, it is better to start tuning with about 10Vdc and increase it to 13.6 Vdc after you determine there are no problems.)

**Note:** Do not retune repeater output stage or other driving source with RPA-30 connected. Driving source should be tuned into 50 ohm load and left alone afterwards. Input of RPA-30 is tuned then to present 50 ohm load to driver.

d. Apply drive to PA, and alternately adjust C1, C2, C12, and C13 for maximum output. Do this several times to work out any interactions. Use an insulated tool with a small metal screwdriver bit in the end.

e. When fully tuned, the PA should deliver about 30 to 45 Watts with 9-11 Watts drive when using a 13.6Vdc power supply. If the dc voltage is low, the output will be less. You may also experience considerable loss in the output coax if it is not a good low-loss uhf type. The PA will draw about 6 to 7 Amp at full output.

**Note:** It is normal for C12 to be near full clockwise and C13 to be near minimum capacitance (screw exposed about 1/2 inch) when operating into a 50 ohm load at 445 MHz.

## COVER.

The cover slides over the PA assembly and is secured to the Pem nuts and angle brackets on the end plates, using eight 4-40 x 1/4 inch screws. Tighten the screws on the bottom first to draw the cover down tight, and then tighten the screws on the sides. The four rubber feet should be stuck in place about 1/2 inch in from each corner on the bottom of the cover. If you remove the cover for service, be careful not to inadvertently loosen the screws on the outside surface of the end plates which attach the angle brackets to the end plates.

## MOUNTING.

There are several ways to install the RPA-30, none of which is critical as long as air flow is not restricted around fins. The simplest is merely to set the PA, fins up, on a shelf near the repeater. If you wish to mount the PA to a blank rack panel or other vertical surface, such as a cabinet wall, simply drill a few holes in the cover and mount the cover. Then, slide the PA assembly into the cover, and secure with eight 4-40 x 1/4 inch screws. (The cover must be installed to prevent repeater de-sense.)

## POWER.

The RPA-30 requires well-regulated 13.6Vdc, free of transients, at about 6 to 7 Amp. An 8 Amp continuous-duty power supply would have some reserve. Use fairly short, heavy leads to connect positive to feedthru capacitor and negative to adjacent ground lug. If there are any relays or other inductive devices on the same power supply, be sure to put a reverse diode across the device to absorb reverse voltage spikes generated by inductive kick-back. It would be wise to connect an 8 Amp, fast-acting fuse in series with the PA

power lead if the power supply is capable of more than 8 Amps.

**CAUTION:** RF power transistors are fully tested by the manufacturer and are not guaranteed because they are easily damaged by physical or electrical abuse. They are very expensive to replace. Be sure to use adequate precautions to avoid damage.

## OPERATION.

Once tuned, the PA will automatically operate when sufficient drive is applied. Since it operates class C, it will draw no current when no rf power is applied. It is designed for continuous duty at up to 45 Watts. Do not operate it above that level. Reduce drive if necessary so it will operate at this level, which is sufficiently conservative if heatsink is not blocked and ambient temperature is below 100 degrees F.

## REPAIR.

Should it be necessary to replace the transistor, be sure to use an exact replacement. To remove old transistor, carefully peel each lead away from the pc board while applying heat to melt solder. Then, remove transistor from unit, and clean excess solder from board. This is important to avoid tearing leads from new transistor when hardware is tightened. Also, clean off old heat-sink compound, which may be dirty, and apply a fresh coat to the new transistor. Remember to resolder any components removed for access to transistor.

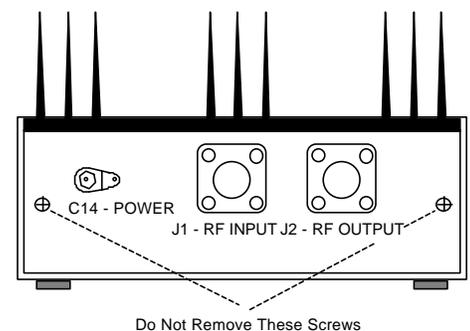
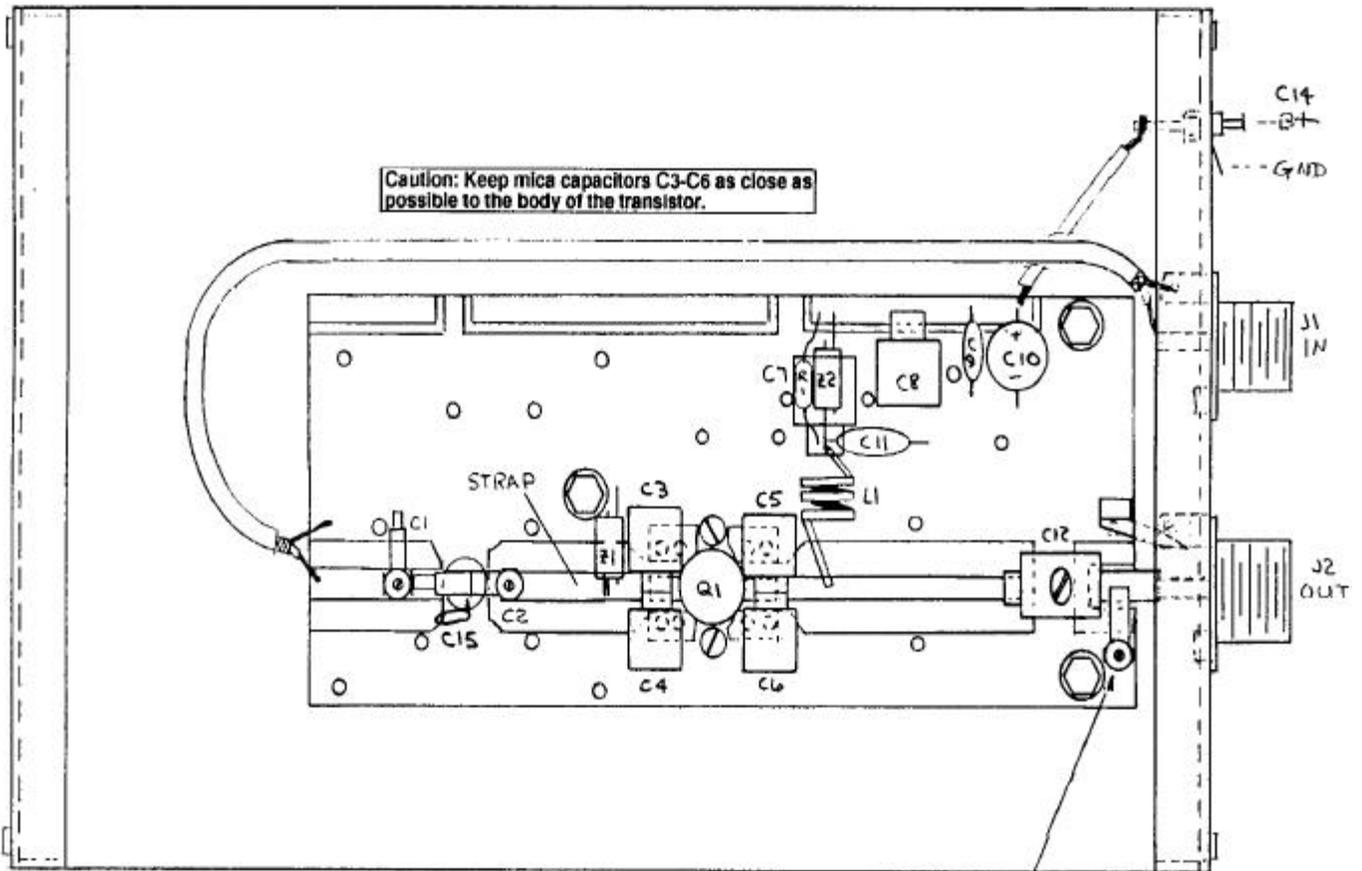
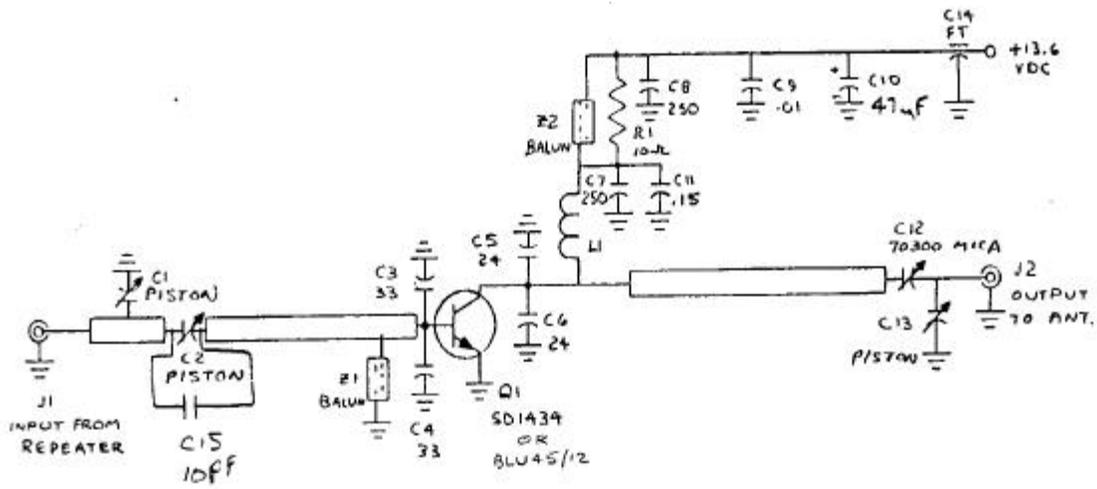
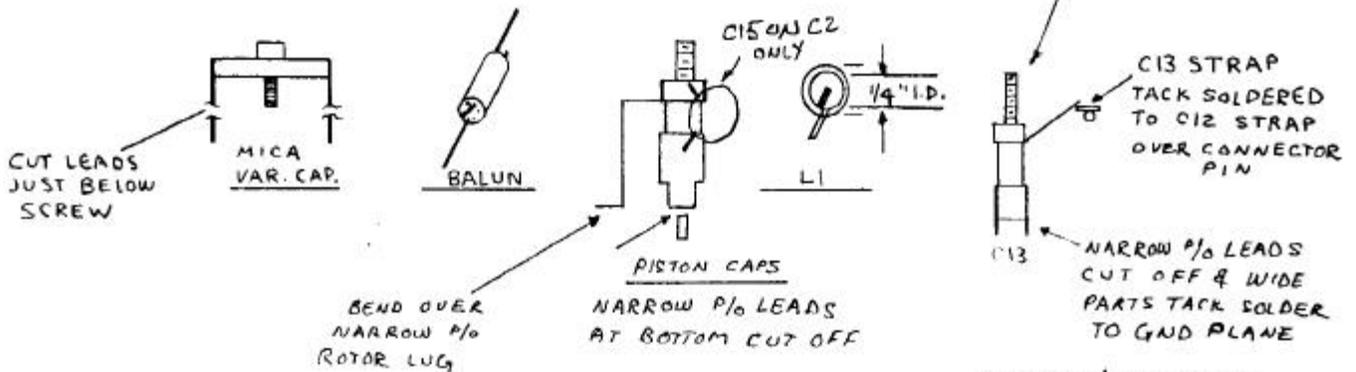


Figure 3. PA in Operating Position



Caution: Keep mica capacitors C3-C6 as close as possible to the body of the transistor.



RPA-30/440 MHz