HAMTRONICS® LPA 4-10R UHF REPEATER POWER AMPLIFIER

GENERAL INFORMATION.

The LPA 4-10R is designed to be installed as an integral part of a transmitter enclosure in a repeater installation with a 2.5 Watt exciter module. The transistor is biased for class-C operation to give 10-14 Watts output. The LPA 4-10R operates on +13.6 Vdc at about 2 Amp. It has a 50-ohm input and output impedance and is designed for continuous duty.

CONSTRUCTION.

General.

Most of the pertinent construction details are given in the component location and schematic diagrams and parts list. All parts are tack soldered to the pc board; so it is necessary to cut and form leads so that they seat properly on the board and be sure to keep leads as short and direct as possible.

Mounting the board.

Note: This series of power amplifiers is designed to be mounted in an rf tight enclosure with the exciter in a separate rf tight box to avoid feedback into the exciter. The unit is supplied less heatsink since the enclosure acts as a heatsink. It is important to mount the unit carefully to avoid damage to the transistor by pulling the leads off the ceramic case. The PA is designed to have the thickness of two thin #4 flat washers (about 0.050 inch total) as a spacer between the pc board and the chassis which the transistor is mounted on.

a. Mark and drill four clearance holes for mounting the board with 4-40 screws and one 8-32 clearance hole to mount the transistor in the center of the cutout in the board. The latter hole must be close to the diameter of the xstr stud to provide maximum surface for the shoulder of the transistor to contact the chassis for heatsinking; so do not make this hole oversize.

b. Carefully open the package of heatsink compound with scissors. Use the toothpick to apply a small amount of compound to the shoulder of the transistor where it contacts the heatsink. Only a light coating is needed.

c. Install four 4-40 x 3/8 inch screws from the bottom of the enclosure. Place two flat washers as spacers over each of the screws, as previously described.

d. Set pc board over screws, and align so transistor is centered over hole in enclosure. Secure the board with 4-40 nuts and lockwashers.

e. Secure transistor with #8 lockwasher and 8-32 nut. Do not overtighten nut; tighten with a nut driver only to the point of being snug. ***Caution: Since heatsink compound is used, it is unnecessary to use a lot of torque, which could break the stud.***

Installing Other Parts.

a. Cut tabs of variable mica capacitor C6 and piston variable capacitors C2, C3, C7, and C8 as shown in the detail on the component location diagram, and solder them to the board in the exact positions shown. Doing so leaves adequate space for coil connections. Mount the capacitors oriented as shown so the rotor screw is connected to the proper side of the circuit.

Note: There are two sizes of bus wire in the kit: #22 is the finest and #14 is the heaviest.

b. Z2 is a ferrite bead with leads tack soldered as shown. (Note ferrite choke is not used as shown in inset.)

c. Tack solder R2 across Z2 as shown, being careful not to short to turns on the choke.

d. Install chip capacitors as indicated. After one end of each of the capacitors is soldered and the positions have been confirmed to be correct, solder the ground plane end of each capacitor.

e. Form the coils exactly as specified in the component location diagram, and tack solder them to the board.

f. Tack solder electrolytic capacitor C12. Bend the leads at right angles, and observe polarity.

g. Tack solder one lead of a ferrite bead to the B+ pad to the left of C12 as shown. If you prefer, a hookup wire can be used with the ferrite bead clipped off its wire and installed over the hookup wire.

h. Tack solder R1 and L5 as shown. Ferrite bead Z1 is installed on the ground lead of choke L5.

i. Check to be sure all parts are installed according to parts list, and check all solder connections.

RF INPUT/OUTPUT CONNECTIONS.

The input and output connections are made with RG-174/u or similar 50-ohm coax cable connected to the appropriate input and output pads and ground plane of the pc board. See diagram. Connect cables by stripping as illustrated and tack-soldering to board. Note that stripped length of coax is inductive; so keep leads short and neat.

Avoid melting polyethelene insulation on cable by pretinning board and cable and then tacking them together quickly.

POWER CONNECTIONS.

+13.6Vdc should be connected to the B+ pad at the top of the pc board through the ferrite bead provided. A hookup wire should be attached to the ferrite bead's lead or the bead can be removed and installed directly on hookup wire tack soldered in place of the lead the bead is on (as shown in Fig. 2). The ground return normally is connected to the pc board through the mounting hardware.

Note that the output capability of the PA drops rapidly as the voltage is reduced below 13.6Vdc; therefore, you should try to use a power source of sufficient voltage and minimize cable losses so that you have full B+ available at the PA.

CAUTIONS TO PROTECT TRANSISTORS.

Because it is so easy to damage rf power transistors in the field due to accidents and abuse, transistor manufacturers do not provide any warranty to cover replacements once a transistor is installed in the unit. They test them thoroughly at the factory because they are expensive parts and they want to be sure you get good parts with your kit. Therefore, they do not honor claims that "the transistor must have been bad from the factory". *For your protection, please be sure to observe the following precautions:*

1. Transistors are made to operate in specific circuits. Do not try to check with ohmmeter, etc. Sometimes, you can blow a transistor when you reverse polarity.

2. Sometimes, transistors may be destroyed by parasitic oscillations occurring during tuning because of the extremes of capacitor settings, or due to accidental shorting of components. To protect against such damage as much as possible, turn power supply voltage down to 9 or 10 Volts when you first apply power until the unit is tuned. Then, turn up to full 13.6Vdc. Of course, final tuning should be done at full 13.6V.

3. Never exceed 13.6Vdc, as even a small over-voltage causes strain on transistors.

4. Be sure you have a low impedance connection to the power supply, i.e., short, heavy cable.

5. Do not attempt to operate PA until exciter has been properly aligned by itself, operating into a 50-ohm load.

ALIGNMENT.

Alignment is very simple. Connect the input to an exciter which has already been tuned into a 50-ohm dummy load. Connect the output to a 50-ohm load of sufficient power rating. Use an in-line power meter, or monitor output with a dc voltmeter connected to rf detector test point pad on pc board.

Apply B+ and rf drive. First, adjust mica variable capacitor C6 for maximum output. Then, alternately tune the various mica and piston trimmer capacitors for maximum output. Continue repeaking capacitors until maximum output is achieved and all interactions between capacitors are worked out.

Note: If the output is less than 10-14 Watts, check to be sure that the input tuned circuits are not tuned to a false peak, which can happen if the piston capacitors in the input circuit are adjusted with only about 1/4 inch of piston exposed. The true peak (assuming operation in the 440-470 MHz range) will occur with about 1/2 inch of piston exposed.

If you happen to have a spectrum analyzer (not required), you can fine tune C8 for lowest harmonic level and repeak C6 and C7 for maximum; otherwise, just peak all the capacitors for maximum output.

Note: Do not retune exciter with PA connected. Once the exciter is tuned into a 50-ohm load, it should never be tuned again. Tuning the input of the PA takes care of matching the PA to the exciter.

OPERATION.

Operation is quite simple. B+ can be applied all the time if desired. Merely apply an rf signal to the PA when you want to transmit. Being class C, the pa only draws current when driven.

TROUBLESHOOTING.

Since the unit has only one simple amplifier stage, there isn't much which can go wrong. The circuitry is straightforward, with shorted coax cables or incorrect or shorted pc board component connections being the first things to suspect should there be no output.

Should it be necessary to replace rf power transistor Q1, be sure to use an exact replacement. There are other transistors rated at similar output level, but they may have lower gain or different impedance characteristics.

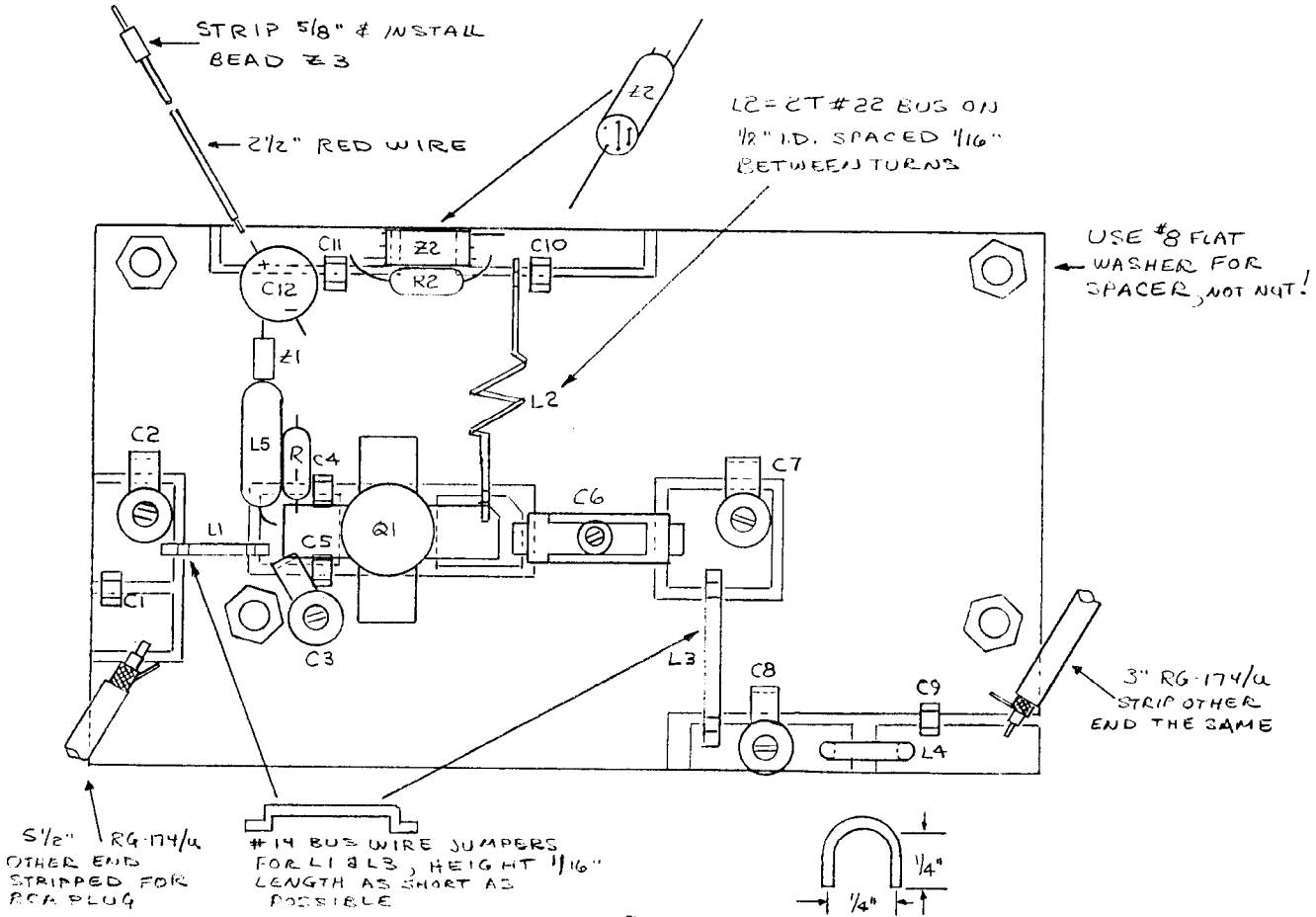
To replace the transistor, carefully peel each lead away from the pc board while melting the solder. Then, remove the mounting hardware and gently push the old transistor out of the heatsink. Clean all the old solder off the pc board. Add new heatsink compound, and install new transistor with collector lead in correct location. Carefully tighten nut on transistor without over-torquing. Then, flatten leads against the board, and sweat solder them to the board. Remember to resolder any components removed for access to the transistor leads.

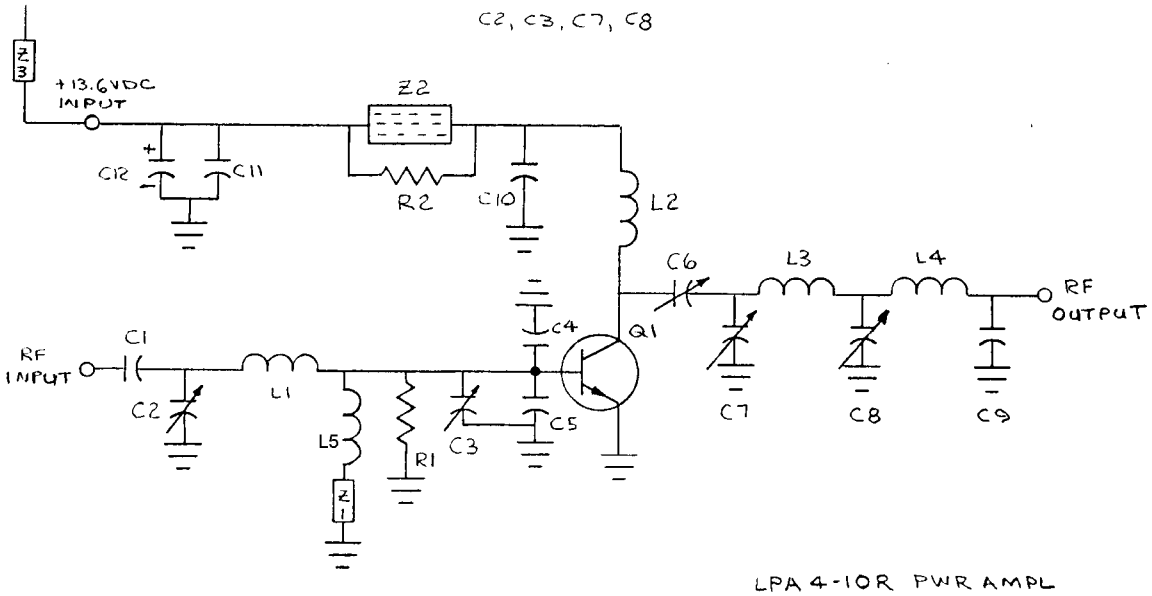
A word about relay coils. Any relay coil connected to the same B+ line as solid state equipment should have a reverse diode connected across it to absorb the inductive kickback which occurs when the coil is de-energized. Relay coils and similar inductors can cause transients up to several hundred volts. This is the most common problem related to damaged semiconductors. You should also be sure that your power supply does not have an inductive surge when you turn it on or off. If in doubt, borrow an oscilloscope and watch the B+ line when you turn the switch on and off.

PARTS LIST.

Note: Some design changes have been made since the diagrams were made. Text and parts list take preference.

Ref Desig	Description (marking)
C1	82 pf chip capacitor
C2-C3	11 pf piston trimmer cap.
C4	18pf chip capacitor
C5	not used
C6	mica variable (C4203/08)
C7-C8	11 pf piston trimmer cap.
C9	not used
C10	220pf chip capacitor
C11	0.1 uf chip capacitor
C12	100 uf electrolytic cap
L1-L4	form per diagram
L5	0.22 µh rf choke
Q1	M2519 or MRF654
R1	270 ohms, 1/4W
R2	10 ohms, 1/4W
Z1-Z3	Ferrite bead





LPA4-10R PWR AMPL

