# Controlling the MLA-2500

## Control and QSK

A bit ago I became the proud owner of a Dentron MLA-2500B. This amplifier had been converted at some point in time by Lawson Summerrow, W4EMF to GI-7B's. After a period of use, the owner was having issue's with arcing and fuses blowing and was a bit tired of trying to find the cause (luckily for me). He sold it to me at a very good price and I proceeded to get it back into working order.

After several checks of the usual things, I finally found the problem: an electrolytic had arced inside (to the can) and would heal after the power was removed. Then it would do it again once power was turned back on. It was hard to catch, but luckily I did. This also damaged another capacitor in the string, so I decided to replace them all.

Please note, that during the GI-7B conversion, some of the 'B' features were removed (to simplify bias, etc). The "B' version is basically different from the non-B version in that a relay is used to switch taps on the transformer's high voltage winding (thus lowering the plate voltage) and to switch the bias zener in the CW mode. During this modification, I made it even more like the non-B version by making the CW/Tune switch bypass all the resistors in series with the cooling fan. The non-B version switches this with the relay that also switches cutoff bias when not transmitting (in transmit), but there didn't seem a good reason to increase complexity by switching this fan to high during transmit in CW/Tune mode. Instead, it's in high anytime the CW/TUNE switch is pushed, transmitting or receiving.

The Boxer fan is another story that probably should be addressed at some point. I had it off of the amp for a bit while wiring things and noted that there's really not a lot of air coming out of it at full speed. A fan able to push a lot more CFM would be better and then slowed with series resistors for sound considerations. You'd still get more air flow than with this fan. At least that's the case with the one I have.

Also, to accommodate the taller GI-7B (and other physical feature differences), the RF pickup board was moved from the output SO-239 to a spot nearer the tank coil and oriented horizontally (this is visible in some of the photos); the choke and potentiometer on that board stick out too far for it to remain in its 'as designed' location. A piece of approximately #13 wire goes from the tank coil, through the pickup and down to the relay.

The electrolytics in the amp at the time I got it were pretty much like the originals, they mounted on the chassis in a vertical orientation. The transformer for the GI-7B filaments had been mounted on the outside back of the amp. While this worked ok, it was a problem for me because of space limitations, so I decided to use shorter, fatter electrolytics and mounted them horizontally on a vertical insulating board, like this http://w4emf.gs35b.com/mla2500-retro-gi7/, and moved the transformer to the inside as these pictures show. I used 6 of these

(http://www.allelectronics.com/cgi-bin/item/EC-1450/140300/150_UF_450_V_SNAP-IN_CAPICITOR_.html ) and a piece of a polyethylene cutting board to mount them on.

Once all new electrolytics (plus equalizing resistors and diodes, just to be sure) were in place, I tested everything with no tubes and on 120v with a 60 watt bulb in series (amp is wired for 240). Checked the voltages across the caps and looked for the usual. A few things had to be 'adjusted', but they were minor. Finally it all worked and I was a semi-happy camper.

## The need for speed!

Everything worked, but I did miss a couple of things when using the amp:

- Using a headset and VOX on SSB
- Full QSK on cw when the need arose.

The TR relay in the 2500 was just too slow (even though the one in my amp had been replaced with a faster one).

I looked at several options. The one with the most promise was Rich Measures QSK circuit (www.somis.org) with a reed relay and a vacuum relay. There was, however one big obstacle (a very big one for me): how to get 100 vdc to power the circuit. I know you can use a transformer-less power supply for it, but I just could not bring myself to do that. It was just not acceptable to me to connect anything with RF (or nearly anything else) directly to the 120 vac line.

The problem then was how to power it. The 2500 has little space for much additional hardware and with a 12.6vac 4 amp transformer in the section where the electrolytics are, most of the space was in use. So this problem plagued me for several weeks; I thought of reversing a 12v transformer (feeding it with 12 vac and using the 120 vac side for the supply), but that really wouldn't make the transformer any smaller. Then I thought about feeding a 24 volt transformer with 12 volts and using a voltage doubler, but again, electrolytics require space and still the transformer wouldn't really be any smaller. I looked everywhere for a flat transformer that might fit, but nothing could be found (that wasn't way too expensive).

# Eureka!

Looking at the control board one day, it dawned on me: if I redesigned the control circuit, got rid of the relay and the thermal timing relay, there might just be enough room for a small transformer. Then I realized that if I had to supply the functions of the relays on that board, why not drive the QSK relays with the same circuit? Basically it would only need a microcontroller and a handful of other parts. It wouldn't require balancing resistor values and it would be more 'repeatable' and easier to control. Additionally, other features could be incorporated into the design to help protect the relays from hot switching.

# The Plan

I knew I needed to incorporate a speedup circuit in the design to push the vacuum relay a bit. Basically I needed to hit it with 2-3 times its rated voltage for a short period and then back it off to the correct voltage. I experimented with several things, but realized as I looked at a control system very similar to what I had in mind at WV7U's website (www.wv7u.com), that I was overcomplicating it. Basically he used two MOSFETs; one switched 48 vdc to the vacuum relay coil and remained on for 2 ms and then the other would switch 48vdc, but with a resistor (two in parallel in this case) in series to give ~26vdc across the relay coil. This was so simple that I hadn't even considered it! Sometimes simpler is better!

This is the approach I took here. The transformer on the control board didn't have to supply all the voltages required by the circuit, since 12 vac was available in the amp already (just had to change the meter bulbs to LED's and use the 6 vac winding with a diode and capacitor, something I had planned to do anyway); it only had to supply 48vdc (at approx 80 ma) for the vacuum relay. This allowed a smaller transformer to be used. Still, the control board layout is a bit crowded (the diodes, capacitors and meter multipliers are on there too, like the original control board).

# New Control

The PC board layout isn't perfect for the new control board by any means. I'm sure it could be improved upon. One thing I discovered after I had etched the board and installed all the components was that somehow in weeks of testing (wires everywhere on a small breadboard) I had completely missed one thing: Standby!

I hate to admit it, but I hadn't even thought of it. I was so concerned about getting the keying sequence correct, protecting the relays, checking voltages, etc, I had completely ignored it! So I had to mount a couple of components on the solder side of the board to make an input for Standby (a 10k pull-up resistor and a .001 bypass capacitor). Not my favorite way, but necessary with this layout because there just wasn't room to add anything to the component side.

**Fig 1: The new control board being tested (the meter multipliers aren't installed yet)**

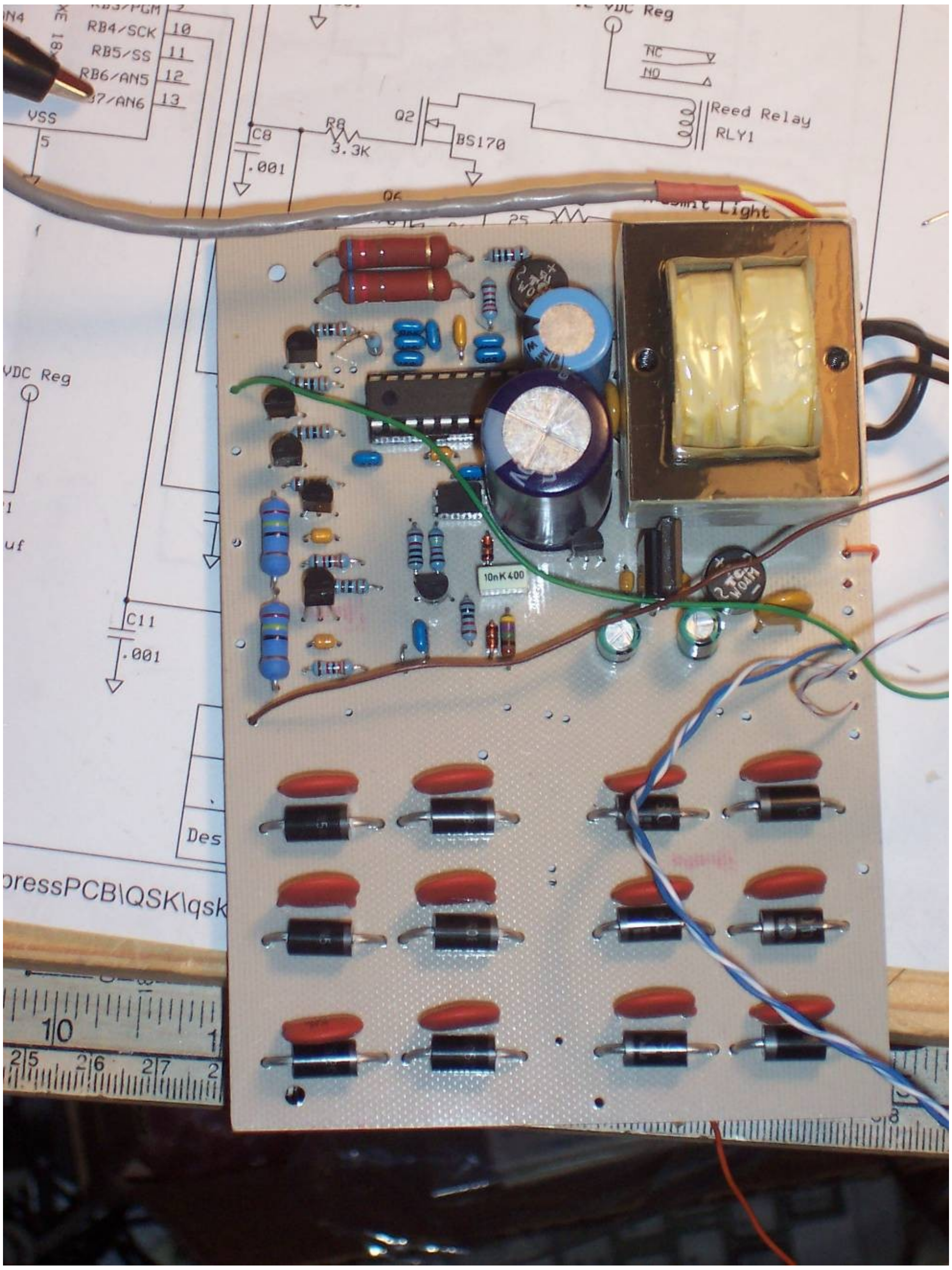



Figure 1 shows the new control board. It is identical in size to the one in the 2500 (B version in my case). One thing I found had to be changed after testing this for several minutes: The two 3 watt resistors (which are in parallel) at the top left of the picture were changed to two 5 watt cement filled versions. The 3-watters just got too hot. They would have been fine if the transformer, which was rated at 36vac, 170 ma, had actually been 36 volts. Instead it was approximately 43, so instead of 48 vdc, I got something closer to 62 with no load. The 5 watt resistors get pretty warm, but tolerable.

# A Ship in a Bottle!

Now the really fun part of this entire project wasn't the control board; it took a while to get right, but the real tedious piece was mounting the relays and getting them wired.

**Figure 2: Relay mounting bracket and wiring**

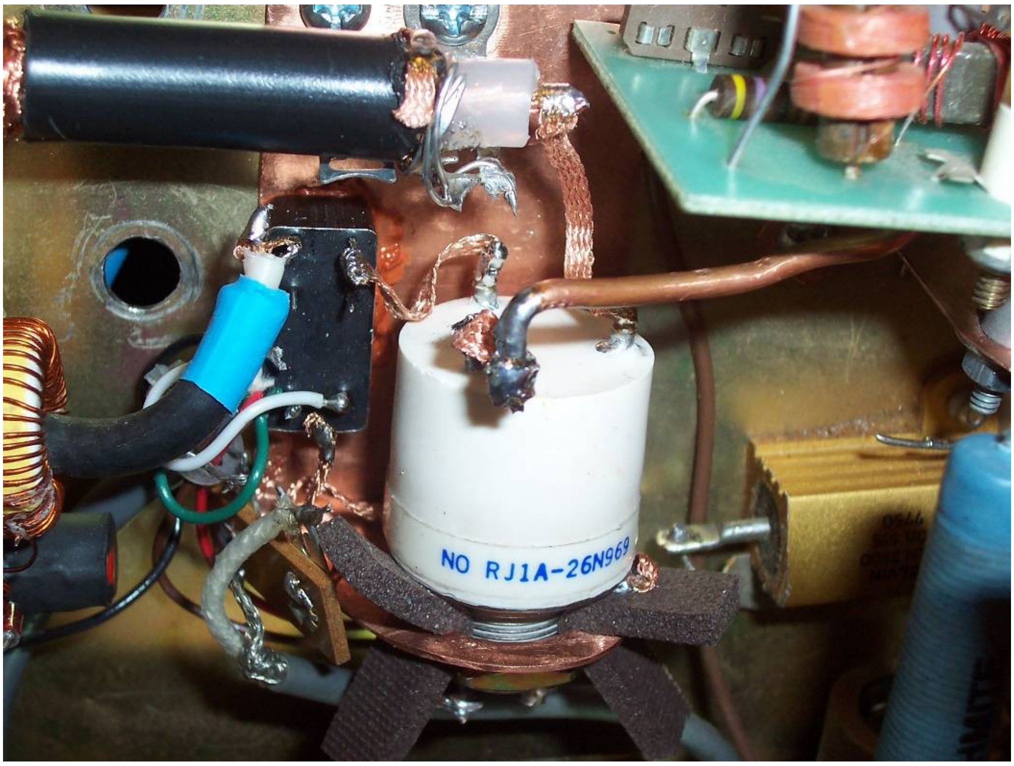
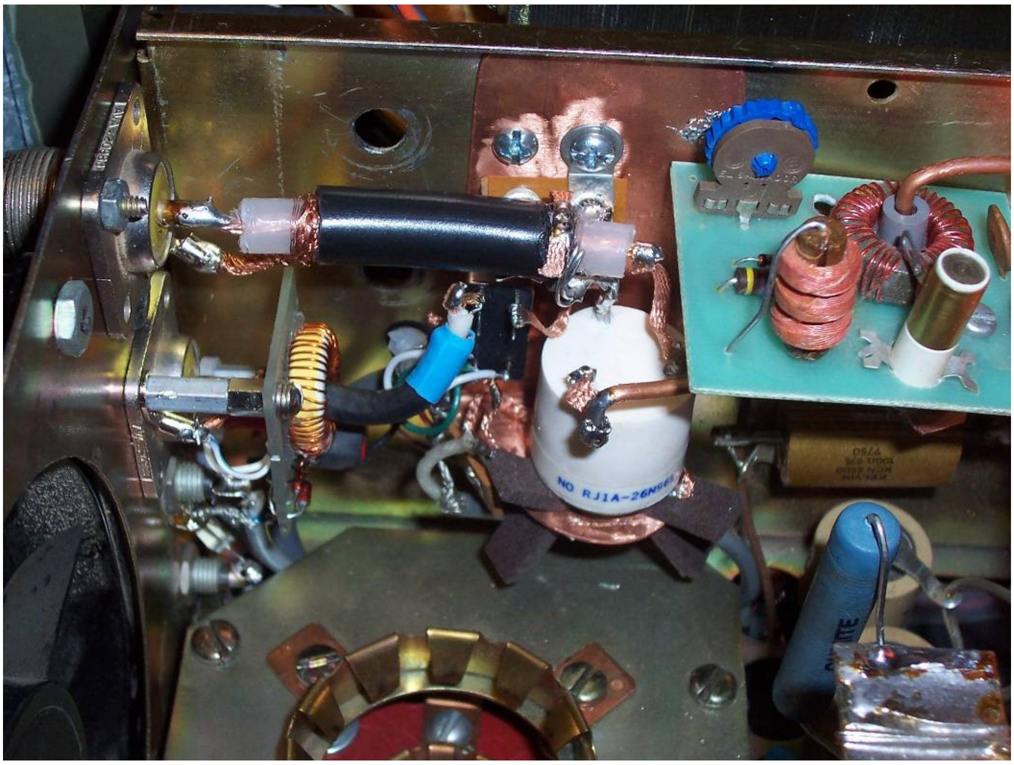



**Figure 3: Wider view of relay bracket**



Please note: There's actually a wiring error in the preceding two pictures, but they show the bracket better than any of the other pictures I took, so I decided to put them here. The coax with the blue heat shrink tubing should be down at the tie down with the lead going to the common connection on the reed relay (where the grey coax is in the picture, going to the cathodes; this piece was too short when I corrected the error, so the piece that says 'Tandy' is its replacement). I didn't notice it until I was reviewing these pictures (I'm glad I found it before I tested the amp)!

The bracket is copper, actually made from a piece of 5/8" soft copper tubing, split down the middle and hammered out flat. Working the copper made it somewhat less 'soft' and it is very easy to work with (can be cut easily with tin-snips) and to solder to, making it ideal for this bracket. The vacuum relay hole is offset. It comes off at an angle from the vertical section (nearly tear drop shaped) so it will not be too close to the tube and it is down far enough to be below the anode cooler.

There is a rough, not-to-scale drawing of the bracket done with Express PCB. It has 'Imperial' dimensions that are pretty close, but you'll need a little fudge factor to get everything to fit.

Caution should be exercised when drilling large holes in a small piece of copper; since it's relatively soft, the drill can catch very easily; so don't hold it in your hand while drilling. Make sure it is firmly secured and drill smaller pilot holes first! I used a Dremel with a fine grinding attachment to make the hole larger than the size of the relay mount so it would fit just snug with the silicone rubber in place (without requiring too much force to push it in). The bracket is mounted in two holes used by the original relay (using lock washers for good electrical connectivity).

All connections to the relays, except power and keying signals are made with short pieces of copper braid; a medium-sized version Radio Shack sales (or at least did) for de-soldering. I used a flux removal pen on it before using it. The vacuum relay (used but tested, from Allen Bond at Max Gain Systems, www.mgs4u.com) has two short pieces soldered to its base on each side (to the body of the relay, do it quickly to prevent damage!) and grounded (soldered to the bracket). It is mounted with 3 strips of silicone rubber (supplied by Max Gain Systems). These strips are placed in a triangular pattern (the 3rd one is in the back) and the nut tightened down till it just compresses the rubber. I left these strips long so they could be adjusted easily. The hole in the bracket is made big enough to accommodate this arrangement. Mounted in this fashion, the relay will move some in its 'nest' but will not come out. It's is also silent when operating.

One word of caution: if you use the same type transformer I did, the DC voltage feeding the relay will be very close to the maximum ratings of the MOSFET. Do not put a capacitor across the vacuum relay coil, and if one is there already, remove it. The capacitor will damage the MOSFET. Use the resistor/diode combination as in the schematic.

The reed relay (from Rich Measures, www.somis.org) is mounted with Permatex Ultra Copper high temp RTV. I first put a thin film of it on the bracket and let it get a little tacky, and then put a dot on the relay. I pushed it down and pulled it back so as to have a fairly thick layer with some holes, not a solid mass. This relay is also silent when operating.

As can be seen in the photos, RF comes in and goes out through coax; RG-58 foam for the input and RG-213 for the output. There are two 'tie points' as they seem to be called now (I used to always call them terminal strips) on the bracket to support and connect the coax, (these I got from All Electronics, www.allelectronics.com).

At the upper section you can see one with two terminals (a free one and one to ground). This acts as a support for the RG-213 as well as the ground point for the shield (it is a good idea to 'form' the coax a bit too, bend it several times, not sharply, but enough so it goes toward the side of the chassis and further from the tube; RG-213 this short is pretty stiff).

I first soldered two parallel pieces of #22 hookup wire to the shield to allow me to 'lash' the coax down to the ground connection on the tie point, then a piece of the same type of copper braid used for the relay connections is wrapped around the coax shield and through the tie point and everything was well soldered.

The other tie point (terminal strip) is soldered onto the left lower section of the bracket (it is a bit obscured in the pictures), along the edge of the 'tear drop'. It's used as an intermediate point for the RF input. The coax center goes to the free point on this one, and then the braid from the relay goes to this point. The ground terminal on this one is not soldered to, but rather acts as an anchor point for the multi-wire shielded cable that carries the reed and vacuum relay keying signals , the +12 and +48 volt lines (4 wires + shield). This cable is wire-tied to the ground lug and the wires (with plenty of 'give') are soldered to their respective points. The shield is soldered to the bracket itself.

The cable I used has 5 conductors with a foil shield. This is a piece I happen to have had on hand, but I note All Electronics (www.allelectronics.com) has something very similar. It doesn't have to carry a huge amount of either voltage or current, so #22 to even #26 wire should be ok; just be aware that it has to run under the chassis and there's not a lot of room under there and that the leads should be stranded. You could even use 4 pieces of RG-174, but that bundle might be pretty thick and you'd have 4 shields to ground somewhere. Another possibility is to use the jacket and shield from a piece of shielded cable and slide 4 wires of suitable type inside.

It would be good to review the schematic at Rich Measure's site ([www.somis.org](http://www.somis.org)) for the relay contact wiring details. In my case, I didn't find the 39pf capacitor necessary. As a matter of fact, changing the relays actually corrected a problem I was having where I needed full loading (and then some) on some bands.

## Please don't Bite!

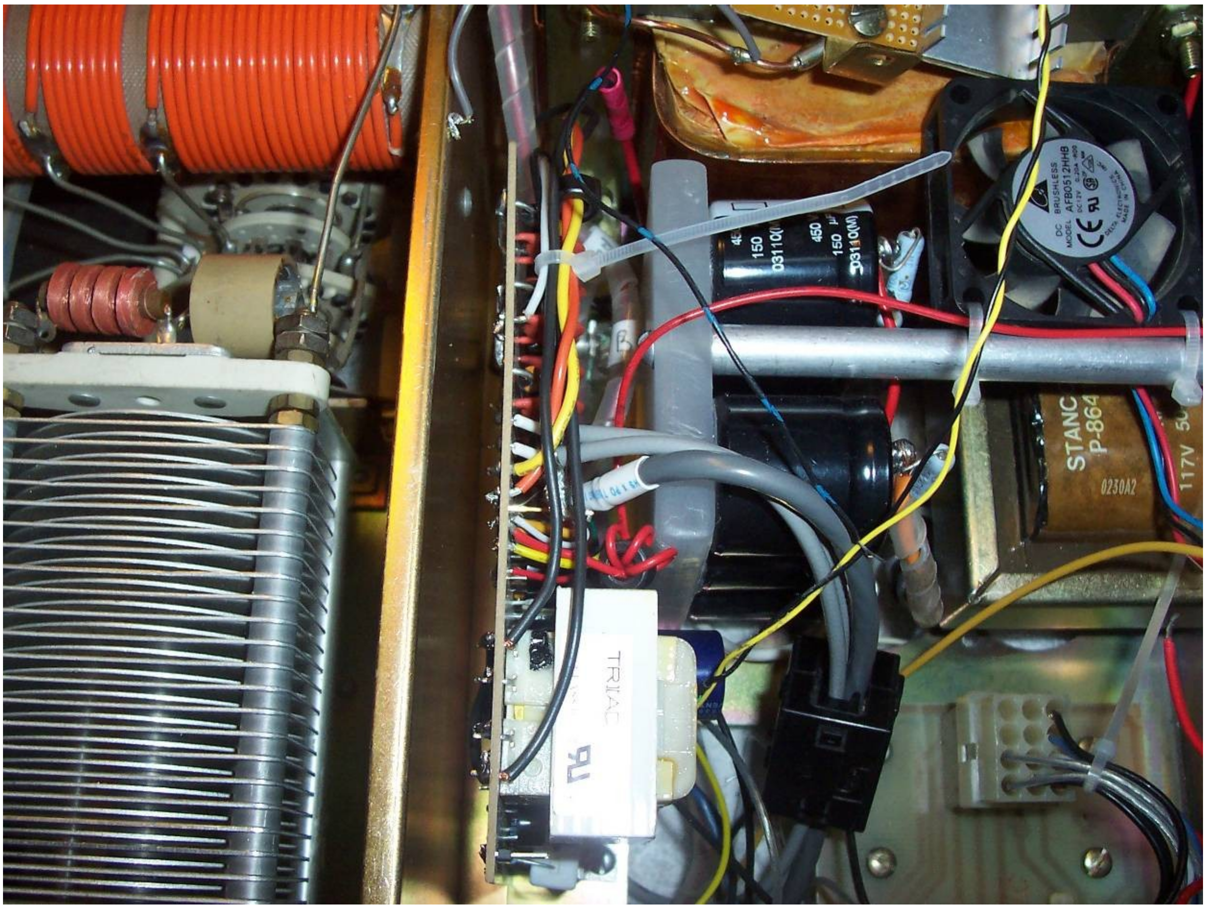
It is very important to make this as RF proof as possible; you don't want RF to get to the microcontroller and you don't want any noise from the control circuit to get back to the receiver. Cables from the relays is where much of this could come from because they are basically in the RF compartment, so you want to be nearly fanatical about keeping these RF 'clean'.

Under the chassis, where this cable comes through, I placed a ferrite core (I'm not sure of all the details for this core; I got several in a bulk package. It's basically a 'sleeve', .75 inch outside diameter, .375 inside diameter, 1.125 inches long. I see them at Mouser, All Electronics, eBay, etc. They are very good as common mode chokes). I put two turns of the cable through it before it runs to its final destination (the control board).

The same considerations should be made for the RF pickup board cable, due to both its function and location. For it I used a piece of double shielded coaxial cable; some I happen to have scrap pieces of, but RG-174 should work as well, maybe better because what I used has a solid center conductor. I didn't feel this one needed the core because of the double shield and the amount of RF is typically much lower.

Please note, that at the control board end, the cable to the relays, the RF pickup cable and the keying line cable (also double shielded) are bundled together and a snap on common mode choke is clipped around them. Also, any single wire leads going to an input or output has several turns of the lead on a ferrite bead (type 43 is what I used). Even where I split out the wires from the multi-wire cable to the relays, I put beads on the leads going to the MOSFETs (these leads turned out to be a bit longer than I'd planned because of how I had to handle grounding of the shields). This is probably overkill, but I've seen the results of RF and microcontrollers and it isn't pretty; better safe than sorry!

**Figure 4: New Control Board installed; well, mostly!**



# Are you There?

One 'feature' I added was to detect the presence of RF at the input so that if a state change is requested (key or un-key) and RF was still present, no change in the relay state would take place until that RF went away. This is an additional check to help prevent hot switching.

In order to add this functionality, the input goes through an RF pickup made up of approximately 30 turns of #27 enamel wire on a toroidal core (white-yellow from a PC switching power supply; fairly high permeability). The center and ground of the RG-58 are connected at the SO-239, but the other end isn't grounded. This is important for the coil to be able to pick up enough signal to supply voltage to the switching diode and zener diode and ultimately to a MOSFET that switches an input to the microcontroller.

I used a 1N4148 instead of a germanium diode because I really didn't need the sensitivity and germanium diodes will go bad pretty easily with much RF. In practice it is very sensitive, switching the MOSFET with just the very low RF produced when the plastic slides on the PTT button on the microphone, almost imperceptible on the output meter.

This coil was mounted on a small piece of glass epoxy pc board material (with no copper of course) and holes were drilled for the diodes, coil wires and choke. This little board is made a bit longer than the outline of the SO-239 to accommodate the other components. The toroid is attached to the board with Loctite Extreme Repair. This stuff is great for this sort of thing; it's a non corrosive RTV. A piece of double-shielded cable is used for this board. A piece of RG-174 or something similar should work as well. A wire tie holds the cable to one of the standoffs

Before I could mount this little board, something that always brings joy to my heart had to be done: I had to drill out the rivets that held the SO-239 in place. I absolutely hate rivets on SO-239's or the like, so putting real hardware on this socket was great! Just use a twist drill a little smaller than the hole size of the SO-239, and drill in the center with a little pressure.

**Figure 5: RF input pickup**

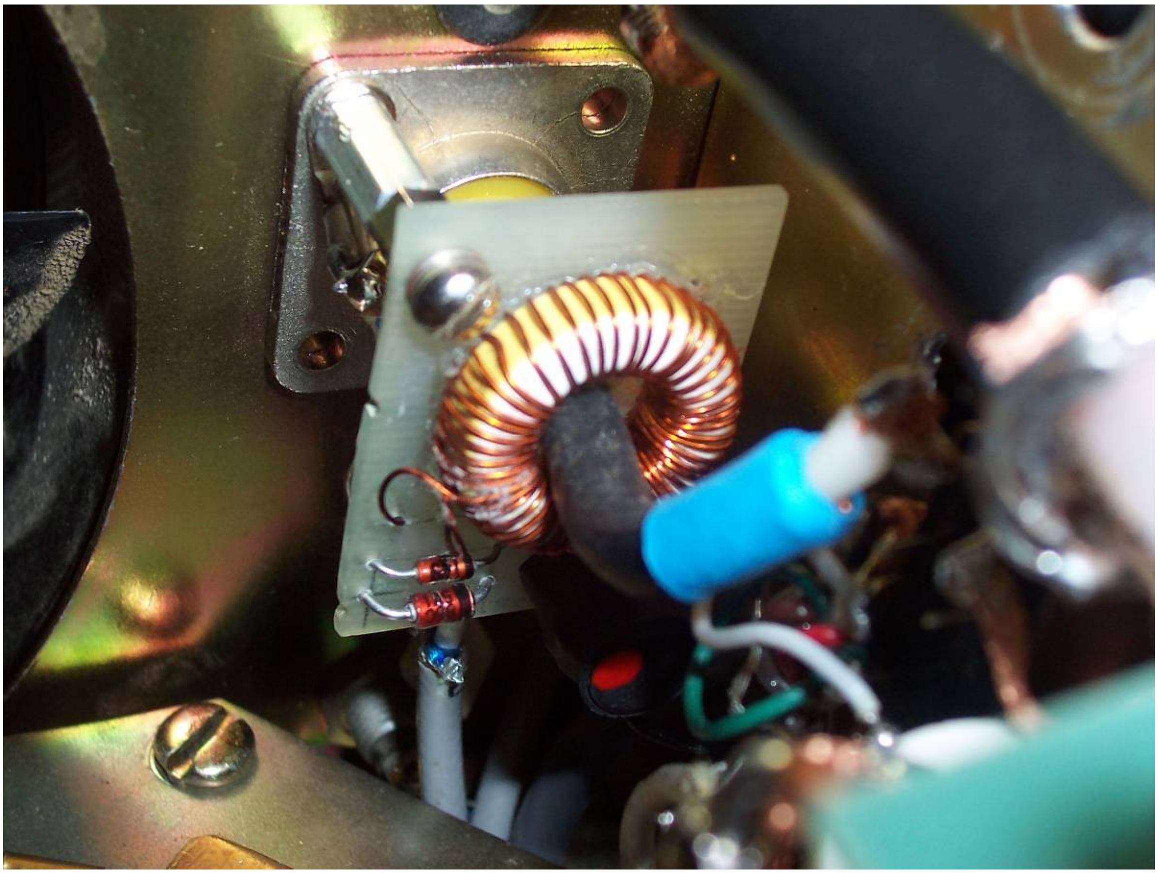
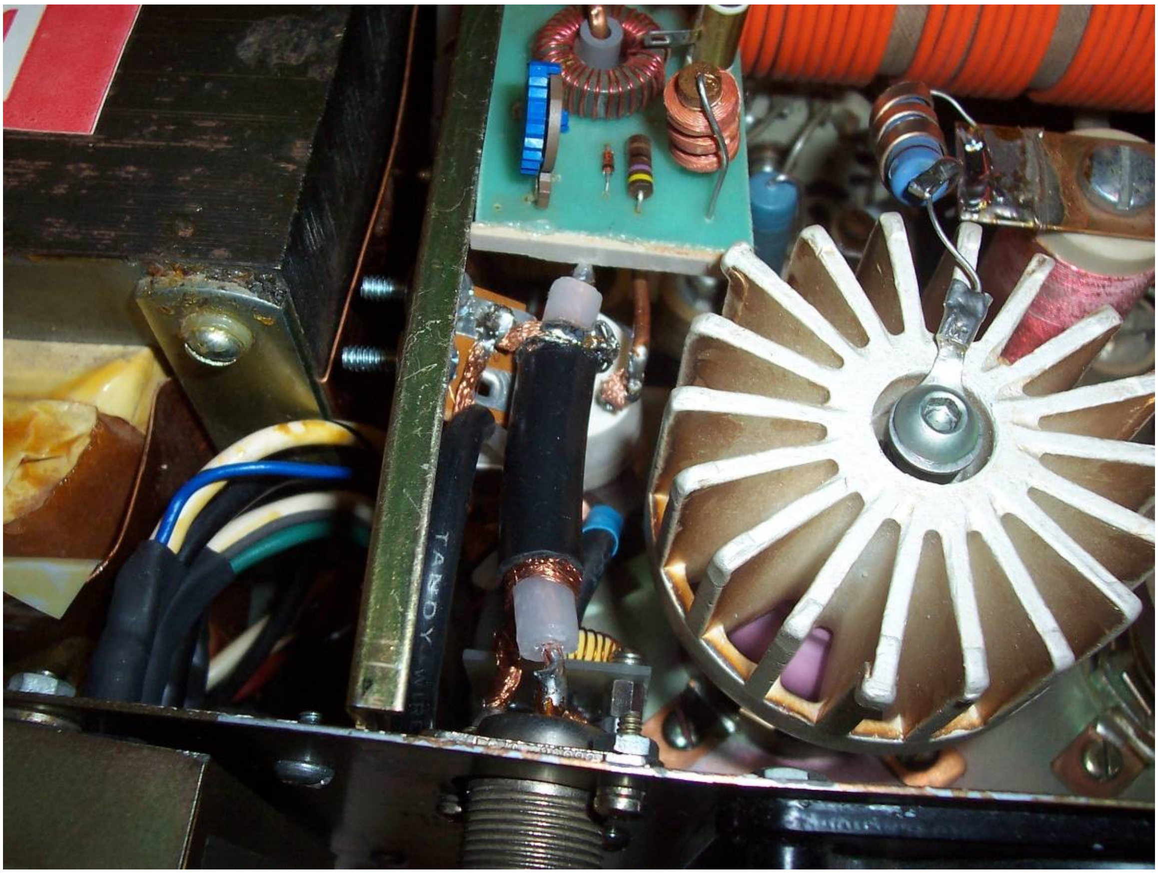
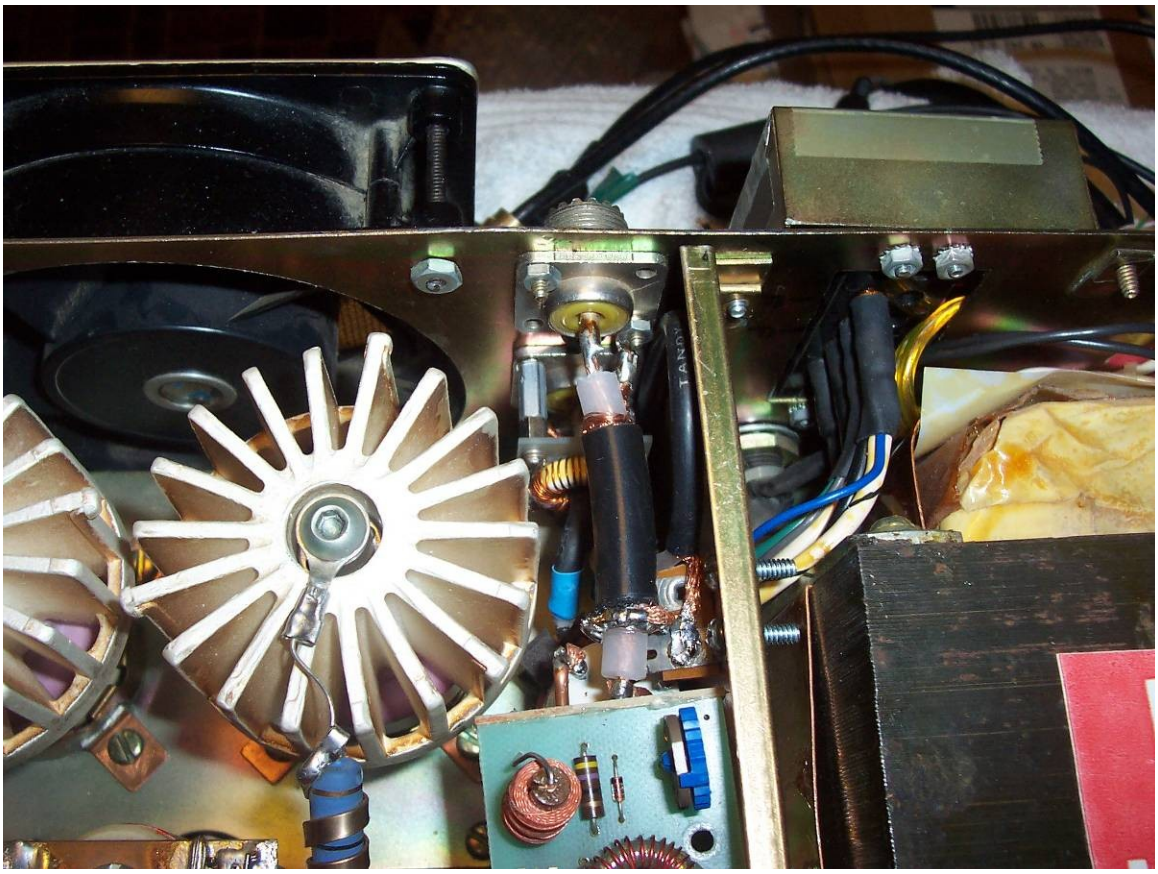


**Figure 6: Views of bracket and pickup with tube installed**





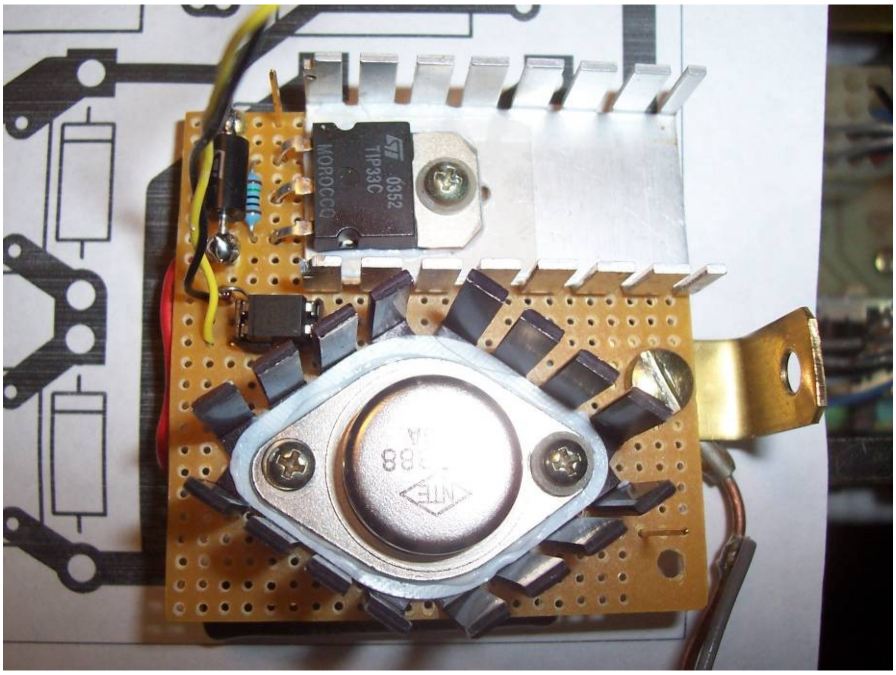

After installing everything, I noted that the end of the RG-213 was a little too close to the power module. I used Extreme Repair again to attach a scrap piece of PC board to the edge, just to make sure there was no arcing. Also, please ignore the Tandy name on the coax. This is an older piece that actually has a shield!

The new control board doesn't have the diode and electrolytic capacitor for the ALC. Instead I found a radial lead electrolytic of the appropriate value with a small enough diameter to fit under the chassis. I mounted another terminal strip beside the one with the shunt toward the front of the amp (I cut off the tops first, due to the space constraints underneath the chassis). I soldered the new electrolytic in place, it extends toward the front, and a diode in the appropriate place along this strip. This is also where I put the electrolytic and diode for the dc supply for the meter LED's (on different terminals of course, powered from the 6 vac line). Unfortunately I didn't take any pictures of the underside, but there's not much in the way of details here anyway. You do have to remove the 12 vac lead that is grounded and connect some smaller wire to each lead to connect them to the control board.

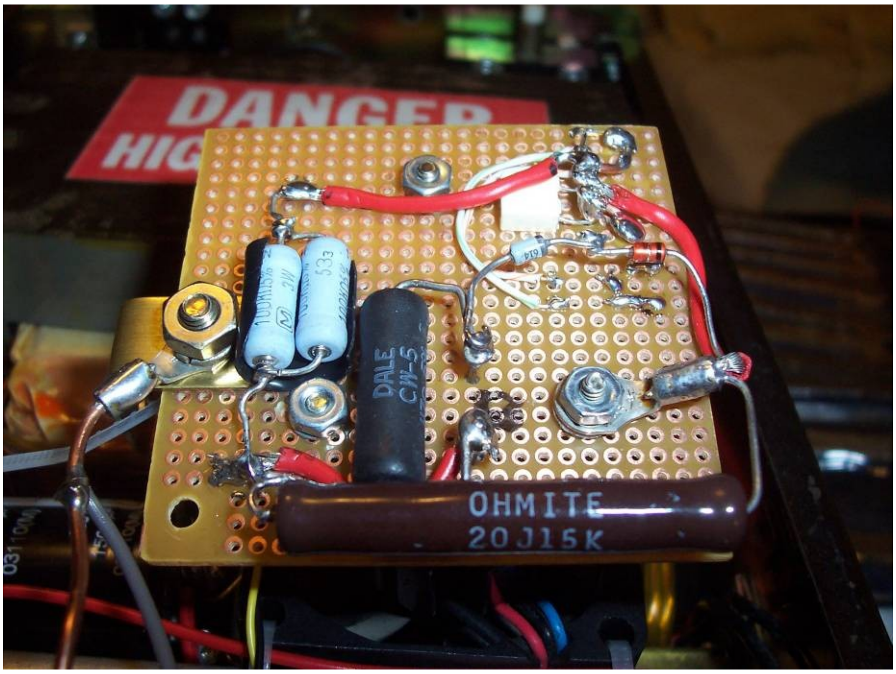
# BIAS and Electronic Switching Module

A BIAS module was already installed in the amp. It consisted of a NTE388 power transistor, a zener and a couple of resistors. Basically it is a zener with a pass transistor. Since this module can handle quite a bit of current, I decided just to use it for BIAS, just putting it on the same board that the electronic switching circuit was on. You could also use another BIAS circuit if you wish. The one problem with this one is that it's fixed; you can only adjust it by changing or adding zeners. I had to add a 3.6 volt zener in series with the 27 that was there originally because the set of GI7BT's I had was showing too much resting current, this brought the current down to about 90 ma. Tony King, W4ZT, has an adjustable BIAS board available (http://bias.gs35b.com/) that should work fine as well, you'd just need to make heat sink and layout changes and follow his recommendations for this board. Just be sure the cutoff resistor is connected as shown in the schematic; it should be across the BIAS and electronic switching module (basically from the cathodes/transformer CT to ground).

**Figure 7: BIAS and ECBS Top View**




**Bottom View**




This board is 2.5 inches x 2.5 inches. The heat sink for the TO-3 transistor was already there, I just put it on this board. The heat sink for the TIP33C is from a switching power supply, I just cut off the solder tabs on the bottom.

Both transistors are insulated from the heat sink and silicon thermal grease is used on them. Not really necessary, but I didn’t want something to fall down between the heat sinks and short things out.

The PC2501 optoisolator is in a socket made by cutting off one side of an 8 pin IC socket.

I put any of the switching circuit components that might break down during a glitch on this separate board. Only the resistor from the microcontroller output is on the control board connected to a two pin header. A plug is on the end of the black/yellow wire to connect to this header (you can also just see a ferrite bead at the plug end of this wire on the control board picture, #2 at Figure 4). This cable/plug assembly is actually from an old PC power supply fan; the header is from the same supply (.100, pretty easy to find). You can just solder the wires in if you like, but I did it this way in case a glitch damaged something on this board, it’s easier to remove and repair with a plug on it. Due to space limitations on the control board, the header doesn't have a 'key', so I put a diode in series with the optoisolator to prevent damage in case the plug is reversed.

It's hard to tell from the picture, but the transient suppressor is soldered on top of two small brass wood screws. This makes it easier to replace and puts it up a little above the other components. These screws are just big enough to catch on the perforated board hole and screw in a bit, then a little crazy glue holds them in. I did cut the slot a little deeper in the heads with a Dremel and a cutting wheel.

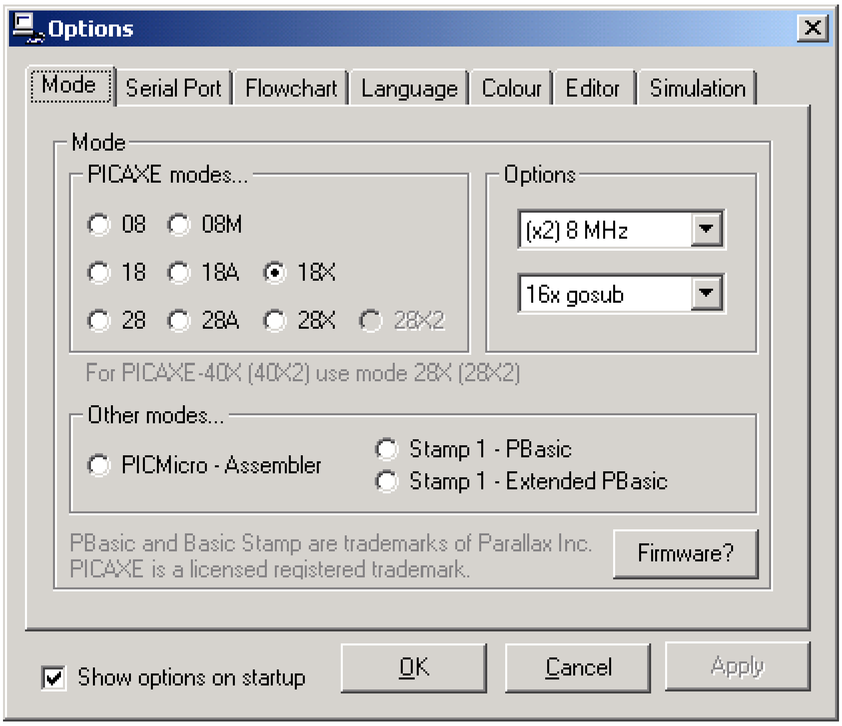
This board mounts over the plug where the push button switches are, with a single screw in the "L" bracket you see in the picture. An additional hole is drilled for it. This must have a flat head screw (and counter-sunk hole, if that's the proper form of the word) so that the top can fit as it should, and it should be down far enough for clearance between the top and the heat sinks. There is also a 'ring' lug on the end of a piece of ~#14 wire as you can see. The other end of which goes to a another lug that attaches to the screw on the meter nearest the module; this is a ground point for the front, so it's just to make sure the ground connection is solid.

# A Few More Notes

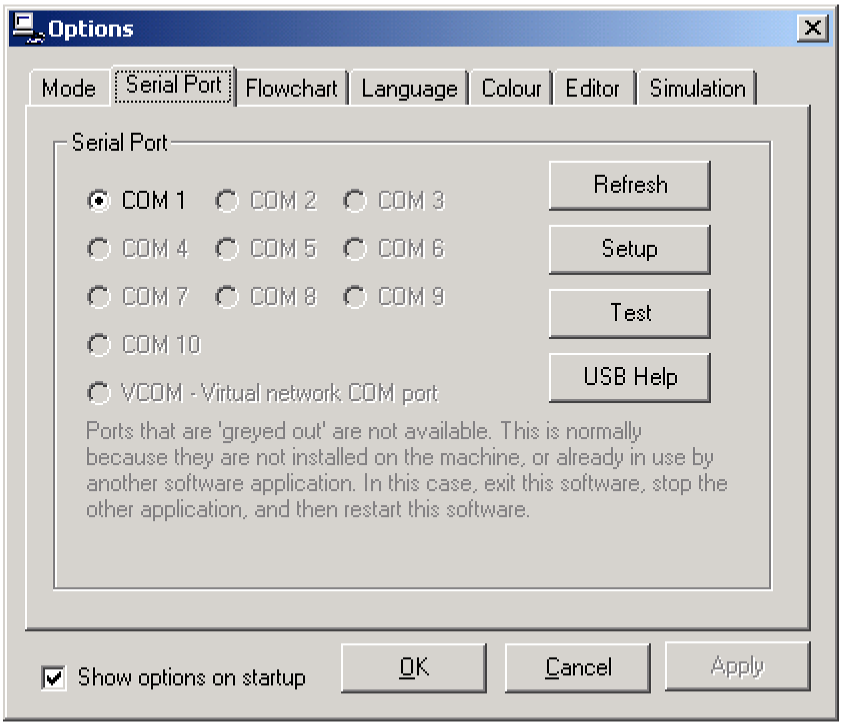
- In figure 4, you can see a small CPU fan. When I first put the new electrolytics and resistors in, I noticed that the heat from the lower rows and the heat from the filament transformer was combining and this compartment was get much warmer than I wanted it to. Unfortunately, there isn't a lot of ventilation in this section, so I thought I'd just try a small 12 vdc CPU fan set to draw the heat out. This one has a 100 ohm resistor in series to slow it down some (it whines at full speed). Although you wouldn't think a fan this small would make much of a difference, it did; a considerable difference as a matter of fact. With the new control board, I'm feeding it from the regulated 12 volt supply, with a ferrite bead where it comes off the board (about 3 or 4 turns). The size is 60mm; it's wire-tied to the long standoff that holds the insulating board and just rests on the edge of the transformer. Available space dictates the size; one a little thicker could be used, but not one any larger in other ways. Also, the amount of current it draws is a consideration since the 12 volt regulator on the control board doesn't have a heat sink and it also feeds the 5 volt regulator.
- Grounding the shields of the cables was a little challenging. When I laid this board out, I made a single grounding connection like the original control board had. The problem with this is that it doesn't provide a convenient location for grounding the shields. The better way would be to add a connection for the shield at all terminals that have shielded cables, but due to space restrictions, this would have been very difficult. Instead, I used a long gold plated lead I removed from a pc board header. It doesn't have to be gold plated, I just happen to have a few about 1.25" long. I drilled a hole behind the resetable fuse, bent this lead and soldered it to the ground connection (with a good ¼" of it actually solder to the ground trace; this lead has extra stress, so it needs a firm connection). The shields from the relay cable, the keying line and the RF detection board solder here. The other leads go to their proper terminating point. As mentioned previously, the leads that go to the MOSFETs from the relay cable have ferrite beads with several turns of the lead around them.
- The schematic and board layout were done with Express PCB (www.expresspcb.com). This software is free for downloading.
- The programming connection is shown on the schematic with the 9 pin serial port pin numbers. I originally had in mind to use a 1/8" stereo jack for this, but I forgot about how far the top of the jack sticks out, so I put a 3 pin header there instead and made a cable. If the layout was changed so the jack is located down a little further it should work ok, you just have to be sure that it's not hitting the meter or is in the way of something else. I didn't change the layout because it works and I didn't want to make a change by mistake and make it not work.

One thing to remember: it better not to operate the amplifier with the programming cable connected. It can make a nice little antenna for RF to get into the microcontroller.

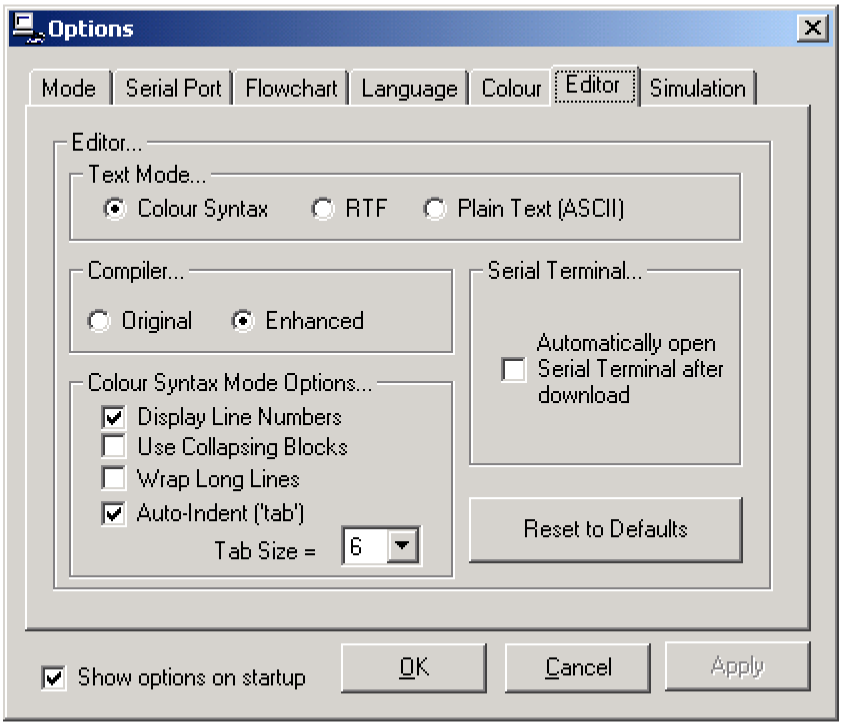
- The editor for programming the PICAXE is available free at www.rev-ed.co.uk/picaxe. Note that when you start a session, it asks for the PICAXE type and speed. In this application, it is a 18X and it's should be running at 8 MHz:




**The proper serial port should be selected:**



And for this application select the Enhanced Compiler:




You may have to start in 4 MHz mode until you download the program to the PICAXE, then close and restart the editor in 8 MHz mode. Might be necessary to turn the amp off and back on too, once the program is downloaded.

- The program for the microcontroller is very simple. At first I had it nicely laid out with subroutines for all functions and only calls to them in the main loop. When I first tested this in the amp, I noticed that the RF protection piece was preventing the amp from keying/un-keying part of the time. At first this really didn't make sense to me.

I use an IC-751A and I didn't think that it's transmit delay was that short. The QSK piece seemed to work ok with this RF check removed from the keying part of the program but still in the un-keying part.

The microcontroller basically runs an interpreter. The editor 'tokenizes' the instructions and the interpreter in the PICAXE executes the instructions one by one. As I thought about it, I began to wonder if there wasn't some delays being introduced because of the overhead caused by the way I had structured the program. Subroutines take more time; usually Boolean functions (AND. OR, etc) are slower. I had a 'case' statement at first, but started to wonder if multiple if's might not produce a more optimized set of instructions. I was also setting 8 outputs at the same time when switching their states, which seemed like a good idea, but I began to suspect that the actual instructions might be setting them one at a time anyway, so I was just doing the same thing 8 times without needing to. So the present program is the optimized version. It's not as pretty, but is much faster. Had this been done with a PIC and a true compiler, it would probably not be an issue, but making program changes easily would have been more difficult.

Some might question the sequence. First the Vacuum Relay Step (higher voltage), then the reed relay, pause 2 ms, then the normal vacuum relay voltage and finally the business end (tubes) are activated. The reason I turn on the Vac Step first is because the vac relay is the slowest part; the reed relay is at least twice as fast (rated at less than 1ms). So the reed relay will engage before the vac relay, even though the vac relay is turned on first. Although electrically the sequence is Vac relay, reed relay, tubes on, the physical sequence is reed relay, vac relay and tubes on. The same is true when it is un-keyed; first the tubes, then the vac relay and lastly the reed relay. Physically it will be tubes, reed relay and lastly the vac relay.

- I used the incandescent bulbs that were originally in place for Ready and Transmit. I calculated 25 ohm resistors for these bulbs switched with MOSFETs that have approximately 2-5 ohm 'on' resistance. I used the unregulated approx 17volts before the regulator. The closest value I could find was 24 ohms, but I think 27-30 ohms would be better for bulb life. The best would be to replace the bulbs with LED's and just use correct resistors for them.

- There are two jumpers that should be installed on the control board. They are on the copper side with “jmp” next to them.
- Even though the layout of the PC board and the relay bracket are particular to a MLA-2500 with GI-7B’s, the principle is the same for any similar amplifier; just a few details will change. This should work with the original tubes as well; just the bracket will be different. In other amps, other ‘things’ may need to be switched. Again, this is just a matter of understanding what needs to be switched and adding the necessary mechanism (MOSFET, additional microcontroller output, program additions, etc).