The Blue Guitar

Peavy Classic 30 mods:
Introduction

Notes on the Adobe Acrobat PDF Format

I've gotten quite a lot of feedback on my articles on the Peavy Classic so I am collecting all of them together in a single Adobe Acrobat PDF file. A few words on the PDF format: the latest version of the Acrobat Reader (4.xx) is available for free at the Adobe site, along with the plug-ins for your browser (click on the icon at the bottom of this page to get the latest versions from Adobe). I personally find the stand-alone Reader to be a lot more versatile than the browser plug-ins so I usually save PDF files to disk and run the Reader off-line to view and print the documents. To save an on-line file to disk, right-click on the link to the file and choose the appropriate command for your browser ("Save Link to Disk" for NetScape 3.05).

There are several options for the Acrobat Reader that make PDF files more manageable. To access the options menu select **F**ile | Pre**f**erences | **G**eneral (or just hit <Ctrl><Shift> G). For "Default Magnification" I find "Fit Width" to be best for reading text documents and "Fit Visible" to be best for viewing schematics and drawings. Also be sure that the box labelled "Smooth Text and Monochrome Images" is checked. There are other options accessible through the **V**iew item on the menu bar. Near the bottom are three choices including Single Page and Continuous. "Continuous" retains page breaks but allows for smoother scrolling between pages; also, the "hand tool" will work across page breaks.

As for the articles themselves, they were written over a 4 month period as I was experimenting with various mods on the Classic 30. I have added comments and revisions when appropriate. As always, if you have any questions, comments or suggestions, feel free to send me e-mail.

Good luck!

Steve Ahola

December 12, 1998

(Revised 12/18/98)

steve_ahola@yahoo.com

http://www.blueguitar.org/

The Blue Guitar

Peavy Classic 30 Mods:
Basic Mods

Overview

Many of us have bought the Peavy Classic 30 because it is a nice-sounding, small-sized, vintage-looking yet economical tube amp with a good voice for guitar leads (or miked harmonica). After playing it for awhile, its limitations become obvious: as tubed from the factory, the sound can be overly harsh, the bass response is very thin, and the boost switch radically alters the tone as well as the gain so it is unusable for many guitarists looking for vintage sounds. After a few months, I put it in the back of my closet, deciding that it was more of a "toy" amp than a real amp. Many amp techs have mentioned that customers would bring in Classic 30's to see if anything could be done to improve the tone; however with the small transformers and printed circuit board design they were reluctant to promise any improvements that would justify the costs involved. As a hobbyist with a Classic 30 sitting around just gathering dust I figured I might as well try out some different mods to see if I could get some better tones out of the amp. After doing the mods outlined in this article, the amp captures the sounds I've been looking for. You may want to try changing some of the values I recommend to capture the sound you are looking for.

Retubing

Check out my Righteous Tubes! page for the details on the latest preamp tube combinations which seem to work best for me (as I find better combinations, I will revise that page).

The Classic 30 uses 3 12AX7 preamp tubes, labelled V1, V2 and V3 from right to left as viewed from the rear of the amp. The C30 isn't a true 2 channel amp; the channel select switch adds in the 2 additional gain stages of V2, between the initial and final preamp stages of V1. V3 uses both stages for the driver circuit before the 4 EL84 output tubes.

As for which brands and styles of 12AX7 tubes that work best in the Classic 30, let us address the V3 driver tube first. If you are looking for clean guitar tones from the Normal channel, you will want to use a driver tube that is fairly transparent. I have found that the stock Chinese tubes that ship with the amp work well as driver tubes; for an even better sound, check out a Golden Dragon 12AX7 or Ruby Tubes 7025STR: they are very clean and transparent tubes with a little more gain than the stock tubes.

The guitar signal goes directly to the first stage of V1 in all modes so its selection is very critical to the sound you are looking for. If you use the Normal channel a lot, you should choose a tube which sounds well in this mode. For crystal clarity (at the expense

of lower gain), you can use a 5751 tube. I personally prefer the Sovtek 12AX7WBT+ because it produces a warmer tone, very similar to a vintage Telefunken. For V2 (the 2 gain stages added in overdrive mode), I prefer the Sovtek 12AX7WB, which has lower gain than the WBT+. This tube is bypassed in the normal mode, so you can try out different tubes here to decide what works best for you in the overdrive mode.

If you use the Classic 30 strictly in overdrive mode, you can try out higher gain tubes in all 3 positions, with one suggestion here. I always thought of changing preamp tubes as being like changing spark plugs in your car: decide which brand and style works best for you and replace them all with the same type. In trying out different tubes, what I found is that if all tubes are the same, it exaggerates the tonal characteristics of that particular tube. Perhaps that is exactly what you are looking for, but you can generally get a fuller sound if you mix and match different tubes. You may want to bring your amp down to your local music store and see if they will let you try out different combinations of preamp tubes.

General Information on mods for Classic 30

Warning! Tube amps have high voltages inside of them, even when the amp is unplugged! The large power supply filter capacitors can be safely discharged using a well insulated test probe connected to the chassis ground through a 10K resistor. With the chassis removed from the cabinet and the FX jacks to your left you will notice several large 5 and 1 watt resistors mounted on stand-offs away from the board. Directly above from the Bass control is R58; with the insulated 10k resistor/probe short first the left lead and then the right lead. Directly above from the Pre gain pot is R59 mounted horizontally and R60 mounted vertically. With your special resistor probe, short first the left and then the right leads of R59, and then fisrt the back and the front leads of R60. Generally any charge will be drained through the OT (output transformer) after a minute or two, but its best not to take any chances.

To remove the Classic 30 from the cabinet to work on it, first unscrew the reverb spring bag and cable straps, unplug the speaker and reverb leads, and then remove the 8 shoulder screws on the top and sides of the cabinet holding the chassis. I generally label tubes with their socket numbers using a Sharpie marker before I pull them out so I know where to put them back; this also helps in lining them up properly so you don't bend the pins. In putting the tubes back into the Classic 30, the gap between pins 9 and 1 for the preamp tubes faces the front of the amp, and the gap for the output tubes faces the rear of the amp.

To remove the 3-sided circuit board from the chassis, remove the chicken head knobs and unscrew the 11/32" nuts holding down the 7 pots and 1/2" nuts securing the 5 jacks. Pull out the small jack board. Unplug the yellow and red wire harness from the power transformer as well as the yellow and blue speaker plug, two OT plugs (the lower OT plug is Blue-Red-Brown) and the reverb cable connector. Remove the 8 black screws holding in the circuit board with the tube sockets and then gently push in first the tube sockets and then the pots to remove the 3-sided circuit board from the chassis (it should be free to come out completely). As I remove different components from the board, I

tape them to the inside of the chassis and label them with the reference numbers and value in the event I want to reinstall them later.

After taking the amp apart about a dozen times in developing these mods, I noticed that some of the pot bushings would not tighten down properly and that some of the chicken-head knobs were loose enough to rattle or slip. I found that teflon tape (for plumbing) works great for both of these problems; for the pot bushings wind a few wraps of the teflon tape clockwise around the bushing. For the loose knobs, fold over the tape so that it is about 4 layers thick and place it on the shaft before pushing the knob back on. If I am just making a quick test of a mod, I'll only replace maybe 3 of the pot nuts, and only tighten them down loosely. But be sure to tighten down the input and extension speaker jacks as these establish the grounds for the circuit board and power tubes.

A few other tips: label the bottom of the knobs with a Sharpie permanent marker when you first take them off. Although they are all supposed to be identical, they will slip on some pots but not others. After having one of the grounds break on a reverb tank plug, I put heat shrink tubing on both of the plugs to help protect the solder connections. After unfolding the circuit board a dozen times, I found the hinged jumper wires starting to break; be careful when you unfold them and if you notice any copper showing through that means the wire is ready to break- either replace it with 22 ga bus wire or you can try reinforcing it with a short length of 24 ga bus wire.

As for replacing components on a printed circuit board there are a few tricks I learned. Desoldering braid works better for small solder connections than a desoldering tool. Although you can get it at Radio Shack (#64-2090B), the Chem-Wik line carried at electronics parts houses uses a finer braid that is less abrasive to the board. Be sure to check all of the sections of the board you work on for solder bridges (which are short circuits between two traces). In the event that a solder trace breaks off when you are reworking the board you can reestablish the connection by bending the component lead over to where the trace had gone originally (check the layout drawing from Peavy). The bottom of the circuit board is covered with a protective coating; I'll polish a trace with the desolder braid and a dab of solder until the solder adheres to the trace where I intend to run the lead. One last note on soldering: be sure to use a damp sponge to keep the tip clean.

Tone Cap Mods for the Classic 30

Modify the tonal response of this amp by replacing the tone and boost circuit caps!

By changing the values and style of capacitors used in the tone and boost circuitry of the Classic 30, the tonal response can be changed dramatically. Most amp builders and connoisseurs prefer Sprague-style Orange Drop caps for the midrange and bass caps; many of them likewise prefer silver mica caps for the treble caps.

As for the values of the tone caps, Peavy uses a 270pf cap for treble and a pair of .022uf caps for midrange and bass. They also use a .047uf cap in the boost circuit, which drastically increases the gain and midrange response of the preamp. The boost cap bypasses the treble cap, in effect raising the value of the treble cap to the sum of the two

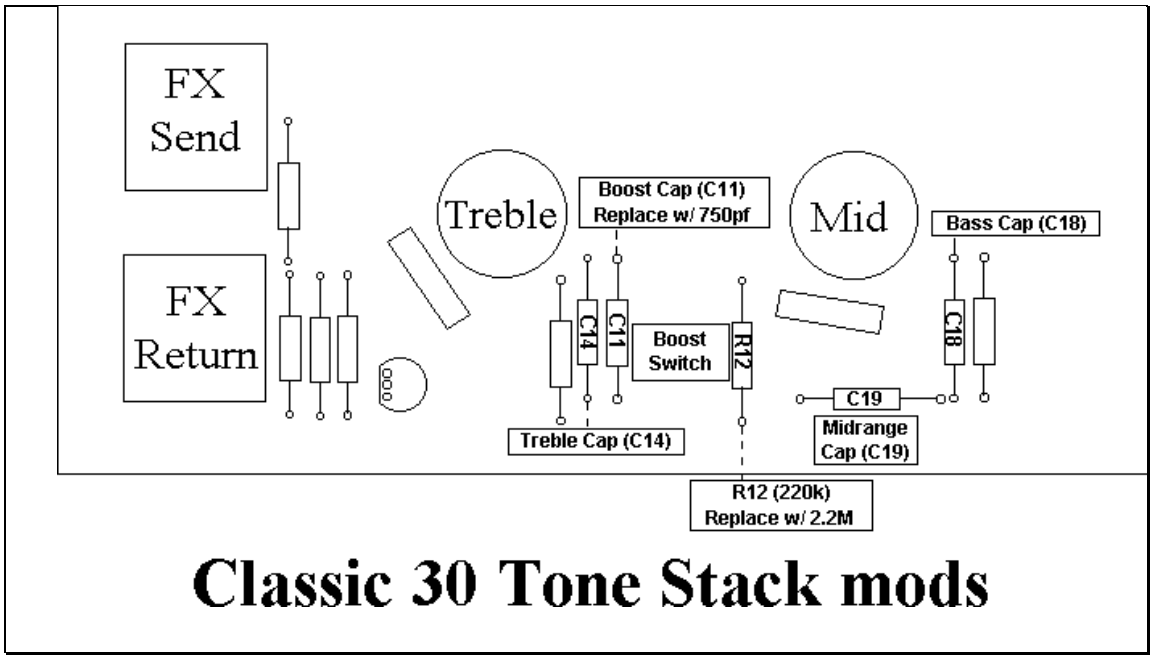
values. Because of the very high value used (most boost circuits use a 750pf to .0015 cap) a 220k resistor to ground is used to reducing popping when the boost circuit is switched in or out.

For this mod, I recommend replacing the .022uf bass cap (C18) with a .047uf Orange Drop-style cap for improved bass response. (If you prefer a higher-gain overdrive tone, you may prefer to use a .022uf Orange Drop cap instead for a more midrangy sound). The .022uf midrange cap (C19) should be replaced with a .022uf Orange Drop. I put in a 270pf silver mica cap in place of the 270pf tubular ceramic treble cap (C14- it looks like a resistor but with a green body instead of a tan). However, the stock treble cap can be used if you can't find a silver mica cap.

For the boost cap (C11), I recommend using a 750pf cap. With this value, the boost switch works similar to a Shift switch on an older Mesa Boogie amp: it kicks the volume up a notch and boosts the midrange response. For more boost and tonal shift, you can use a .001uf or .0015uf cap instead. Using smaller values such as these, the 220k resistor (R12) to ground could be eliminated or replaced with a very high value (I used a 2.2M resistor). With the stock boost cap, I found the gain boost and tonal shift to be too drastic to be usable for vintage blues tones. With the values I recommend, the boost switch offers an alternative voicing which retains much of the tone and character of the unboosted mode.

If you choose to replace the boost cap with a lower value as recommended here, you will sacrifice much of the gain of the stock boost circuit. To recapture some of the gain lost I suggest that you replace the 100K plate load resistor for V3A with a 120K or 150K resistor as outlined later in this article.

This drawing illustrates the location of the components in the tone and boost circuits:



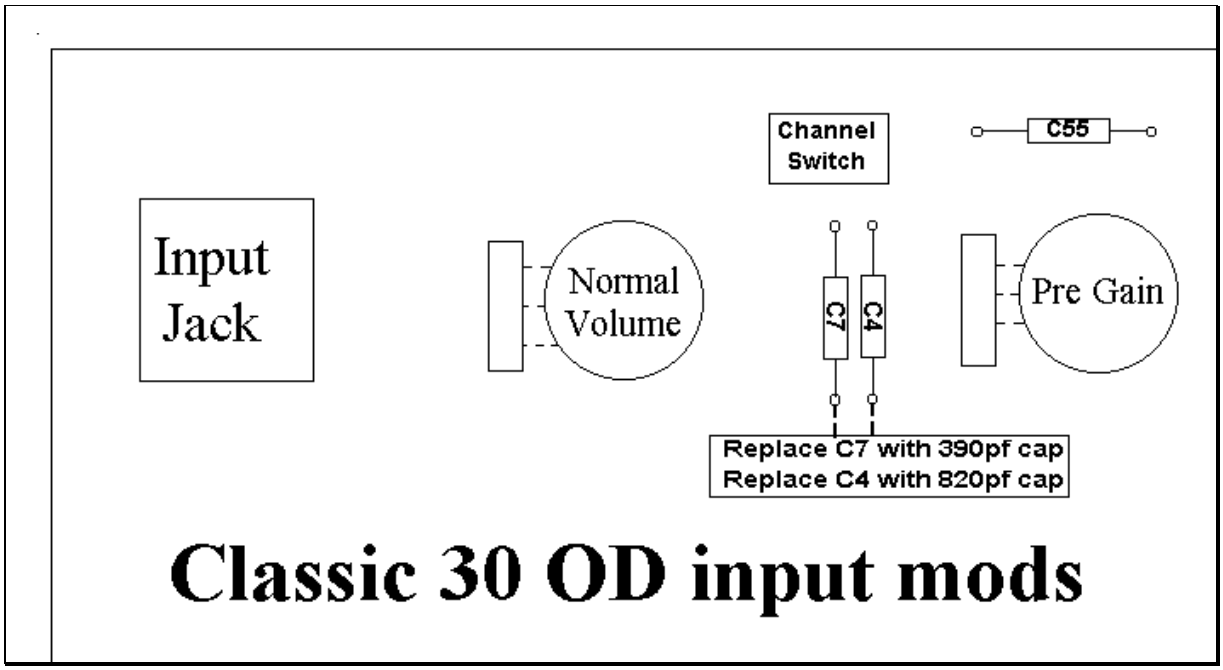
Overdrive Channel input mod for the Classic 30

Replace C4 cap to tone down the harshness of the OD Channel.

Another common complaint concerning the Classic 30 is that the Overdrive Channel is too harsh-sounding. After replacing the tone and boost caps as outlined above, I wasn't able to get a really nice sound from the OD channel unless I kicked in the Boost switch. In re-examining the schematic, I noticed that the signal from V1A is routed first through a .047uf coupling cap and then sent to both the Normal and OD channels. The Normal channel gets its signal from a .001uf cap paralleled with a 680k resistor, while the entire signal going to the OD channel is routed through a 470pf cap (C4)! A cap of that value will allow mainly treble and midrange frequencies through, and effectively blocks most of the low frequencies from V1A.

To reduce the harshness of the OD channel, I recommend replacing C4 with a 820pf mica cap and C7 with a 390pf mica cap. To locate C4, look for the 2 tubular caps (they look like resistors but with a green body) between the Normal volume pot and the Pre volume pot for OD channel; C4 is the tubular cap closer to the Pre volume pot and C7 is closer to the Normal volume pot. For a heavier distortion sound you can replace C4 with a 1000pf mica cap and optionally add a resistor (1 meg) in parallel with the cap; solder the resistor between the 2 cap leads on the top of the board and then insert the cap leads through the holes in the circuit board. (After trying the 1 meg resistor with a 1000pf cap, I switched back to a 820pf cap which gets a better tone for blues.) Replacing the 470pf stock value of C7 with a 390pf mica cap adds back a touch of brightness to the OD signal.

Here is the diagram for OD channel input mod:



Mods to the Tube board

Replace C1 cap and R5 resistor to tone down the harshness of the OD Channel. Replace R41 cap to increase gain of driver stages (only if you converted boost switch to shift switch as described above).

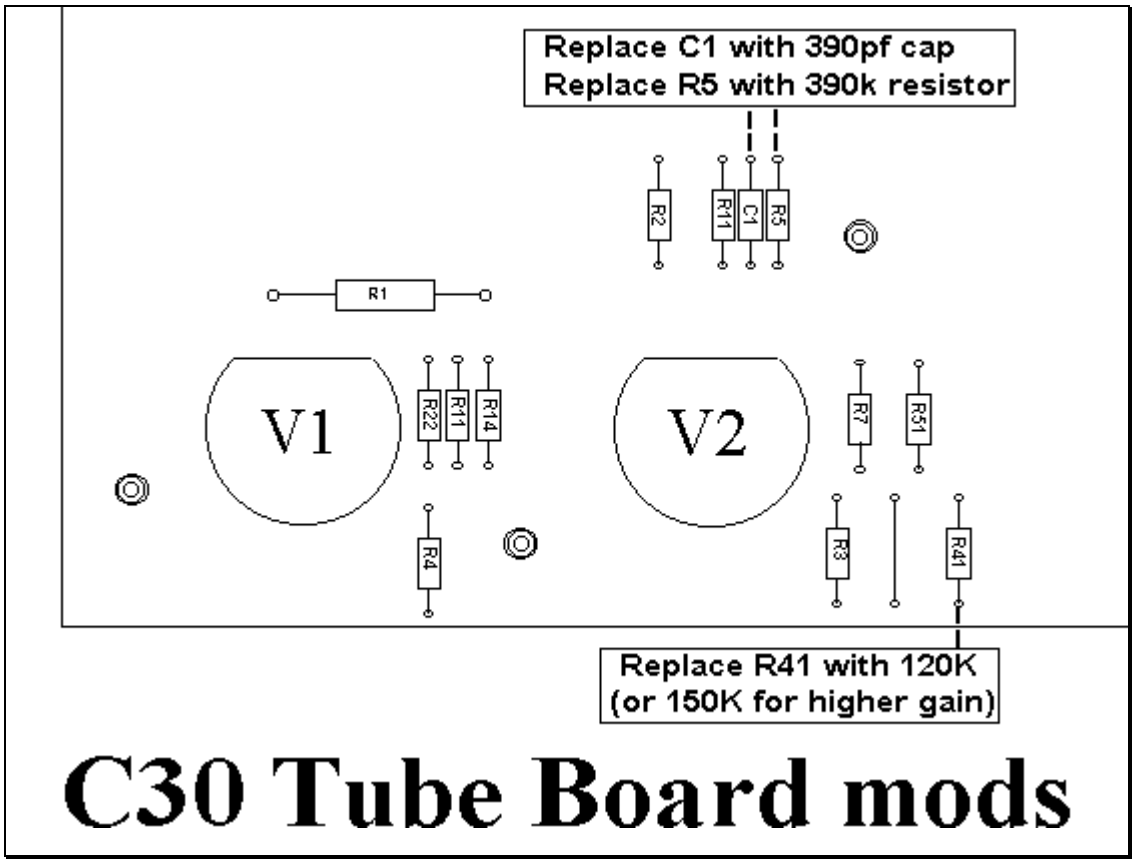
Further down the OD channel circuit, the .001uf coupling cap (C2) between V2A and V2B is followed by a 470k resistor (R5) paralleled with a 470pf cap (C1), which make up an RC network. I recommend replacing C1 with a 390pf silver mica cap and R5 with a 390k resistor. With the other mods outlined here, those values give a tone which is bright enough for blues, yet has a stronger bottom end; the bass and treble controls work well to fine-tune your sound with these values.

For a stronger and fuller OD sound, you can also replace the .001uf coupling cap (C2) with a .01uf / 600v Orange Drop cap. C2 is located on the middle circuit board right next to the blue channel switching relay: it is the white "rectangular box" cap. (In the Advanced Mods article, I explain how to hook up a toggle switch to select between the two values for C2: .001uf for a brighter blues tone and .01 uf for a fuller OD tone.)

C1 is the tubular cap between the V2 tube socket and the middle circuit board; there is a group of 2 resistors and 1 tubular cap next to the threaded post. R5 is the resistor between C1 and the threaded post. To desolder them you will need to remove the 3 black phillips machine screws that hold the circuit board to the angle bracket. There is very little clearance for a mica cap here so you will need to bend it over the resistor R5. Although I replaced C1 with a 390pf one for a tone bright enough for blues, you may want to experiment with different values here. A 560pf cap with 470k resistor was mentioned in one post as having an almost magical effect in guitar amps, but I didn't think it worked that well in the Classic 30. For a thicker tone for rock, you can drop C1 to 100-250pf, or increase it to 680-820pf for a different effect; a lower value for R5 will also produce a louder, thicker sound. In my experiments I replaced these two parts so many times that the copper traces on the circuit board wore out (I used 24 ga bus wire to make the connections).

There is one other mod I recommend if you chose to replace the .047uf boost cap with a 750pf shift cap (thus eliminating the very strong gain boost of that switch). You can make up for the gain lost in that mod by replacing the 100K plate resistor (R41) for V3A with a higher value (120K to 150K). I put in the 150K resistor for the maximum increase in gain, but you need to use some discretion here: if you plug your guitar into a stomp box that adds plenty of gain to the signal, you may blow out one of the internal fuses if you crank the volumes up to 12. If you have little control over the guitarists using the amp, you may want to put in a 120K resistor which increases the gain of the driver circuit less than the 150K resistor. There is a tradeoff involved here: although the gain of the stage is increased, its headroom is decreased so if you are looking for a strong, clean Normal tone you may want to skip this mod.

Here is the diagram for the 3 mods on the Tube Board:



Final notes on these mods

Tips to reduce buzzing and rattles with increased low frequency response.

After replacing the tone caps as outlined above, I found my amp cabinet and chassis buzzing a lot because it simply wasn't designed for the fuller bass response. The chromed chassis is a lot lighter than those used in the older Fender amps so to reduce its buzzing, I glued weather-stripping along each of the sides that was secured to the cabinet. I used an open cell weatherstripping (1/2" wide by 7/16" thick) so that it could be compressed enough so that the 8 shoulder screws would still line up. For the top with the controls I cut the weatherstripping down so that its width and thickness was 1/4". Self-stick weatherstripping tends to peel off shiny metal very easily so I ran small beads of crazy glue on the chassis. I also noticed the pilot light buzzing so I put a bead of silicon around the light housing underneath the panel.

To further reduce any chassis buzzing or rattles, you could also try gluing small o-rings to the 8 threaded posts which secure the circuit board with the tube sockets. I used 5-minute Epoxy in the "hypo" tube along to glue the Perfect Match #14504P o-rings (9/32"x5/32"x1/16"). These o-rings tend to fall off when you take the amp apart so I wouldn't recommend adding them until you are completely satisfied with the amp mods.

[If you try adding these o-rings, wait overnight for the glue dry. I didn't and one of the screws broke off inside which was a real hassle to fix. After that when the o-rings fell off I just left them off, although I may add them all back someday.] There is a tendency for the chassis bottom to vibrate at high volume levels; I may glue a piece of reinforced neoprene parallel to the tube sockets to reduce these vibrations. [In the Advanced Mods, I added pots and switches behind the tubes so you may want to skip this suggestion as well.]

Another solution might be to add a jack for the built-in speaker so that you could unplug it and use an external speaker when you need to crank the amp up loud. I drilled a hole below the power switch and indicator light for a speaker jack (connect the yellow wire to the hot terminal and the blue wire to the ground terminal). The added jack is connected to the 16 ohm tap, the existing jack is connected to the 8 ohm tap, and if you plug into both jacks, they are connected in parallel to the 8 ohm tap. This last mods makes the amp much more versatile.

I strongly recommend that you replace the stock 12" 16 ohm speaker. (I put in an 8 ohm Celestion V12-60 "Silver Series" for about $60 and was fairly pleased with the performance.) What I did notice when I put the stock speaker back in, the amp sounds much more alive if I plug it into the existing "Extension Speaker" jack (which uses the 8 ohm tap). I also noticed a similar response when testing the amp with the 16 ohm load of my Classic 50-410 speakers. I suspect that putting the speaker load on the 8 ohm tap has an effect on the feedback loop; in any event, for a nice blues lead guitar tone use the 8 ohm jack whenever feasible.

There is a simple trick to switch the built-in speaker from the 16 ohm tap to the 8 ohm tap: plug a bare 1/4" plug into the Extension Speaker jack. The internal switching contacts of the jack will connect the built-in speaker in parallel to the 8 ohm tap when anything is plugged into the Extension Speaker jack. If you can't afford to replace the stock speaker at this time, be sure to switch it over to the 8 ohm tap.

In Conclusion

Legal disclaimers, suggestions and parting comments.

In conclusion I thought I better issue any appropriate disclaimers. These mods are not endorsed by Peavy and will obviously void any warranty on your Peavy Classic 30. The values of caps and resistors I recommend reflect my own tastes, but you are welcome to try other values. For the boost/shift cap, I like 750pf because it does not drastically change the tone; a higher value such as 1000-1500pf alters the tone more, but may be more appropriate for highly distorted sounds. For the tone caps, you may want to stick with the original values (.022uf for bass and midrange), but I'd definitely recommend putting in a higher quality cap than the tan globs that Peavy uses. Many people consider the Sprague-style Orange Drop caps to be the best, although other metallized polypropylene caps work well, too.

For the OD channel input mod, you may want to try a cap larger than the 680pf to 820pf cap I recommend, and you may want to try paralleling it with a 1.0M+ resistor to increase the low frequencies. As for the mods to the tube board, you can replace the 390pf silver mica cap I recommend with a 100-250pf or 680-820pf for a more "midrangy" sound perhaps more suitable for modern rock. As for replacing the V3A plate load resistor R41 (100k) with a 120k or 150k resistor to increase the gain of the driver stages, this is only to compensate for the loss in gain when converting the boost switch to a shift switch; if you choose to use the 150k resistor, use discretion when turning up the volume pots.

The Classic 30 isn't the easiest amp to work on with its printed circuit board design, but with these mods as a starting point you may be able to fine-tune your amp to get the sounds you are looking for.

Good luck.

Steve Ahola

March 6, 1998

(Revised 3/14/98)

steve_ahola@yahoo.com

http://www.blueguitar.org/

The Blue Guitar

Peavy Classic 30 Advanced Mods:
A Text Overview

The Advanced Mods:

- Master Volume + Mod: c30_mvpc.htm
- More Cap Mods: c30_cksw.htm
- Adjustable Bias Mod: c30_bias.htm
- Boost Switch Relay Board: c30relay.htm

Overview

After completing the mods detailed in **c30_mods.htm** there were still a few features I wanted to add to my Classic 30. Being able to toggle the Boost/Shift circuit on and off with the footswitch was requested by practically everyone who plays a Classic 30. My own "wish list" included being able to select between a .047uf bass cap for the Normal mode and a .022uf cap for the OD mode. I also wanted to be able to produce a wider range of tones in both Normal and OD modes to increase the versatility of the amp. Adding a master volume control on the power amp section was also on my wish list for 2 reasons: to able to balance the volume of the C30 when slaving it to another amp through the FX return jack, and to be able to use the FX loop at lower volumes without having to reprogram the patches for different input levels.

To redesign the footswitch circuit involved adding a separate relay board which duplicated the circuitry for the channel switching relay. Making the board was actually fairly easy, using a Radio Shack #276-159 "general purpose IC PC board" (2 for $1.69), a 16 pin ic socket, an ECG RLY5142 DPDT 12vdc relay and a few resistors and capacitors. I had first mounted the board on the bottom inside of chassis roughly halfway between the 2 transformers, but felt that the 12" of shielded cabling adversely affected the sound of the tone stack, so I relocated the board directly under the tone caps.

Since the Boost/Shift circuit used only half of the DPDT relay I decided to use the other half to toggle the value of the bass cap between .022uf in the boosted mode and .055uf in the unboosted mode by running a .033uf cap in parallel with the .022uf cap on the main circuit board. To further expand the versatility of this arrangement, I wired in a "trick" on-on-on DPDT mini-toggle switch to give me three options for the bass cap: (1) always .022uf, (2) always .055uf, and (3) have it follow the state of the relay as explained above.

I originally didn't want to drill any holes in the chassis, but once I added the "trick" DPDT mini-toggle switch, I figured what the heck- go crazy! There is one location for mini-toggle switches that is fairly accessible yet protected from errant roadies: on the bottom of the chassis next to the V1 tube socket. So I added 2 center-off DPDT mini-toggle switches to select between different values for the cathode resistor bypass caps for V1A and V2B. For V1A, the choice is between 22uf (stock- for a full sound), 0uf (for an "un"boosted sound- great for "squeaky clean" Normal channel sounds) and 0.68uf (for a midrangy, Marshall-like sound). For V2B, the choice is between 22uf (stock), 0uf (low gain) and 1.0uf (for a brighter OD channel sound). A 4th switch was added behind the preamp tubes to toggle between 2 values for the C2, the coupling cap at the anode of V2A. Since higher voltages are present at this point in the circuit I used a full-sized toggle switch to choose between the .001uf on the board (for a more stock Peavy OD sound) and adding in a .01uf cap at the switch (for a fuller-bodied sound).

In adding all of these circuits and switches, I went through and changed the values of several components in the signal path, in some cases undoing the changes done in the original mod. In the following section I will trace the signal from input to output, noting the changes that were made. Incidentally, all of the mica caps are rated for 500 volts and the Orange Drop caps are rated at 600 volts.

Details of the Modifications

The input signal first goes to the initial preamp stage V1A. As mentioned above I added a center-off DPDT mini-toggle switch to offer 3 choices for the cathode resistor bypass cap C12. I removed the stock 22uf/25v cap and soldered the positive end to one of the outer terminals of the switch. I soldered the positive end of the added 0.68uf/25+v cap to the opposite terminal of the switch. Using small gauge shielded cable I soldered the center conductor to the middle terminal of the switch and the shield to the negative leads of both caps. In attaching the other end of the cable to the circuit board, I soldered the center conductor to the pad coming from pin 3 of V1A and the braided shield to a spot I polished up on the grounded trace. (The cable is soldered to the copper side of the board, with the center lead inserted "backwards" into the existing hole from the stock cap.) To eliminate popping noises from the switch, I tied 470k resistors between the outer terminals of the switch to the back center terminal, which I then jumpered to the front center terminal. Before soldering the cable to the circuit board, I put several pieces of heat shrink tubing over the caps and wires to protect the connections. So that I could remember which switch did what for which stage, I put the V1A switch closest to the rear of the chassis, with the handle towards the cabinet for the stock sound.

Continuing along the signal path, the coupling cap at the anode of V1A then goes to both the Normal volume pot and Pre gain pot for the OD channel. For the Normal volume pot I added a "bright" cap by using a pin vise to drill 2 small holes adjacent to the pads for the two ungrounded terminals of VR1. In experimenting with different values, I ended up using a 22pf /500v mica cap since I felt that only a touch of brightness was needed at lower volume settings of the Normal channel. You may decide to use a higher valued cap (47pf - 100pf) for a brighter sound, or not use a bright cap at all if you think that the sound is bright enough already.

In splitting the signal between the two channels, Peavy uses a cheap 470pf tubular cap C4 for the OD channel (compared to a .001uf cap paralleled with a 680k resistor for the Normal channel). In the original mod, I recommended using an 820pf mica for C4 for more bass response; after doing other mods outlined in this article, I decided that a 680pf cap works better in preserving some of the high frequency content of the guitar signal. Immediately after the VR2 Pre gain pot there is another 470pf tubular cap (C7) that shunts some of the high frequencies to ground; I replaced this cap with a 390pf mica cap.

The OD signal continues through V2A to a rectangular .001uf/630v coupling cap (C2). I replaced that cap with an axial .001uf/630v cap with 2 leads soldered around the legs. I then ran the two leads to the full-sized toggle switch with the .01uf Orange Drop cap wired for full bypass. Alternately, you could drill out 2 small holes with a pin vise (as I did with the bright cap for VR1). As the leads were only 3" long I did not use shielded cable here.

For the RC network of R5 and C1 immediately after the C2 coupling cap I again tried many different values and ended up using a 390k resistor and 390pf mica cap.

The OD signal then goes to V2B, which uses a 22uf cathode resistor bypass cap for a very full-bodied sound. As detailed above (Click here) remove the existing cap and move it to a center-off DPDT mini-toggle switch, only for this stage you add in a 1.0uf/25+v cap for a brighter, less Boogie-like OD sound (great for blues leads and Roy Buchanan-like tones). For an even brighter sound, you can use a .47uf cap here. I mounted this switch immediately behind the switch for V1A, with it oriented so that the handle faced the cabinet side for the stock sound.

Most of the mods I did to the Classic 30 were to thicken out the sound of the OD channel, which most players thought was too thin and "wimpy". In experimenting with different valued caps, I found that sometimes the sound was still a little too bright or, alternately, not bright enough. You could adjust the tone controls to compensate for that but when you'd switch back to the Normal channel the sound would be off. Because of that I decided that it would be useful to add a tone control exclusively for the OD channel so that you could add or subtract high frequencies as needed. At the CW tab of the OD Post gain pot is an RC circuit to ground which was very similiar to a treble-cut tone control on a guitar (only the resistor was fixed). So I pulled out the 10k resistor (R13) and ran it through a 4.7k resistor to a chassis-mounted 10K linear taper pot wired as a variable resistor. With the control in the middle you get the sound of the stock circuit; turn the control up to increase the high frequency content, or back it off to bleed more of the highs to ground through the 0.015uf tan tubular cap (C16). The resistor R13 is mounted directly under the Post gain pot up front next to the CW terminal. I used multi-conductor shielded cable to hook up the 10k pot, with the shield grounded to the body of the pot.

The OD and Normal signals then go to the channel switching relay and on through to V1B to the tone stack. At this point you need to decide if you want to add the relay board for the Boost/Shift circuit immediately, perhaps later, or not at all. I suggest that you leave your options on this open but first fine-tune the amp to your own tastes before

adding the relay board. Once the relay is in place it becomes more difficult to change parts in the tone stack.

For the tone stack, I recommend that you replace the 270pf tubular treble cap (C14) with a 270pf mica cap. For the stock .047uf Boost cap (C11) my personal recommendation is that you replace it with a 750pf or 820pf mica cap for a less drastic boost that shifts the tonal response of the tone stack down approximately an octave. You may want to use a 1000pf to a 1500pf for a stronger boost, but I feel that those values muddy up the sound too much. If you may add the relay board later, leave the leads for the treble cap uncut as if they are long enough they will run directly to the relay board. (To restore some of the gain lost from the stock Boost switch, we change the value of the screen load resistor for V3A later.) The 220k value for R12 is replaced with a 2.2k resistor to help reduce "pops" when switching in the Boost/Shift circuit. I recommend replacing both the midrange cap (C19) and bass cap (C18) with .022uf/600v Orange Drop caps. As with the treble cap, leave the leads from the bass cap uncut so that they can be run directly to the relay board. (With the Marshall-style tone stack used here there are only subtle differences between a .022uf and .047uf bass cap that are heard more when strumming a chord than just plucking a bass note.) Once you are satisfied with the tuning and operation of the tone stack, you can add in the relay board as explained in detail later.

The signal continues through the FX loop, which uses a transistor circuit to drive the FX Send jack. Fortunately for tube freaks, the audio signal is routed through the transistor only when the FX loop is used, which is a fair enough compromise because most FX processors use solid state components in the signal path anyway. With nothing plugged into the FX Return jack, the signal from V2B passes directly to V3A only through the 0.1uf coupling capacitor C31.

After experimenting with a Torres dual stage master volume control between the split load driver V3B and the output tubes I decided to use a more conventional master volume control at the grid of V3A. From the tube board remove the 1 meg grid load resistor R48 along with jumper JP414. Using multi-conductor shielded cable, connect the wiper of a 1 meg pot to the tube side solder pad for JP414 and the CW terminal of the pot to the solder pad JP414 shared with the hinged jumper wire to the middle board. In order that the designed ground paths not be altered I ran the CCW pot terminal to the grounded pad that R48 had been soldered to and soldered the cable shield to the back of the pot. According to TUT, you should connect a 100k resistor in series with the wiper for a smoother response, although this will result in a 10% loss of signal going to the V3A pre-driver. I tried it both ways and the control responded much more smoothly with the 100k resistor between the pot wiper and grid.

At V3A, we replace the 100k value of the anode resistor R41 with a 120k to 150k resistor to recapture some of the gain lost when we replaced the 0.047uf boost cap with a lower value (750pf to 1500pf). Do NOT replace the 100k resistor if you are using the stock 0.047uf boost cap as this could push the gain of the amp to the point where it might blow a fuse or become unstable. If the amp will be used by someone who might crank everything up to 10, paying no attention to any groans and whimpers coming from the amp, you are advised to replace R41 with nothing higher than 120k. I put in a 150k

resistor (along with a 750pf boost cap) which works fine for me. It should be noted that there is a tradeoff involved here: as you increase the gain of the stage you also decrease its clean headroom. If you are looking for a strong and clean Normal sound, you may want to skip this mod.

In the event you'd rather use a Torres-style master volume circuit, here are the instructions: Following the signal through the split load driver to the power tubes, I figured out a quick and dirty way to add a Dan Torres-style dual stage master volume control to the output section. I removed the two .022uf coupling caps (C32 and C35) and soldered in four .047uf/630v axial metallized polypropylene caps (after reforming the leads a bit so that they would fit). I put colored heat shrink tubing on the 4 leads and ran them directly to a chassis mounted dual-ganged 500k audio taper pot with the CCW terminal connected to a ground lead soldered to the jack board. I had originally tried hooking up the presence control (a dual-ganged 1M linear pot connected to the MV pot with two 500pf caps) but found that it added hum at the higher settings so I switched to a fixed presence cap. While Dan's recommended value of 250pf might work okay in a Fender amp, I found it to be way too bright on the Peavy so I eventually settled on 10pf to 22pf caps. [My opinion of the Torres circuit in the Classic 30 is that although two .047uf caps in series are electrically equivalent to a single .022uf cap, they don't sound the same.]

Proceeding to the very end of the signal chain, I strongly recommend adding an open circuit mono phone jack for the built-in speaker. There is a nice location for this jack on the bottom of the chassis directly below the indicator light. The added jack is 16 ohms, while the stock speaker jack is connected to the 8 ohm tap (as are both jacks when both jacks are used together). I found that the signal from the 8 ohm jack is a lot more responsive than the 16 ohm jack; my theory on this is that the speaker robs some of the voltage used in the negative feedback loop.

There is additional mod that can be done which affects the FB loop: the signal from the 8 ohm speaker tap goes to the cathode circuit of V3A through an RC network (R56 and C37) and then through R57 (100k). I replaced R57 with a chassis mounted "presence" control using a 250K audio taper pot (wired as a variable resistor) in series with a 100k resistor. By opening up this control, the response of the amp is changed dramatically. Higher settings tend to bring out a harshness in the OD channel so you may want to turn down the OD channel treble-cut pot mentioned previously.

Adding a relay board for the Boost/Shift circuit

Caution: this modification involves cutting traces on the circuit board and as such cannot be easily reversed (unlike the other mods described in this article and the previous one). If you do not need to use the footswitch to switch the Boost/Shift circuit on and off this modification is not required.

Having presented the caveats about this mod, I would like to mention that I did find it to be the most rewarding modification to the Classic 30 on a personal level, as I was adding functionality to the amp, and not merely replacing caps and resistors. While

adding the relay board will probably take a few hours to complete, it is actually much simpler than I had originally thought.

The first step in adding the relay board is to find and identify the jumper which connects the reverb circuit on the main board to the footswitch and remove it. The pad closer to the middle board will be connected to the Boost switch and the other pad needs to connected to ground so that the reverb will work (I ran a short jumper over to a small hole I drilled at the grounded end of R37). You will need to run a length of insulated wire from the pad that goes to the footswitch jack to the boost switch, but the traces connecting the boost switch and treble cap need to be modified (see drawing below). The basic game plan is to remove the audio signal entirely from the Boost switch and wire the switch only to the footswitch and add-on relay board. To remove traces I'll use desoldering braid to polish the copper until it flakes off. You will want to confirm that it has been cut by using a continuity tester.

When replacing the treble and bass caps, hopefully the leads are long enough to connect to the add-on relay board which we will make using a RS #276-159B mini circuit board that has been trimmed to fit under the tone stack using a pair of 11/16" long insulated stand-offs. I have some nylon insulated shafts with 4-40 threaded holes that I cut to length here.) Alternately, you can mount the board on the chassis and run about 12" of shielded cable from the tone stack. I had done this originally, but felt that the added capacitance of the cable adversely affected the tone stack so it was less responsive. However, mounting the board directly under the tone stack makes it more difficult to work on.

While I duplicated the components of the stock channel-switching relay circuit exactly, you may opt to design your own 12 vdc supply for the relay rectifying and filtering the ac voltage directly from the yellow leads from the power transformer. The channel-switching relay circuit uses the -36vdc that also goes to the bias supply; what I noticed in doing the adjustable bias mod (click here) was that the bias current goes up approximately 0.6mA per tube when the OD channel is selected through the relay. With the boost relay engaged as well, the bias current is increased 1.2mA per tube.

Construction notes on these mods

Some tips I learned the hard way...

Having taken the Classic 30 apart several dozen times in developing these mods, I have some suggestions which may help you avoid some of the problems I ran into. Since the knobs seem to fit differently on the different control shafts I'd recommend that you label the knobs with a permanent marker on the bottom. The threaded bushings on the pots strip out very easily so be careful (if you are still experimenting with the circuits, leave most of the pot nuts off when you reassemble the amp for testing and do not tighten them down completely). Be sure to tighten down the input jack and stock speaker/footswitch jacks as they establish the ground connection for the circuit board and the power tubes. The reverb cables will eventually break at the plugs so I recommend that you put heat shrink tubing on the plugs to protect them.

The ribbon cable to the footswitch/speaker jack board eventually broke off so you might want to reinforce the connection at the main circuit board with some silicon if you plan to experiment with the amp a lot. Some of the hinged wires connecting the 3 sections of the circuit board eventually broke so be very careful when unfolding the board. If you see any copper showing on these wires it indicates that they are ready to break; if you reinforce the wire with a short length of 24 ga bus wire you probably won't have to replace the entire jumper later with 22 ga bus wire.

The copper pads on traces on the Classic 30 circuit board are not very thick and tend to disintegrate after replacing a component more than once or twice. I used a lot of desoldering braid (Radio Shack #64-2090B) on the board, both when removing components and also to remove the coating over the copper traces when I'd need to extend the solder pads. Some of the finer traces disappeared altogether after changing the components a few times and I used 24 ga pre-tinned bus wire to replace or reinforce the traces.

In Conclusion

Legal disclaimers, suggestions and parting comments.

In conclusion I thought I better issue any appropriate disclaimers. These mods are not endorsed by Peavy and will obviously void any warranty on your Peavy Classic 30.

Steve Ahola

March 7, 1998

(Revised 3/17/98)

steve_ahola@yahoo.com

http://www.blueguitar.org/

The Blue Guitar

Peavy Classic 30 Advanced Mods:

Master Volume Control

Overview

Adding a Master Volume control at the input of the power amp section greatly increases the versatility of the Classic 30. If you use the FX loop with certain fx processors you may have noticed how you must readjust the levels every time you adjust the volume on the Peavy. With the Master Volume mod detailed in this article, you can set the gain pots for the Normal and OD channels for the tones you want, and use the MV to control the overall volume without having to readjust the input and output levels of the FX processor.

Another advantage to having a Master Volume control is in using the FX return jack to slave the Classic 30 to another guitar amp or preamp. Without a MV control at the input to the power amp section, you have no control over the relative volume of the Peavy as it is running at full throttle.

Although those are the two reasons behind my adding the Master Volume control, I soon found a third reason after completing the mod: with the Normal volume kicked up high and the MV set back to the appropriate playing volume, you can get some really nice mildly-overdriven sounds which complement the higher-distortion sounds of the OD channel. (The OD channel generally needs to be set above 6 to produce a decent sound—you can't just set it low for a moderate amount of overdrive and distortion.)

For an added bonus I've included detailed instructions to add additional controls to the Classic 30. The Presence control here could more correctly be called a "feedback loop" control as it replaces the 100K resistor (R57) in the feedback loop with a 100K resistor in series with a 250K audio taper pot. With the control set to 0 you have the stock feedback loop circuit; as you set the control up higher it gradually increases the resistance of R57 up to 350K for a much looser, more alive sound.

The OD Tone control allows you to fine-tune the high frequency content of the OD channel, while leaving the tone stack set for the sound you want from the Normal channel. If you examine the circuit between V2B and the OD Post gain pot, you will find that there is a 10k resistor R13 at the CW terminal of the pot which bleeds some of the high frequencies to ground through C16, a .015uf cap. This circuit is very similar to a treble-cut tone pot on a guitar, only with a fixed 10k resistor. The mod detailed here shows how to replace R13 with a 4.7k resistor in series with a 10K linear taper pot. At the middle position, the control duplicates the stock circuitry. As you turn the control CW, the tone becomes brighter; as turn it CCW, the tone is mellowed out.

While these 3 controls can add much to the versatility of the Peavy Classic 30, unfortunately there are few accessible spots on the chassis where a switch or control can be added. The choicest location would be on the bottom of the chassis between V1 and the cabinet. I had already mounted 3 mini-toggle switches here before getting around to adding a master volume control to my amp. I do believe that you can fit in 2 mini-toggle switches towards the rear of the chassis with room to add a pot behind the switches, with all 3 components being fairly accessible. You would have to decide for yourself which control would get to "ride shotgun" in this location. If you need to play a lot at lower volumes, you'd probably want to put the master volume control here; if you usually play loud, you might want to have the presence control (aka feedback loop control) mounted here instead. One other option you may want to look into would be to mount one of the controls actually on the rear panel of the chassis here, but with the shaft cut short and a slot cut in it for screwdriver adjustment. (I think if a longer shaft and knob were sticking out of the back of the amp it'd be a matter of time before it got sheared off.)

The pots and switches that you do not mount between V1 and the cabinet will need to be mounted on the bottom of the chassis behind the tubes where they are not exactly very accessible. It is a compromise necessitated by the design of the amp, although I have considered the idea of mounting the amp chassis in its own cabinet as a "Classic 30 head", with the auxiliary controls detailed in these articles mounted on the front panel (where the transformer leads are currently routed). With the amp chassis in its own cabinet you would eliminate some of the problems with running the amp at full volume such as rattling or microphonics (which can be a problem with the EI 12AX7 tubes and Orange Drop caps).

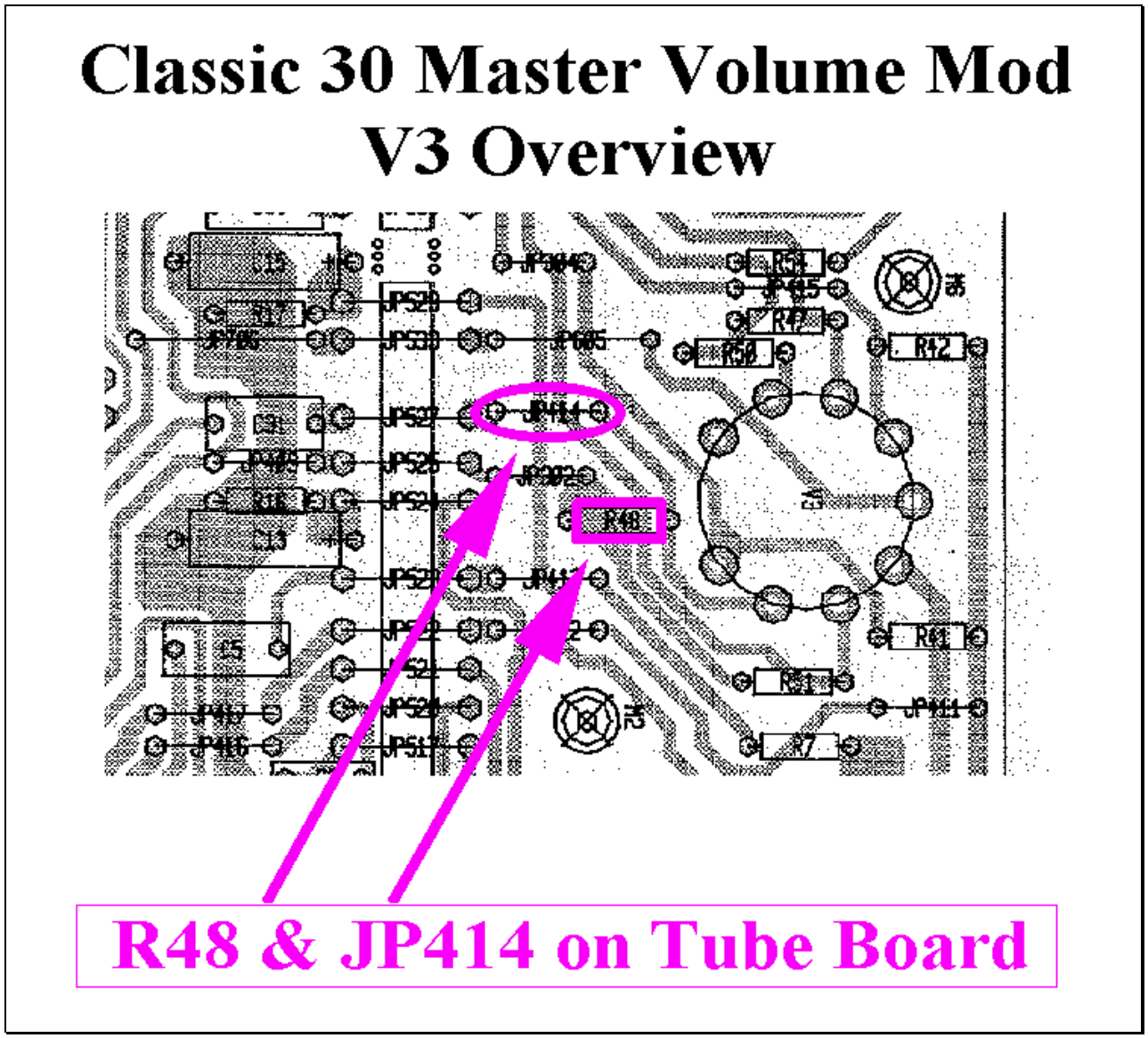
Construction Notes

While the diagrams in the following section should be self-explanatory, there are a few things I should probably mention. For removing the components and soldering shielded cable to the circuit board, I have step-by-step instructions in c30_cksw.htm. For the Master Volume mod, you need to first remove R48 and JP414 from the Tube board, and then solder 2 conductor shielded cable to the pads indicated on the drawing below. I used a 22pf mica cap on the ungrounded terminals of the pot as a "bright" cap to keep the sound from getting muddy at low settings of the master volume control. You may want to try a larger valued cap, or eliminate it altogether. The 100k resistor in series with the pot wiper is optional; it will smooth out the response of the mv control but it will also reduce the signal going into the pre-driver by 10%. I tried it both ways and decided that the control worked much better with the resistor in the circuit.

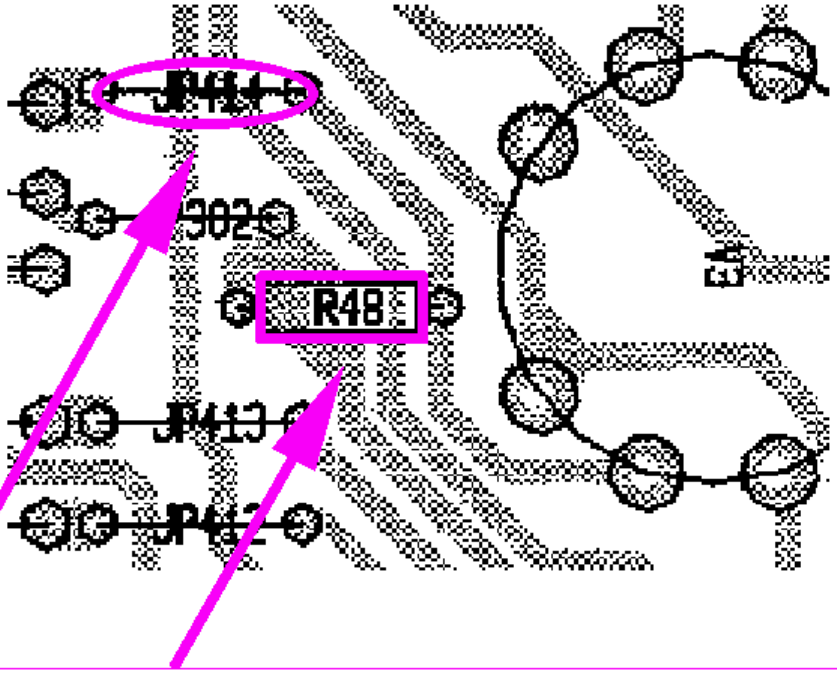
For the presence control, I didn't use shielded cable because the leads were only a few inches long. If you plan on locating the control further away (like next to V1) you may want to use shielded cable so that the signal in the wire doesn't cause interference picked up in the preamp section. I tried several different pots before settling on 250kA; with the audio taper you have much more control over the lower ohm range at which the circuit is most responsive to changes. Throughout most of the pot range the value is under 100k ohms, but by setting it all the way up increases the total value to 350k which essentially removes the feedback loop from the circuit.

The OD tone control is not essential but you may find it helpful in tweaking the OD sounds for a little bit more or less treble (without adjusting the main tone controls shared with the Normal channel). I originally installed the 10k linear pot without the 4.7k series resistor so that the fully cw position duplicated the stock circuitry. I added the series resistor so that the control can boost as well as cut the treble content as compared to the stock circuitry. You may also want to experiment with different values for the .015uf cap C16 (which is difficult to get to under the Post gain pot).

The Diagrams:

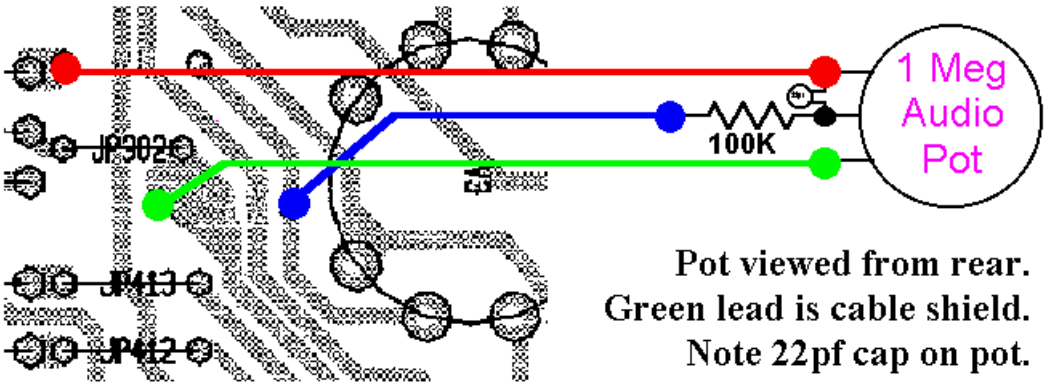


Classic 30 Master Volume Mod
V3 Detail



Remove R48 & JP414 on Tube Board

Peavy Classic 30:
Master Volume Mod

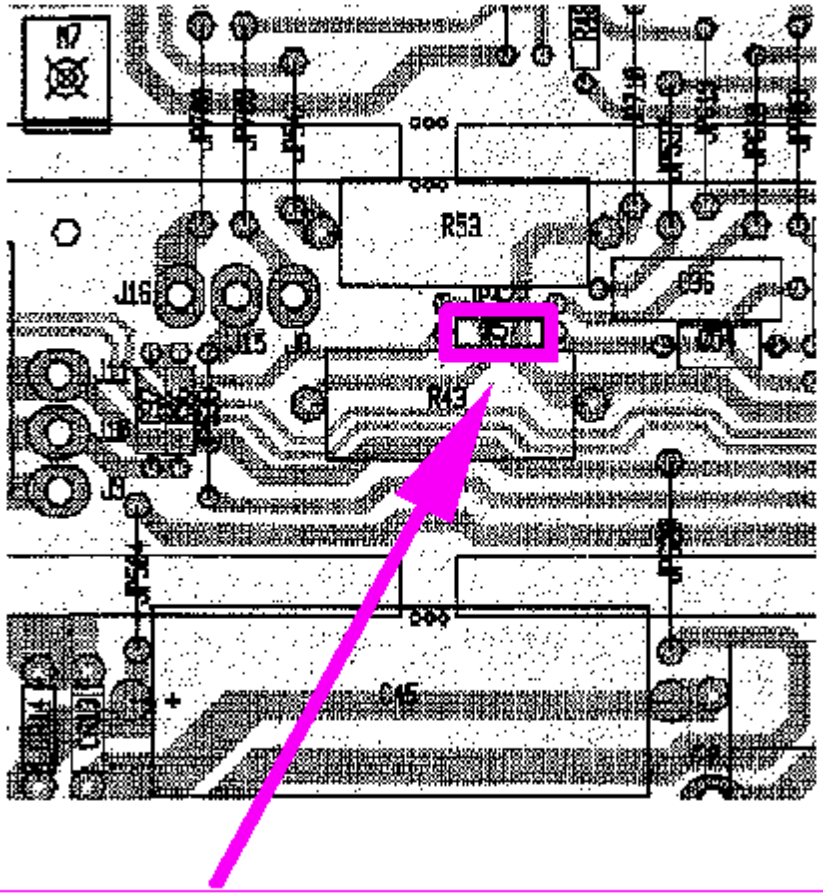


Pot viewed from rear.
Green lead is cable shield.
Note 22pf cap on pot.

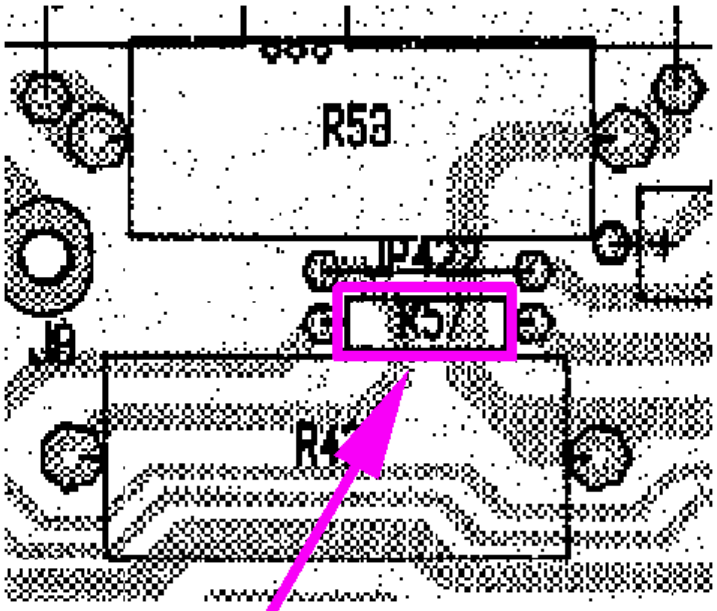
Tube Board near V3

And now for the Presence Control diagrams:

Peavy Classic 30 Mods: Presence Control



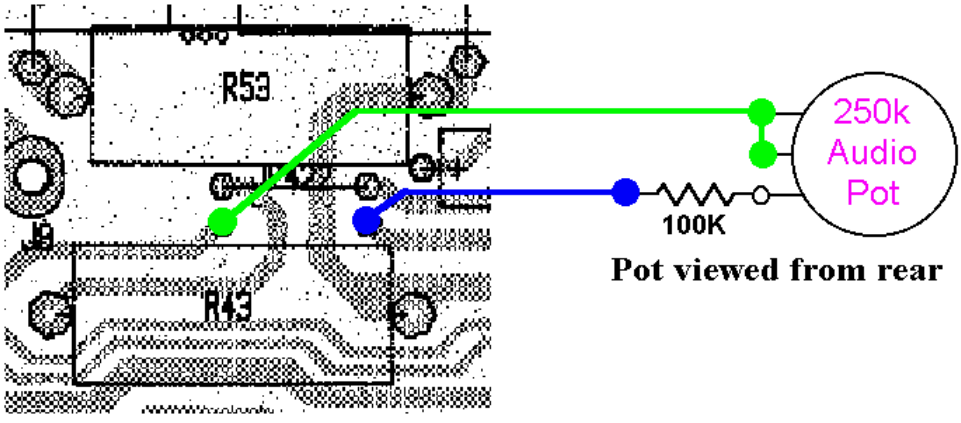
Peavy Classic 30 Mods: Presence Control



R57 on Middle Board

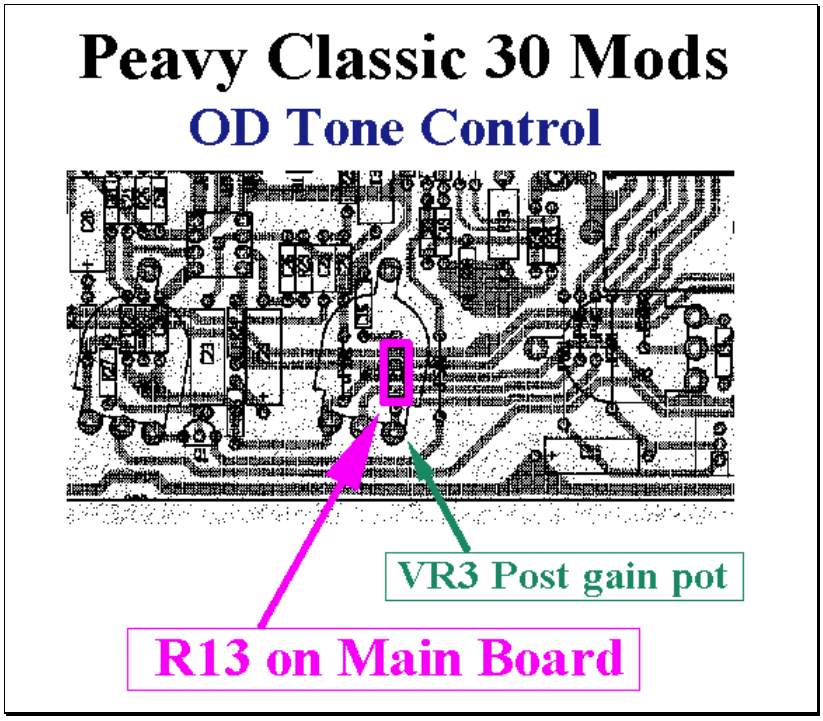
Peavy Classic 30:

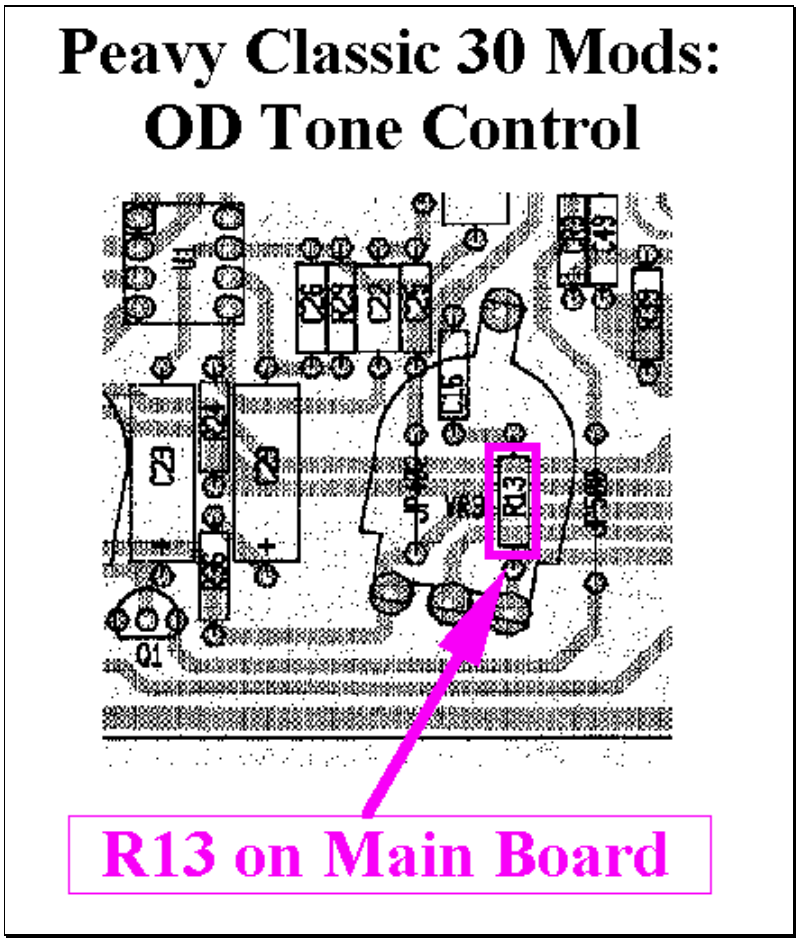
Presence Control Mod

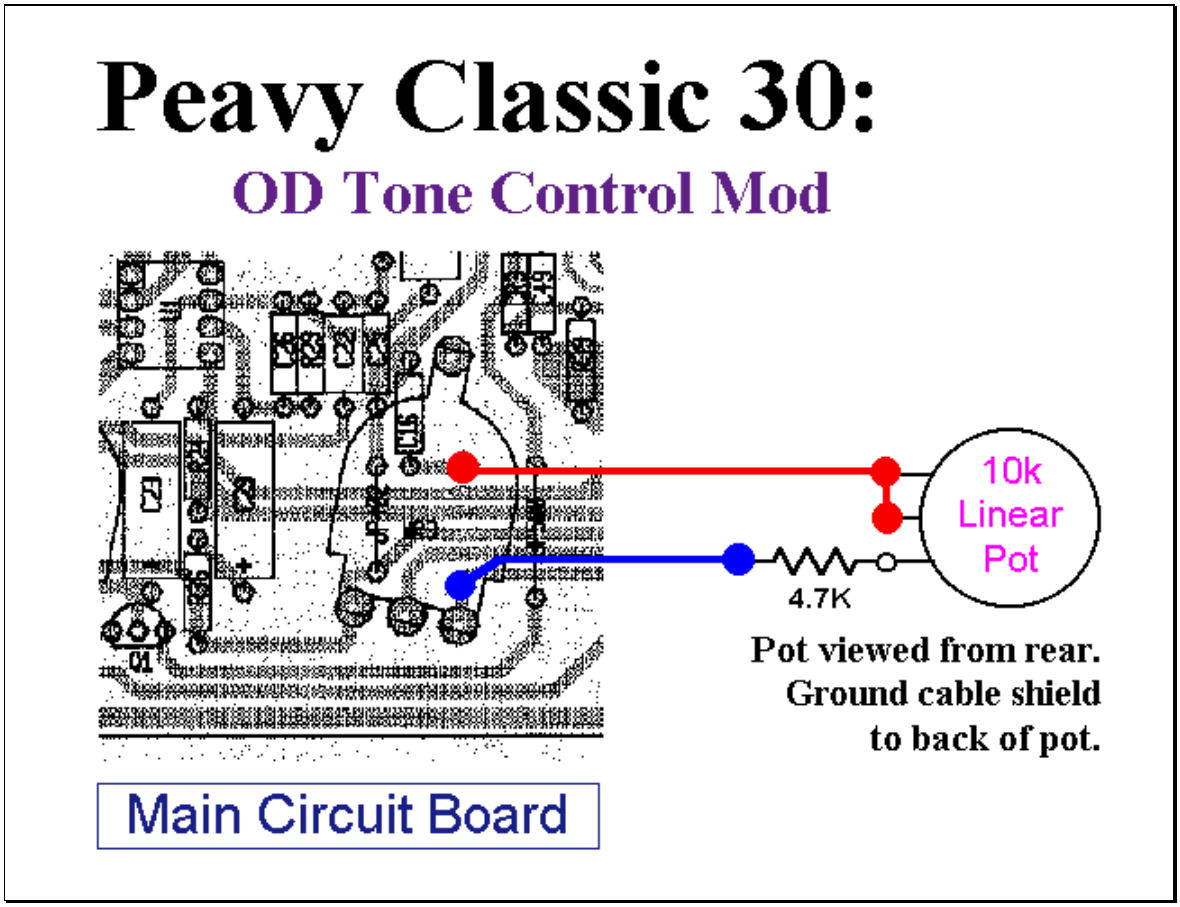


Middle Circuit Board

And now for the OD Tone Control diagrams:







Final Notes

Having added these mods to my Classic 30 has made it a lot more versatile, with many new sounds I wan't getting before. If you have any comments, suggestions or recommendations, please send e-mail to the address listed below.

Good luck!

Steve Ahola

March 30, 1998

(Revised 4/1/98)

steve_ahola@yahoo.com

http://www.blueguitar.org/

The Blue Guitar

Peavy Classic 30 Advanced Mods

More Cap Mods

Ck Switches for V1A & V2B

Overview

"Ck" is the electronics nickname for "cathode resistor bypass capacitor", which will affect the gain and tone of a tube stage. Traditionally, Fender guitar amps would use a 25uf bypass cap with the 1.5k resistor on the cathode of the initial preamp stage (for a fuller sound), while Marshall would use a 0.68uf cap with a 2.7k resistor (for a more midrangy sound). A 25uf cap with a 1.5k resistor will start rolling off the low frequencies below 40hz, while a 0.68uf cap with a 2.7K resistor will start rolling off the bass at 900hz. For clean sounds from the Normal channel, you'd probably want to use the 25uf bypass cap for a fuller response, but when overdriving your amp for leads, the bass frequencies will suck up much of the power, so you can generally get a smoother and louder OD sound with the smaller cap here.

While the mod outlined in this article uses a 0.68uf/25v cap for V1A (along with the stock 22uF/25v cap removed from the board), you may want to experiment with other values. Since we are not switching or replacing the stock 1.5k cathode resistor, the rolloff frequency with a 0.68uf cap is around 1500hz. By using a 1.0uf cap instead, the rolloff frequency would be around 1000hz, which is a lot closer to the Marshall design.

For V2B, I tried several values before settling on a 1.0uf bypass cap to be switched with the stock 22uf cap. I had originally installed a 0.47uf bypass cap here (since it works great in this position in other amps), but with Peavy using that value for V2A already I decided it was a bit "monotonous" (in the literal sense of the word). By tuning each stage to different roll-off frequencies, you can build up a sound with a lot of character (which is similiar in principle to using a different variety of 12AX7 tube for each position- see ritetube.htm).

By using 3-position center-off DPDT mini-toggle switches, we get a third choice for Ck: no cathode resistor bypass cap at all for considerably less gain from that stage but more even frequency response. While that may not seem to be very useful, switching off Ck for V1A is very effective with the Normal channel as it seems to increase the clean headroom. Many amps will toggle Ck on and off in the initial preamp stage for a boost switch (e.g., the "Fat" switch in the Fender Blues Junior). Switching Ck off for V2B cleans up the OD channel a bit for less-distorted OD sounds.

Construction Notes

The basic game plan to replace these two cathode resistor bypass caps with switches is this: to locate and remove the stock caps (C12 & C15) from the middle circuit board, and then solder a length of shielded cable from the copper side of the board (in the place of these two caps) to two center-off dpdt mini-toggle switches, each with 2 caps and 2 resistors (to bleed off any charge on the caps).

C12 is the electrolytic cap closest to the "input jack" edge of the middle circuit board, and if you follow the trace from the ungrounded pad it eventually leads to Pin 3 of V1. C15 is a bit harder to locate as it is in the middle of the middle board. However, it is directly in line with the threaded post between V3 and V4, and it is right next to the perforated break-away section of the board. The diagram below should help you locate it. After removing C12 and C15, polish up a small spot on the ground pads with tinned desolder braid to prepare it for the shielded cable.

Before you solder the cable to the circuit board, first wire up the two switches so that you can insulate and protect them with several layers of heat shrink tubing. I arbitrarily decided to orient the switches so that the keyed side of the bushing faced the middle of the chassis so that when I'd put the amp back together later I'd always remember which way the switches would go. With this arrangement, I mounted the 22uf caps to the keyed side of the switch and the alternate caps to the opposite side. You need to solder the positive (+) ends of the caps to the outer switch terminals, with the inner lead from the shielded cable soldered to the middle terminal. (See c30_ckm4.gif for details.)

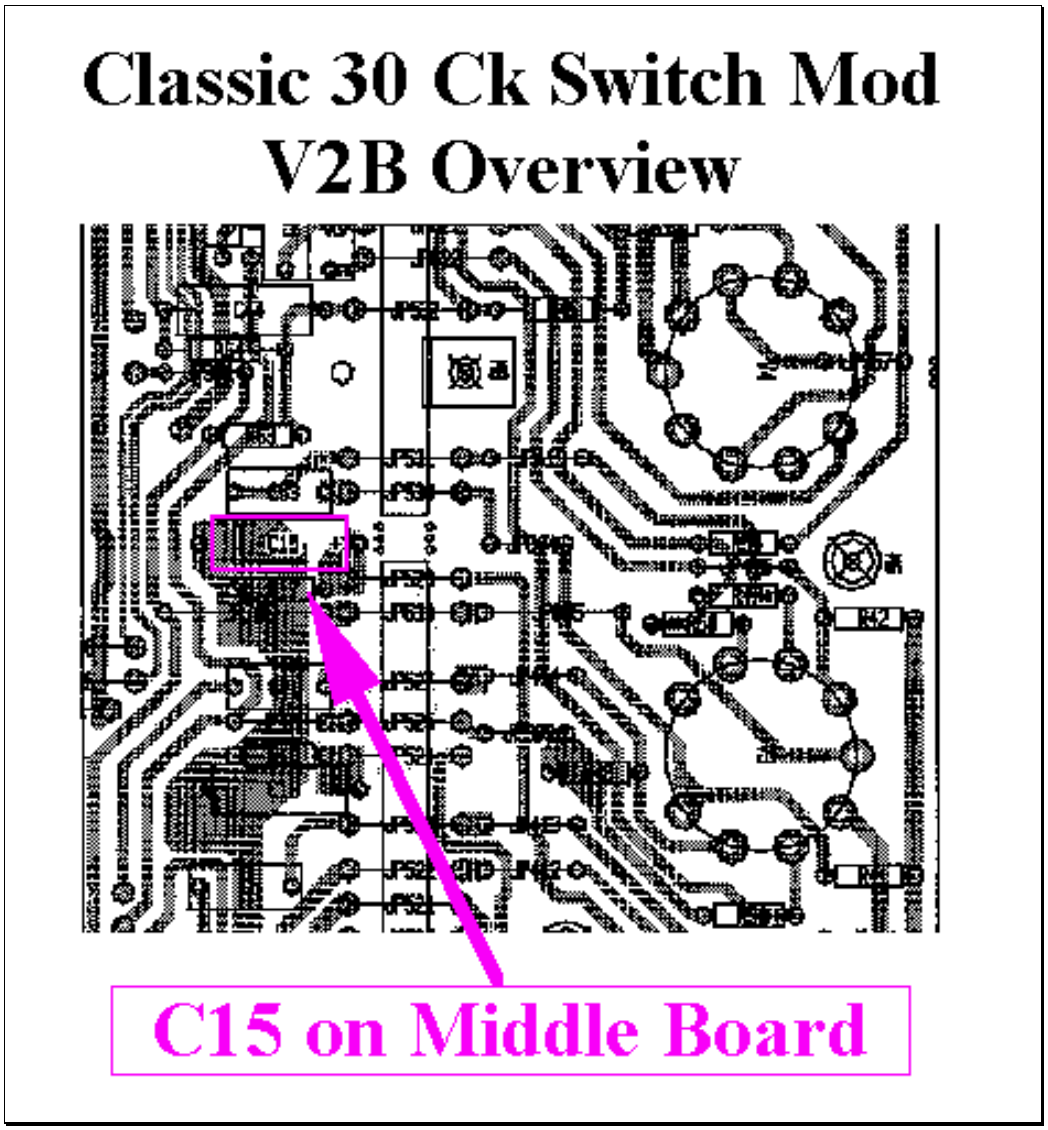
To mount the 470k bleed-off resistors, I ran them from the outside "front" terminals (with the cap leads) to the middle "back" terminal, and ran the uncut lead from one of the resistors up to the middle "front" terminal (with the inner lead from the shielded cable). The 470k value for the bleed-off resistors was chosen arbitrarily; I wanted something that wasn't so low that it affected the tone nor so high that it didn't eliminate the "switch pops", and the 470k resistors seem to do the trick. Once you have made all of the solder connections to the switch you can then solder the negative (–) leads from the bypass caps to the cable shield and cover the switch and caps with several layers of heat shrink tuning in progressively larger sizes.

You do need to decide where you will locate these switches before cutting the cable. There is ONE location on the bottom of the Classic 30 chassis where you can add switches or controls that will be fairly accessible, and that is between V1 and the cabinet. While I located these two Ck switches there, you may want to save that location for a master volume or presence control (to be covered in another article). You may be able to fit 2 mini-toggle switches here with a pot directly behind it (actually closer to the front of the amp) and be able to reach over the switches to adjust the master volume control. (I didn't plan ahead with my own amp and had to put the MV control behind the tubes which usually manage to brand my forearm whenever I adjust the master volume.)

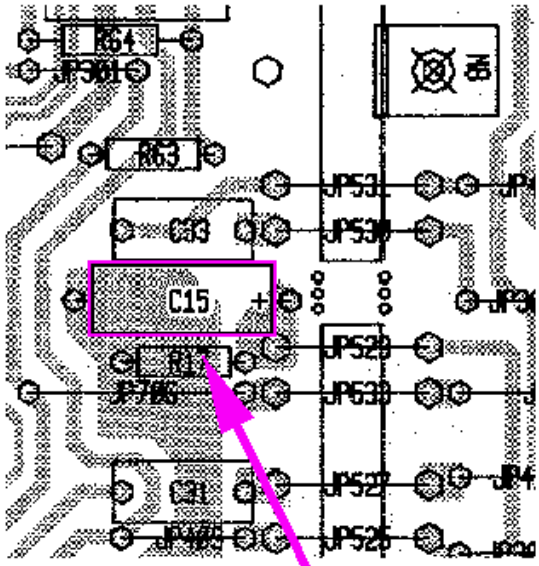
Once you have decided where to locate the switches, cut the cables with enough slack to remove the switches later and prepare the lead end for soldering to circuit board. I always slip a short length of 1/16" heat shrink tubing over the inner lead to protect it,

and a larger diameter piece over the cable jacket to keep the ground shield from shorting anything out. The inner lead is to be inserted backwards into the ungrounded pad recently vacated by C12 or C15 (which is the smaller pad closer to the tube board). By inserting the lead into the now-vacant hole, the solder joint will be a lot stronger and less likely to break later. In soldering the cable shield to a spot on the ground plane (which was polished with tinned desolder braid when you removed the caps earlier), try to arrange it so that there is some slack in the inner conductor, with the ground shield taking any stress from the cable. Before you forget, check to see that the inner lead isn't sticking out too far on the component side of the board and trim it if necessary.

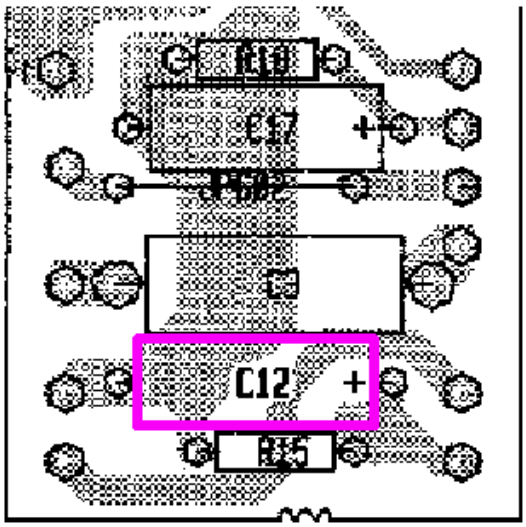
The Diagrams:

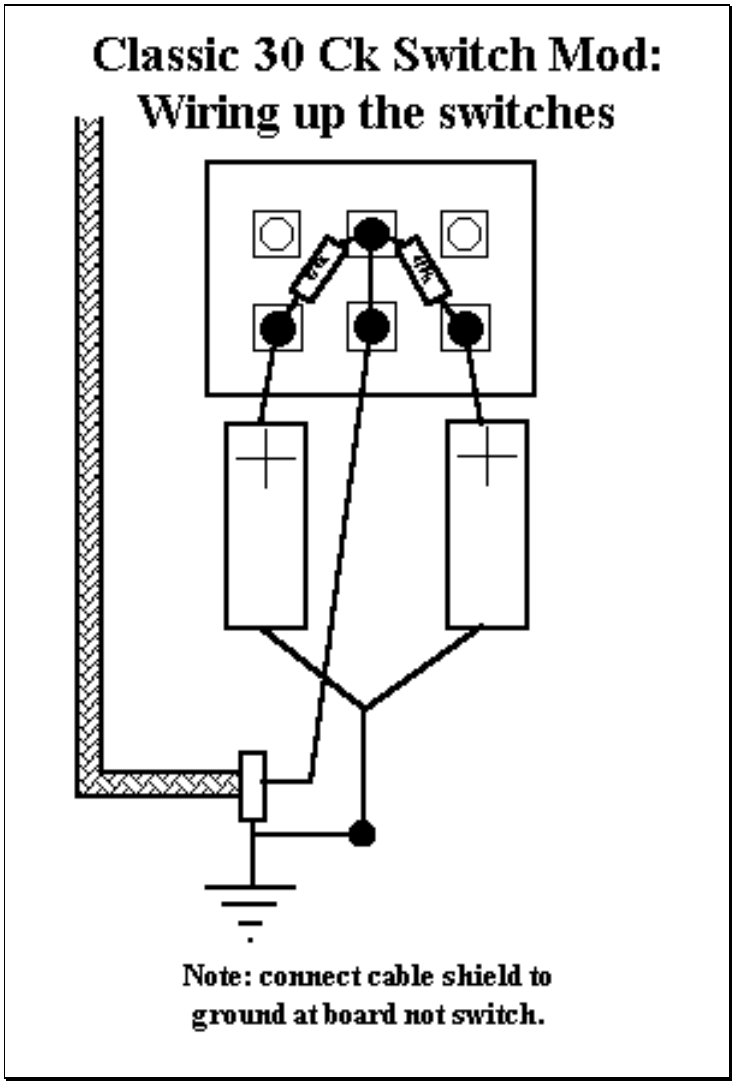


Classic 30 Ck Switch Mod V2B Detail View



Classic 30 Ck Switch Mod V1A Detail View





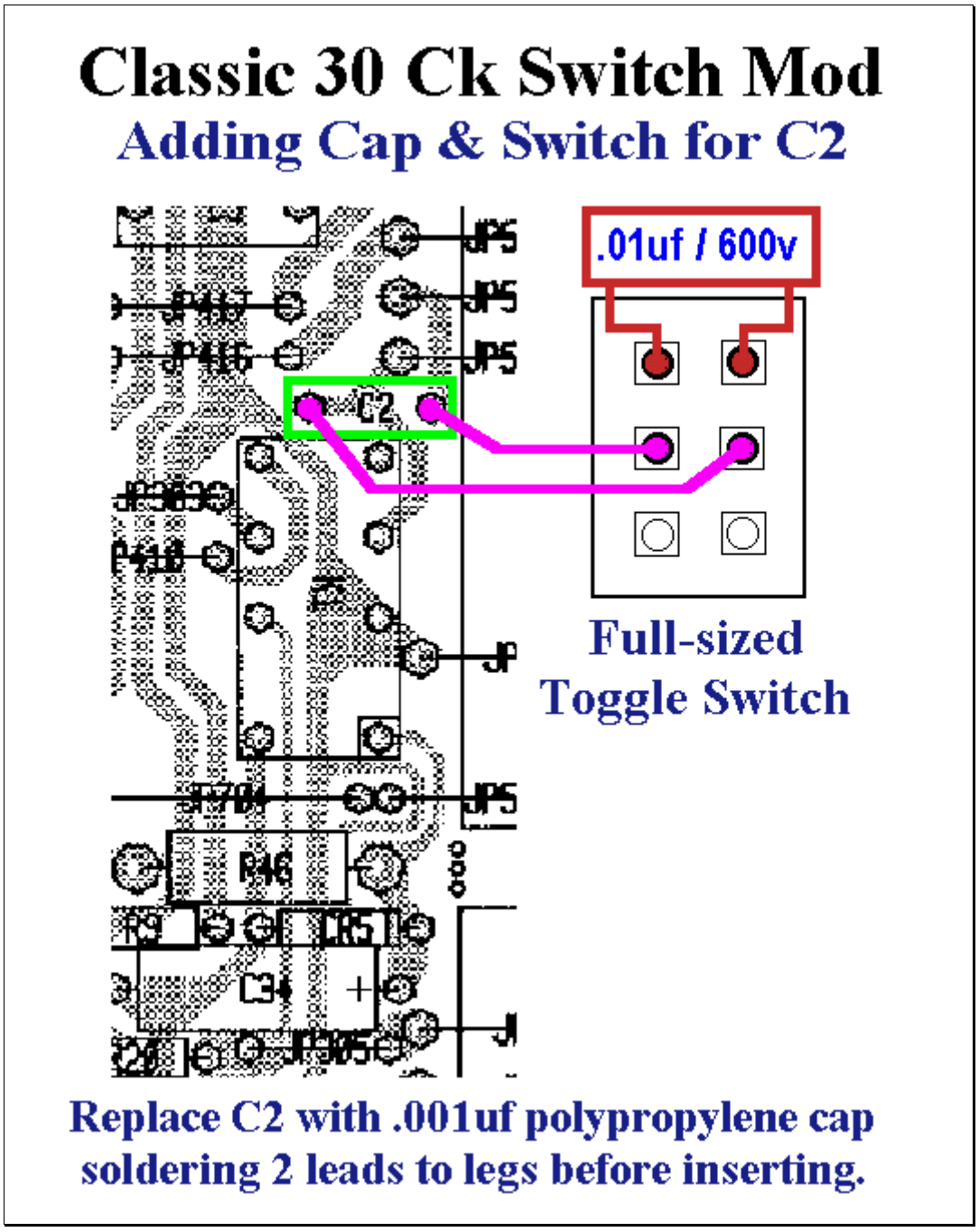
Coupling Cap Mods

Details and Diagrams

You can use a similiar technique to add a switch for the C2 coupling capacitor at the anode of V2A to toggle between 2 different values, only you need to leave the lower valued cap on the circuit board and parallel its 2 leads to a larger cap mounted on the switch. I used a .001uf / 630V axial metallized polypropylene cap in place of the "box" cap adjacent to the channel switching relay and soldered 2 leads to its legs before inserting it into the board. (See c30_ckm5.gif) I then ran those leads to a full-sized toggle switch with a .01uf / 600V Orange Drop cap mounted on it in a full-bypass setup. To keep the leads short, I mounted the switch on the chassis bottom directly behind C2. While I usually try to avoid Radio Shack parts, I used their 12vdc/20A DPDT "automotive flip switch" here because its plastic handle is quite long and easy to locate when reaching behind hot tubes. I used no bleed-off resistors to reduce popping sounds, but really haven't noticed a problem with that in this application. Using a .01uf cap for

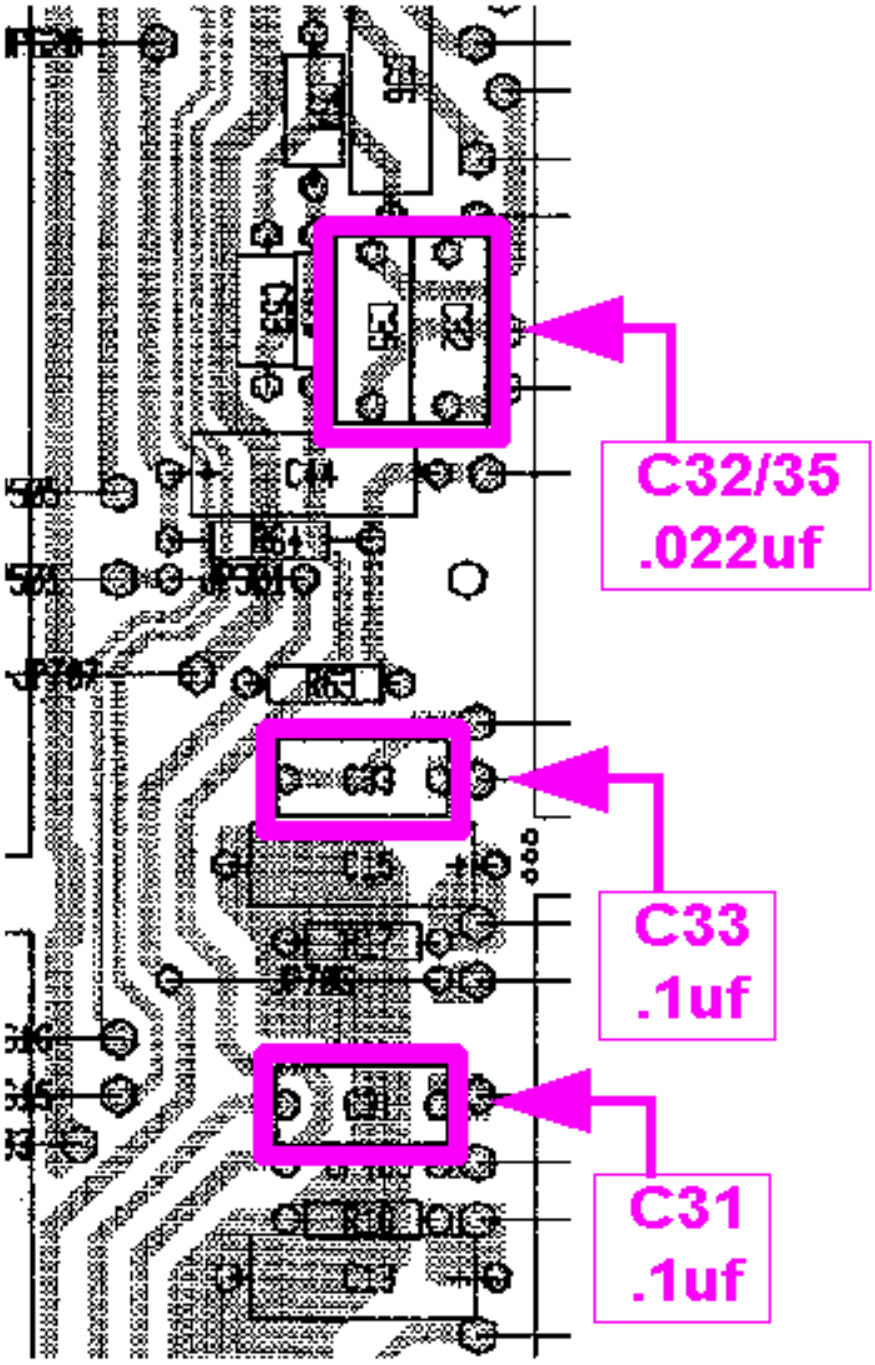
C2 increases the bass response and gain of the OD channel noticeably. With the cap switches for C2, C12, and C15 I can get quite a few different sounds from my Classic 30.

While on the topic of coupling caps, I recently replaced 5 of them in my Classic 30 with 600V Orange Drop caps of the same value: .047uf for C6, .1uf for C31 and C33, and .022uf for C32 and C35. The OD channel has now lost all traces of the harshness in the stock Peavy circuit, with it producing a very full and smooth tone. The Normal channel did lose some of its crystal clarity, so I may try replacing the Bright cap I added previously to the two ungrounded terminals of the Normal volume control with a larger value. (I had settled for a very modest 22pf previously, but I think with the latest series of mods a 47pf mica cap might be more appropriate.)



Classic 30 Ck Switch Mod

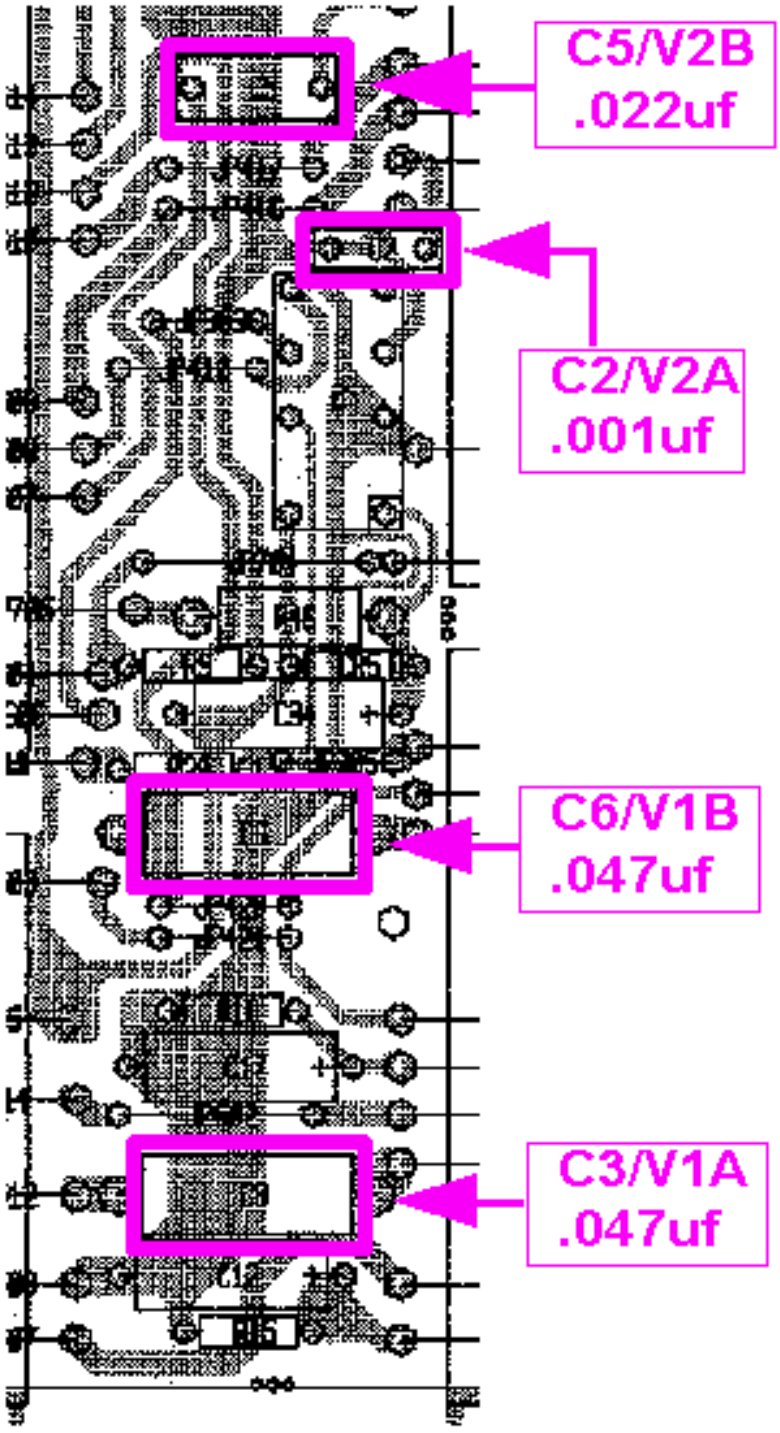
Coupling Caps



Middle Section of Middle Board

Classic 30 Ck Switch Mod

Coupling Caps



Bottom Section of Middle Board

Final Notes

Having added these mods to my Classic 30 has made it a lot more versatile, with many new sounds I wasn't getting before. If you have any comments, suggestions or recommendations, please send e-mail to the address listed below.

Good luck!

Steve Ahola

March 23 1998

(Revised 4/2/98)

steve_ahola@yahoo.com

http://www.blueguitar.org/

The Blue Guitar

Peavy Classic 30 Advanced Mods

Adjustable Bias Mod

Overview

To get the best sound and longest life from stock or replacement output tubes, the bias current should be set within the proper range of values. The modification outlined here measures the voltage across a 1.0 ohm / 5 watt resistor which interrupts the cathode circuit to ground for all 4 of the power tubes. To adjust the bias supply we remove 2 resistors from the middle circuit board and run 3 leads from the vacated solder pads to a 10K linear pot with two 1/2 watt resistors (39K and 22K). While I mounted the pot in a hole drilled on the bottom of the chassis so that it is very accessible, an alternate method would be use a higher quality multi-turn pot epoxied to the circuit board (thanks to Doc at AMPAGE for that suggestion).

According to Ohms Law, the millivoltage measured across the 1.0 ohm resistor will translate directly to the bias current in milliamps for the 4 output tubes (plus the approximate 1.0 mA current from the V3B split load driver). The stock output tubes were measured at approximately 24.5mA each for a total of 99.0mA (including V3B). With the screen voltage for the EL84/6BQ5 tubes measured at 325vdc, the Torres book on amps recommends a bias current of 24.0mA for "Class AB" and up to 30.3mA for what he calls "High AB". These figures would translate to 97.0mv and 122.2mv respectively as measured across the 1.0 cathode resistor. To be safe, I'd suggest keeping the total bias current between 100 and 106mA. Incidentally, the bias current runs slightly higher when the channel switching relay is engaged for OD as it derives its dc voltage from the –36v bias supply tap so be sure to check the values in both modes.

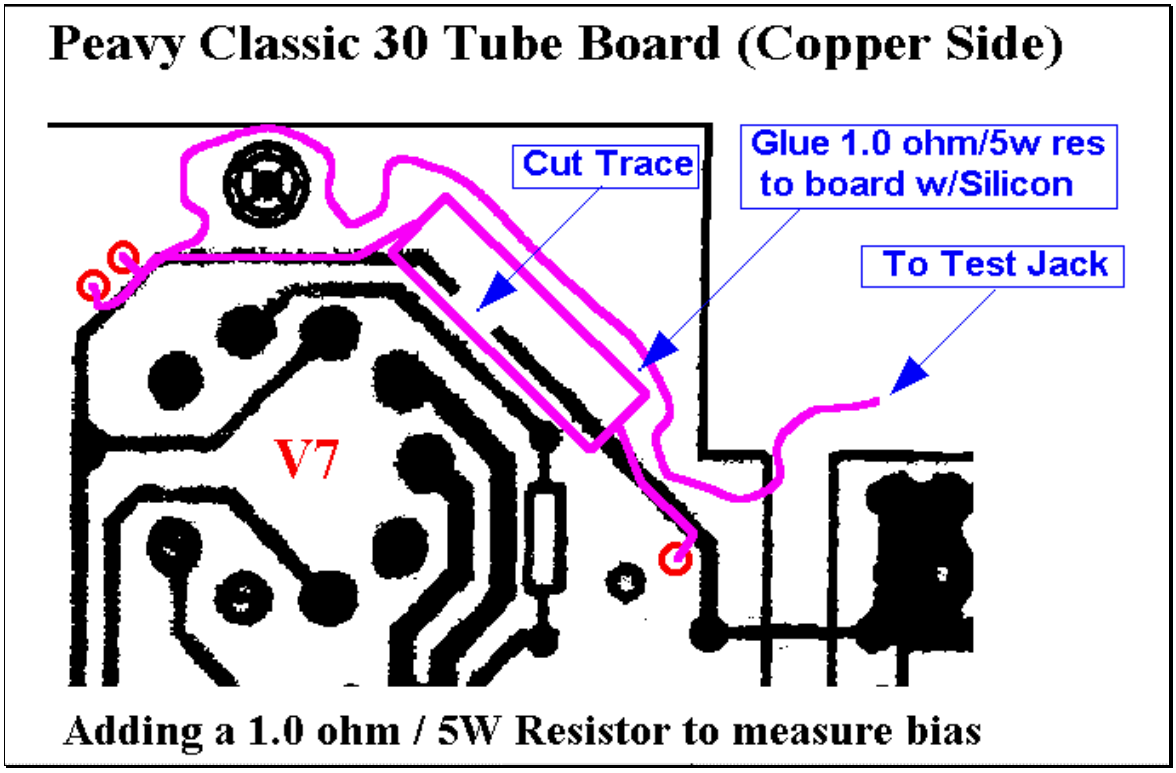
The Details and Drawings

To add the 1.0 ohm cathode resistor I cut the trace on the tube board (as indicated on the drawing below) and soldered on the resistor and a short length of wire which I ran out to a chassis mounted banana jack. The easiest and safest way I've found to cut traces on the Classic 30 circuit board is to polish the section to be cut with desoldering braid and a dab of solder. After maybe 30 seconds, what is left of the trace will flake off and should be disposed of properly (or else it may end up shorting out something else). To allow the wire to be disconnected from the banana jack I formed a quick-connect male bullet terminal around the jack pin and soldered it on. The following drawing indicates where the 5 watt resistor needs to be located so that it does not interfere with the jack board. I used a pin vise with a 61 ga bit (.039") to drill small holes to insert the resistor and wire leads, and after confirming that everything worked properly, squirted some silicone under the resistor and wire to hold them in place and eliminate vibrations.

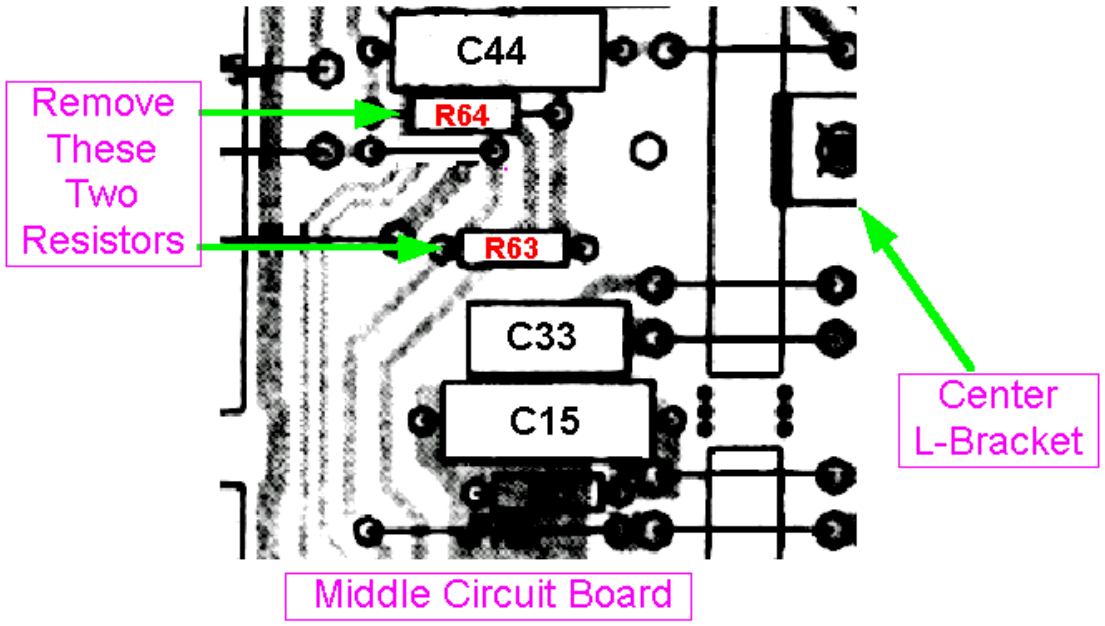
Note: 1.0 ohm 5 watt resistors generally have a tolerance of 5% (i.e., 0.95 to 1.05 ohms) so I bought a half dozen of them and choose the one that was closest to 1.0 ohm. If your local electronics parts supply house has them in bulk (not blister packed) you may be able to measure them there and only buy the ones that are exactly 1.0 ohm.

Further Note: It was mentioned to me that a 5 watt resistor is not required here with the low voltages and currents involved. (I took the "rule of thumb" of using a 1 watt resistor to measure the bias current of a single tube and multiplied that by 4 tubes and rounded that up to 5...) Using Ohm's law the wattage involved here would be well under a 1/4 watt, but the higher wattage resistors stand up to heat better (and the Peavy's do run hot). I guess it would be safe to get a 1.0 ohm 1 watt precision resistor and use it to replace the hinged jumper wire on the end between the tube board and the middle board rather than cut the trace, etc., as detailed in this article.

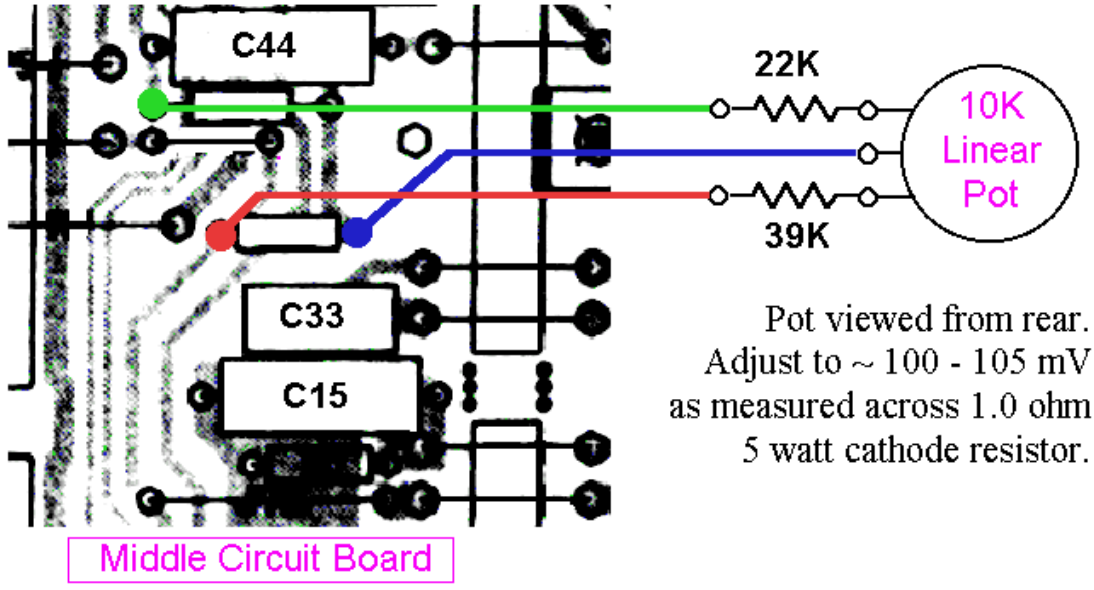
Adding a pot to adjust the bias supply is simpler than that as long as you know which resistors to remove, etc. The following drawings should be self-explanatory. In connecting the leads and resistors to the 10K pot, I used heat shrink tubing to reinforce and insulate the connections. As these leads carry only dc voltages and no audio signal they do not need to be shielded. Incidentally, to keep the pot settings from being accidentally altered, I cut the shaft off very short and used a Dremel tool to add a slot to it for screwdriver adjustment.



Peavy Classic 30: Adjustable Bias Mod



Peavy Classic 30: Adjustable Bias Mod



Steve Ahola

March 7, 1998

(Revised 3/21/98)

steve_ahola@yahoo.com

http://www.blueguitar.org/

The Blue Guitar

Peavy Classic 30 Advanced Mods

Boost Switch Relay Board

Overview

Perhaps the most requested feature for the Peavy Classic 30 is that the Boost switch be connected to the footswitch instead of the reverb. Running the audio signal itself through perhaps 12 feet of cable is not an option for the boost circuit which as redesigned in my previous mods uses a 750pf mica cap instead of the stock .047uf cap. For the Boost circuit to be footswitchable involves adding a second relay on its own mini-circuit board. To add this second relay to the Classic 30 without adding a separate power transformer, voltage regulator and filter capacitor, I choose to duplicate the circuitry for the channel switching relay.

The stock channel switching relay derives its coil voltage from the same tap that supplies the bias voltage to the output tubes so when the stock relay is engaged for the OD mode, the tube bias current is increased approximately 0.6mA per tube. With the second add-on relay engaged as well for the boost circuit, the bias current is increased approximately 1.2mA per tube. The advantage with this arrangement is that the bias currrent can be at a lower setting for the clean sounds from the Normal channel, and at progressively hotter settings for OD and boosted OD sounds.

Constructing the Relay Board

Because it is readily available, I chose to use the Radio Shack #276-159B mini-board designed for DIP ics. These boards come 2 to a pack and must be snapped in half; be advised that these boards are not symmetrical vertically. With the Radio Shack logo at the bottom, the top half has 3 sets of traces aligned vertically; the bottom half has only 2 sets of traces.

I had originally mounted the relay board on the bottom of the chassis between the transformers but felt that the 12"+ of cabling muddied up the sound of the amp so I decided instead to mount the relay board directly under the tone stack, secured to the main board with a pair of 11/16" long insulated standoffs using 4x40 screws.

Rather than solder the ECG # RLY 5142 dpdt relay directly to the mini-board I used a 16 pin DIP socket to allow for easy replacement later and to avoid exposing the relay to excessive temperatures when soldering. Incidentally, the mini-board is to be mounted upside down (with the copper traces facing up) so that it can be easily removed.

While the following diagrams should be self-explanatory, I should point out that the uncut leads from the 1N4148 diode are used as jumpers to the coil-end set of contacts from the DIP socket. The pins of the relay are arranged so that the coil is on the end with the notch. There are then 2 blank DIP spaces before we get to the two relay Common terminals, roughly in the middle of the relay. The NO pair of contacts are on the end of the relay without the notch, and the NC contacts are between the C and NO pins. All of this is printed on the relay box from ECG. To simplify matters, you can remove the unused pins from the 16-pin DIP socket.

With a single set of contacts switching in the 750pf Boost cap (in parallel with the 270pf Treble cap), there are an extra set of contacts to use for other purposes. I chose to use those contacts to offer 2 choices for the Bass cap. Wired in parallel with the .022uf Bass cap on the main board, a .033uf is used in the non-boosted mode and switched out in the boosted mode. The difference between a .022uf and .055uf Bass cap is subtle with the Marshall / 59 Bassman-style tone stack used in the Classic 30, and is more noticeable when strumming an open chord than plucking a bass note. (There is an optional add-on switching circuit that can be used with the relay board to force the value of the bass cap to either .022uf or .055uf all of the time, or allow it to follow the mode of the boost relay as shown in the basic design here. I omitted it from this article because it uses a special on-on-on dpdt mini-toggle switch used for "trick" wiring on guitars.)

Another use for the extra set of contacts would be to switch the value of the V2B cathode resistor bypass cap between 22uf in the unboosted mode and something like 1.0uf in the boosted mode. (I use center-off DPDT mini-toggle switches to switch the values of Ck for V1A and V2B as outlined in c30_plus.htm.)

Getting back to the circuit in this article, to mount the relay board directly under the tone stack you need to cut off about 1/4" from the top of the mini-board (the top is the side that doesn't say "Radio Shack"). As mentioned earlier, these boards are not symmetrical vertically so make sure you get it right or the circuit will NOT work. You need to run 7 leads from the main circuit board up to the mini-board. For the .022uF Bass cap, if you leave the leads to the 715P Orange Drop cap uncut they should be long enough to reach the board. If not, you can use a pin vise to drill some holes (like .039"/61 ga). I generally do not try to drill a hole through a small trace, but drill the hole immediately adjacent to the trace and bend the component lead over to solder it to the pad. For the leads in parallel to the 270pf mica Treble cap, if you follow the modifications to the tone stack of the main board carefully you can run them through the holes vacated by the stock Boost cap, C14, bending over the lead I've marked "R" over to the adjacent pad from the Treble cap, C11.

At this point I should explain my preference for the flying leads. If the cap lead isn't long and/or strong enough, I use pre-tinned 22 ga bus wire with color-coded 1/16" heat shrink tubing. 3 foot lengths of 1/16" heat shrink tubing are generally under $2 apiece at electronics supply houses so I consider it a good investment for your sanity to buy all of the colors available in this size to handle many of your wiring needs with guitars and amps. (Rather than stock and strip insulated wires in various colors, I will use

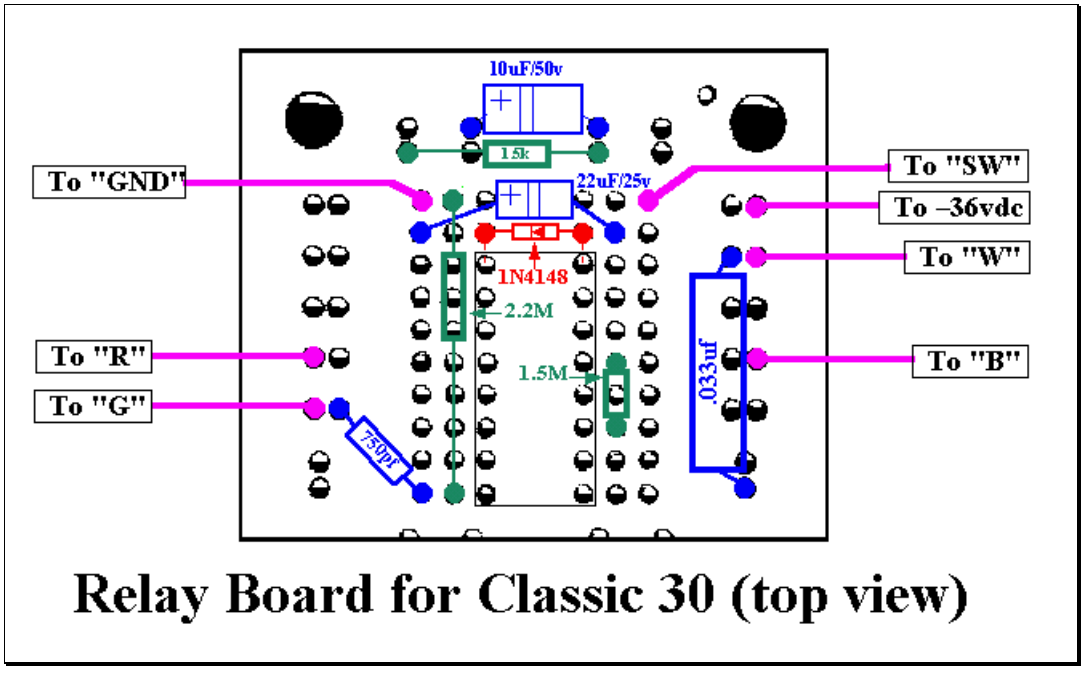
the 22 ga bus wire along with heat shrink tubing when the application doesn't call for shielded cable or stranded wire.)

Getting back to the circuit, there are 3 other flying leads to connect. For the terminals marked "SW" on both the main board and relay board, I used the bus wire with blue heat shrink tubing, and for "GND" I used green heat shrink tubing. Incidentally, the location for the GND wire on the main circuit was rather arbitrary as long as you solder it to the ground plane indicated on the diagram. To make the solder joint more secure, I drilled a small hole with a pin vise and ran the bus wire through backwards (so that the end pokes through to the component side). For the terminal marked "–36vdc", I tapped the voltage supply from R33, with a small hole drilled next to end closest to the middle board and color coded it yellow (you may want to use stranded wire for this application).

For the 11/16" long insulated stand-offs securing the relay board to the main board I used some nylon stock I had around and cut it to length using a cut-off wheel with my Dremel Moto-tool. The hole nearest the FX jacks was actually under the C39 filter cap a bit. For wiring up the flying leads, I pulled the "GND" and "SW" leads through first, and then the "B" and "W" leads (note that they do cross) and finally the "R" and "G" and "–36vdc" leads. Once all 7 leads were inserted in the proper holes, I pulled them tight and bent them over, leaving about a 1/4" on all of the outer leads (you need that slack if you ever need to remove and reinstall the relay board later).

Incidentally, if you'd prefer to mount the relay board directly on the chassis, the mini-board is wired up essentially the same only you wouldn't cut 1/4" off the board. I used 4 conductor shielded cable to connect the 4 leads from the tone stack, and separate leads for the –36vdc, GND and SW terminals.

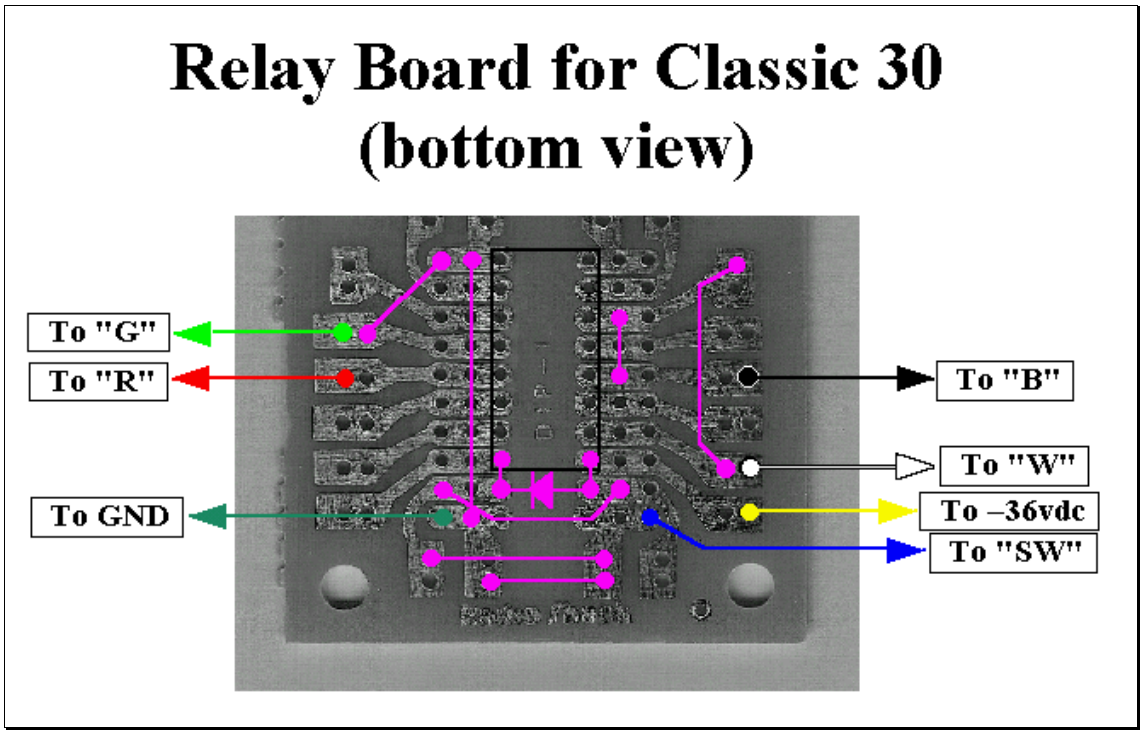
And now we get to the diagrams for the add-on relay board:



Relay Board for Classic 30 (top view)

Just a few notes on that diagram. As mentioned before the leads for the 1N4148 are bent over and soldered to the coil terminals for the relay. The 1.5M and 2.2M 1/4 watt resistors are used to reduce "pops" when switching modes by bleeding off any charge that is building up on the .033uf or 750pf caps. Those values seem to work for me but you are welcome to try other values. (Go too low and it will affect the tone; go too high and there will be more noise when switching.) Incidentally, it is important to connect the .033uf and 750pf caps as shown on these diagrams. I had first tried hooking them up so that the .033uf cap was always connected to Treble and Bass controls, thinking it would reduce switching noises, but I found that having the cap there in the circuit would swallow up some of the high frequencies even when the other end of the cap was switched off with the relay in the Boost mode.

Here is the copper side of the same board:



Modifications to Main Circuit Board

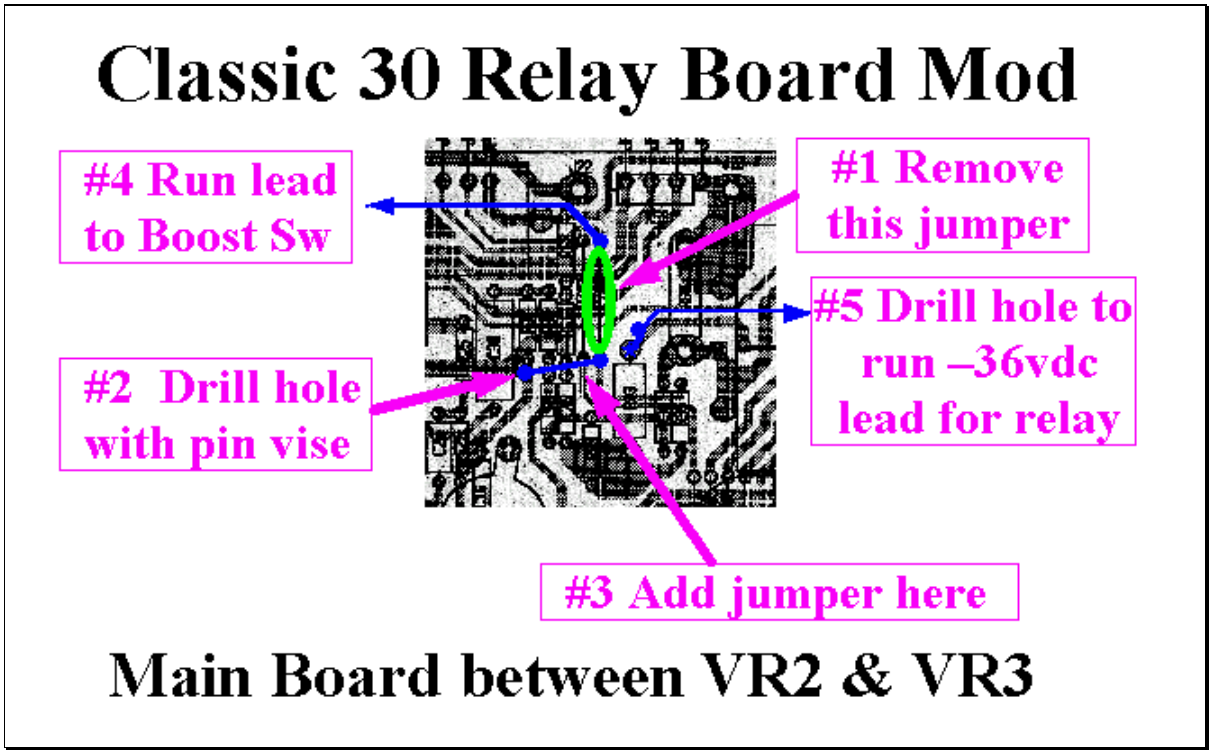
If you followed these instructions so far, you are now ready to perform some unreversable alterations to the main circuit board so the faint-hearted may wish to leave. The first step is to alter the stock circuit for the reverb and footswitch, and since it is located in the same part of the board, add your –36vdc tap for the relay.

To switch the reverb on through the footswitch, R35 is grounded through a maze of jumper wires and traces that eventually end up at the footswitch jack (which is normally closed unless a plug is inserted). We can ignore the maze of wires and just make our connections at the pads for the JP700 jumper. After removing this jumper, use

a pin vise to auger a small hole in the larger copper pad that R37 is soldered to. This hole will be the ground connection that switches on the reverb circuit. You will need to run a short insulated jumper wire from this new hole over to pad from JP700 that is closer to the pots. To insure a good ground connection, polish a small area of the ground plane using desolder braid and a dab of solder to remove the insulated coating. When the solder adheres to the copper, it is ready to accept the jumper wire.

To connect the on-board Boost switch (soon to be modified) to the footswitch you need to run a ~20" length of stranded wire from the pad vacated by JP700 over to the Boost switch. The last modification to be done on this section of the board is to add the –36vdc tap to the pad from R33 closer to the middle circuit board. A length of wire approximately 12" long is to be added on the copper side of the circuit board. While you can just solder the wire to the existing copper pad, the wire will be more secure if you drill a small hole with a pin vise adjacent to the copper trace and insert the wire in backwards (so that the end is poking through to the component side).

Circuit board modifications for reverb/footswitch:

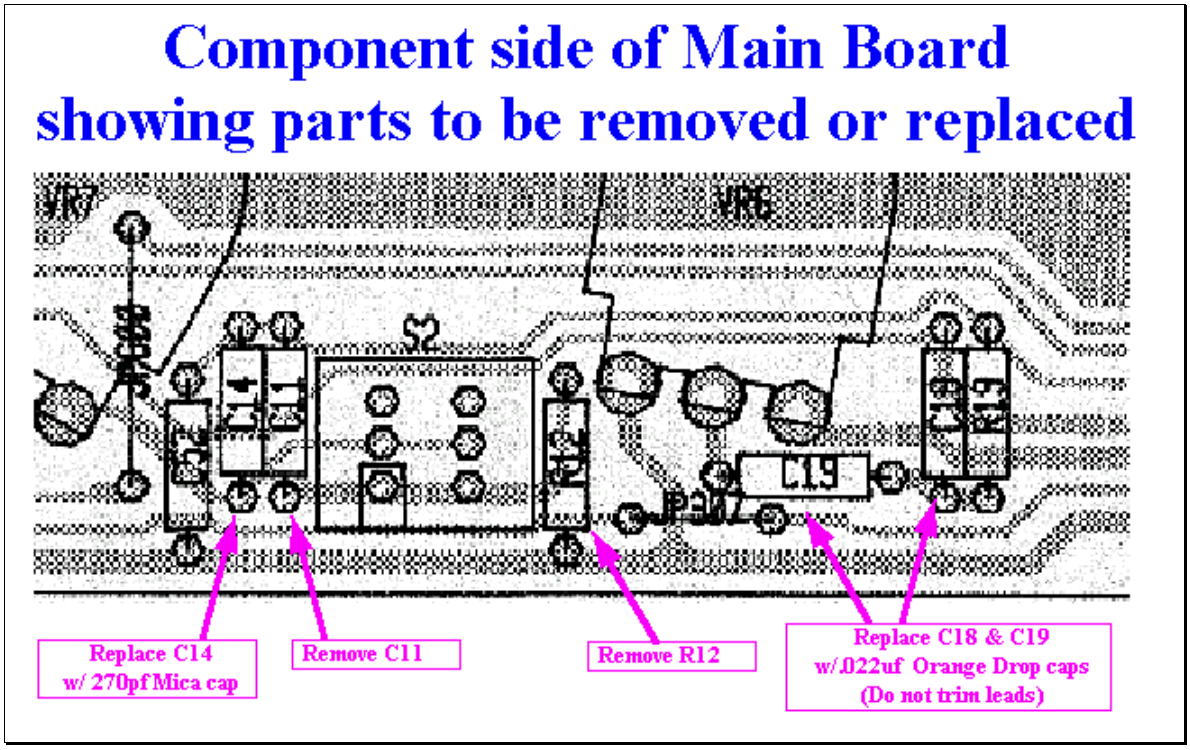


Further Modifications to the Main Board

If you made it through the last section, we will now proceed to perform some downright vandalism on the Tone Stack/Boost Switch section of the main circuit board. The game plan here is to remove the Boost switch from the audio signal entirely and convert it over to switch dc voltages for the Boost relay board. I found the best way to remove copper traces is to work them over with a used piece of desolder braid (something that you'd normally cut off and throw away). With the braid you first remove the

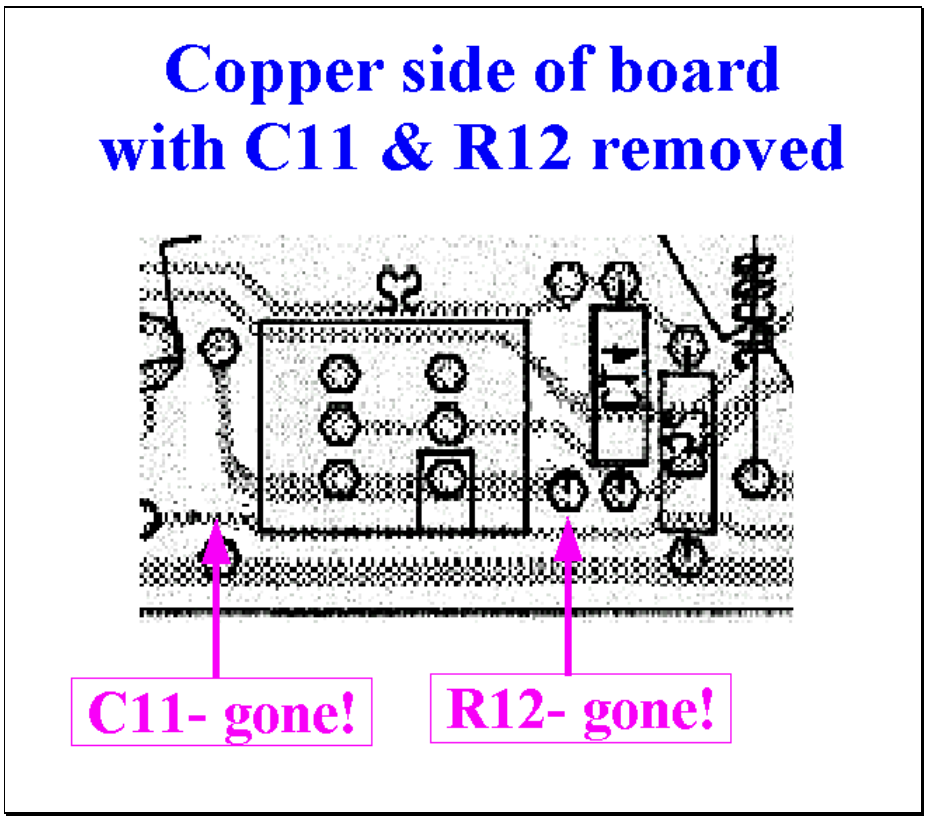
protective coating and then make sure the trace gets very hot and well-tinned. If it doesn't disintegrate entirely, it should flake off after a minute or so of this mistreatment. At this point, I will explain how to reconnect these traces if you decide you want to go back to the stock circuit: using the layout drawing as a guide, reconstruct the traces with 24 ga bus wire, essentially going from point to point. (If you are putting in any new components, the excess leads may be long enough so that you don't need to use the 24 ga bus wire.)

And now for the step-by-step illustrated instructions on how perform mayhem on your Classic 30:

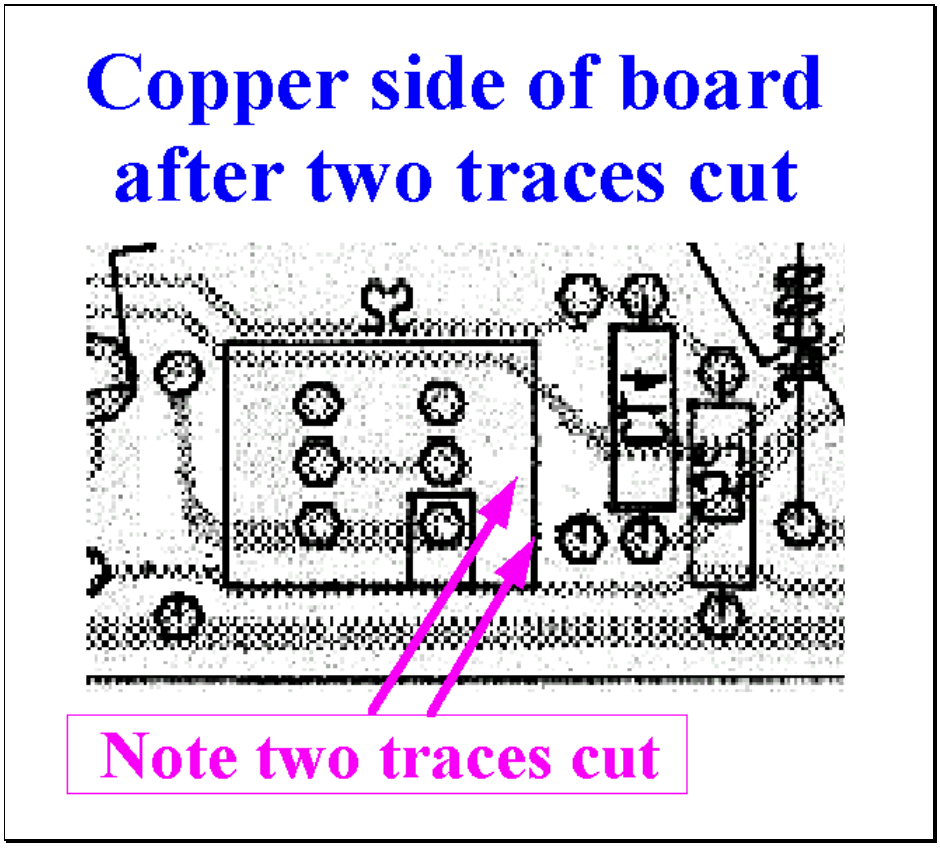


As the diagram indicates, you need to remove C11 and R12. If you haven't done so already, you should replace the C14 Treble cap with a 270pf/500V mica cap, and both C18 and C19 with high quality .022uf caps. While I used 600V Orange Drop caps, you might like to try 630v metallized polyester caps for a brighter, clearer sound. Leave the leads for the C18 Bass cap uncut as you may want to use them for flying leads up to the add-on relay board.

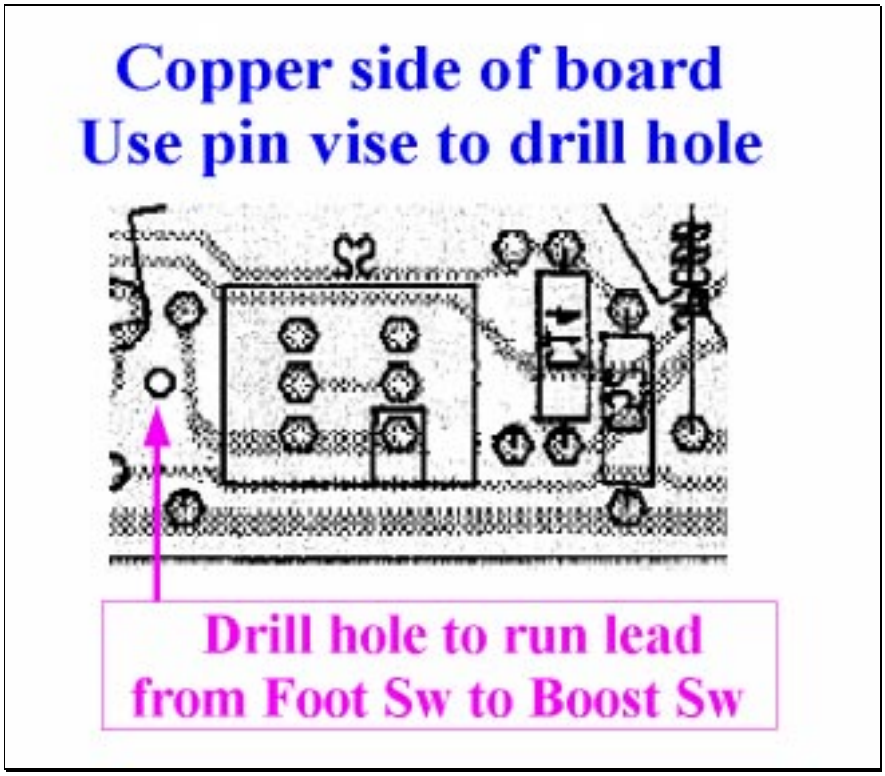
The drawings below are followed by short text comments:



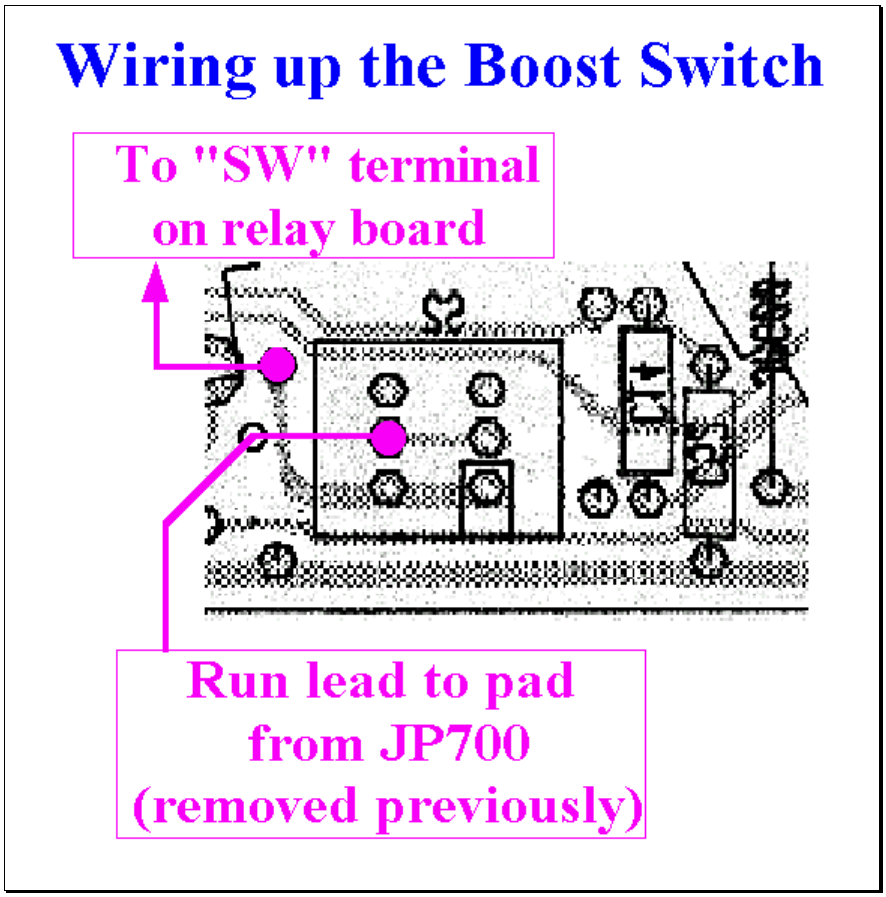
This diagram shows the copper side of the board after C11 and R12 have been removed, but before the traces have been cut. (Note: the labels for C11 and R12 are backwards. Sorry!)



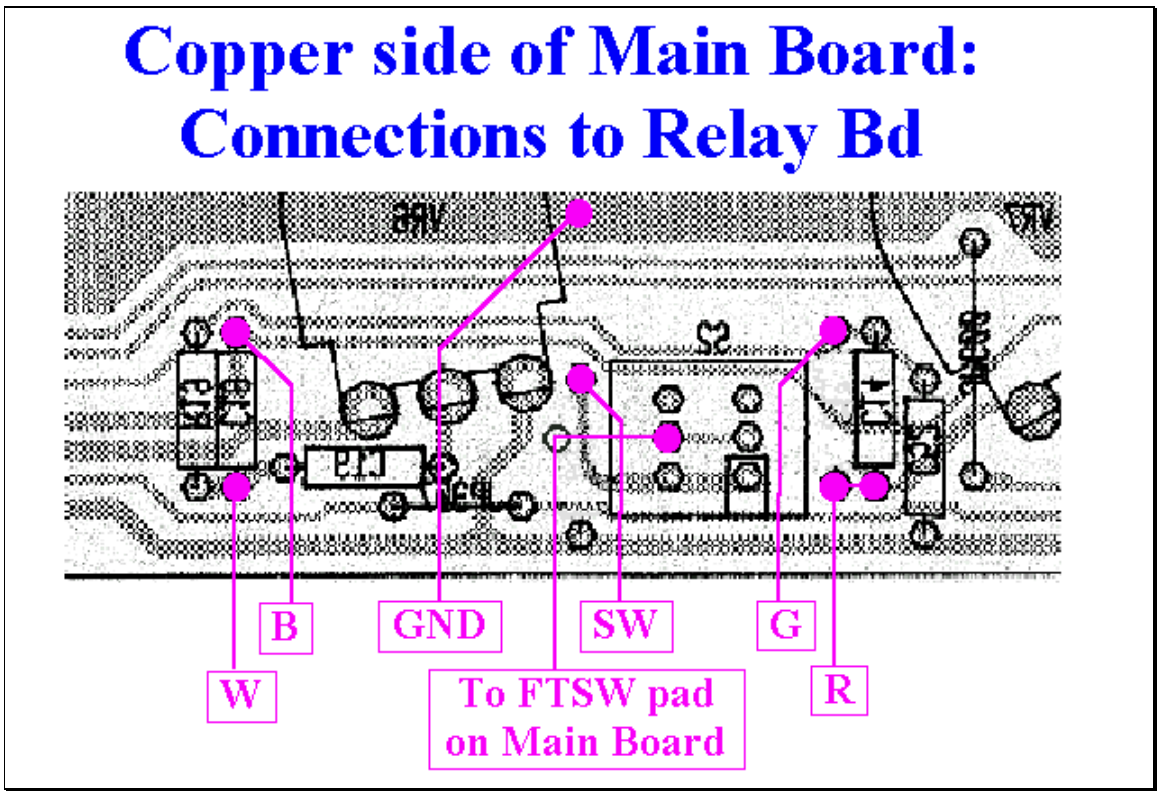
This diagram shows the copper side of the board after the two traces have been removed.



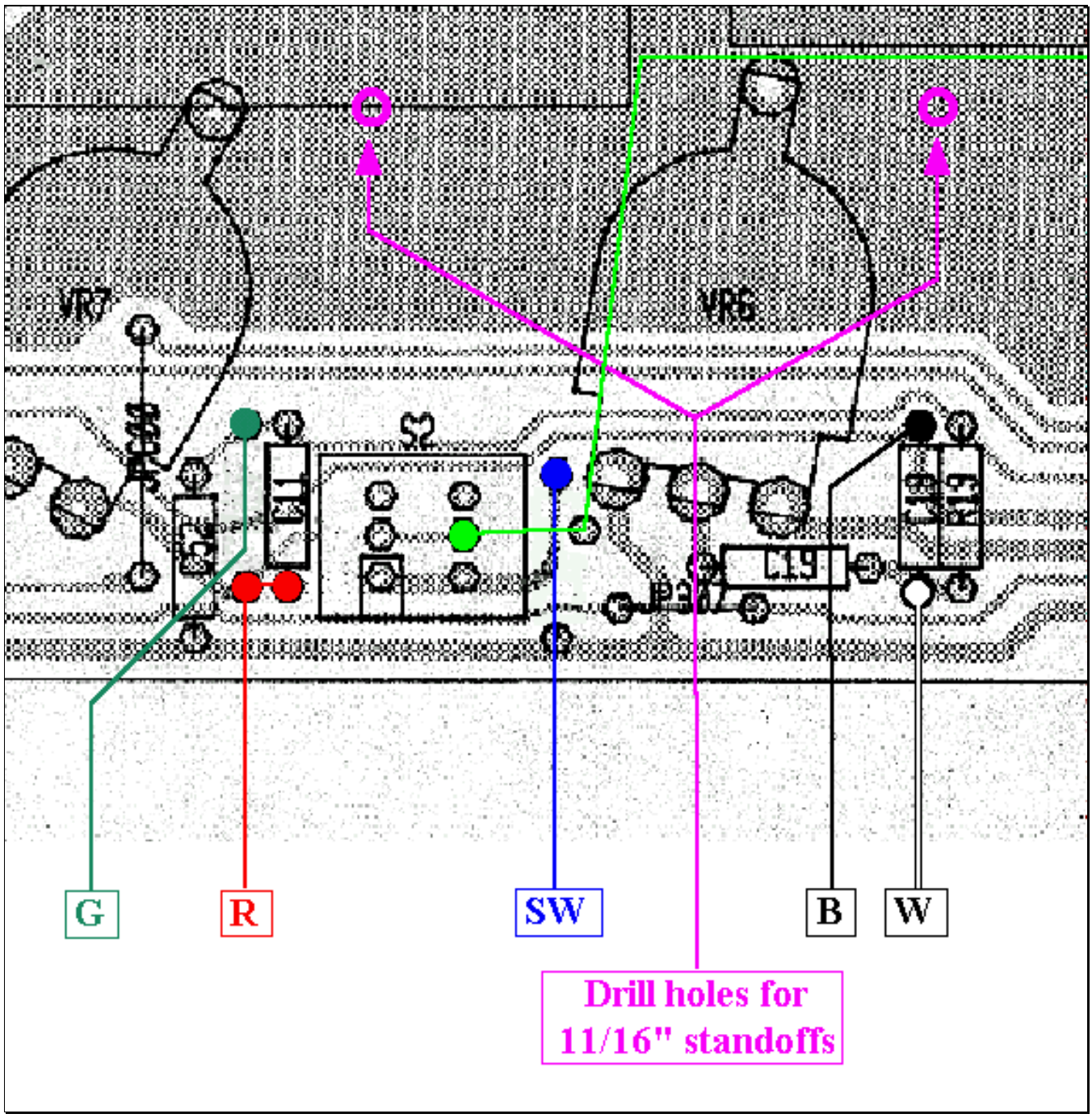
This diagram shows where to drill a small hole with a pin vise to run the lead from the Foot Switch pad.



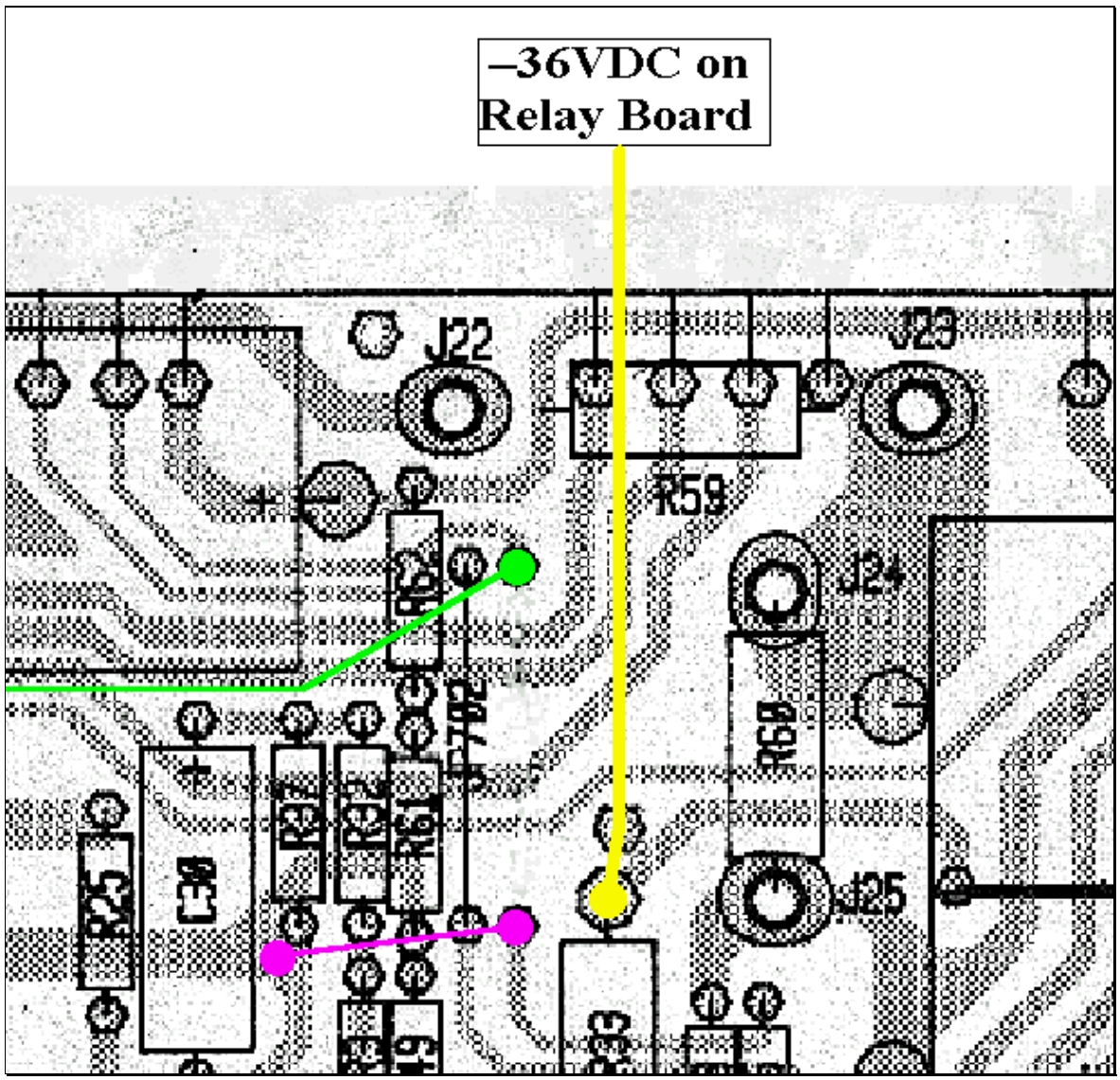
This diagram shows how to hook up the 2 new leads to the Boost switch.



This diagram shows how the wires from the Tone Stack and Boost Switch hook up to the add-on relay board.



This drawing shows the Tone Stack/Boost Switch section of Main Board (component side):



This drawing shows the connections for the relay board and footswitch on the main board (component side):

Final Notes on these mods:

Adding the relay board for the redesigned boost circuit does require a lot of work but it makes the Classic 30 a lot more versatile. If you have any questions or suggestions, send them to me at the e-mail address listed below.

Steve Ahola

March 21, 1998

(Revised 3/22/98)

steve_ahola@yahoo.com

http://www.blueguitar.org/

The Blue Guitar

Peavy Classic 30 Advanced Mods

In Retrospect

After posting these articles on the Peavy Classic 30 I've been getting a lot of e-mail asking me which mods I recommend most strongly, etc. My replies tend to say the same thing over and over again so I decided to write up this evaluation of the various mods.

By far the most critical mod for the OD channel is to modify the Boost Switch circuit. No one except Peavy has ever used a .047uF boost cap to parallel the treble cap. If you check schematics from various vendors, you'll see that boost caps can be as low as 500pf and as high as .0022uf (~2200pf). I personally like a 750pf/500v mica boost cap in the Classic 30 because it doesn't drastically alter the tone structure- it just moves the frequency response curve down approximately an octave for a more midrangy sound that works great for the OD channel, along with kicking the volume up a notch. If you can't locate a 750pf mica cap, you can use a 820pf for a slightly stronger boost and frequency shift. You can try higher values here, but once you exceed 1200pf it really starts to flatten out the frequency response curve (which is good for an audio amp, but not a guitar amp). When you remove the stock boost cap, be sure to take out the 220k bleed resistor and put in something like 1.5M or 2.2M which will reduce popping noises without altering the actual tones.

If you decide to wire in the boost relay you may want to ignore the second set of contacts which adds in a second 0.022uf or 0.033uF cap to the 0.022uF bass cap on the circuit board. The difference between the bass response of a 0.022uF bass cap vs. a 0.055uF one is very subtle; to increase the bass response it would be more effective to replace the 68k slope resistor with a lower value such as 56k or 47k. I may redo the relay board to select between a 33k-39k slope resistor with the boost and a 56k slope resistor without the boost. [Note: a recent post at AMPAGE pointed out that the you can increase the bass response by replacing the **mid** cap, not the bass cap with a larger-valued cap.]

After redoing the boost switch, if you are still looking for a stronger and fuller OD sound, try replacing the .001uF coupling cap (Cx) with a .01uF cap- preferably a Type 715P Orange Drop or a high quality metallized film cap rated at 630v. The larger cap here will allow more of the signal to pass through, especially the lower frequencies. If on the other hand you'd like the OD sound to have more brightness and definition, I'd suggest changing the 22uF cathode resistor bypass cap to a value like 1.0uF. For both of these caps I wired in DPDT switches so that I can select between the 2 values to increase the versatility of the amp.

The Presence control mod can make your amp sound much more alive by decreasing the negative feedback going to the pre-driver cathode circuit. If you don't want to drill a hole to mount a pot and run the wires off the board you might want to try

replacing the 100k resistor with something like 180k or 220k. I usually set the control to fully clockwise (100k) for a stock sound or halfway (approximately 200k) for a more alive sound. Since I mounted the presence control behind the power tubes, it is not very accessible for careful adjustment during a performance. For my uses, a more accessible mini-toggle switch to choose between 100k and 200k resistors would be even more practical.

The Master Volume mod does wonders for the Normal channel- most guitarists have not been able to turn the Normal channel up to 12 and actually survive the experience. But with the MV mod, you can set the Normal volume control to 12 and use the mv to adjust the overall room volume for a very decent cranked Fender sound that is unavailable through the OD channel. I don't think that the MV mod adds much to the OD channel- you can get the same effect by turning down the post volume control. However the main reason I wanted to add the MV in the first place was to be able to turn down the power amp section when the FX return jack was used, either for the loop or to slave the Classic 30 to another amp. The effect on the Normal was like a surprise bonus for me- BTW the MV on the Classic 50 does NOT produce those great cranked Fender tones when the Normal volume is set to 12.

Many guitarists have added the adjustable bias modification and one revision for measuring the bias current is to skip the 5 watt resistor and just replace the hinged jumper wire on the very end to a 1.0 ohm 1 watt precision resistor. There is very little current going through this resistor so a 1 watt resistor is more than adequate.

Other mods not to be overlooked are replacing the preamp tubes and speaker- especially for those guitarists who aren't comfortable working on their guitar amps. Some people have asked why I don't recommend replacing the power tubes as well. I had tried out a few types of EL84's and did not notice as drastic a difference in the sound of the amp as I did when I'd try out different preamp tubes. My opinion on power tubes is that if you can't bias them properly, you aren't necessarily going to get a better sound by switching to a higher quality tube. (The Adjustable Bias Mod is definitely recommended to anyone serious about their Classic 30.) From right to left looking at the back of the amp the three 12AX7 preamp tubes are labelled V1, V2 and V3. For V1 I prefer a Yugoslavian EI 12AX7 for a warmer, sweeter sound perfect for blues leads, although the Sovtek 12AX7WXT+ is also excellent for hard rock leads. The EI 12AX7 is supposed to be a decent copy of a vintage Mullard ECC83, while the Sovtek WXT+ is a very passable copy of a vintage Telefunken tube. For V2, I found the WXT+ to be just too damned hot so I've been using a Sovtek 12AX7WB there (the Yugo EI has too much "character" to work well in that position, at least to my ears). For V3, the stock Chinese 12AX7 works fairly well although my presonal preference is a strong, clean tube like a NOS GE 12AX7WA or Ruby Tubes 7025STR. As for speakers, most people love the added midrange response from a nice Celestion in the Classic 30. If after replacing the tubes and speaker, you still aren't happy with your Peavy amp, you could pay an amp tech to rework the boost circuit as outlined above.

I've gotten some e-messages suggesting other mods for the Classic. One common modification has been to add a cooling fan to reduce the heat build-up from the output

tubes. Over at AMPAGE I've read many posts that recommend using a 230VAC TubeAxial fan wired to 120VAC for lower noise. I think you would want to get the model with ball bearings rather than sleeve bearings. One e-message suggested adding a smoked plexiglass plate to help protect the tubes, with the fan mounted in this plate.

Another common suggestion is to add a Standby switch. While you can use a center-off DPDT toggle switch to replace the stock power switch, they do make a "progressive" switch which would go from Off to Standby to On. Another suggestion was to add a center-off DPDT toggle switch for a Standby switch that would select between 2 tubes for a half-power switch and all 4 tubes for full power, with the center-off position being Standby. This switch would interrupt the normal cathode connections to both pairs of power tubes.

Another question I get asked a lot is: "So how does your amp sound with all of these mods? Is there any way you could post a sound sample?" One answer to the first question is "better than I ever expected it to sound"; more to the point, it has sounds from a Fender, a Marshall, and a Mesa Boogie combo amp. I think that it sounds most like the Marshall Bluesbreaker amp used by Clapton with John Mayall. With strat single coil pickups (especially with the neck and bridge in parallel), you can get the cleaner OD sounds with a nice "bite" not unlike SRV. However, you can't clean up the OD channel by backing off the Pre gain control; with the Pre gain control below 6, the sound is basically unusable (this is the case before and after the mods). I really don't know what Peavy had in mind with over half of the range of the Pre gain control being unusable; to correct that would probably entail a complete redesign of the OD channel (my tone mods are basically just circuit "tweaks"). As for posting sound samples on this site, the file size would be prohibitive and I don't have the hardware hooked up to record WAV files on my computer at this time. And with all of the variables such as guitar type, pickups, controls, playing style and room acoustics, any sound sample posted might be misleading.

Conclusions:

I've had a lot fun working on these projects for the Classic 30 which basically started off as a dare. Most amp techs wouldn't attempt mods to improve the amp because of its printed circuit board design. I really don't blame them for not wanting to experiment with a customer's amp, not knowing if in fact the sound could be improved enough to justify the cost.

In my case, I had bought the amp a few years ago when I was still using mainly humbuckers on my guitars and thought that the Classic 30 sounded better than most of the other amps around in that price range. It wasn't until I switched over to single coil pickups from Lindy Fralin and Van Zandt that I noticed how harsh the OD channel sounded. By that time I was using other amps and considered my Classic 30 to be totally worthless to me.

In on-line forums on tube amps, the issue of the Peavy Classic 30 would come up from time to time ("harsh and weak OD channel", "limited bass response") and I'd suggest to various amp techs that it shouldn't be THAT hard to tweak the circuit enough

to get some decent sounds from the amp. The less-polite replies were basically "if it's that easy then YOU do it!" So I ordered the schematic and board layout drawings from Peavy for $2.50 and compared them to other amps to get some ideas on where to start.

Steve Ahola

August 22, 1998

(Revised 8/22/98)

steve_ahola@yahoo.com

http://www.blueguitar.org/