

CAUTION

This document is only meant for those who are proficient with electronics, in theory and practice—for those who are familiar with electronic safety precautions necessary for working on high voltage electronic devices. This is *not* intended to be a step-by-step guide on how to work on your amp, but just some basic information altering this amp's bias supply circuit to make it adjustable. It is not an official modification of any sort—only an example of what should work well for this amp if the modification is performed properly, and with due care.

It is implied that you know how to prepare your amp safely so that there is no danger to you or your amp before you start this modification. The author of this document takes no responsibility for *any* damage or injury you cause to your amp, yourself, anyone near the amp (while you work on it or afterwards), the electrical system of your building, anyone who ever uses or touches the amp after this modification, anyone who has ever heard of this amp, or anyone who resides on the planet Earth for that matter.

There are high voltages present inside this amp that can kill anyone who doesn't clearly understand how to remove those voltages before working on the amp. Also, when working on the amp, it's possible to damage it such that high voltages become present on the chassis or instrument jacks etc.—if this happens, injury or death could result from someone using the amp. It is assumed anyone who reads this document understands this, and that he tests the amp afterwards for any potential hazard he may have inadvertently caused while working on the amp.

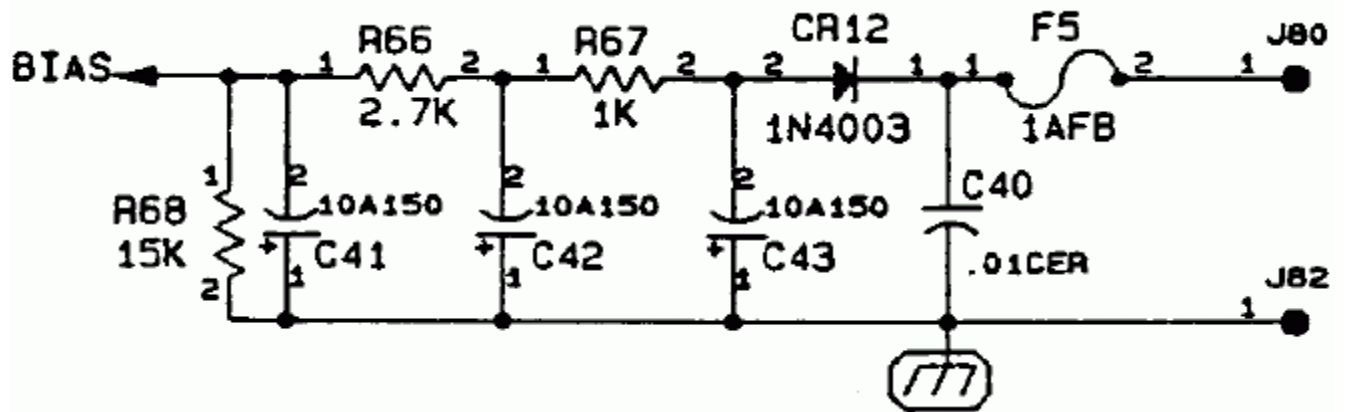
You should understand what the bias circuit's function is and how to troubleshoot it if you don't perform this modification properly. If this modification is done improperly, it is very likely you will destroy your power tubes and quite possibly cause damage to other parts of your amp. As a result, a real possibility is that the amp could become a serious fire hazard. This is normally the type of work you should refer to a trained electronics technician, and not attempt yourself.

Proceed at your own risk.

Take a look at the picture below. This shows the part of the circuit that has the bias supply.

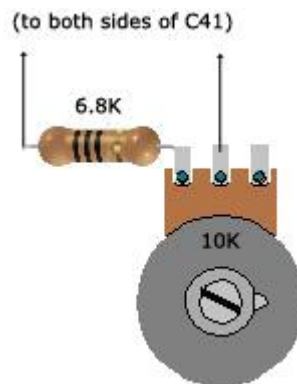


This next picture shows a schematic representation of the bias circuit, for reference.



That 15K (R68) resistor is what you want to change. Cut that resistor out of there with side-cutters. That 10uF cap (C41) directly to the right of it (in both the picture and the schematic) is in parallel with R68. For this bias mod, you'll be adding components to this cap's legs, soldering to them (out of convenience, rather than flipping the board over and soldering to the old traces where the 15K resistor was).

Now what you want to do is wire some components in where that 15K resistor used to be.



Use a 10K pot and wire it in series with a 6.8K resistor, then install that combination of parts in parallel with that 10uF capacitor (C41). If you can't find 6.8K, use a 6K or 7K. (It's not that important—it's just that the 6.8K value is common.) I'd use 1/2W or higher power ratings for both the resistor and the pot.

Use the two pins of the pot, like in the picture. (Assume the shaft of the pot is facing upwards.) This means as you turn the pot clockwise, the bias current will increase (the bias gets "hotter")--counterclockwise decreases the bias current (makes it "colder"). Anyway, you don't have to worry about which end of this combo of resistor/pot connects to which end of C41. There is no polarity to observe. Just make sure one side goes to one end of the cap, and the other side goes to the other end of the cap.

I'd use some decent wire to make the connections—22-gauge or 20-gauge wire. And when connecting the resistor/pot to C41, wrap the wires around the legs of C41 before you apply the solder, to give a good solid connection which won't break if the amp vibrates etc. (don't just touch the two together and use a blob of solder to hold them). For that matter, if the pot doesn't have holes to put the resistor leg (or wire) through, wrap the wire and resistor leg around the posts of the pot before soldering them. Avoiding cold solder or broken solder joints in this case can make the difference between keeping your output tubes operating safely or frying them.

If you're using a pot that's a bit large (like a standard-sized pot used on amps or effect pedals), you may want to use a small blob of silicone to attach the pot to the board so it won't move around when the amp gets transported. That'll take the stress off the solder joints so they'll last.

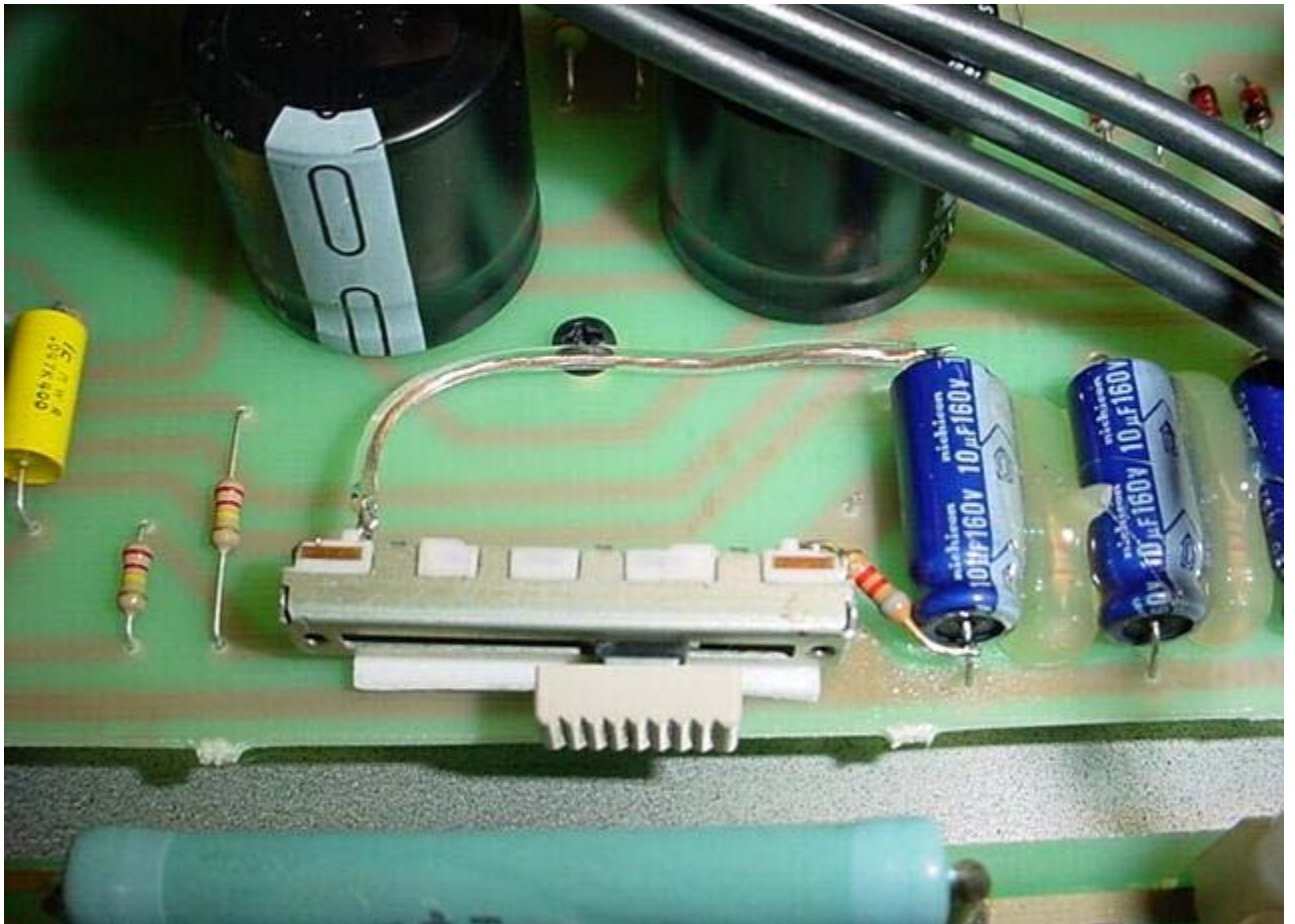
Make sure that any exposed metal elements (wire, solder lugs, component legs) are properly covered in shrink-wrap tubing so they can't come into contact with anything they're not supposed to. If it's not a smaller "thumbwheel" type of pot, once again, the pot itself should be securely held in place on the PCB.

When biasing, start with the pot in the full counter-clockwise position. This will give the full resistance (around 16-17K) across the pot and the resistor combined, meaning indirectly that this will provide the coldest bias setting.

Use a bias meter to help you set your bias current, using the specific tubes' plate power dissipation rating (as well as the plate voltage) as guidelines for your maximum bias current.

Use the formula $I = P / V$ for your current (**I**) calculation, then take $\frac{3}{4}$ of that number as your maximum safe bias current value. Refer to your bias meter's instructions for more info on this. (This document doesn't contain instructions on how to bias your amp, or what settings are recommended.)

Turn the pot clockwise until the bias current gets near the maximum safe value (within a few mA), then remove the bias meter and test the amp. You'll probably want to bias it a bit colder for more definition at higher volumes. Remember that biasing colder is safe—the sound just won't be as good once you bias it too cold.



Someone who used a sliding rheostat instead of a pot to do his bias mod took this picture.

End of document.