AL80B (AL800, AL800H) AL572B Mods and Changes

W8JI rev1e Mar18, 2024

I was responsible for the AL80 series from 1983 until MFJ took over. The first AL80 was a Twinsburg design Prime Instruments inherited. Ameritron-Prime recalled all known AL80s and remanufactured them to Ameritron-Prime standards. Remanufactured units were assigned S/N 300 and up. Revised new units were S/N 500 and up.

The larger and higher-performance AL-80A was the first full Prime design, replacing the AL-80 in the mid-1980s. I sold the kit rights, with some modifications, to Heathkit as an SB1000.

The AL80A ran until I designed the AL-80B. The AL80B has a larger transformer and more features, such as true peak reading directional coupler wattmeters. The AL80B frame and main circuit board, with a different transformer, were also used in the AL-572, AL-800, and AL-800H. This was to increase sales volume using mostly the same parts. This is referred to as the AL8X frame

Required Mods

The AL-80B design was released to MFJ/Ameritron with an open-frame antenna relay. The original Schumacher Electric transformer had a 19 Vac control voltage winding with a center tap. 9.5V on each side went to a full wave rectifier to produce approximately 13.3Vdc. 13-14 Vdc is the target low voltage supply voltage range. A half-wave rectifier powered a 12Vdc negative bus for op-amp use, also at around 13.3Vdc but negative. The negative voltage can be as low as 8-10 volts without ill effect since it only runs the ALC system.

At some point, the antenna relay system and the power transformer were incorrectly modified at MFJ. This causes the voltage in some usings to exceed op-amp power supply differential ratings. Also, looking at all the soldering and fastener tightness in any amplifier is always a good idea. The later the production date, the more likely assembly problems. This kit addresses most issues with the AL8X frame.

The AL8X kit contains:

1. one 1N4739A 9.1V 1-watt Zener (EBS correction)
2. one 2.2K resistor (relay keying correction)
3. one 1N752A 5.6V Zener (relay keying threshold correction)
4. one .33uF to .47uF timing capacitor to replace C152 (C52)
5. two 1N5335B 3.9V 5W low voltage supply correction diodes
6. two 1N5408 meter protection diodes
7. braiding for ground grids in some early AL572
8. two 230V GDTs for tube filaments
9. PTC fuse for 12V aux line to replace 10-ohm fuse resistor

Warning! If your amplifier has pink colored bleeder resistors, they should be replaced. The pink resistors were pulled from production because of high failure rates. When a resistor fails, it damages all filter capacitors in the bank. MFJ, when they ran out of good resistors, started using the bad resistors again. This means any year might have the old defective resistors. If you need these resistors we can supply reliable substitutes. Regardless of the replacement source, you must change the 50K 7-watt pink-color bleeder resistors.

Electronic Bias System

There was one very early change in the bias system. The RF sample pick point was moved to the output of the input circuit (tube side of the input). The early tap point at the relay caused threshold-level problems with some radios and some amplifier-to-radio cable lengths. This early correction removed the EBS sample point from the antenna relay. The tap was moved to the tuned input switch tube side. It traditionally uses a violet wire and relocates C3 from the power

Figure 1 Violet wire EBS Tap Point

supply board to the violet wire's end at the input switch. See **Error! Reference source not f ound.**

(This early 1990s violet wire change has never been corrected on circuit boards or in the schematic.)

The AL80B only needs one EBS system update. Sometimes audio momentarily clips when the amplifier auto-bias is coming out of the cut-off state. Adding the 1N4739A 9.1V 1-watt Zener supplied in the AL8X kit corrects this issue.

In older open-frame relay units the kit Zener installs as shown with the black-banded diode end toward the empty hole at the end of the trace from the large black transistor on the center panel. The other end of the diode sweat solders to the junction of R30, D3 band end, and C32 far end. R30, D3, and C32 are a common connection point for the unbanded diode lead.

Figure 2 older unit EBS Zener mod

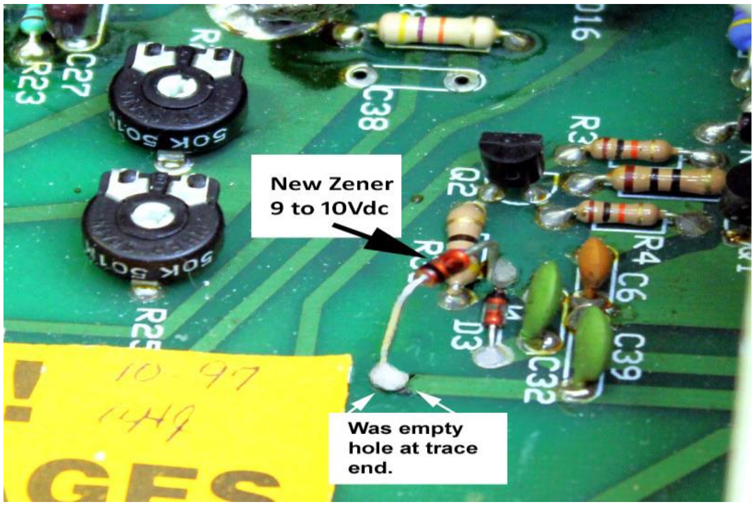


Figure 2 older unit EBS Zener mod

Newer units lack the empty hole in this trace. Later circuit boards with cube (enclosed) relays need the bias Zener installed differently. This is the same electrical circuit position, just a physical location change. In newer units, the Zener fits where this orange arrow shows. Figure 3 Newer unit EBS Zener mod

With newer units, pre-form the ~ 9V Zener as shown (note: the exact voltage is not critical). Cut the leads each about ¾ inch or so long before bending. Just be sure the diode will fit the final position before snipping! Figure 3 Newer unit EBS Zener mod

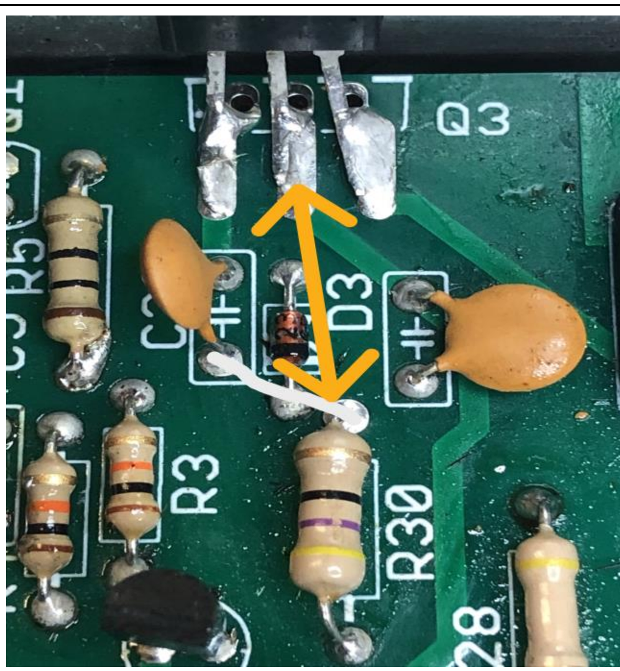


Figure 3 Newer unit EBS Zener mod Zener diode location

Zener diode prep for newer models (lacking board hole)

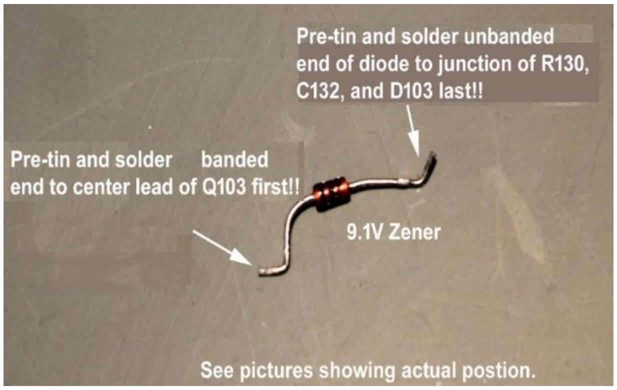


Figure 4 Prep Zener for later AL8X board

Later AL8X frame amplifiers require the banded Zener lead sweat solder directly to Q3 (big black power transistor) center lead. The unbanded wire end ties to either R30 or D3 banded end. R30, C32, and D3 are common. A short or accidental solder bridge between them at the common point does not matter.

Reminder: The schematic and parts list starts at 100 for this board, making schematic and parts list D103 show as D3 on the board. The circuit board part number is 100 less than the schematic, so C108 on the schematic is C8 on the circuit board printing.

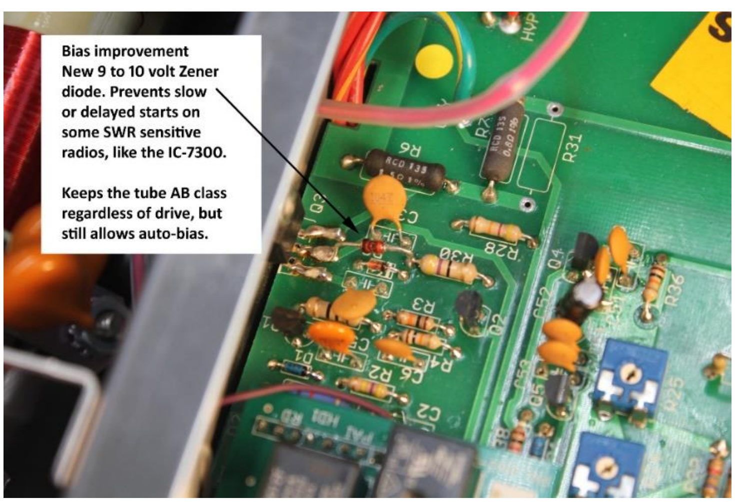


Figure 5 new diode from center of transistor Q3 to R30 or D3 (banded) end.

Antenna Relay System

Note: ***The early open frame relay boards do not have relay keying voltage and speed issues. The early amplifier relays switch in time<13 mS and have normal current. Early open-frame relay amplifiers do not need antenna relay system corrections.***

Early production amplifiers used larger open-frame relays. The early relays have a 13 mS or faster transfer time. Keep this in mind when setting TX delay times. 15mS is plenty of TX delay in radios like the IC-7300. Here is an early open-frame relay in the early AL8X series:

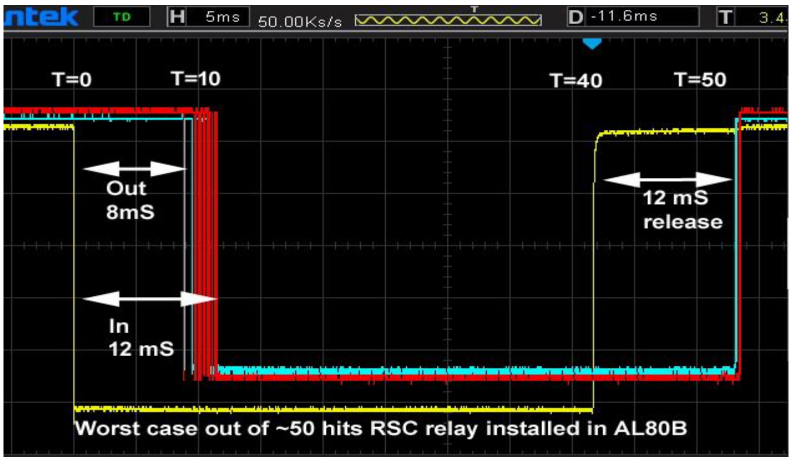


Figure 6 Relay timing early open-frame RSC relay

The later MFJ-modified AL8X enclosed-relay (cube relay) systems have severe design problems.

All unmodified two-relay (cube or DIP-style relay) AL80B, AL800, AL800H, and AL572 amplifiers have three problems as later (post ~2005) amplifiers are shipped from the factory:

1. The keying line state threshold is too low, a drop of only 0.6 volts from open circuit voltage partly enables the relay system
2. The keying line impedance is too high, even 100k ohms leakage affects the relay system
3. A relay timing problem, the input relay is delayed far too long

These errors cause slow switching times and shorten relay life. They also make receiving through the amplifier less reliable. A timing measurement is shown in Figure 7 unmodified cube-relay amplifier timing

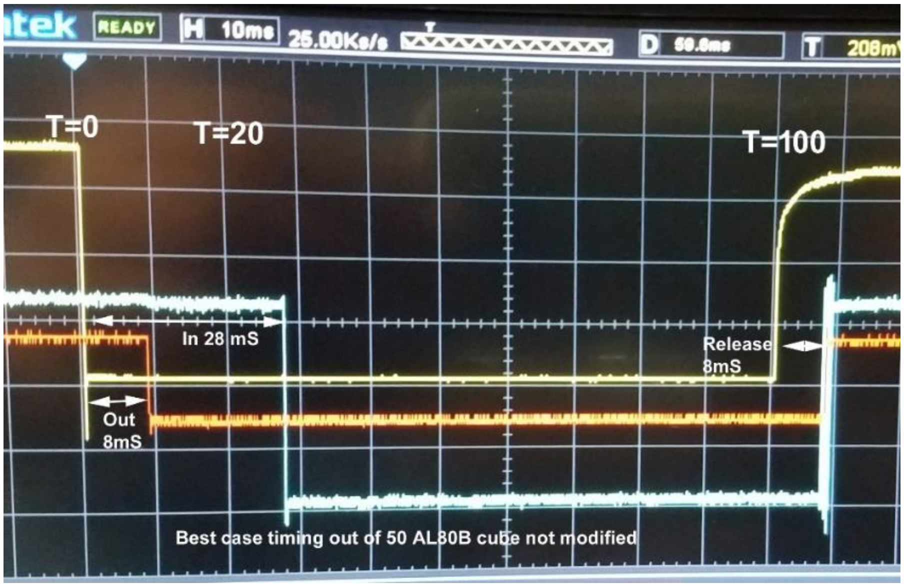


Figure 7 unmodified cube-relay amplifier timing

A reasonably simple circuit modification corrects best-case timing from 25-35 mS to about 7-8 mS in the worst case. This mod uses a 2.2K resistor, a 1N752A 5.6V Zener, and one .33uF to .47uF timing capacitor. One diode (not on the MFJ schematic) is removed, and one electrolytic (C52) is replaced by smaller capacitor.

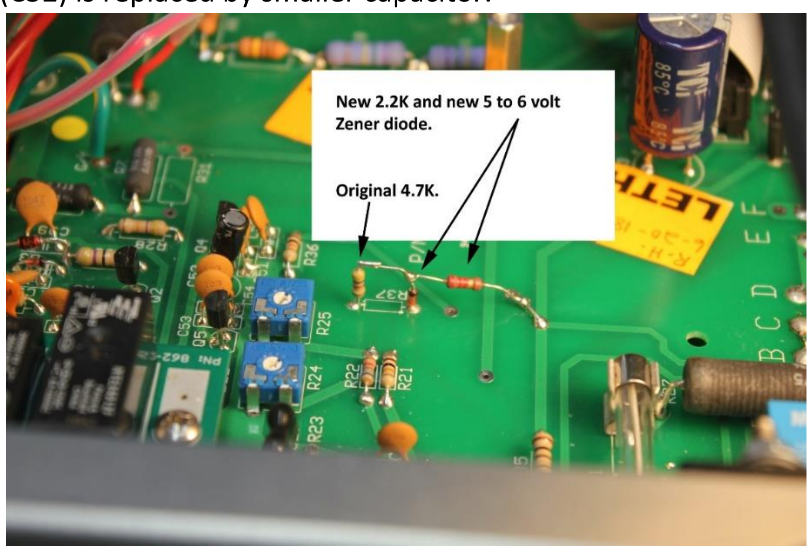


Figure 8

The original 4.7k resistor R37 is lifted on the end shown. A Zener and 2.2K pull-up resistor are added. This modification creates a much lower source impedance via the new 2.2K resistor. The ~5-volt Zener greatly increases the threshold. The source current goes from a fraction of a milliampere to about 4 mA with a threshold voltage of about 5-6 volts instead of less than .7

volts. This modified system is well within the range of virtually any radio. It makes the keying line less sensitive to capacitance, RF, or leakage resistances. (Diode D121 is shown backward on the schematic.)

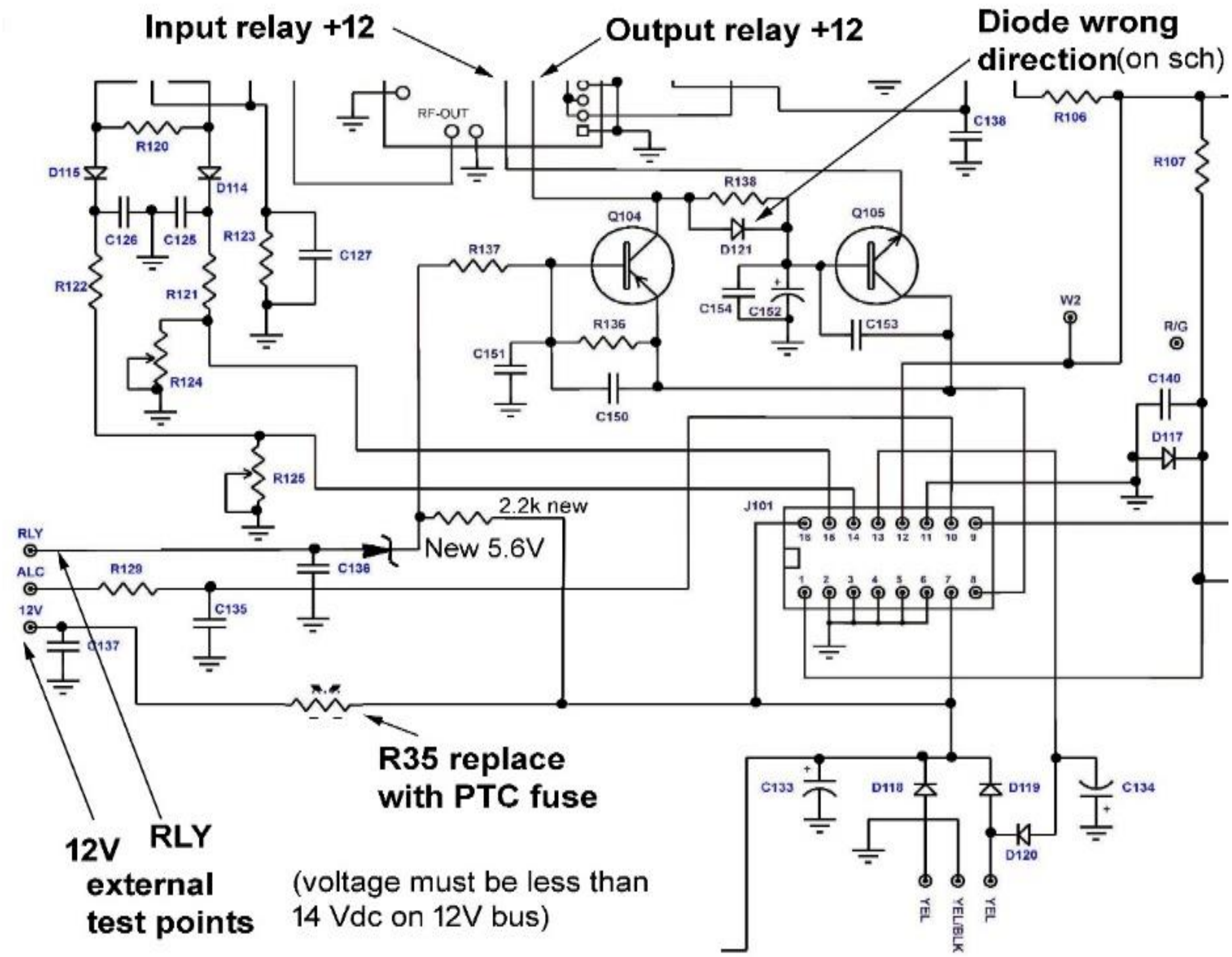


Figure 9 Relay area schematic

C152 (labeled as C52 on the board), a small electrolytic, must be removed and replaced with a .33 to .47uF capacitor.

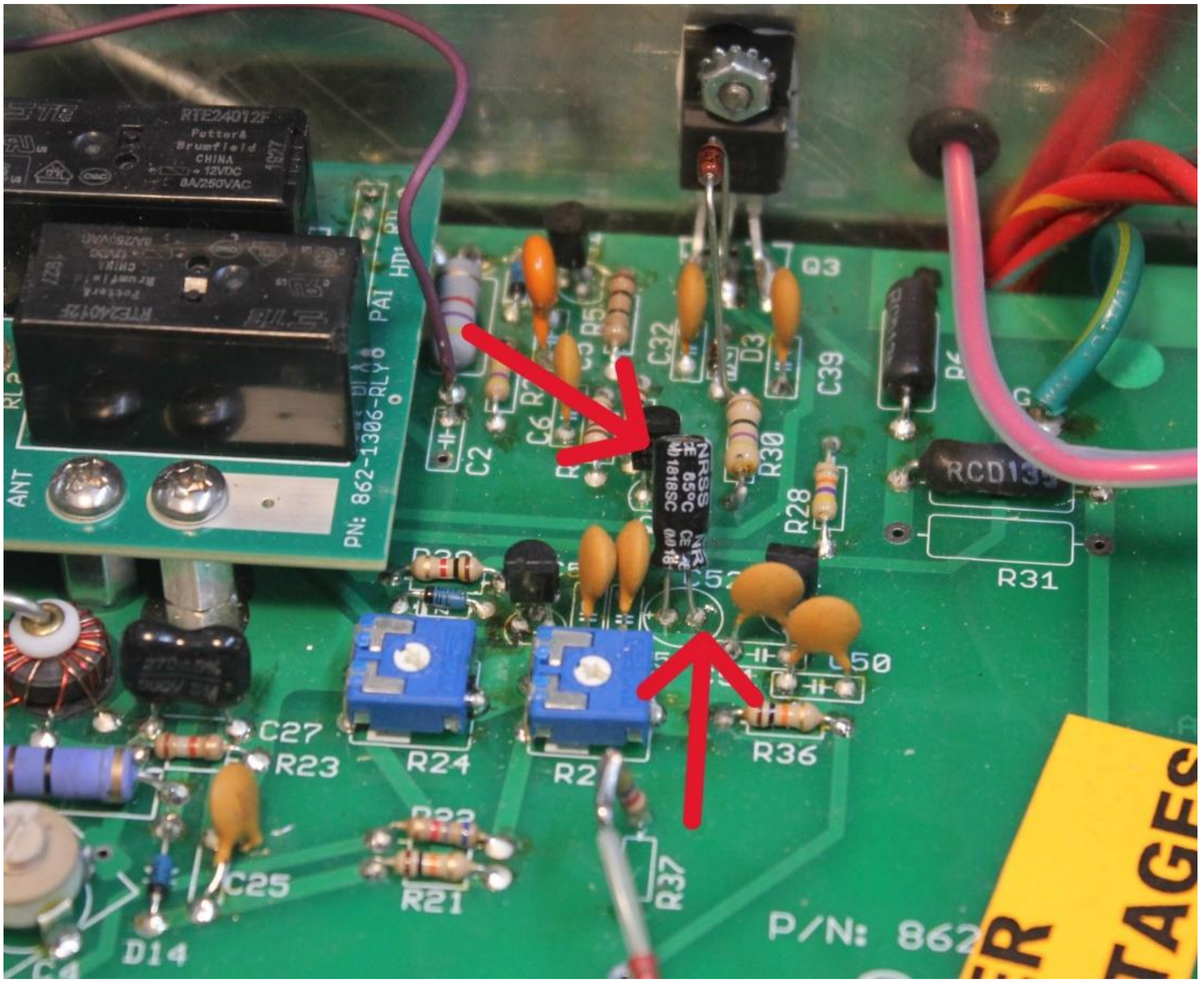


Figure 10 remove C52 (C152)

C152 is replaced with the kit's small .33 to .47 uF capacitor. The kit capacitor is not sensitive to direction.

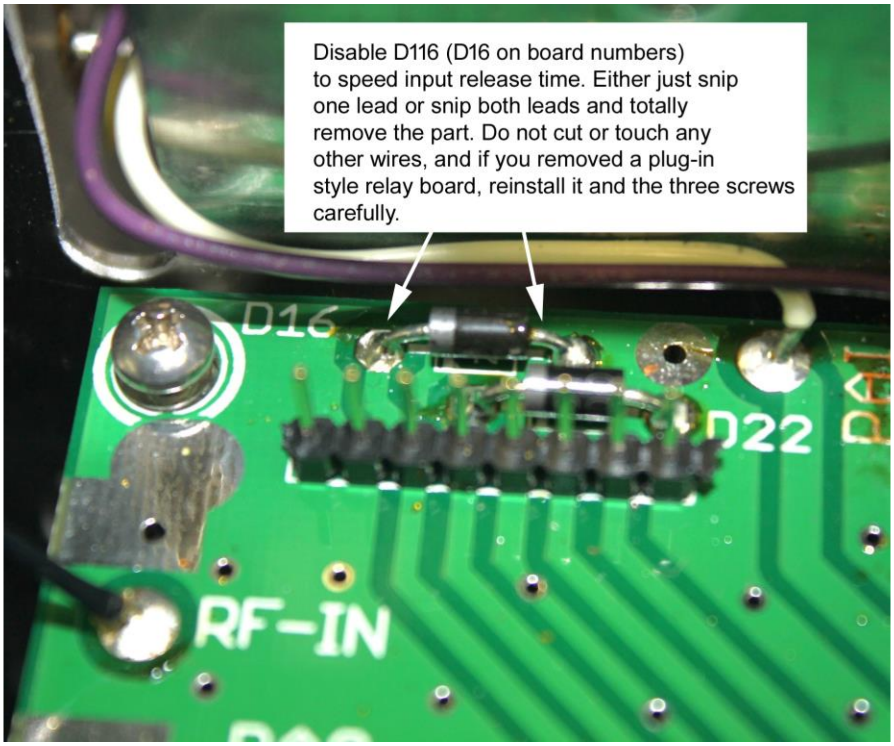


Figure 11 Remove D16 (D116)

These mods make the internal relay switching time about 7 mS as opposed to 25-35 mS.

High Voltage Power Supply

The high-voltage power supply in the AL8X series (AL572, AL80B, AL800) is pretty reliable. The only common problem spots in the HV supply area are units with pink or light tan colored 50K 7-watt bleeder resistors. We have a policy of changing the pink or tan resistors shown in Figure 11. Any good quality 7-watt 50k-75K ohm resistor can be used to replace the troublesome resistors.

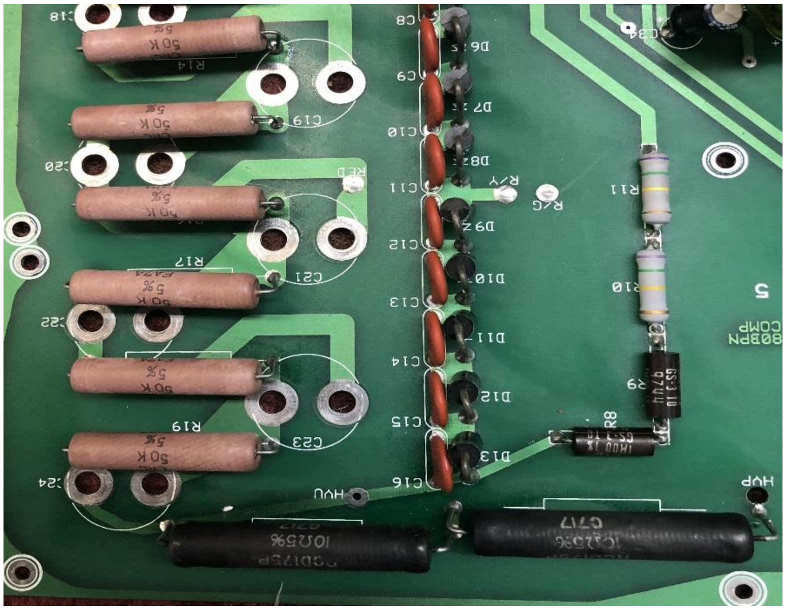


Figure 12 Pink Bleeders and fault resistors

The two black 10-ohm fault limiting resistors at the bottom of Figure 12 are an excellent idea. If you need the replacement bleeders or the 10-ohm parts let us know.

Low Voltage Supply System

Some transformers, I have no data on exactly how many, are incorrectly wound. The safe way to determine incorrect transformer voltages is by measuring the 12VDC rear panel jack center pin to the amplifier chassis or rear panel. This amplifier must have a minimum of 13 volts and a maximum of 15 volts on the rear panel 12VDC jack. The ideal target is 13.5-14 Vdc. The absolute maximum is 16 volts. Voltage above 16Vdc places one of the ALC op-amps and other components over maximum voltage ratings. This can lead to component failure. Going too low on voltage will excessively slow the T/R relay.

Voltage can be reduced by patching in bucking Zener diodes at the low-voltage rectifiers. Our kit has two 1N5335B 3.9Vdc Zener diodes. If the voltage is over 17 Vdc, install a suppled 3.9V 1N5335B Zener diode in the negative and positive system as shown. Be sure the 12V line, as tested at the rear jack, does not go below 13.5 Vdc. If the voltage is 14-16Vdc, just install one Zener in the negative single rectifier. You can leave the dual diodes on the positive side alone.

The op-amp that goes over-voltage runs on a differential between the negative and positive supplies and is rated at 32 Vdc differential. At 16 Vdc on each supply, the op-amp is right at 32 Vdc. Reducing the negative supply to -10 to -12 volts will be enough to save that op-amp.

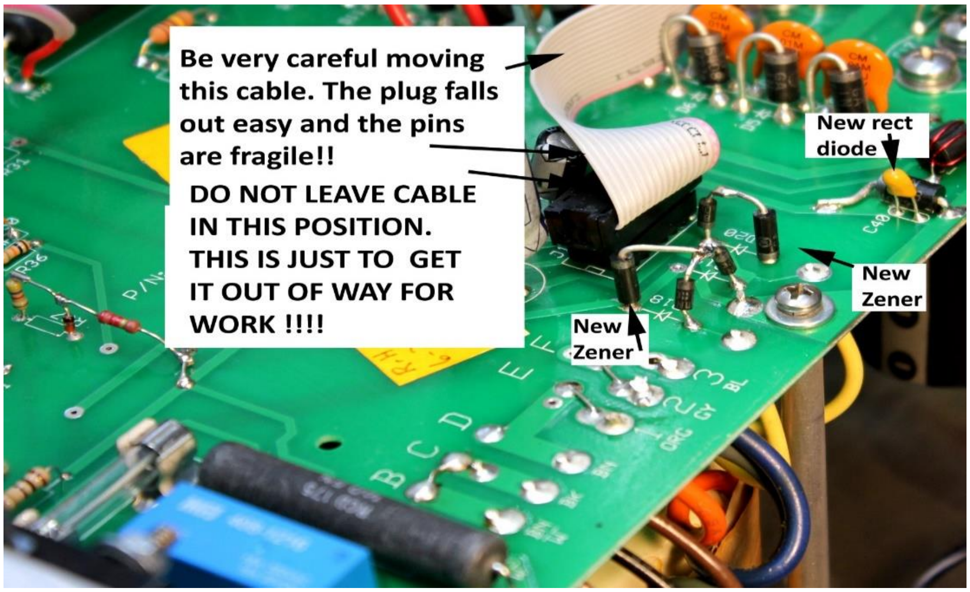


Figure 13 New Zener buck diode in severe 12V supply cases installed as shown.

While working on the board, it does not hurt to upsize D17, the meter protection diode, to a 1N5408 or higher current rectifier diode. This will reduce D17 failures from minor tube arcs. We include a new D17 as a 1N5408.

12V External Fuse

R135 (R35 on board) should be a 10-ohm ¼-watt film-type resistor (ideally metal) used as a fuse. The 12V jack is low current, provided for external “power on” or external accessory lights or metering in antenna tuners. To prevent damage if the 12V jack is overloaded or shorted, R35 was added. R35 limits short current to 1.5 amps until the resistor opens.

R35 can be replaced with a PTC auto-resettable fuse included in this kit.

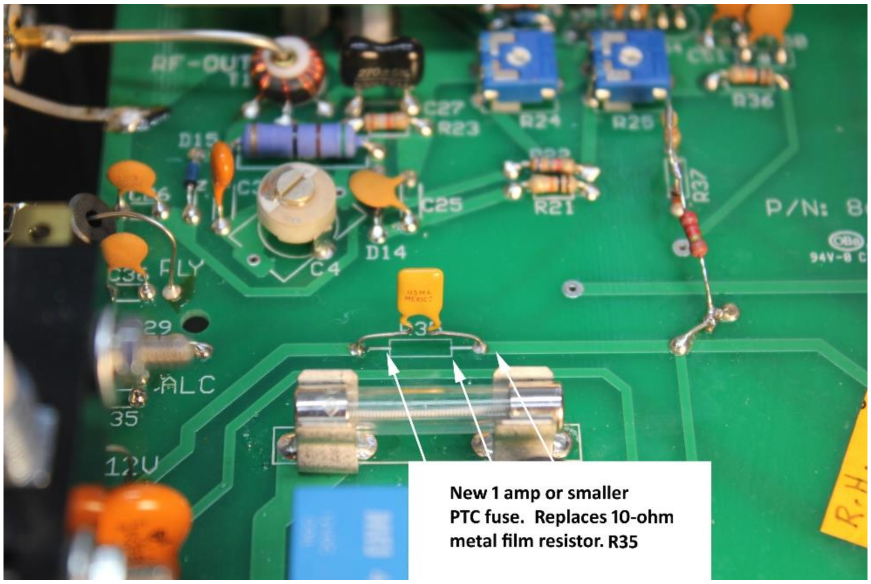
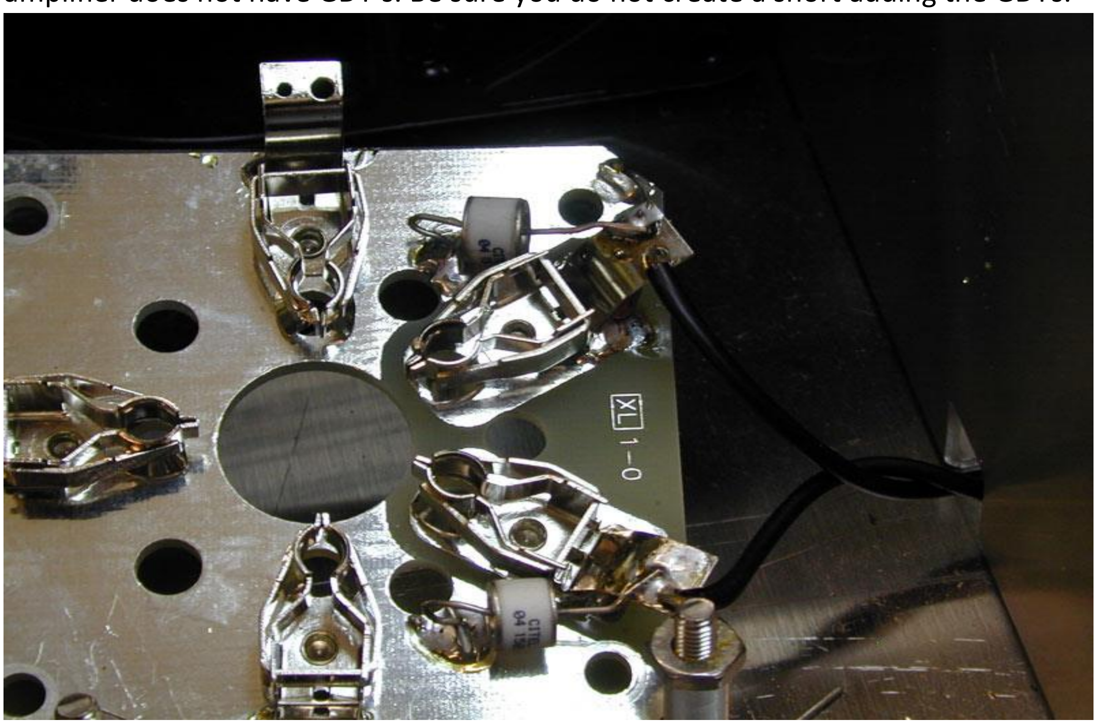


Figure 14

Socket Mods

Remove any red color MOVs near the filament choke. Install two supplied GDTs under the socket, unless your unit already has them. The socket is relatively easy to remove if your amplifier does not have GDT's. Be sure you do not create a short adding the GDTs.



Additionally, look for red MOVs (they will not have a capacitance value on them) on the supply side of the filament choke. Remove all MOVs.

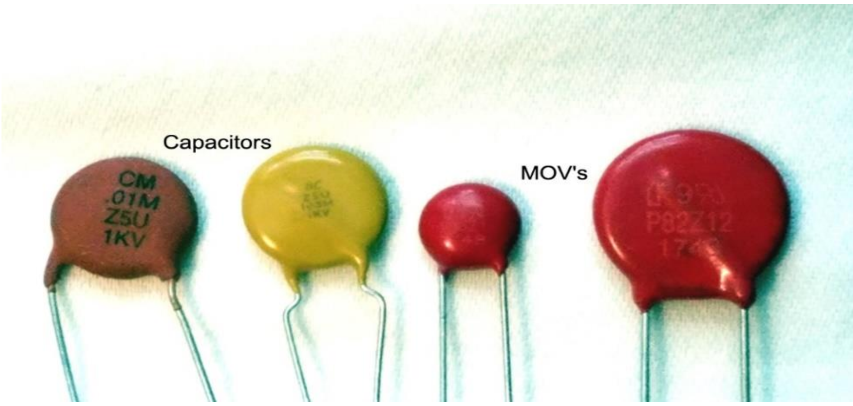


Figure 15

This is the final ribbon cable location!!!

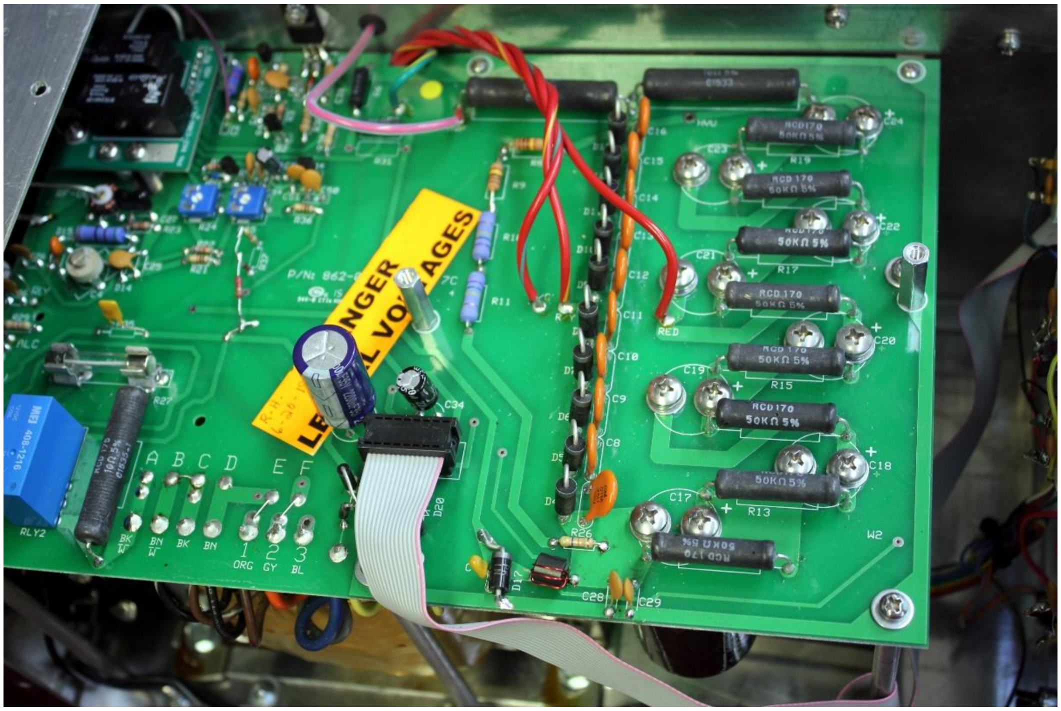


Figure 16 properly updated unit

Early AL572 Control Grid Modifications

Early AL572 amplifier had control grid floating. We include braiding to ground the grids. Hopefully your amplifier will have a removable chassis bottom plate below the tubes.

Remove that plate and remove the four resistors and the orange .01 uF 1kV disk capacitors that go from the control grid pins to the printed circuit board that is used as a tube chassis. The braid can be soldered directly to that silver board.

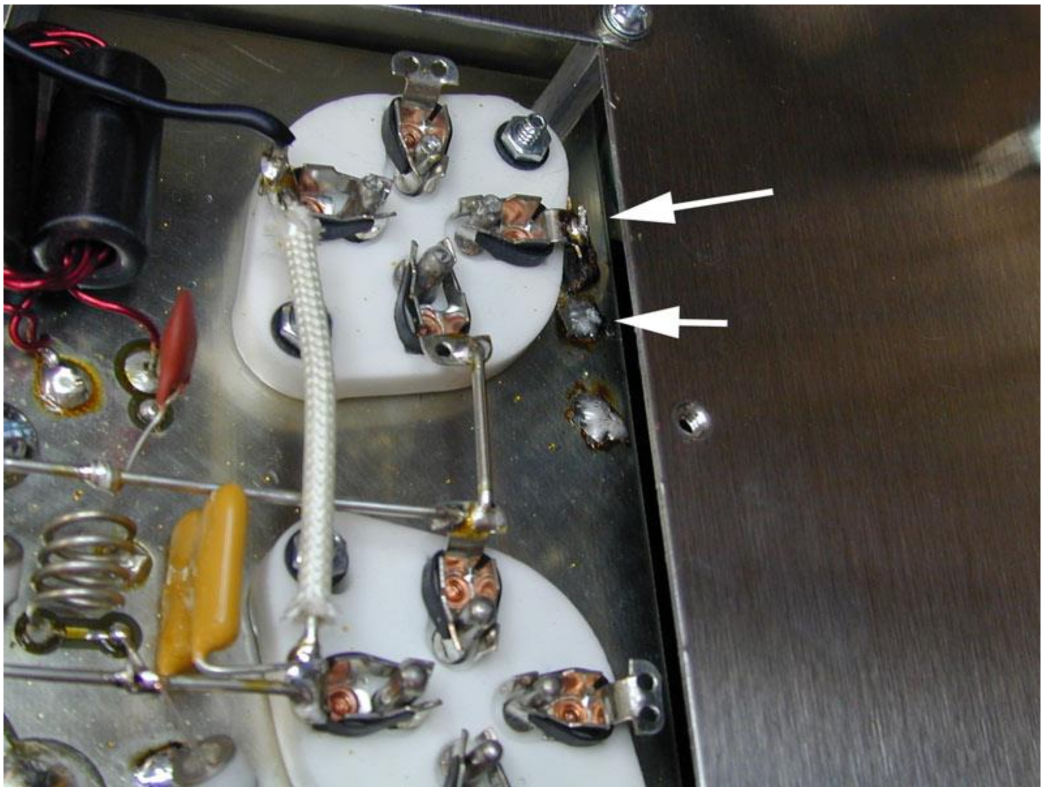


Figure 17 Ground 572B control grid pins

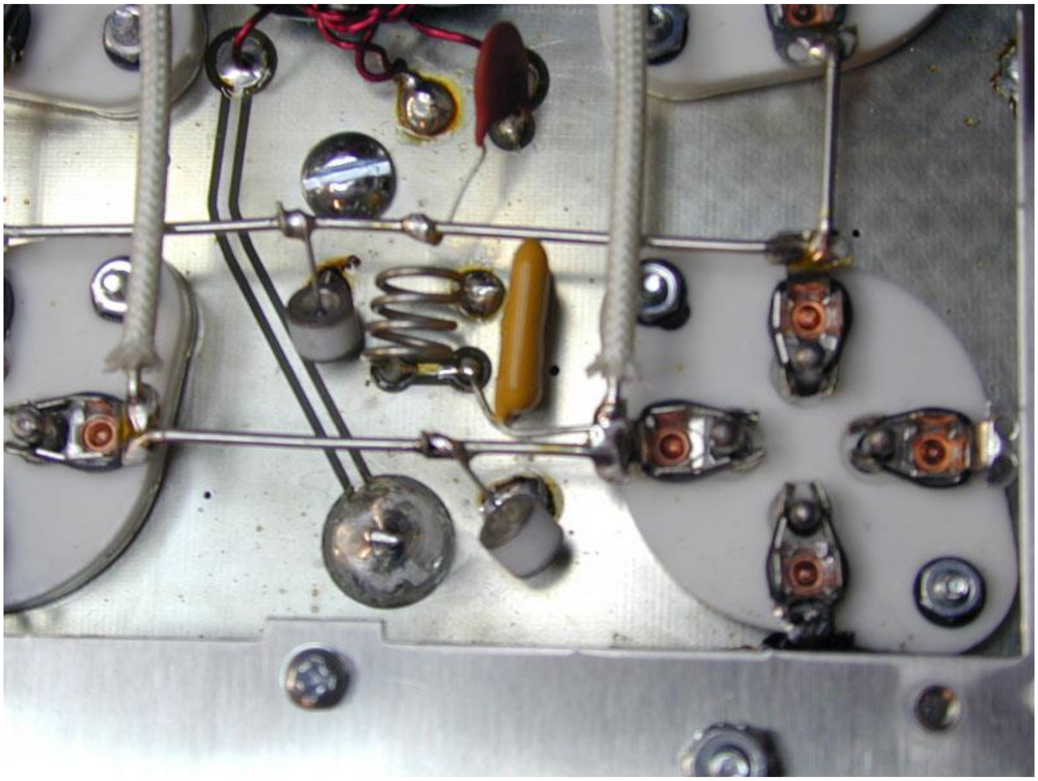


Figure 18 GDTs AL 572 amplifier

Add GDTs, one from each side of the filament, to the silver board. Be sure to not accidentally cause a short circuit.

SWR Bridge/ Directional Coupler

The SWR bridge and directional coupler is another chronic problem. The original layout was supposed to have a grounded eyelet in the coupler transformer. The grounded eyelet allows the use of a Teflon-insulated wire through the eyelet.

A patch for this error was changing the center insulator from plastic to a white Teflon. A good transformer has a pure white Teflon center insulator in the toroid.

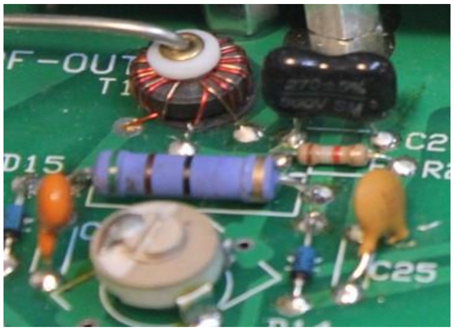


Figure 19 Good transformer insulator

A translucent plastic insulator will occasionally arc, damaging the bridge diodes.

Figure 20 unreliable insulator

In severe cases the wrong insulator will cause the circuit board to carbon track and fail:

Figure 21 damaged board

We now have a replacement bridge for chronic diode or carbon-track board failures.