AL80B AL572 AL800(H) Updates and Error Corrections

Rev2A 2/17/23 W8JI

Note: Because these parts are inexpensive when compared to shipping and handling costs, all of these parts are integrated into one AL8X series parts kit. The kit contains everything in each category and is identical across this amplifier frame series.

Relay System

AL80B, AL572, and AL800 amplifiers all share a common basic frame and power supply layout. This amplifier group originally used open-frame relays for both step-start (12Vdc SPDT) and antenna relays. The original antenna relays were 100mA 12Vdc coil 3-pole relays. The outer two signal poles are traditional double throws, the center pole is a unique single throw normally-open pole. Removal of the center normally-closed pole increases contact pressure on the receive pass-through signal poles, increasing receive reliability.

The original open frame Rx/Tx transmit switch time is less than 12mS, a 10-13mS radio TX delay should be more than enough with these large open frame relays. Early open-frame relay systems behave well, requiring only normal minor care. Unless abused by improper cleaning or other damage these relays will last decades.

At some point, someone at MFJ modified the antenna relay system to use two plastic case miniature cube relays. MFJ-modified systems using two relays have major relay timing and keying line impedance (sensitivity) problems. The small cube or enclosed DIP relays themselves switch and settle in 6mS or less. However, MFJ circuit design errors needlessly extend relay closure into the 20-30mS region. The system should actually be in the 6mS area. Making matters worse, the relay return-to-receive is very unreliable due to major relay control line impedance errors.

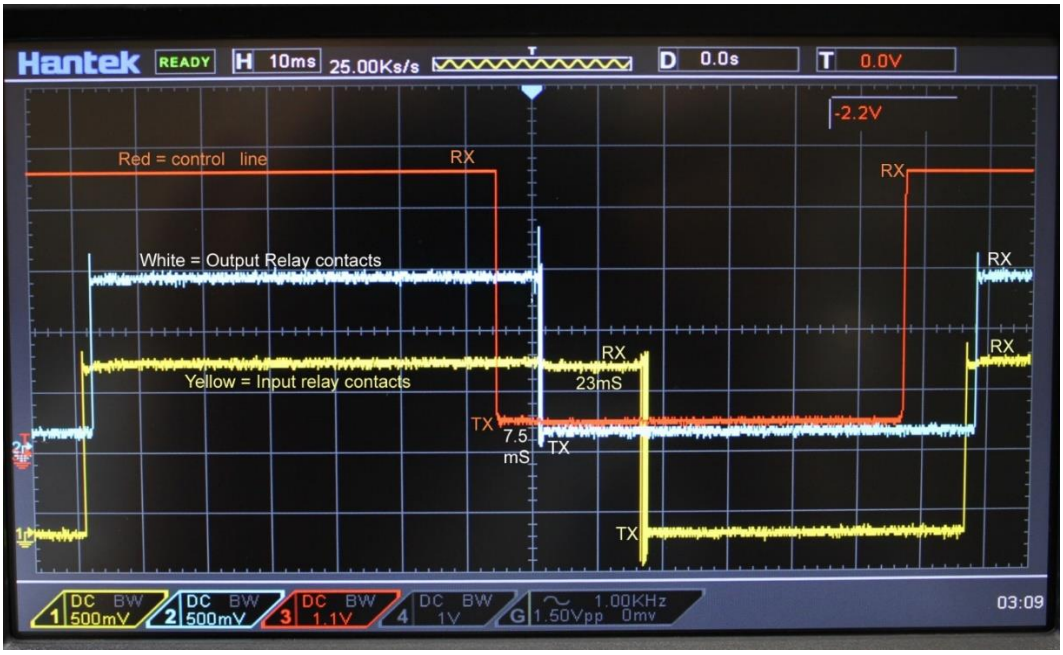


Figure 1 Stock timing

Factory circuit errors in all “AL8B frames” using small enclosed relays cause shortened relay life, unreliable receive return, and grossly excessive TX delay time requirements. The basic dual relay keying circuit design is very poorly planned, but a few simple patches will make it workable.

Relay System Modifications (Dual Cube Relays of all models and dates)

Parts Required:
(1) 2.2k ¼-watt or larger resistor
(1) 5.6-volt small (1/2 watt or larger) Zener diode
(1) .33uF to .47uF capacitor
(1) little itty-bitty bit of sleeving

The switch to transmit time is the critical time that must be programmed into the radio. Unless the radio has a severe design defect the receive-to-transmit window is the only switching window causing hot-switching and thus the only window of concern. Figure 2 is the leading-edge (RX-to-TX) result of these changes (other issues not shown that improve relay life and receive recovery time are also corrected):

Figure 2 modified timing

Note: Components on this board have the leading digit omitted. In addition there are some label and schematic errors. I will point out any errors.

1.) Remove D116 (the board’s numbering omits the leading 1 and says “D16”). D116 needlessly slows input relay return time. D116 is near the center panel rear. Plug-in relay units will need the relay board removed. Just snip either end of D116 with small cutters. There is no reason to remove D116

entirely so long as it is disabled by snipping a lead. D116 is the diode with zero ohms continuity from Q106 emitter to D116 striped end (cathode).

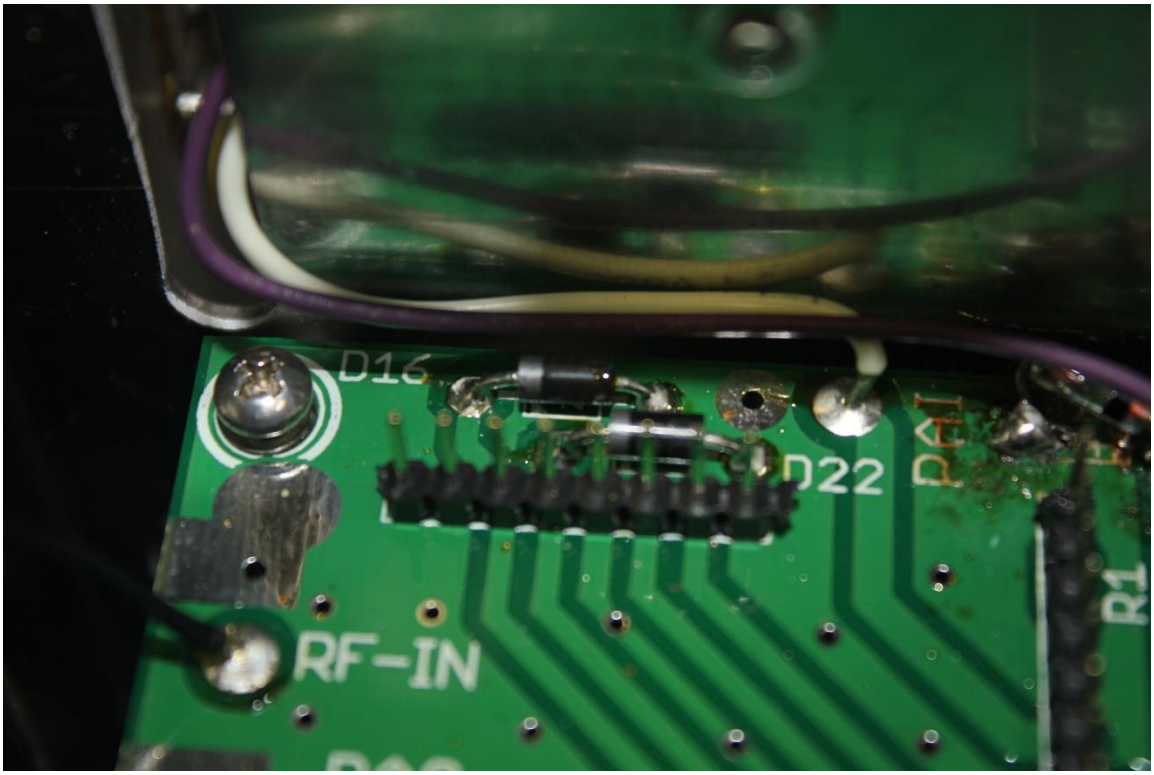


Figure 3 (plug-in relays) D116 location

2.) Unsolder and lift the ***RLY jack end*** of R137 4.7k from the circuit board pad. It is a good idea to first re-wet or reflow that solder connection with regular 60/40 solder. Be careful to not overheat the pad and lift it.

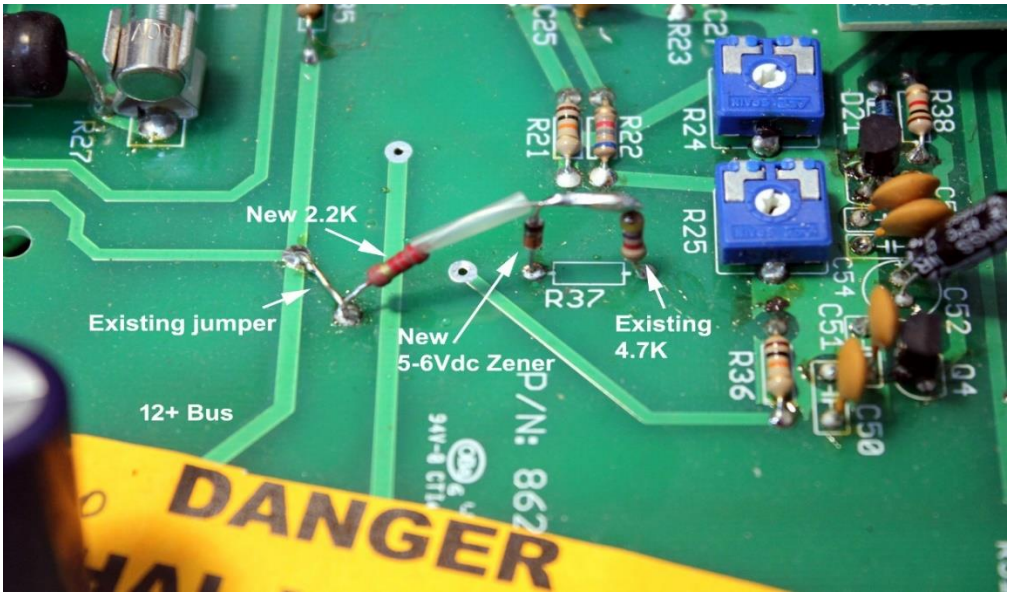


Figure 4 Zener and resistor mod

3.) Referring to figure 4, the new 5.6Vdc Zener diode connects with the banded end up to the end of the 4.7k lifted in step 1. This diode makes the threshold voltage on the relay control jack more reasonable at normal logic levels.

4.) A new 2.2K resistor bridges from the ~12Vdc control line voltage bus to the junction of the Zener banded end and the lifted end of R137. This resistor reduces the relay control line impedance to a more reasonable level of a few thousand ohms, making receive return more consistent.

5.) Radial lead 10uF C152 (sometimes listed in parts as C153 while labeled C52) needs removed and replaced with a .33uF to .47uF capacitor. This capacitor largely causes the significant transmit timing problem in dual relay amplifiers.

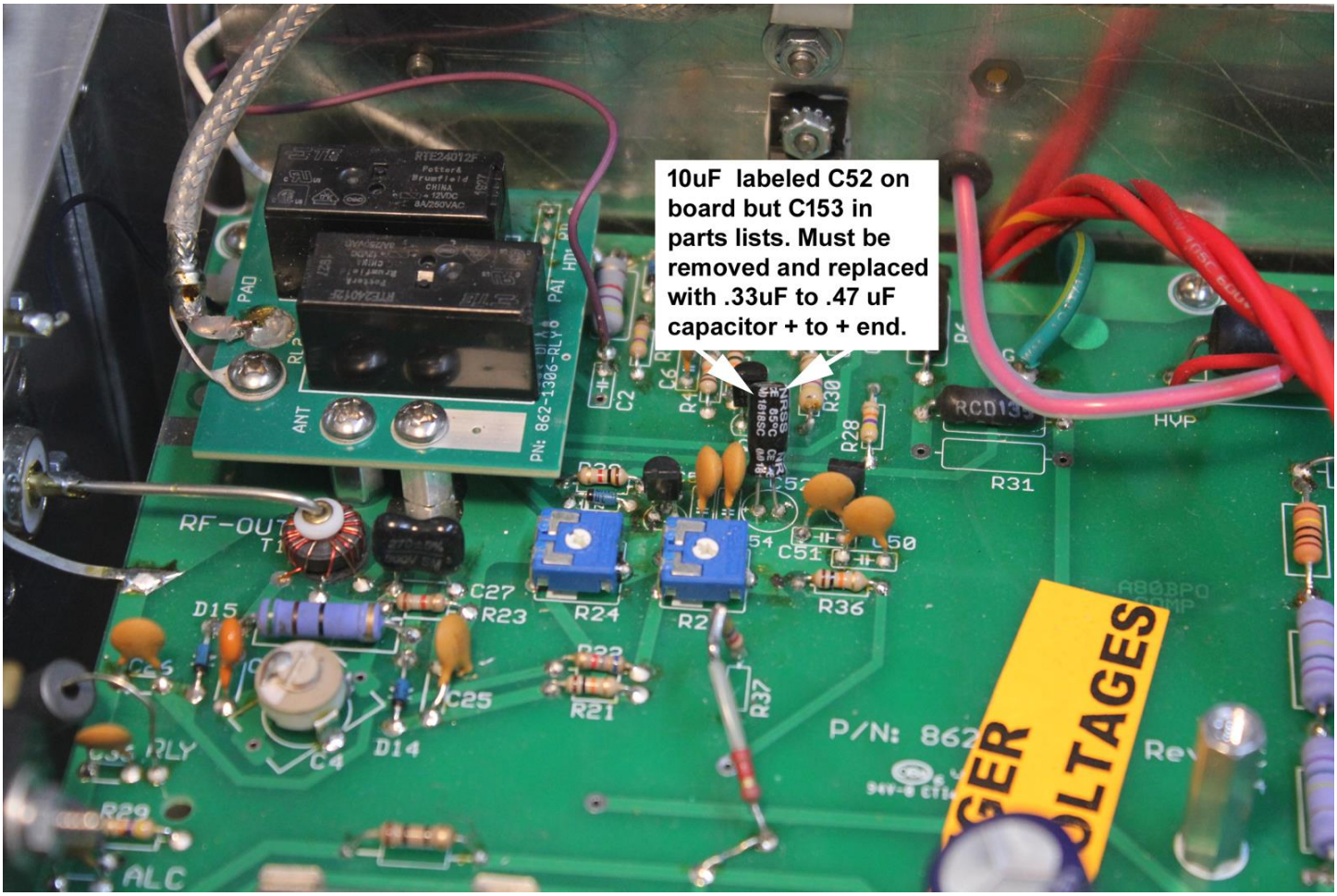


Figure 5 Relay Timing Mod

The reworked relay system now looks like this (note that D121 is drawn backward in some or all MFJ schematics, although D121 is usually installed in the correct direction as mounted in the circuit board):

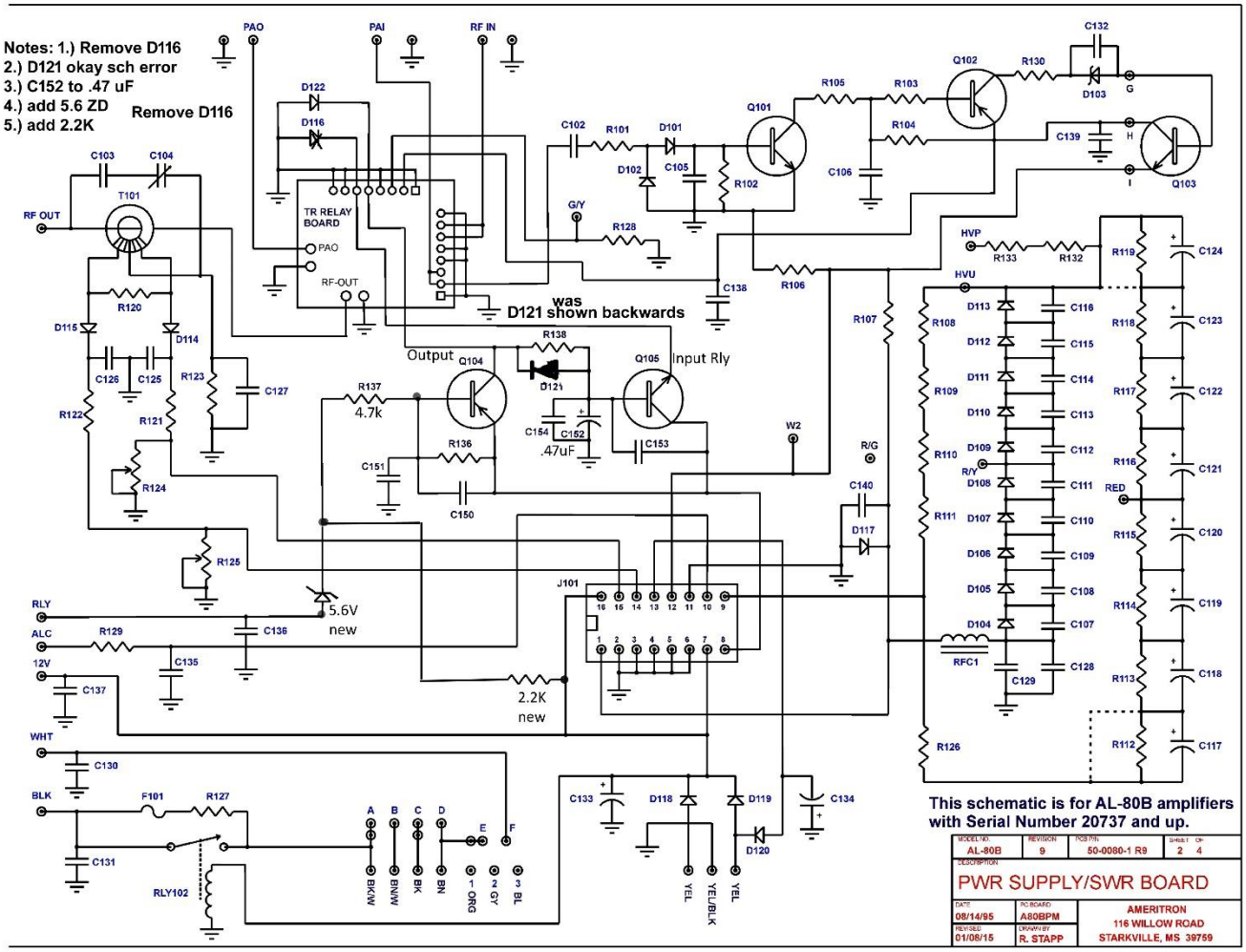


Figure 6 Modified relay circuit

The relay system with these simple mods is now about 6mS receive-to-transmit turnover time. Any exciter TX delay setting beyond 7mS will be more than enough.

NOTE: NONE of these changes, including TX delay settings, affect ALC overshoot! ALC overshoot is not related to relay switching times. ALC overshoot is an exciter (radio) design problem.

Electronic Bias Modifications (all units)

Parts Required:
(1) 9.6Vdc Zener diode

(1) .33 to.47uF capacitor

(1) .1 uF disc capacitor (careful, it looks like the PTC fuse)

The electronic bias system in the AL8B frame amplifiers went through one authorized change very early in production. This change was relocating the sample point from the T/R relay tuned input contact to the output side of the tuned input. This was accomplished by adding a violet jumper wire directly from the input switch wafer to C102. I have never seen this corrected in schematics, but this correction must be made.

1.) Add 9.6V Zener diode from either side of R130 to collector (middle terminal) of Q103, banded end to Q103. The Zener can sit up in the air a little.

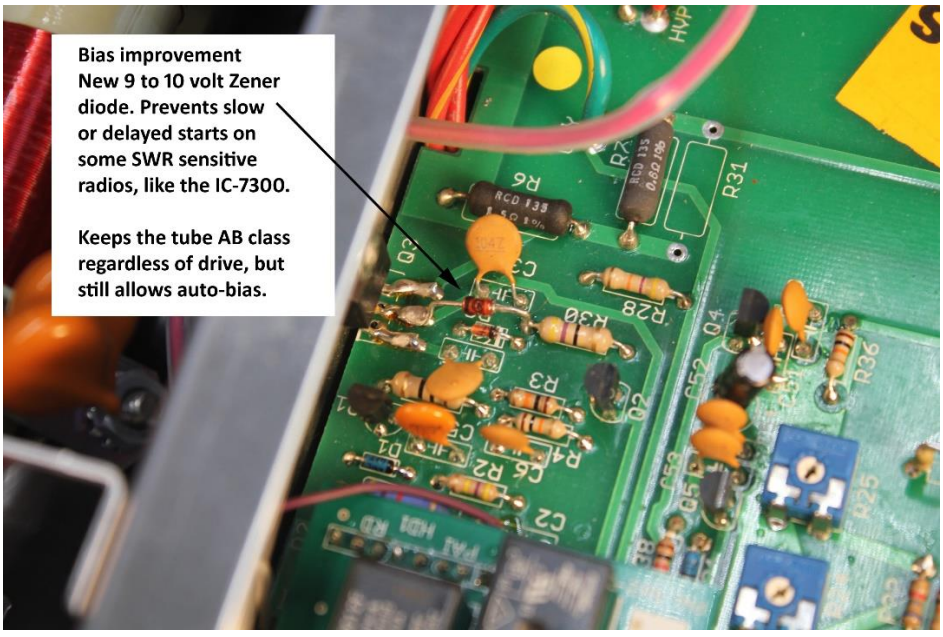


Figure 7 bias changes

2.) Tack-in a new 0.1uF capacitor from junction of R103, 104, 105, and C106 to ground. You may want to clean up some of the MFJ soldering while working on the amplifier. This one has not

been cleaned up!

Figure 8 bias hang time

Corrected Schematic All Mods

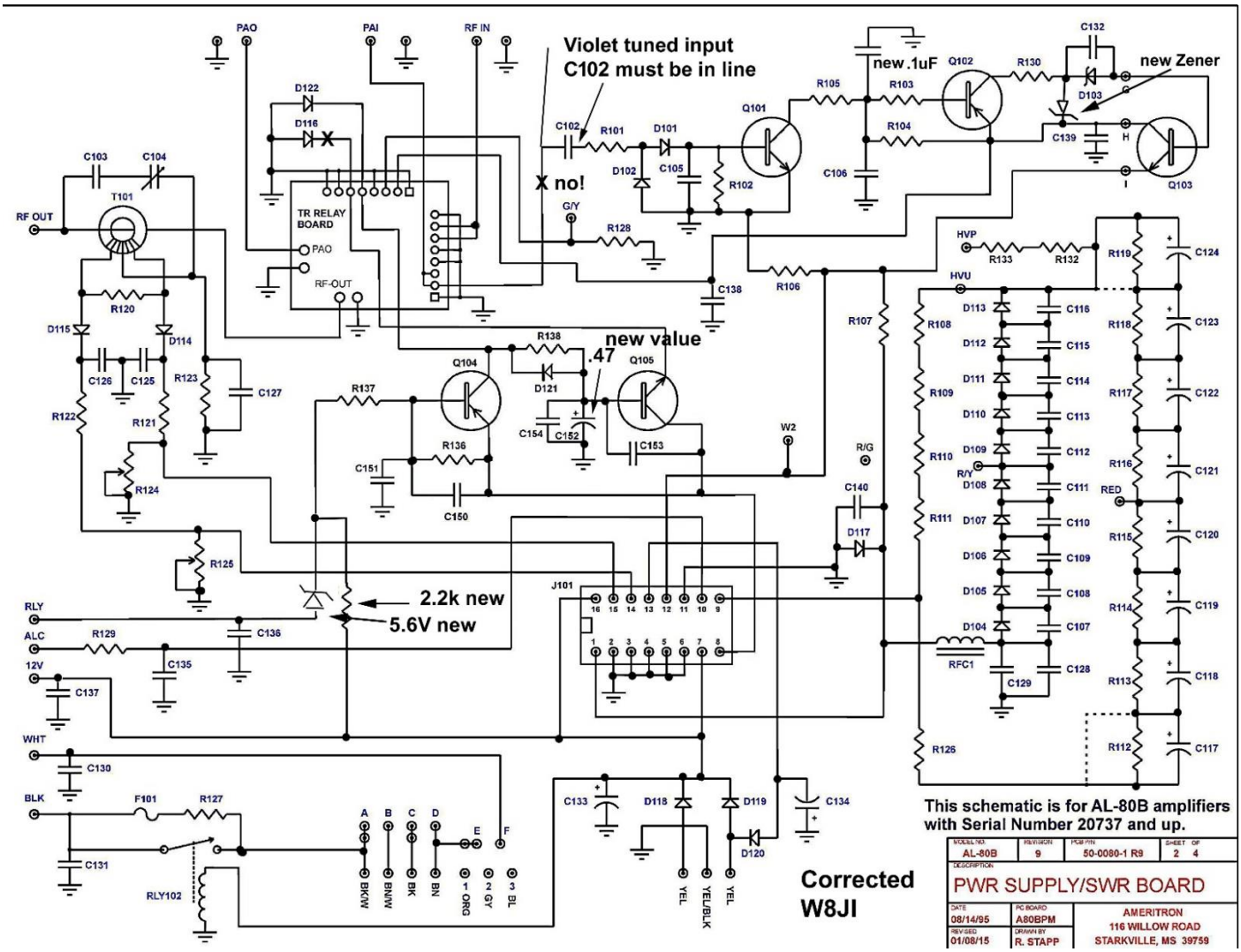


Figure 9 Corrected PS Schematic All Mods

12Vdc Bus System Errors

1 PTC 500mA fuse (careful, looks like a capacitor)
5 1N5408 buck or protection diodes

The AL8X frame amplifiers were designed to have a 13 to 14 Vdc nominal 12V bus voltage. The positive bus appears at the rear 12V jack. Either a small trace link is used on the board, or a 10-ohm ¼-watt metal film resistor is used for short circuit protection. We replace those with a 900mA thermal reset PTC thermistor for fusing.

The 12V bus system originally used a 21Vac CT transformer winding. Something happened over time and some A8X frames, including the AL80B, AL800, AL800H, and AL572, now might have grossly excessive bus voltages. The bus rails are both dc negative and positive, and these dual polarity rails feed a metering/ALC op-amp rated at 30-32Vdc maximum supply differential. Depending on the op-amp used and the rail voltages, the op-amp can fail and stop providing power meter and ALC functions.
I strongly suggest using bucking diodes or dropping diodes to get voltage to rated voltages if the positive bus exceeds 15Vdc.

If your amplifier has a 10-ohm resistor or a fuse link they can be replaced with a thermal auto reset fuse. We included one auto reset fuse in the kit. We can also supply bucking diodes.

Arc Protection and Control Grids

Parts Required:
(2) 150V GDT arc suppressors

Grid pins of 572 tubes (AL572 amplifier) must be directly grounded and GDTs should be added to the filaments. This is easy to do because the tube chassis is a tinned circuit board without solder masking. You can solder directly to the board's ground plane without any lugs. Follow these pictures and make sure you make good connections by using enough heat to flow the solder.

This is AL80B! AL572 follows!

1. Remove the top nuts to flip the socket over

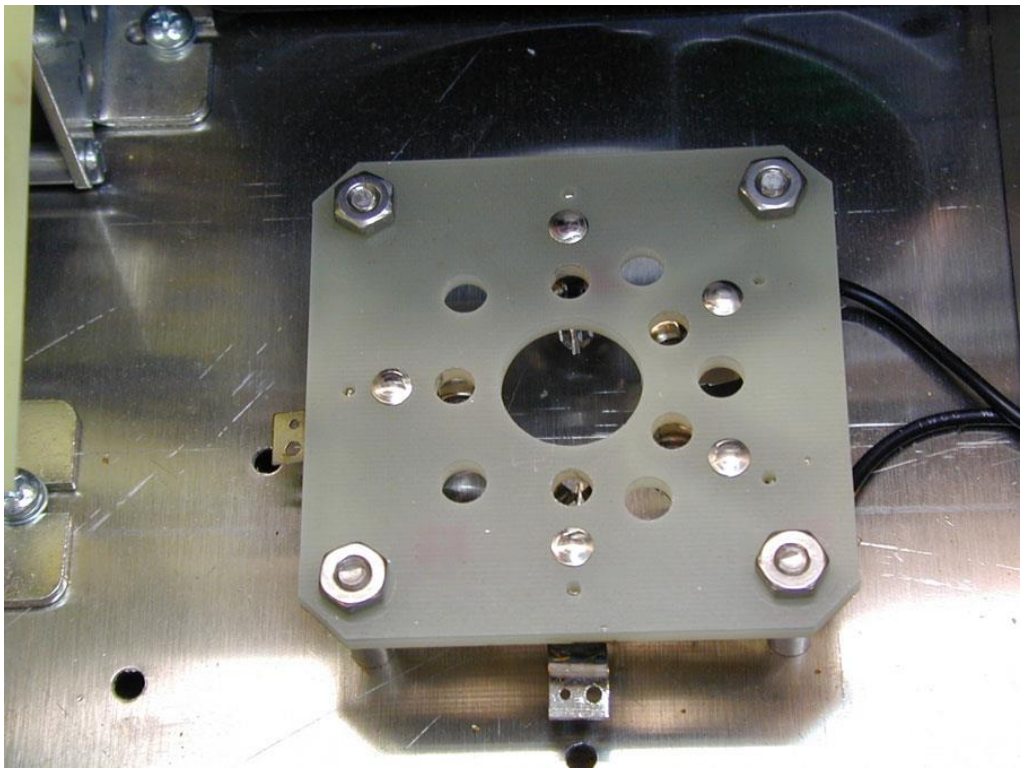


Figure 10 remove top nuts

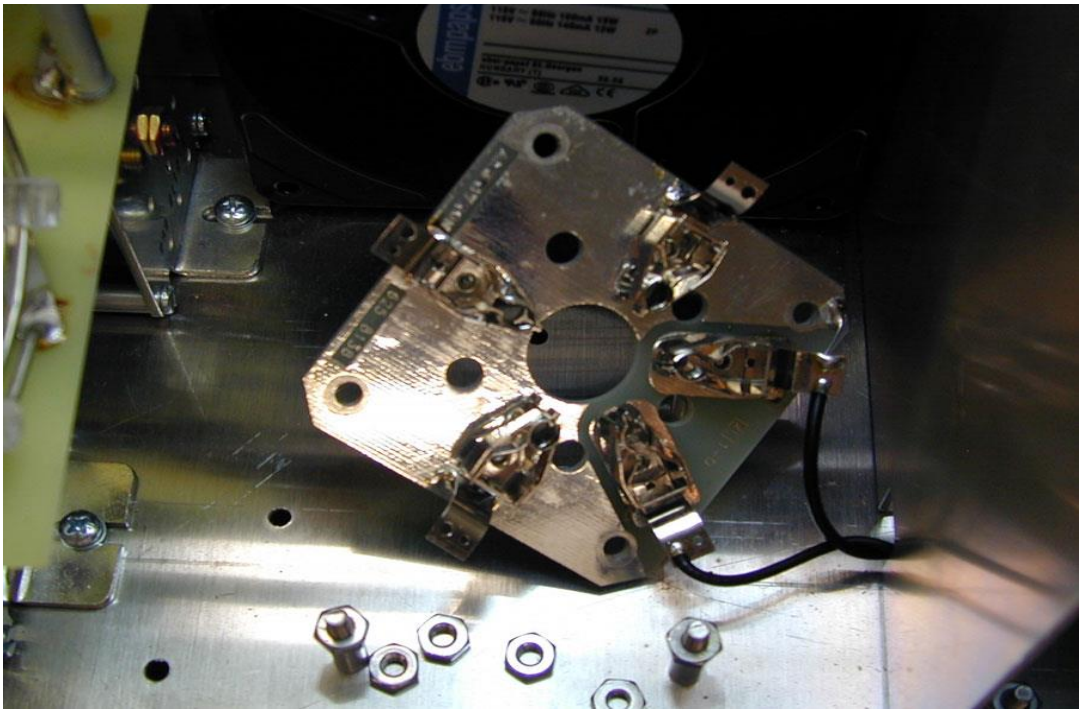


Figure 11 flip over

2. If missing, add two GDT's, one from each side of filament system from filament pins to ground plane of board. Be sure to stay clear of holes. Pre-tin all the parts and connection points with fresh 60/40 solder

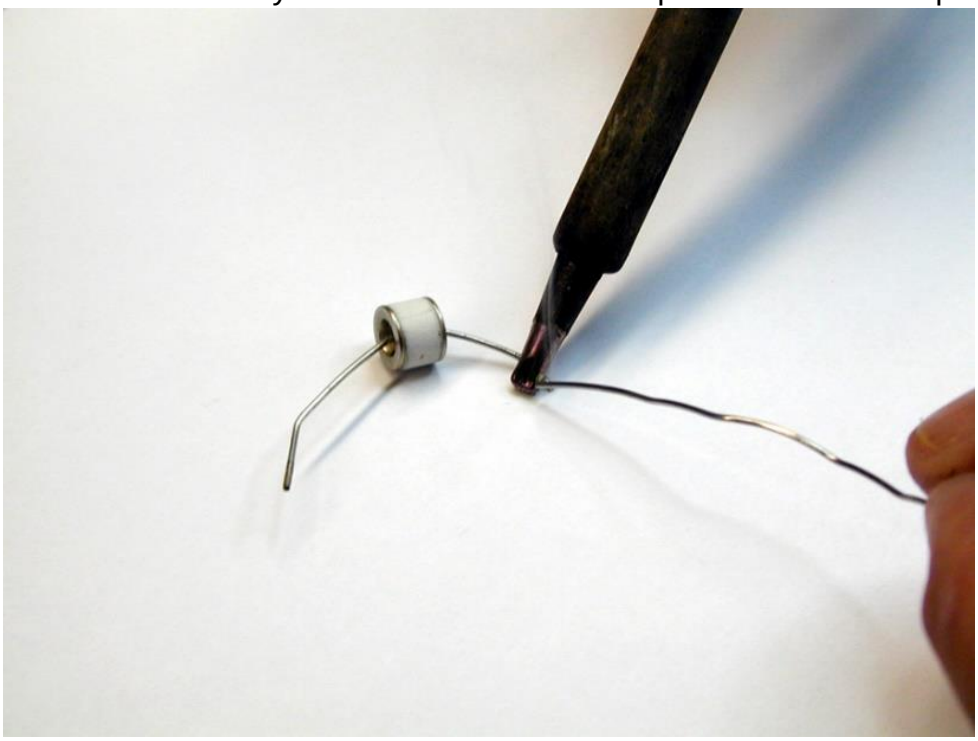


Figure 12 pre tin GDT leads

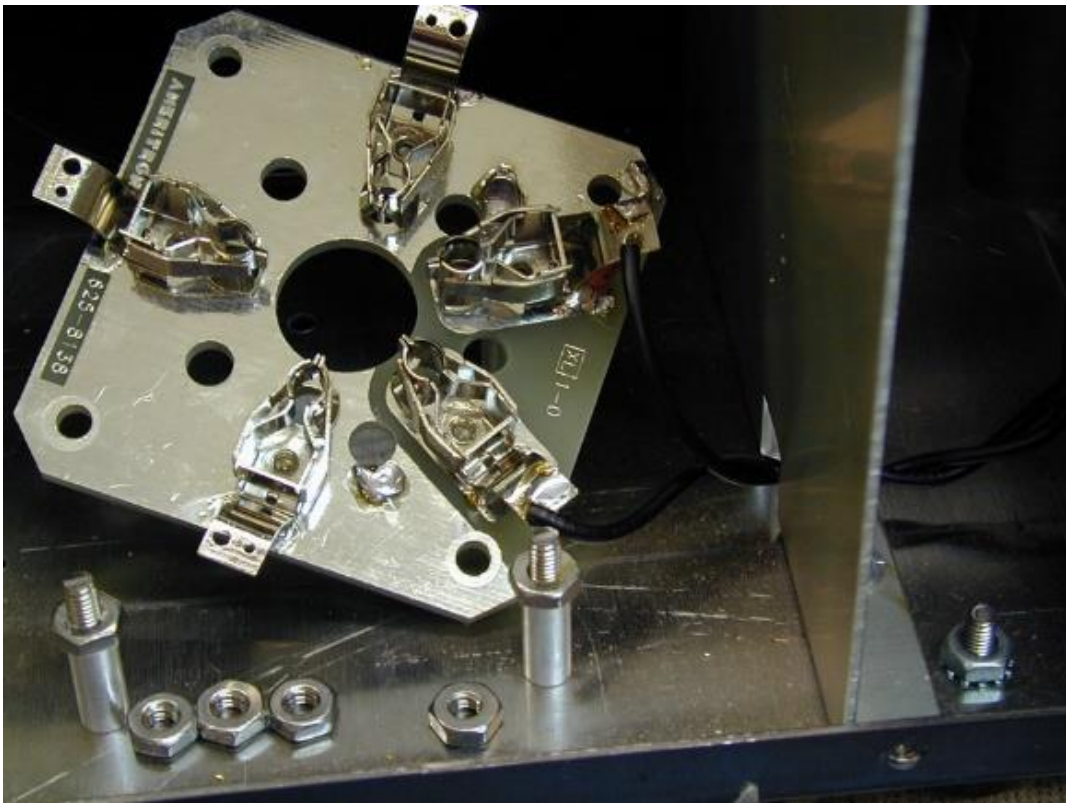


Figure 13 Pre tin socket ground plane near vent holes

3. Attach GDT to socket by sweat soldering. Solder to ground plane first

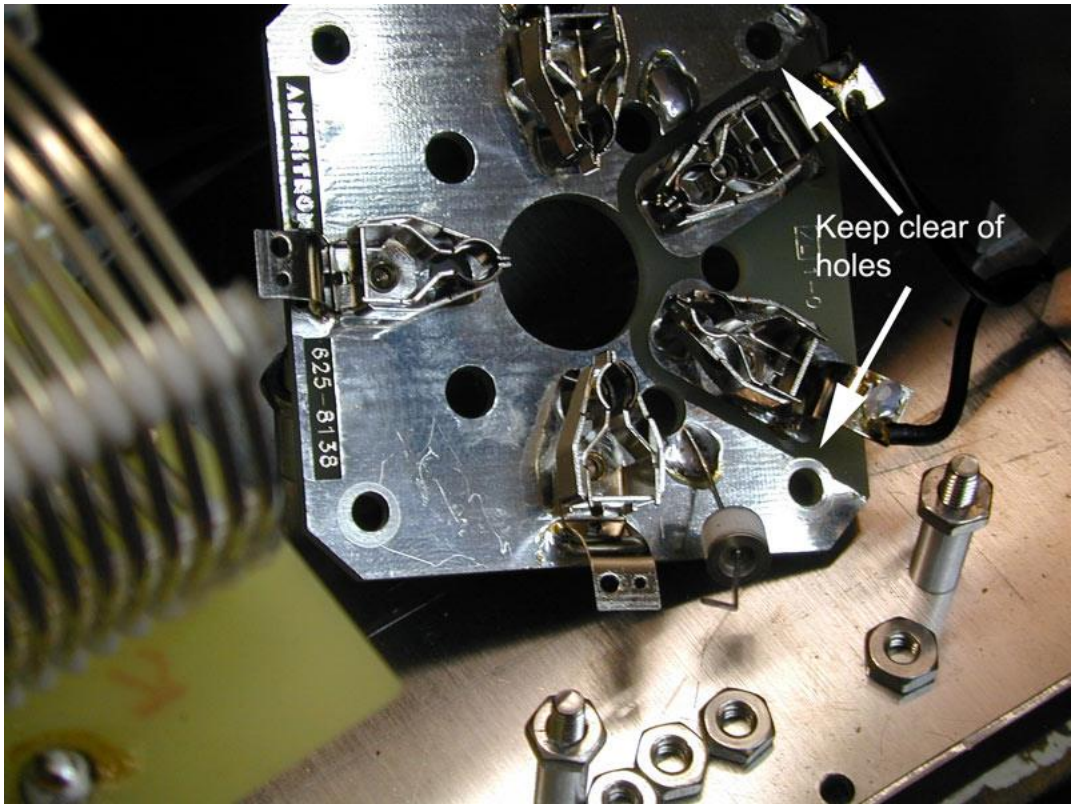


Figure 14 Sweat on GDT

4. Final socket with GDT ready to reinstall. Be sure GDT's clear chassis and socket mounting hardware.

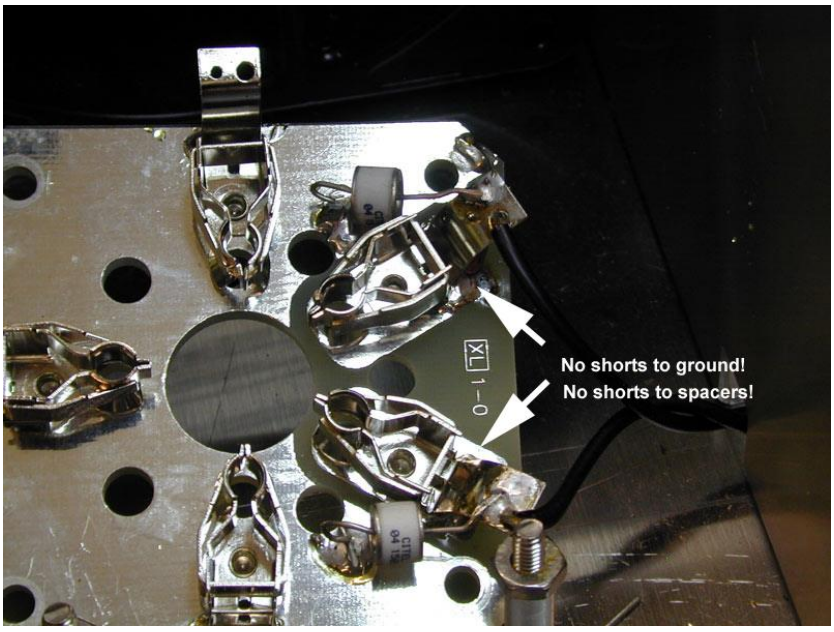


Figure 15 no shorts

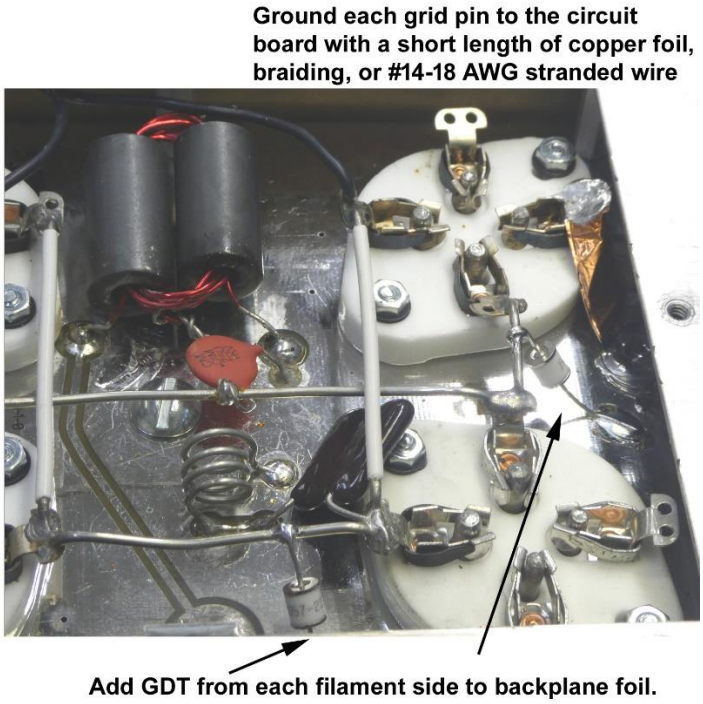
5. Reinstall socket, be sure GDT's clear spacers and chassis, snug the nuts

Note: In the AL800 and AL800H the GDTs go only on the cathode pins!

AL572 Sockets and GDT's

Early AL572 amplifiers had the control grids floated through equalizing resistors, much like the early AL811H. I initially bought into the equalizing resistor idea Collins started until I made measurements and analyzed performance. Additionally, we had field problems with amplifiers damaging radios. This problem is substantially aggravated by floating control grids off ground in triodes.

The first thing to do is to remove any resistors and bypass capacitors and directly ground the grids with the supplied braiding.



The second thing to do is add GDTs (gas discharge tubes) from each side of the filament to ground.

Note: In the AL800 and AL800H the GDTs go only on the cathode pins!

VSWR Reflected and Forward Power Diode Failures

I recently discovered that years ago, despite conversations, emails, and documents to MFJ in the design stages, a layout person changed the main circuit board in the current transformer area. The problem is someone made the shield eyelet hot with RF. The brass eyelet was always supposed to just fit inside the pickup coil and be grounded. The RF was supposed to pass through the eyelet using a Teflon insulated wire. This error is all units in the AL8X frame, including the AL800, AL800H, AL572, and AL80B units

The symptom is forward and reflected bridge diode failures or destruction of the PC board and transformer.

Figure 16 Incorrect transformer

The brass eyelet in the toroid center was supposed to be a grounded electrostatic shield. This makes directional coupler performance better while also isolating the diodes and transformer from damaging static discharges and/or transients from arcs in antenna tuners and feedlines.

Someone at MFJ negated all that by making the eyelet hot, common with the center conductor. Compounding this error, MFJ sometimes uses cheap regular plastic or nylon insulators to isolate the electrically hot eyelet from the pick-up coil instead of Teflon. Even a Teflon bushing is not a good cure, and nylon is much worse.

I have not found a simple fix yet for this error, other than removing the feed wire and eyelet, gluing the transformer down with RTV, and passing a Teflon insulated wire through the transformer. This unfortunately is the most difficult factory error to correct.

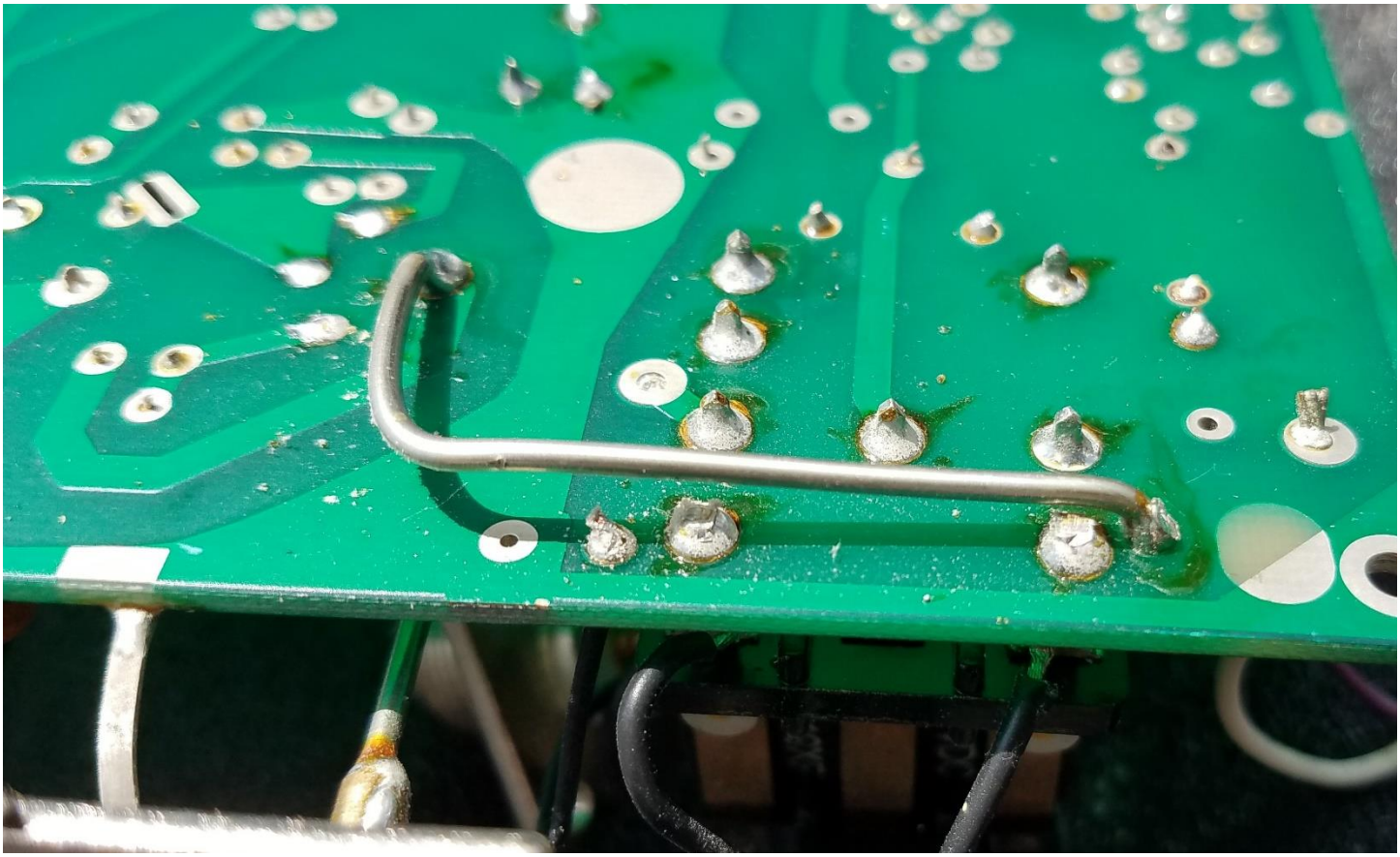


Figure 17 Bottom view SWR transformer error

The bare buss wire could be replaced all the way through the transformer with a Teflon insulated 18-gauge wire, but this is likely well beyond most field repair. I hope to eventually have a board that can be scabbed in to correct this problem. It is on my list.

A new detector board is the only field solution I can think of.