Latest AL811 AL811H Cooling Fan Kit For Fan Kits with Circuit Board!

Rev 1A on Nov 14, 2024

This kit contains a plug-in fan along with a circuit board containing two 5-watt Zener bias diodes, a GDT, and all necessary RF noise filtering. The circuit board has a hard wired high/low switch attached, a shunt jumper system that allows three bias settings, and all necessary hardware. This kit requires simple mechanical work and between one and four solder connections.

Insufficient airflow is a leading cause of anode connector and tube area hardware failure. Inadequate airflow greatly reduces amplifier component life. Most Ameritron 811 amplifiers have too little airflow even in normal SSB operation.

The Cooltron fan, appearing since at least 2009, flows roughly 20-30% of the necessary airflow on 60Hz mains. With 50Hz mains, the Cooltron fan only flows <5 cfm. The Cooltron fan has too little airflow for the three-tube amplifier while resting on standby! **The fan needs to be replaced if the fan label says "Cooltron".**



Good air movement should be felt several inches from the tube-side exhaust holes. With proper fan flow, a regular BIC lighter will not stay lit when held about one foot from the tube-side vent.

The metal cover's temperature directly above the tubes should be within 10 degrees F of room temperature regardless of amplifier idle time. (Do not transmit in this test.)

Normal CW and SSB operation of an AL811H requires at least 25 cfm airflow *through the cabinet* at normal sea-level barometric pressure. A proper fan cannot be selected from very generous fan advertisements. We typically use a 45-50 cfm rated fan to manage 25 cfm of cabinet airflow.

The advantages of this 12V fan conversion are:

- 1.) Same airflow and noise performance on 50 or 60 Hz mains
- 2.) Reduced fan depth
- 3.) Safer installation and wiring
- 4.) Easier fan speed control

Initial Design and Technical History

(skip reading this part unless you are interested in technical aspects)

In early 1991, at MFJ's request, I designed the AL811 and AL811H series amplifiers as the cheapest possible amplifiers for medium-power amateur SSB and CW use.

The AL811/811H designs were finalized long before FT8 and today's popular digital modes. In the AL811 series, no thought or consideration was given to low-efficiency AM or steady carrier mode usage.

The AL811 series can be used for digital if correct operator tuning, fan, and tube bias are used. *All Ameritron amplifiers manufactured after 2008 with original fans have inadequate airflow for any mode. If your amplifier has a Cooltron fan, the fan is worthless.*

Operating normal SSB and CW correct *minimum airflow* is about 18-20 cfm with three tubes (25% less power) and ~25 cfm *minimum* on higher duty cycle modes for three or four 811 tubes. Airflow has to be measured with the cover on the amplifier. This airflow results in a ~40° F cabinet air increase around the tubes *at the maximum average rated tube dissipation*. 811 tubes safely dissipate about 60 watts per tube *average* anode heat per tube.

A Word About Tube Swaps

572 tubes do not make the amplifier or cabinet cooler. For the same power dissipated, the heat produced always remains the same.

• 572 tubes make tuning time much less critical.

- 572 tubes also allow the dissipation-limited three-tube 811 to operate at the same power levels as the 811H.
- 572 tubes have a much shorter emission life but have more immunity to operator error.
- Tube life is a function of filament hours in the 572B tube and the anode temperature with 811 tubes.
- Tube life is not a function of grid current or drive power.

Regardless of the tube type used in any amplifier, when dissipated power is the same the total thermal rise in the cabinet will be the same for a given airflow. Bigger tubes will not make it run cooler.

KF811 and KF811H Fan Kit (Kit revised to circuit board Sept 2024)

We offer a convenient drop-in fan for both the AL-811H internal fan and external-fan AL-811 three-tube amplifiers. Note the external 811 fan and internal 811H fans are slightly different. You must order the proper unit, the KF811H *internal mount fan fits the AL811H* and the KF811 *external mount fan fits the AL811H* and the KF811 *external mount fan fits three-tube AL811* amplifiers.

Our kit contains a fan that flows about 15 cfm on low voltage (~10Vdc) and near 30 cfm at 15Vdc, the typical AL811 full DC bus voltage. *This flow rate has been verified with the amplifier cover in place.*

Some 811 amplifiers, due to transformer winding errors, might range up to 17Vdc on the "12V bus". Proper 12V bus voltage is 14 Vdc nominal.

If you are going to run the fan at high speed (full voltage) most of the time, check your amplifier's yellow wire voltage. Excessive voltage can be scrubbed with a series bucking Zener or a series forward silicon dropping-diode (~0.7Vdc per series diode).

Amplifier Bias Selection

Operating bias is a critical part of high-duty-cycle tube life. This circuit board provides two 3.9V Zener diodes for bias. A common movable black plastic header shunt with a metal clip inside selects no diodes, one diode, or both diodes in series.

To add this feature, the board bias terminals large pad holes must be connected in series with the transformer white center tap lead. This heavy white center tap lead already routes past the board mounting location.

The bias modification requires cutting the white lead and soldering it to the board. If you are not completely comfortable soldering, seek assistance from someone who is. An experienced hobbyist should be able to change the fan and do the bias modification in well under two hours.

All very early amplifiers using 811 tubes need the bias modification unless SSB and casual CW operation only. This modification will extend tube life in all amplifiers using 811 tubes.

The ideal idle plate current for minimum tube heat without compromising distortion or splatter is 10 to 20 mA per tube. The three-tube AL811 amplifier should idle, keyed with no drive, between 30 and 60 mA. The four-tube AL811H should idle between 40 and 80 mA.

The bias jumper is the black plastic shunt to the right (outside edge) of this board. The lowest plate current jumper position occurs with no jumper or with the shunt jumper positioned off to the side with any two pins completely open:



Medium idle plate current position jumper at bottom two pins:



Highest idle plate current position without additional bias. Jumper across top two pins:



Removing the fan for replacement opens up a clear work area to install the bias and fan speed board.

Input Board Types

There are two basic input board bias systems used in the AL811 series. One is when your amplifier has no bias diodes. The type without diodes will usually require both Zener diodes active, which is with the shunt one pin connected to the side. This is like completely removing the shunt.



The two later input boards, Generation II and Generation III, usually only need one additional Zener:





Warning!!! Kits shipped before September 2024 included "floating" tube bias diodes with a white jumper and no circuit board. Starting in September, we changed to a small circuit board. This instruction set is for the post-September 2024 circuit board kits.

Dropping Rear Panel

Normally a fan can be swapped without dropping the rear panel.

The AL811H is a little easier to work with. We can successfully swap fans in both AL811 and AL811H amplifiers without using steps 3 through 7 in this section. Almost everyone should be able to do this fan replacement without a back panel drop. Special tools like long nose pliers, long forceps or large tweezers, and longer ¼ inch (and occasionally 3/16") box end wrenches are required. We do NOT recommend dropping the back panel, but have included those instructions in steps 3 through 7. We strongly suggest **not** dropping the rear panel!

- 1.) Unplug mains power and remove the amplifier cover
- 2.) Be careful with the blue switch on the back circuit board. Treat the long shaft and blue switch with extreme caution. You do not want to damage the switch by bending, prying, or pushing on the switch!

3.) (drop panel only) Loosen the front screw of the shaft coupler. **Do not loosen back** screw:



- 4.) With shaft coupler front screw completely loose, remove the three rear panel bottom screws along the back and the two side rail screws.
- 5.) Pull the rear panel straight back while watching the switch-to-shaft angle. Do not cock the shaft in the switch. Gently slide the shaft straight forward out of the blue switch wafer. Do not tug on the shaft or bend it. Keep the shaft as straight out of the wafer as you can.



- 6.) By carefully pulling back you should be able to slip the shaft safely out of the switch. Be careful and work slowly.
- 7.) If you have other kits to install or want to inspect the back panel tuned input board, this is a good time. (End drop back panel.)

Installing the Fan and Circuit Board

These kits are 12-volt RF noise-suppressed two-speed systems with fuse. Note the 811H internal fan and 811 external fan systems are different. Before starting, be sure you have the correct system for internal (AL811H



Figure 1 kits KF811 for external fans and KF811H for inside fans

Tools required:

screwdrivers long nose pliers jumbo tweezers soldering iron at least 700F small tip 60/40 rosin solder small wire cutters, longer reach is easier ¼ inch combination open-end and box-end wrench (the longer the better)

Replacement Procedure

The AL811 uses an external fan, the AL811H fan is internal. We thermalweld 6-32 press nuts in internal mount fans. External fans use traditional nuts.

- 1) Observe the HV meter position. Be sure the HV meter is working. Turn the amplifier off and watch the HV decrease. When HV reaches zero the amplifier HV is discharged. The normal safe contact time is less than 5 minutes.
- 2) Unplug the amplifier from the outlet and remove the cover. Observe the area shown in Figure 2. Remove the small (normally) black fan wires by unsoldering or cutting. If any tie is holding the fan wires, very carefully remove any wire ties. This is best done by cutting or

crushing only the tie's head. (At times MFJ routes fan leads to the board rear. Remove the line voltage selection cover to access rear-routed fan wires.



Figure 2 Old fan power leads

3) Unbolt the fan. (Save the hardware.) The internal fan is a little more difficult to work with, but a long wrench fixes this.



Figure 3 unbolt old fan

4) Remove the fan. We supply new screws. Other hardware is reused. See Figure 4.



Figure 4 remove fan

5) Rear mount AL811 fans use the outside hardware stack below. The spacers (which can be any color) allow reasonably tight screws without breaking or bending the fan mounting tabs. Our inside mount fan kits for the AL811H have press nuts in the fans and do not use spacers. Do not pinch wires during the installation! Keep checking yourself. The longest screw goes at the upper outside fan hole for any model!



Figure 5 AL811 three-tube external fan hardware stack

6) While the fan is out, cut the thick white transformer center tap wire toward the left hole side as shown. While holding the wire to prevent pulling on existing connections, strip both new wire ends about ¼ inch and tightly twist the strands. Do not allow stray strands.

(This wire carries just under one ampere. If you cut or break a few fine wire strands it is not a big deal.)



Figure 6 cut center tap wire for bias

7) Solder the cut and stripped white transformer center tap wires into the large board holes as shown. At the left side, be careful to not create a bridge or short between ZD2 trace and the grounded nut. Any clearance is good enough, the voltage is low.



Figure 7 bias wires

8) Clear any lost hardware or debris. Move the board to allow mounting the switch in the big hole above and to the right of the fan. The big hole was used for the fan wire grommet in the AL811 external three tube models, but should exist in every unit.



Figure 8 Switch hole

- 9) Mount switch with the white dot up. The dot indicates the high-speed closed switch position. This switch handles a fraction of an ampere at 12 volts.
- 10) A large white nylon clamp usually fastens the cord to the chassis or to the fan (Figure 3 top left of the fan). You can either slip the nylon cable clamp over a new fan screw and add a nut to hold it in place or just throw it away. The clamp is not necessary, I throw them away.



Figure 9 Fan Direction label in for all fans

11) <u>IMPORTANT!</u> Carefully install the white fan plug onto the board fan pins with the red fan wire toward the board center. The black fan wire is outward toward the board edge. Black connects to the board ground trace. Do not reverse the plug direction. Red is always in toward the middle or + marked pin. Reversing the wires might damage the fan.



Figure 10

- 12) The fan must blow into the amplifier. The fan inlet must never be restricted. The fan label is inward. Keep this in mind!
- 13) The board ground pad will mount over and ground to the upper outer fan screw. This means from the rear view the upper left (outside) fan screw is a longer screw. The board always mounts above and mostly clear of the fan outlet.

14) This is the external fan hardware setup:



External fan mount details AL811 three tube

Figure 11 Outside mount fan

15) The inside hardware stack in the lower right board hole is:

- 1: Internal tooth lock washer
- 2: Nut snug with #2 Phillips screwdriver tightness, do not warp fan
- 3: Metal spacer 3/16" to ¼"
- 4: Nut tight with wrench, hold screw head steady with #2 Phillips
- 5.) Circuit board
- 6.) Nut. Hold screw and tighten tight with wrench until board does not easily move
- 16) The AL811H inside mount fan comes with meld-in 6-32 press nuts. The screws thread into the 6-32 nuts and the fan tightens with a #2 Phillips screw at normal hand screw tightness.
- 17) The following hardware stack applies:



Figure 11 Outside fan hardware stack

- 1.) Longer screw tightens hard with #2 Phillips
- 2.) #6-32 nut finger-tightens only against the fan flange. Do not hard tighten, just remove clearance!
- 3.) 3/16" to ¼" aluminum spacer
- 4.) Circuit board
- 5.) #6-32 nut. Hold the nut (2) at the fan and tighten nut 5 as tightly as reasonably possible. With proper hardware assembly the board will be fairly rigid. The screw should be locked by the meld-nut insert. Nuts 2 and 5 lock the board to the screw.
- 18) Route the yellow fan power wire up along the chassis front-to-rear brace for connection to the meter's yellow wire 12V lamp supply. You can also connect to the standby switch yellow wire terminal (which is more difficult) by routing the yellow fan wire along the chassis bottom to the standby switch. Just tack-solder the yellow wire with fresh solder, gently pulling on the yellow fan wire to make sure you made a good connection <u>https://www.youtube.com/watch?v=YG9eHe1Bpzo</u>



Figure 12



Figure 13