Flexible Amplifier QSK Keying Interface: Add Turn-Off Delay, and Low-Current Ground or +12V Keying
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Introduction

As a CW operator, I enjoy QSK operation with my ALS-600 amplifier (see the ALS-500/600 QSK modification on this website). The interface described here resolves a possible QSK transceiver/amplifier un-key timing problem, and adds a few things to improve transceiver/amplifier interfacing. This interface is applicable amplifiers with an open-circuit amp-enable keying input up to +80VDC and a maximum enable current of ½-amp.

QSK Un-Key Timing

When the CW key opens, the transceiver's RF output should decay to zero prior to the amp-enable line going high. But if the amp-enable line goes high prematurely, your transceiver and/or amplifier outputs can be hot-switched. Key clicks typically occur with relay-based QSK units since the relay's 3-5ms operate time permits most of the RF to decay. However PIN-diode or high-speed vacuum relay QSK switching occurs much faster, so you can hot-switch at high power levels. I am not sure how many transceivers have a premature amp-release issue. This does occur with the Icom IC-706MKIIG. As Photo A shows, RF energy is available up to 5ms after HSEND goes high. This also occurs in the IC-7600 (Photo B). So if the QSK switch occurs in less time than this, you'll have an unkey hot-switching problem.

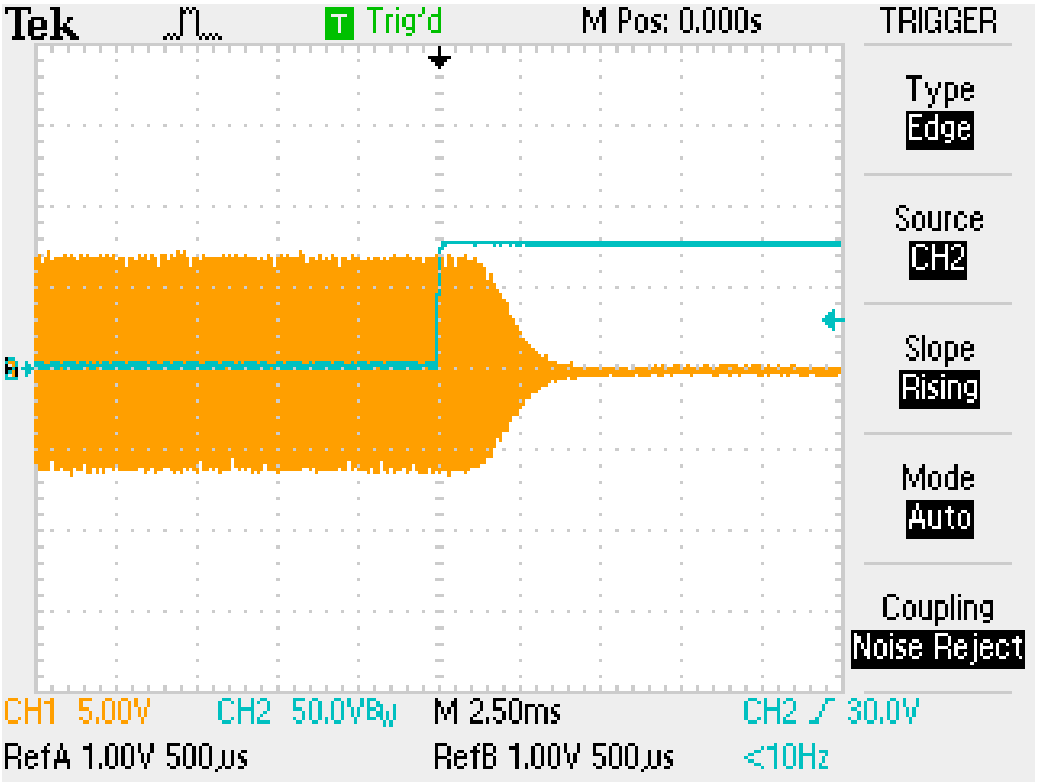

Photo A: IC-706MKIIG RF output ***after*** HSEND (blue trace) goes high

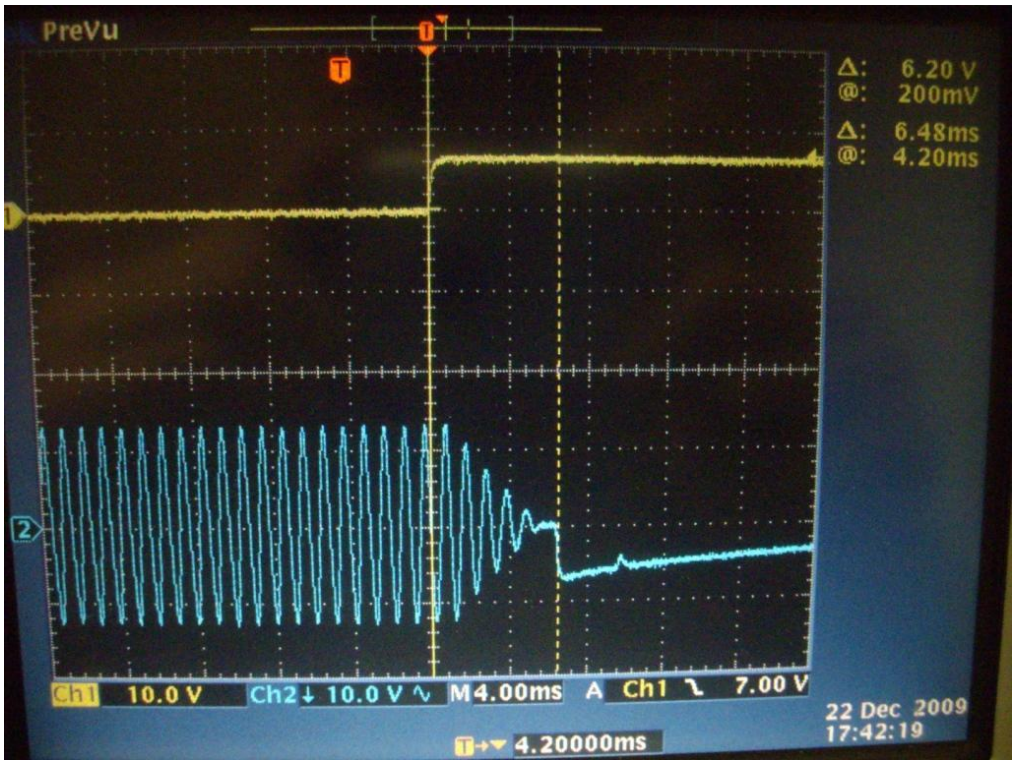

Photo B: IC-7600 Un-Key Timing Diagram (amp enable is upper trace)

Premature amplifier release is also an issue with at least some TenTec transceivers when the TX OUT/TX EN is used with QSK-switched amplifiers. A recent QEX article (March/April 2009 QEX Issue 253, page 6 by K7NTW) shows that the OmniVI RF output fully decays almost 10ms after TX OUT/TX EN goes high. The OmniVI does have a relay output for amp-keying, but this is not designed for QSK operation.

Transceivers with a premature amp-disable output, normally relegate you to semi-break-in operation only when using an amplifier. However, it would be nice if you could just add a little delay to the QSK release time when necessary. This is the main purpose of the circuit described in this article.

Other Improvements

I also designed this interface so you can key the amplifiers with either a closure to ground or a +12VDC output. The +12V keying is mostly applicable to Kenwood transceivers. While Kenwood radios provide a relay contact closure-to-ground for amplifier keying, they also provide a +12VDC solid-state output on transmit. Many folks would rather not use the internal Kenwood relay for amplifier keying, especially when operating QSK.

I also wanted the amplifier keying interface to be low-current and low voltage. A typical amplifier keying requirement is about 100ma (12VDC open circuit voltage). Some transceivers can't directly key these amplifiers without an external keying interface. And some transceivers output +8VDC signal on the amp-key interface when in receive, and could have problems with an open amp-keying DC voltage much above this.

The Interface

Figure 1 is the schematic of the interface. The un-keyed input open-circuit voltage is less than 8VDC, and the current required to key the unit is less than two milliamps. JMP1 provides for either a "ground to key" or "+12V to key". JMP2 adds about 5ms additional turn-off delay for transceivers with a premature amplifier release output. I use 5ms (provided by the 0.22uf capacitor) as my relay-based QSK unit takes 3-5ms for the relays to operate, giving a total delay of 8-10ms. For a high-speed vacuum relay, change the capacitor to 0.33uf for 7.5ms delay. For a PIN-diode switch, the delay capacitor should be changed to 0.47uf to increase the delay to about 10ms. Frankly, unless you are absolutely certain that your transceiver doesn't have a premature amplifier release output, you should leave this delay strapped in.

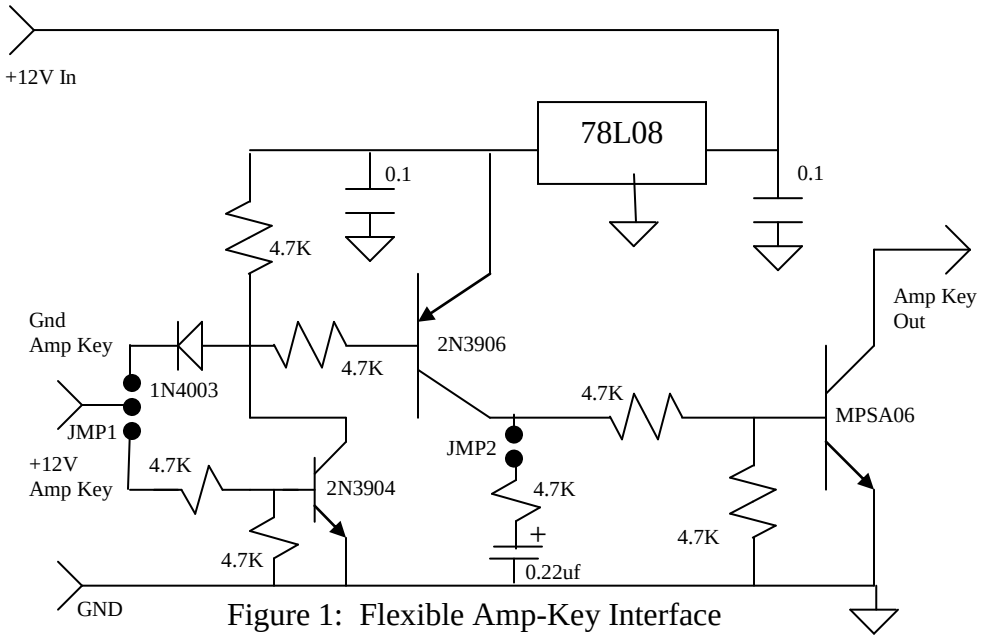

Figure 1: Flexible Amp-Key Interface

Construction

The parts list is shown in Table 1. While you can build the circuit on a small piece of perf-board, I implemented the circuit on a small printed circuit board. The connection points and component locations for my pc-board are shown in Figure 2. The #4-threaded standoff provides the pc-board mount as well as a DC ground. My normal strapping is shown – i.e. "ground to key" and "delay". For Kenwood +12V solid-state keying, slide the JMP1 strap down to the lower two pins. I leave JMP2 strapped for the additional turn-off delay all the time. Select the appropriate delay capacitor as discussed earlier.

Parts List: Flexible Amp-Key Interface

QTY	Description	Mouser/Part Number	Price ea.
1	0.22uf elec. Capacitor (5ms)	647-UFG1HR22MDM	$0.13
or	0.33uf elec. Capacitor (7.5ms)	647-UVZ1HR33MDD	$0.09
or	0.47uf elec. Capacitor (10ms)	647-UKW1HR47MDD	$0.09
2	0.1uf 100V capacitor	581-SR211C104KAR	$0.16

1	MPSA06 transistor	512-MPSA06	$0.23
1	78L08 regulator	863-MC78L08ACPG	$0.21
1	2-pin header	538-90120-0122	$0.19
1	3-pin header	538-90120-0123	$0.25
2	Jumper	538-15-29-1024	$0.18
1	1N4003 diode	863-1N4003G	$0.05
1	2N3904 NPN Transistor	512-2N3904TA	$0.05
1	2N3906 PNP Transistor	512-2N3906TA	$0.05
7	4.7K resistor	660-MF1/4LCT52R472J	$0.05
1	0.25” long #4 AL stand-off	534-8714	$0.37
1	4-40 screw and #4 split lockwasher		
*1	#4 threaded L-bracket	534-621	$0.36
**1	1.5x2.25x1.375” AL box	537-M00-P	$4.37
**2	RCA jack	161-0253-EX	$0.95
**1	2.1x5.5mm DC jack	163-1060-EX	$0.88

* Used for mounting pc board in author’s ALS-600
** For externally housed universal keying interface

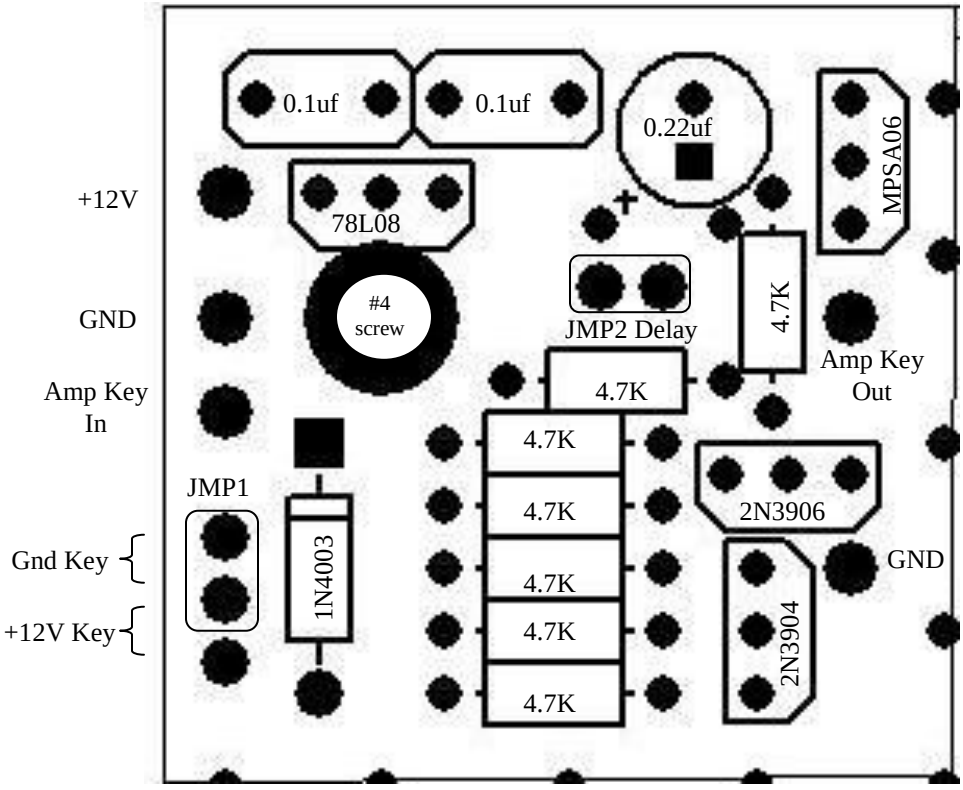

Figure 2: PC board component placement

I built my first flexible amp-key interface into a small aluminum project box as shown in Photos C below.

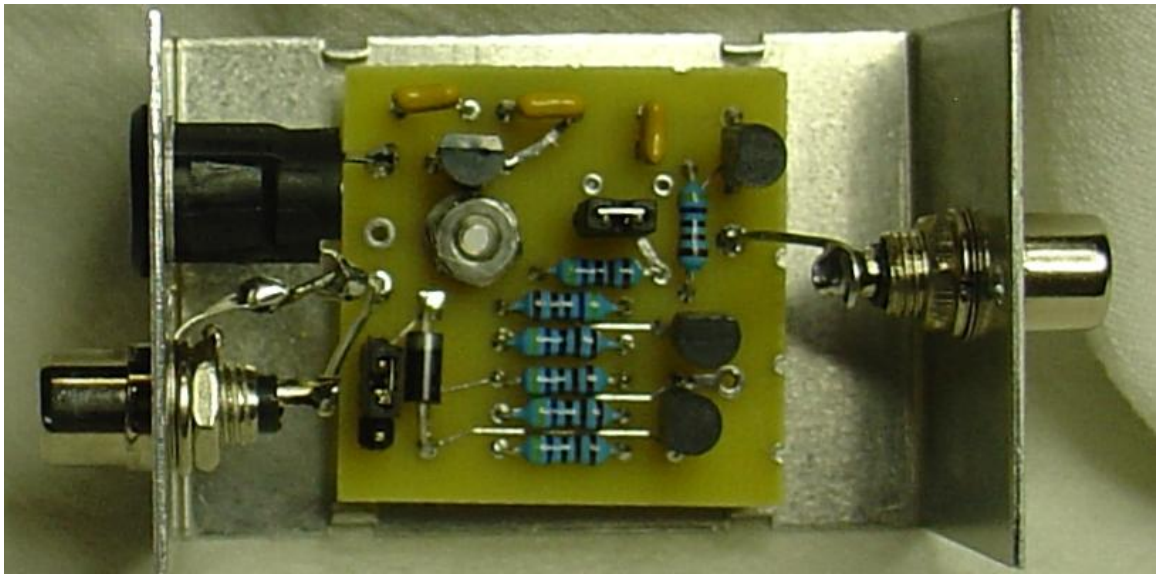

Photo C: Internal view of stand-alone interface

After building and using the keying interface, it occurred to me that the pc board was small enough to easily fit inside my ALS-600 amplifier. I added the threaded L-bracket to the standoff (Photo D), and drilled a mounting hole inside my ALS-600.

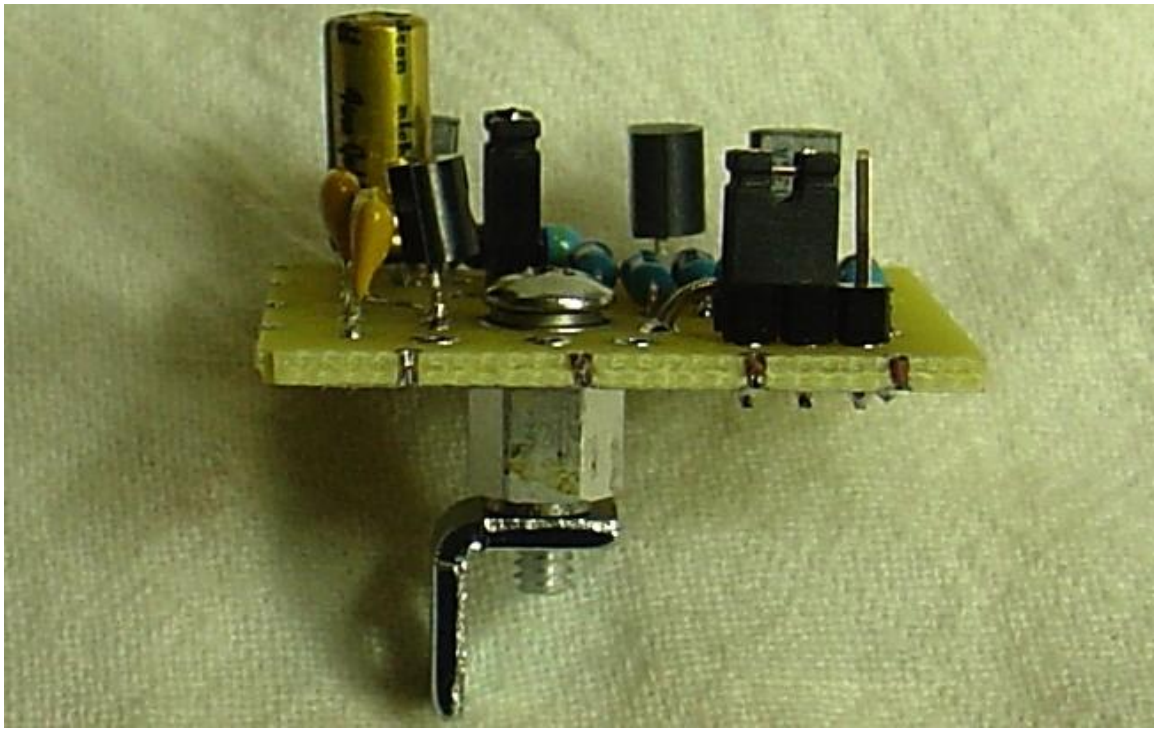

Photo D: Threaded L-bracket added to standoff

The amp-keying input from the phono jack on the rear of the ALS-600 amplifier is a blue wire that connects to J4 on the bottom amplifier pc board. I cut this blue wire close to J4 and soldered the blue wire from the RCA jack to the “Amp Key In” on the keying

interface pc board. The blue wire going to J4 is soldered to the "Amp Key Out" on the keying interface pc board. The 12VDC operating voltage is on a white wire also connected to J4 and going to the back panel 12V accessory connector. I cut this wire so I could splice in another wire going to the +12V input on the keying interface pc board. Photo E shows the added mounting hole and the cut blue wire and the soon-to-be-cut white wire. Photo F shows the pc board mounted in the ALS-600. You'll note that JMP2 is strapped for turn-off delay. As I stated earlier, it is not a bad idea to leave this delay strapped in all the time unless you are absolutely sure that your transceiver doesn't have the premature amplifier release output. Adding 5-10ms of between-element delay to your Morse characters will not be noticeable to anyone but the highest CW speed operators. As an example, the length of the space between Morse elements within a letter is 1200/WPM in milliseconds. So at 40WPM, this inter-element gap is 30ms. A 10ms reduction (5ms relay operate time plus 5ms added turn-off delay) in receive time between elements would be hardly noticeable at this speed.

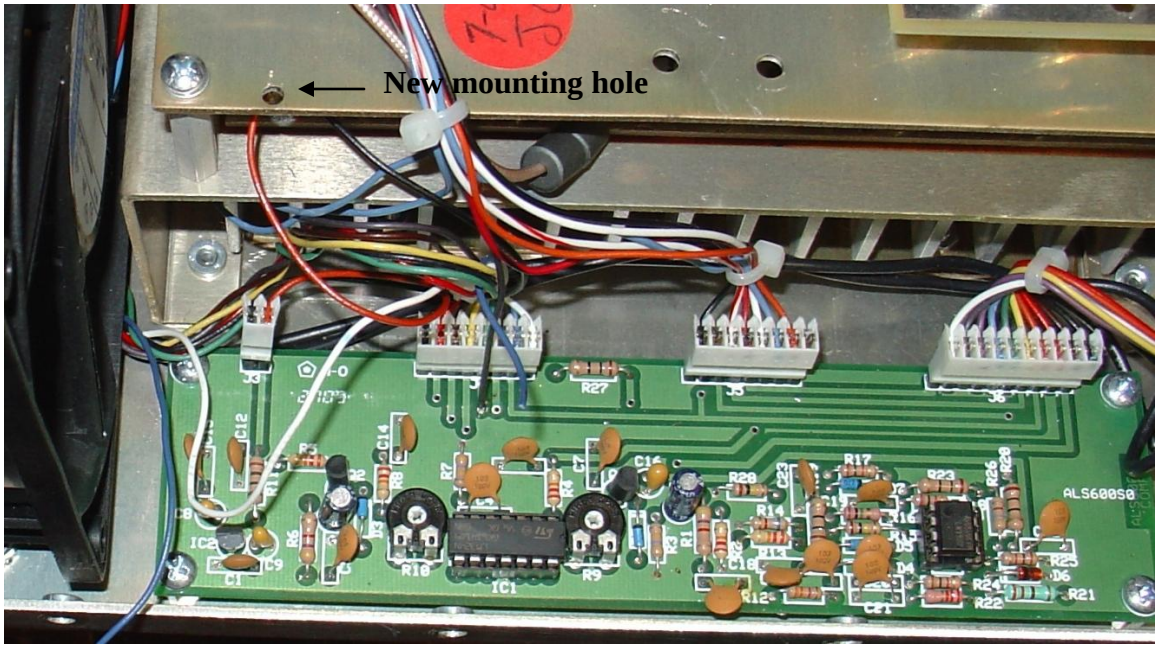

Photo E: 1/8"D mtg hole added by upper left screw. Blue (amp key) and white (+12V) wires at lower left. The blue wire has already been cut.

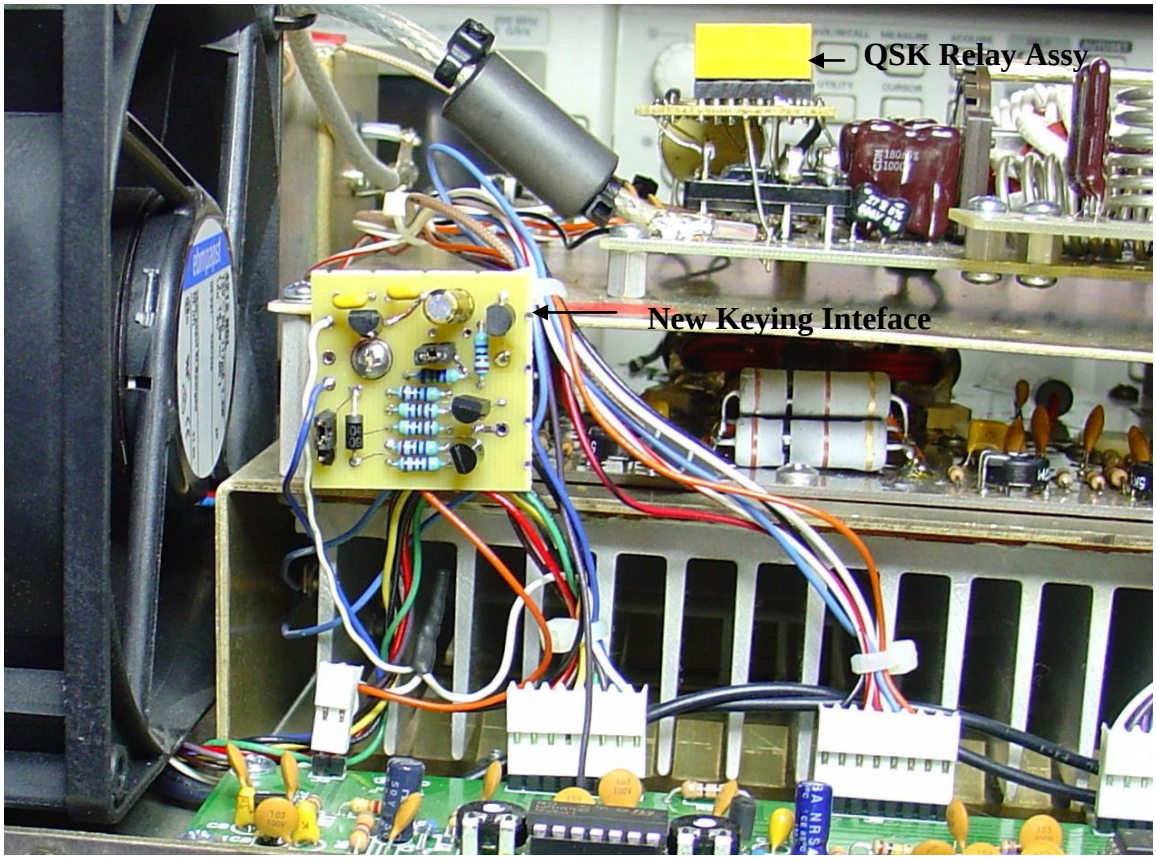

Photo F: Keying interface mounted in place in author's QSK-modified ALS-600.

Conclusion

I've described a flexible keying interface that will work with most amplifiers. This unit provides a low current keying interface, the option for either ground or +12V keying, and turn-off delay when using QSK amplifiers and a transceiver with a premature amp-disable signal. Give this circuit a try if you have the need for any of these features.