

## The R-390A/URR and its Squelch facility

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It seems necessary to add another detail to the R-390A saga: this receiver's inherent SQUELCH ability.

At the beginning of the *Cost Reduction Program*, the engineers at Collins were obliged to reduce the costs of the Collins Radio Receiver R-390/URR and to employ the latest improvements into the subsequent receiver R-390A/URR. A squelch facility was considered as superfluous. After many discussions pro and contra, a compromise between the Collins engineers and the Army was reached. In all the production runs of the new R-390A the factories had to prepare the chassis and its wirings for a later Field Installation of the squelch facility.

But the Program's *Final Progress Report* offers no wiring details and remains kind of vague: "*At the start of the contract it was considered desirable to drop the squelch requirement... Later on, the Signal Corps decided to make this an optional unit retaining the cable wiring and function switch and leaving out the parts in the AF unit.*" (p.3, p.12). The Cost Reduction Department at Collins suggests: "...*An optional kit of parts can be made available for field installation of the squelch facility.*" (p.14.) As to construction details, the *Report* confirms that "*The audio unit was lengthened somewhat and rearranged to accommodate the optional squelch function.*" (*Phase "E" Construction of "A" Models*, p.26.)

Evidently, the R-390A's AF unit has a bundle of wires underneath its chassis, which end up to no apparent use: white-black (6.3V filament voltage), white-green (from the FUNCTION switch) and white-red-green from the cathode follower V601B (1/2 5814A). One Teflon stand-off is connected to the DIODE LOAD terminal TB103 at the receiver's rear panel.

From a spare AF sub-chassis I removed the lid next to J619 and J620, which covers two factory made cut-outs, one for the insertion of V606 (tube 6C4, as printed on the chassis), and one for the squelch relay K602.

Even the FUNCTION switch holds some surprise. After removing the clamp behind its hex nut, the switch can be turned into a 6th position.

Normally, the clamp arrests the FUNCTION switch at "CAL".

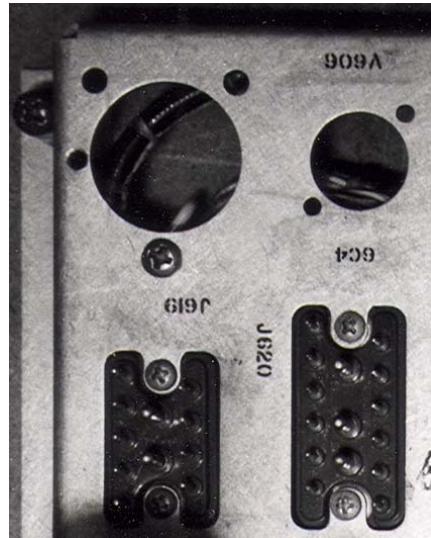


Figure 1. R-390A, Af sub-chassis, top view. Factory cut-outs for tube 6C4 (V606) and relay K602.



Figure 2. R-390A. Af sub-chassis. top view, front section. Squelch tube V606 (6C4) and squelch relay K602 installed.

Now, in the new position next to "CAL", the switch conducts 195 volts DC to the AF sub-chassis via the above mentioned white-green wire.

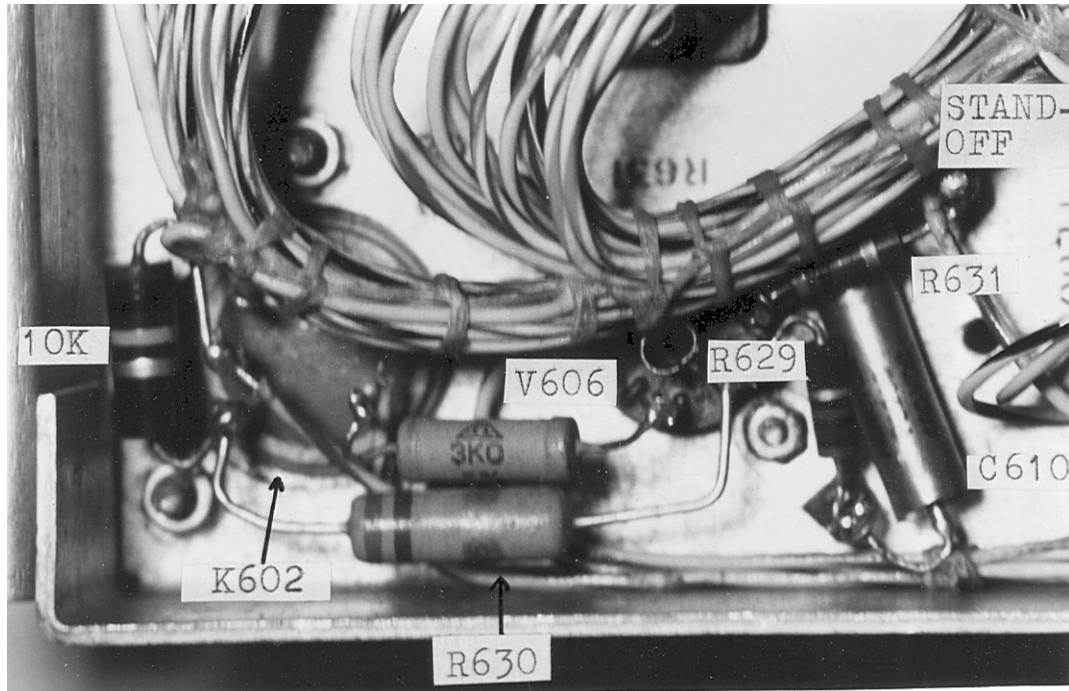
With a "kit of parts", including tube 6C4 with socket, relay K602, a decal "SQUELCH" for the R-390A's FUNCTION switch and the wiring instructions at hand, the conversion process from start to finished job of converting the R-390A into a receiver with the squelch ability is about one hour.

The Technical Manual for the R-390A (TM 11-856A) does not mention any squelch facility, but the schematic diagram of *Figure 106*, p.188, shows two interrupted lines from J 619-8 and J 620-11. I assume that the Collins engineers in their very first drafts, before the discussions started, had designed the squelch tube 6C4, the relay, the resistors and the capacitor C610 into the schematic diagram. When they had to erase the whole squelch section from the diagram, the B+ line from the FUNCTION switch (J619-8) and the DIODE LOAD line (J620-11) from terminal TB 103 were cut off and the place under the AF CATHODE FOLLOWER V601B and the 800 CPS BAND PASS FILTER became an empty area. (see *Figure 106*, p.188 of TM 11-856A). Curiously enough, the Operator's Manual for the R-390A lists the squelch tube 6C4 on p.6: "Figure 5. Running spares. 6C4, V202, V203, V204 OR V606." (TM 11-5820-358-10.)

To complete my R-390A with the squelch facility, I decided to use a spare EAC AF sub-chassis. Installing the tube 6C4 is easy. For the appropriate relay I looked in my parts box. Of course, the original squelch relay from a R-390/URR would have been the best choice. But I found three other relays with the right dimensions to fit into the cut-out. Does one of them has the correct ratings?

Comparing the 6C4 (V606) with the 12AU7 tube in the R-390's squelch circuit revealed similar ratings. The R-390's Technical Manual quotes a coil resistance of 10K for the squelch relay (TM 11-856, Paragraph 102. p.104, *Dc Resistances of Transformers and Coils*). One of my relays had a coil resistance of 6.5K, which was acceptable, if inserting a 3K resistor between the plate of V606 and the coil. Then I compared the B+ voltages of the R-390 and the R-390A. When turning the R-390A's FUNCTION switch to the 6th (SQUELCH) position, the unused white-green wire under the AF deck conducts 195 volts DC. The squelch circuit in the R-390 gets 180 volts, the plate voltage of the R-390's squelch tube (1/2 12AU7) is 155 volts. A 10K 2W resistor should make up for the voltage differences. For stability, I soldered the dropping resistor to an unused pin of the relay socket.

Discarding the arresting clamp on the FUNCTION switch and using an appropriate washer, I fastened the hex nut and the control knob. Again I turned the switch into the SQUELCH position.



*Figure 3. R-390A, Af sub-chassis, bottom view, front section.  
Squelch wiring details*

With the RF GAIN control at 10 and a relatively strong and steady carrier, the CARRIER LEVEL meter read 60 DB. Turning the RF GAIN control back to 9, 8, 7, 6, etc., the DIODE LOAD became more positive, the squelch tube began to conduct and the relay draw enough current from the plate of the 6C4 and B+, to close its contact, which grounded in return the cathode of AF cathode follower V601B, silencing the AF output.

Now the bad news. I could not reverse the procedure. The substitute relay was factory adjusted for straight action: at a given voltage the contact closes and at OV it opens, which is not the working condition in the squelch circuit.

To investigate into this matter, I had to open the relay can with a fine saw.

Between the coil ends (+ 160V above ground), I measured a delta V of 13V to 17V corresponding with 60 DB to 0 DB on the CARRIER LEVEL meter. On 17V the coil core ("pole face") was magnetized and attracted the armature ("lever blade"). On 3V the core was still magnetized and held the blade, grounding the cathode of V601B.

Fortunately, there were screws to adjust (see *Figure 4*). The lever blade was to be prevented from touching the pole face. A distance of 1/2 mm or less, in any energized condition, is desired.

Very carefully I adjusted the screws and secured their lock nuts.

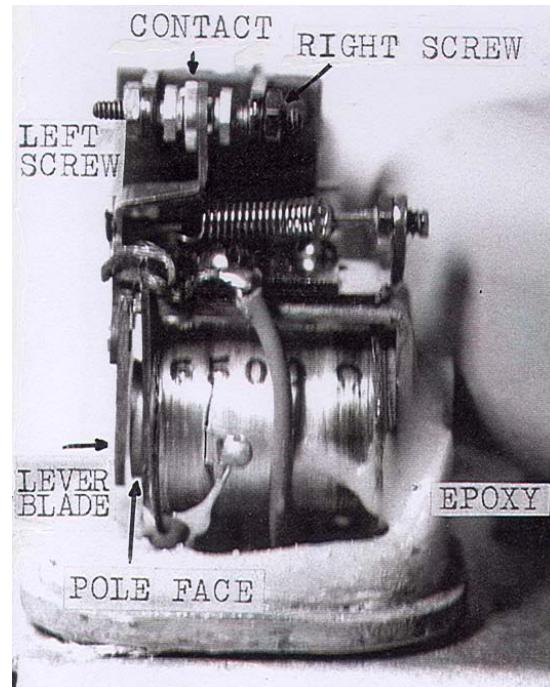
Now the relay responded freely to the RF GAIN control and the different carrier levels. I completed the R-390A's schematic diagram on page 188 of *Figure 106* with the squelch wiring details.

Fair Radio Sales might sell the original squelch relay from the R-390, no mechanical adjustments would be necessary. Since the original relay has the nominal 10K coil resistance as shown in *Figure 5*, the coil is to be connected directly to the plate of V606. The squelch circuit is shown with no or small negative voltage fed to control grid of V606.

**Warning. The tube OA2WA, contains radioactive materials, which are harmful when contacted or inhaled. For that reason, I prefer the OA2WA's predecessor OA2.** See Change 4 of the Operator's Manual.

#### References:

- Radio Receiver R-390/URR, Technical Manual TM 11-856. (January 1955)
- Radio Receiver R-391/URR, Instruction Book, NAVSHIPS 93766. (23 October 1953)
- Cost Reduction Program for Radio Receivers, R-390/391( )/URR, Final Progress Report.
- Radio Receiver R-390A/URR, Technical Manual TM 11-856A. (January 1956)
- Radio Receiver R-390AfURR, Field and Depot Maintenance Manual TM 11-5820-358-35. (8 December 1961)
- Radio Receiver R-390AfURR, Operator's Manual, TM 11-5820-358-10. (16 January 1961) Change No. 4. (7 April 1975)



*Figure 4. R-390A, squelch relay K602 (not original), internal view*

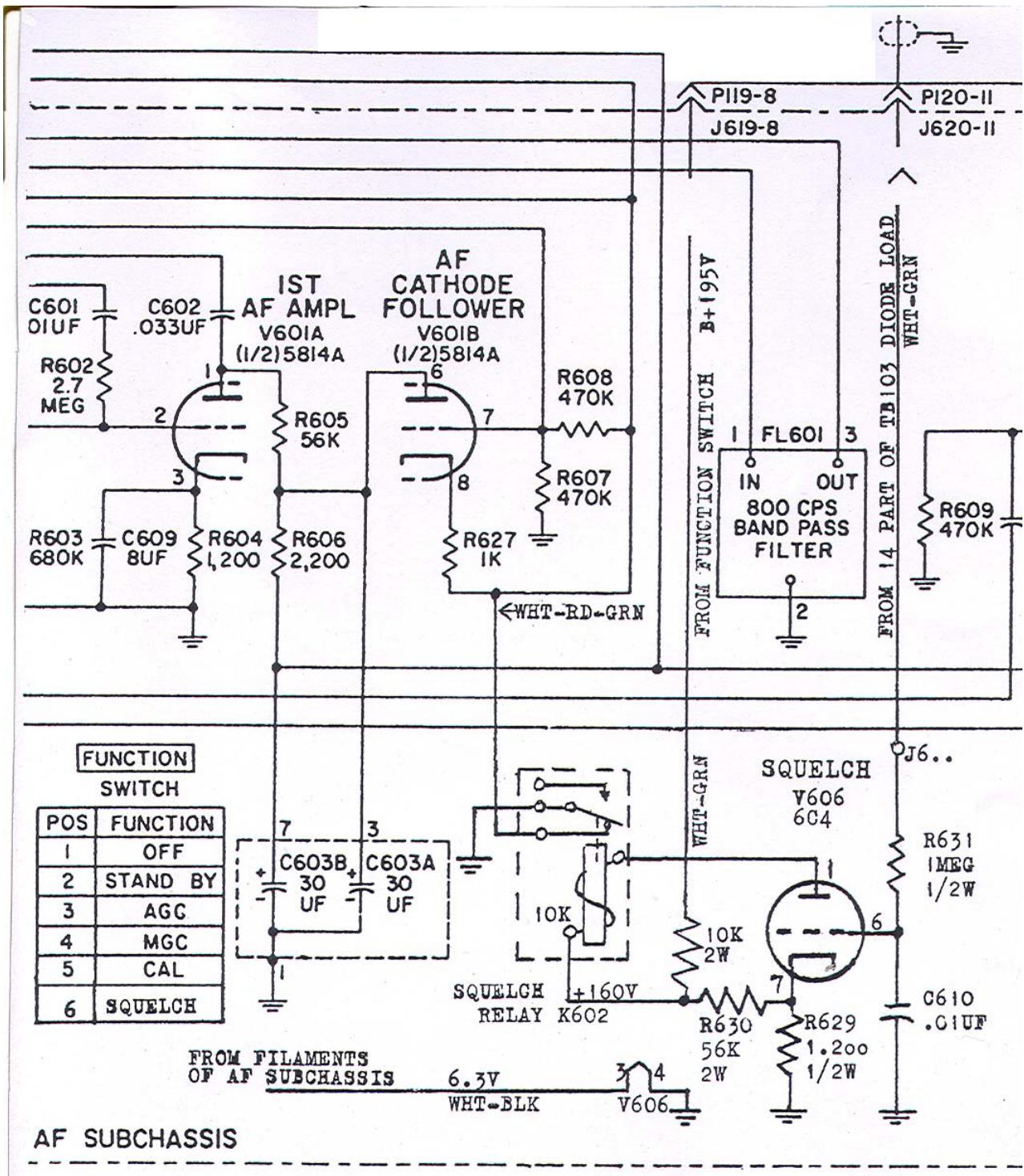


Figure 5. R-390A, squelch circuit inserted into Figure 106, p.188 of Technical Manual TM 11-856A.