

R-390A Ovens and Frequency Stability  
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As you know, it is common practice to operate our R-390As with the 'oven' switch (on the back) turned off. This is very good from the standpoint of preserving the VFO. However, because it also cuts power to the 2nd crystal oscillator deck oven, this does reduce frequency stability a little, during power on warm up.

You may not know, but the 1st crystal oscillator's oven is NOT controlled by the 'oven' switch (on the back), and its oven is on all the time. I did some testing on these oscillators warm up frequency stability and got mixed results, although very close to each other. This is with using the recommended CR-27/U crystal and 75 degree thermostat oven and it working correctly. What I found is that one of the 1st crystal oscillators became stable (within a 2 to 4 cycle operating range) in about 12 minutes. The other 1st crystal oscillator became stable (within a 10 cycle operating range) in about 2 minutes. This difference depends on the crystal and the oven in use (they were of the correct type and specifications, but just had different characteristics). The thermostat cycles on and off allowing a small temperature change to occur in its oven. This causes the small range of frequency change about every minute. Don't forget that it needs to have the correct type of crystal, a CR-27/U, as they are cut to operate best at a certain temperature. And then there's the oven; I've seen a lot of different ones associated with R-390As from 55 to 85 degrees centigrade. The correct one is 75 degrees. When measuring the power on warm up frequency drift, I always do it after being off overnight.

Since the crystal for the calibrator is also in the same small oven, it too becomes stable in about 2 to 12 minutes.

I also did some frequency measurements on the 2nd crystal oscillator deck during power on warm up (on an R-390A I'm currently refurbishing). With the oven heater off ('oven' switch on the back), the 12 MH signal went down 98 cycles in 1.5 hours and another 48 cycles in the next 2 hours. So, that's about 150 cycles in 3.5 hours, but the bad thing is that's a constant change for quite a while. However, with the oven on (I disconnected the VFO oven power inside the VFO), the 12 MH signal goes down 450 cycles and stabilizes in 7 minutes, in a 9 cycle range. Remember, the crystals in the 2nd oscillator deck are a different cut (CR-36/U) than the ones in the small round octal plugin oven (CR-27/U) for the 1st crystal oscillator oven.

I also checked it on my R-390A daily driver. With the 2nd crystal oscillator oven on, I did some frequency measurements on it during power on warm up. It started at 11.999,748 MH and drifted down 341 cycles to 11.999,407 MH in 5 minutes. After another 3 minutes, it stayed at 11.999,399 +/- 3 cycles, for many hours. And, with the 2nd crystal oscillator oven off, I saw very similar results as to the one I'm refurbishing with its 2nd crystal oscillator oven also off (3.5 hours to stability).

With the 'oven' switch (on the back) turned off, the heater power to the VFO AND the 2nd crystal oscillator deck is shut off (which is now quite normal). Thus, the 2nd crystal oscillator deck usually takes about 3 to 4 hours to stabilize. The reason it takes that long is that the temperature of the whole R-390A must stabilize, and it takes about that long. The same is the case for the VFO as for the 2nd crystal oscillator.

With the 2nd crystal oscillator oven on, I just did an 'overall' power on warm up frequency drift measurement using the 5 MH WWV, on the one I'm refurbishing (this includes the 3 conversion oscillators and the BFO). It drifted down 100 cycles the 1st 4 minutes, down 50 cycles from 29 minutes on to 49 minutes on, and down 20 cycles between 6.5 hours on and 9.6 hours on.

So, it looks like if you'd like your R-390A to be fairly stable as soon as possible after power on (about 12 minutes), it needs to have a few things checked or done to it:

1. Verify that the 1st crystal oscillator oven is operating correctly. It should be a 75 degree oven and cycle on and off about every minute (so as to not get too hot). Check that there's a CR-27/U crystal in it. This

yields a stable frequency for this oscillator within about a 3 cycle range (it changes with the temperature of the oven).

2. Disconnect the power (cut a wire) to the VFO oscillator's oven (while leaving the 2nd crystal oscillator oven power on). I like to leave the 'brown' and 'white' oven power wires in tact in the VFO and disconnect the thermostat wires on the inside of the VFO. Turn the 'oven' switch (on the back) to the ON position, providing power to the 2nd crystal oscillator deck oven. Check that all the crystals are CR-36/Us.

3. Temperature stabilize the VFO. This can be done by changing the NTC characteristic of the two 10 pf caps in it.

4. And, if you want to listen to SSB or CW, then your BFO should also be 'temperature stabilized'. I have found that the aging of components in the BFO have caused a lot of them to take a while to also stabilize at power on.

There are also some other technical malfunctions that can cause oscillator instability, such as: 1. incorrect regulation of the +150 volt regulated supply, 2. bad tubes, 3. bad resistors, 4. bad capacitors, 5. VFO shaft grounding contact failure, 6. bad crystal, 7. bad oven, etc.

I usually don't leave my R-390A's on all the time, so to compensate, I have temperature stabilized the VFOs and BFOs in them, but operate with the 'oven' switch (on the back) turned off. This mode (with no power to the ovens in the VFO and 2nd crystal oscillator deck) has been satisfactory, but I still noticed the power on drift in the 2nd crystal oscillator. This prompted me to look into a solution.

The VFO on my R-390A daily driver was past time for maintenance, so I had to go into it a few days ago. While there, I disconnected the oven power inside. Part of step 2 done.

As for oven temperature (with the 2nd crystal oscillator oven on), it does not get near as warm as the 1st crystal oscillator oven. I can leave my fingers on it for a long time, with no discomfort at all. I estimate it to be about 125 degrees fahrenheit (52 degrees Centigrade). This feels like the same temperature as the one I'm currently refurbishing.

I don't think that the improved stability (by powering on the 2nd crystal oscillator deck oven) will be that noticeable or beneficial for AM listening, but could be for SSB or CW reception. I did number 2 above (about a month ago) on the R-390A I'm currently refurbishing, and I could see the improvement as soon as I did it. I listen to SSB quite a bit, so this information is going to help me improve my satisfaction with my R-390As even more than I already am. What I have concluded is that I am going to also implement number 2 above, as I have already done 1, 3, and 4. I'm looking forward to experiencing my new found R-390A improved stability.

Regards, Larry