

Installation Hints for the K2WS 40Mhz OCXO for the SDR-1000

Note: This modification is recommended only for experienced builders. Installation requires careful disassembly of the 4 board stack to have access to the TRX Board in order to swap jumpers and connect the new oscillator. A connection to the 13.8VDC+ supply is necessary to power the new OCXO. Care must be taken so that the transceiver is reassembled correctly. This is not a plug-and-play modification.

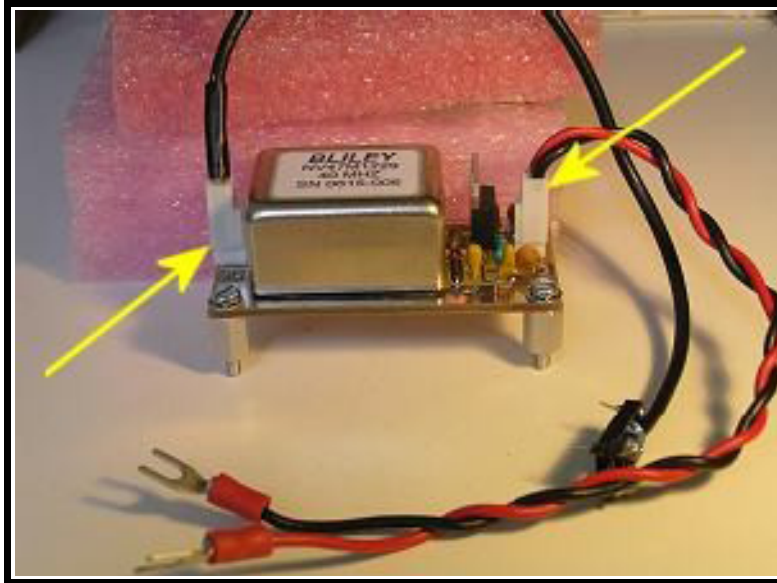


figure 1

The following instructions pertain to cabinets assembled by Flex-Radio prior to June 2006. If you have a newer cabinet (like the ones with the fan mounted inside the cabinet) you will need to carefully read these instructions first and then adapt details as needed.



Before doing any work on your SDR-1000, DISCONNECT the 13.8VDC POWER (turning the rig switch OFF does NOT remove power from the internal boards) Disconnect the Antenna and the remainder of cables. Label them or make a careful note of their proper connections and jacks.

1 . PHYSICAL INSTALLATION of the OCXO board

Please read ALL these instructions before you begin. You have a choice of how to mount the new high stability OCXO with a no-drilling technique.



Orient the SDR-1000 so that the front panel is facing you.
Remove the top shell of the cabinet.
Remove the 2 front screws holding the front panel in place and gently pivot the top the front panel forward and lay flat on the table.



In order to gain access to the location where the OCXO board will be mounted, we have to remove the BPF board and the RFE board – refer to figure 2.

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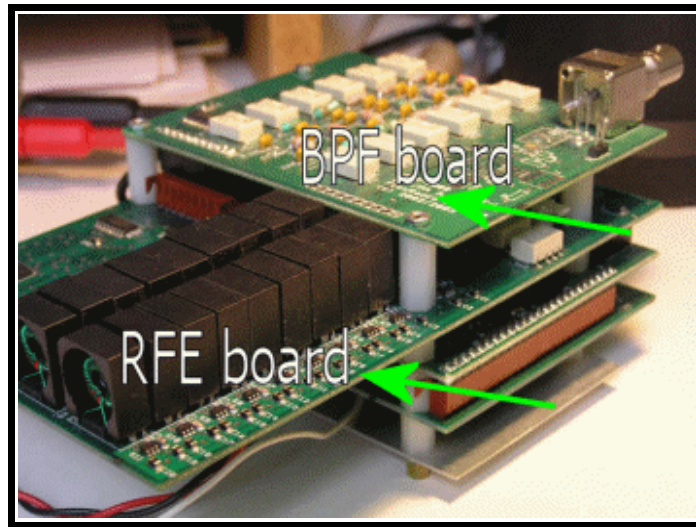


figure 2

Please be careful and note the location of the connecting cables. It's not tough but you need to take your time and possibly use your digital camera to document each step. It takes approx 10min to disassemble and approx 20min to put it back together again.



The top board (BPF) is secured with 4 nuts. The nuts screw onto 4 setscrews that are threaded into spacers.

Note: my boards are fastened together with threaded nylon spacers. Newer models may have substituted metal spacers.

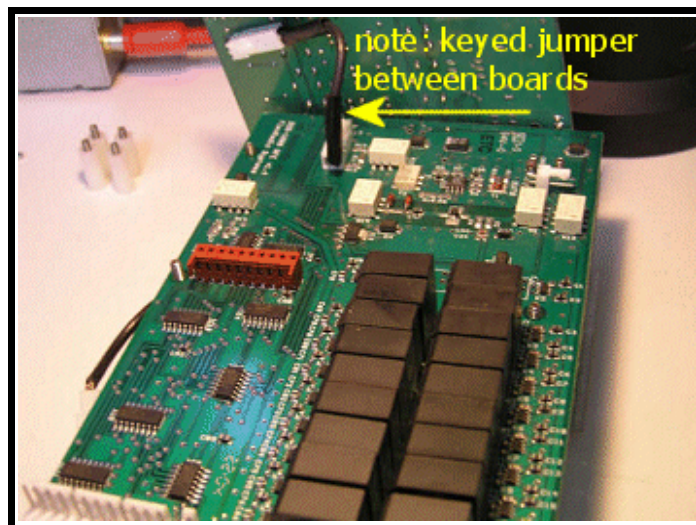


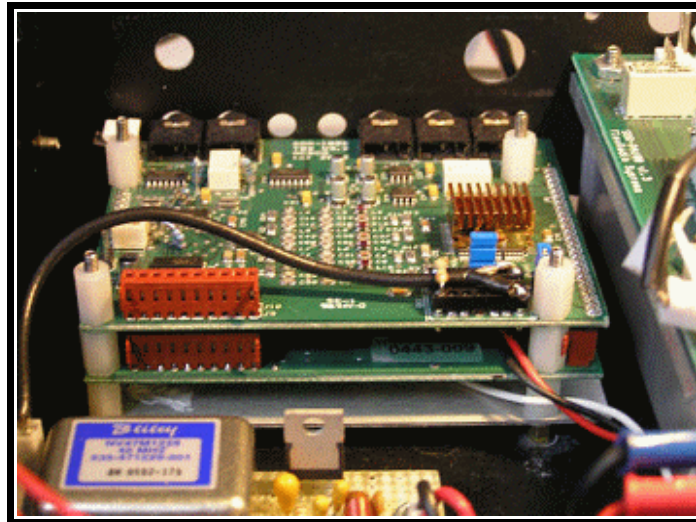
Figure 3

After the BPF board is lifted off, the 4 nylon spacers can be unscrewed, leaving the RFE board with 4 setscrews protruding. The RFE board can then be lifted off and also set aside. Note where the cables plug into their two prong sockets. **Be careful disconnecting the cable.**

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At this point the TRX board is exposed for easy access to the oscillator socket and SV1 and SV2. The OCXO mounting area is in full view as shown in the figure below.



note: this is a picture showing the prototype OCXO
[if you are viewing this online, click on image for full size picture]
figure 4



Select a location for the OCXO board behind the mic. connector and terminal block. Refer to figure 5 for a picture of where I mounted the prototype board in my SDR-1000.

Orient the OCXO board, so that the side with P1 (the osc. output socket) is leftmost and the front of the OCXO board is about 1" behind the terminal block. The exact location is not critical.

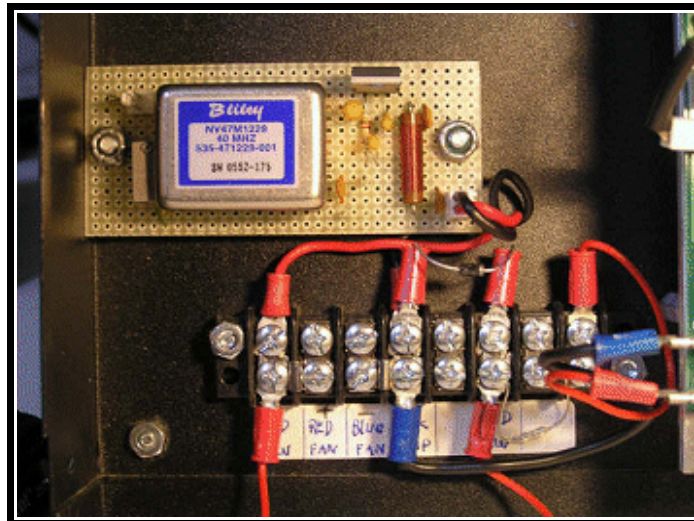


figure 5



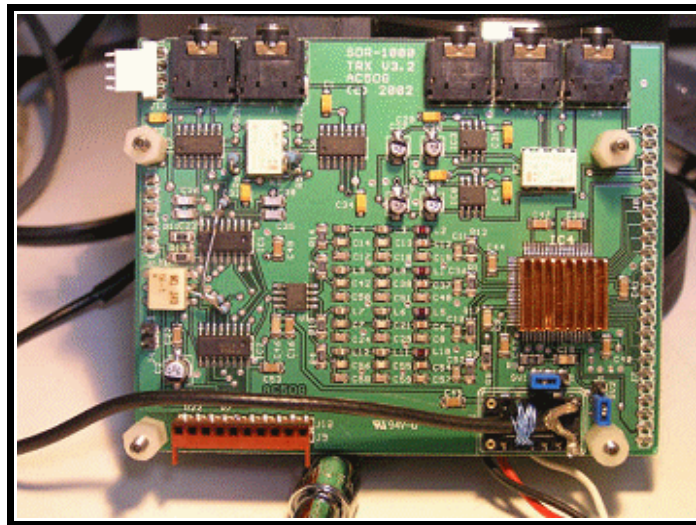
You can cut out the drill hole template and place it on the bottom of the chassis, carefully mark the drill hole positions and drill 4 holes to accommodate 4-40 machine screws. **You MUST BE EXTREMELY CAREFUL NOT TO ALLOW METAL FILINGS TO GET LOOSE!** With care, it can be avoided. Use the standoff hardware to securely mount the OCXO board to

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the bottom shell.

----- OR -----

- If you decide that drilling holes in the bottom shell of the cabinet is not for you, another method is offered. Cut out a scrap piece of aluminum or phenolic material the same size as the drill hole template and drill the 4 holes into it instead. In this case use the standoffs to fasten the OCXO board to this mounting plate. Then stick a 'Superlock Fastener' (Radio Shack 64-2363) to the bottom side of the mounting plate and simply put the assembly into position and press! The board will be secure but can be removed if necessary.
- Once the OCXO board is mounted, we need to connect the power leads and the oscillator cable. Connect the power leads at the same location as the fan is connected. Refer to figure 5. **BE CAREFUL** to connect the dark lead to the negative screw (where the blue lead goes). Then connect the light lead to the positive screw (where the red lead goes). You **MUST** observe polarity and connect it correctly or you will damage the OCXO board. The power connections from the SDR-1000 to the OCXO 12Vdc regulator is not reverse polarity protected. Please **BE CAREFUL**. If the power is not already plugged into P2, do so now observing the keyed connector.
- Next we need to remove the existing oscillator can, change jumpers at SV1 and SV2 and finally plug in the OCXO connector at the oscillator location. All of these things are located on the lower right side of the TRX board – refer to figure 6.



[if you are viewing this online, click on image for full size picture]
figure 6

Once the TRX board is exposed, we need to do 4 things:

- (a) remove the Valpey-Fisher 200mhz oscillator can and save it in a safe place.
- (b) move the jumper at SV-1 from pins 1-2 to pins 2-3.
- (c) move the jumper at SV-2 from pins 1-2 to pins 2-3.
- (d) carefully plug in the osc. plug with pins 7 & 8 plugged in on the right side of the TRX board. The RG-174/u cable exits the plug on the other side (pins 1 & 14) and plugs into P1 on the OCXO board, observing the keyed connector.

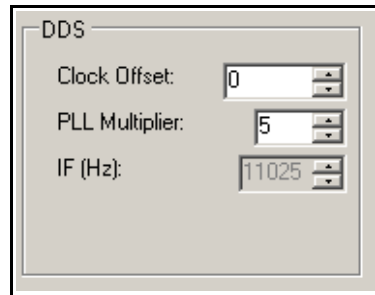
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- Now we need to re-assemble the board stack, so reverse the procedure you used to remove the BPF board and the RFE board. Carefully check that the extra cable plugs are put back.
- Congratulations!** the physical installation of the K2WS 40mHz OCXO Board is complete! Fasten the top of the cabinet and re-connect all the cables, the last being the power cable.

2. Setup and calibration

- Execute the PowerSDR Console, either the standard one or K6JCA's, but don't turn it on yet.

1. Call up the Setup Menu and go to General ->Hardware Config.



2. In the DDS box on the right side, set the Clock offset to 0 (zero).
3. Set the PLL Multiplier to 5 ($5 \times 40\text{MHz} = 200\text{MHz}$).
4. Turn on the rig and wait 3 to 5 minutes for the OCXO to stabilize.
5. Tune in **WWV** at 20, 15, 10 or 5mHz - the highest one with the best signal. Set the SDR-1000's VFO to EXACTLY to WWV down to the Hz and do not change it during the Clock Offset adjustment!
6. **Set the mode to DSB, set the Display mode to Phase, set the bandwidth to 500hz.** You will see the trace spot rotating in a circle. Depending on how far off we are, the speed of the rotating spot may be very rapid or slow. If the rig is off tuned to WWV 10Hz, the trace will make TEN revolutions/second. It may even appear as more than one rotating spot! If the rig is off tuned to WWV 1Hz, the trace will make one revolution/second. If the rig is off tuned to WWV 1/10 Hz, the trace will make one revolution in TEN SECONDS. If the rig is HIGH in freq., the trace rotates CCW. If the rig is LOW in freq., the trace rotates CW.
7. In the DDS box on the right side, CAREFULLY adjust the Clock offset value to slow down the rotating spot to a crawl. It's tricky if the spot is initially rotating faster than 2 rev./sec. You are adjusting correctly when you start to see one and only one rotating spot slow down as you adjust the Clock Offset. Your clock offset values should fall within the range of plus 25 to minus 25. Due to OCXO tolerances, my setting was +16 and another was -5. Remember that each of the offset clock increments represent only a fraction of a Hertz.

Take your time and you will be rewarded with 1Hz or better accuracy!

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This method is far more accurate than 'listening for zero beat' !!

8. CONGRATULATIONS! Your SDR is now as accurate and stable as the Icom IC-7800! Calibration is complete and will not be necessary to repeat. After powering up the SDR-1000 hardware, it takes just 3 to 5 minutes for the OCXO to stabilize. After that time your rig will not deviate more than 1/2Hz from exact. Do NOT use the Freq. Calibration function! It is no longer needed, nor is it designed to calibrate the rig with this kind of precision.

User Notes:

After the 5 minute warmup, your SDR-1000 frequency display is accurate to within 1Hz. Your rig should not drift because of heat buildup caused by long transmissions, changes in room temperature and so forth. The OCXO is rated at 0.03ppm from 0 to 50 degrees C.

You can check the frequency accuracy of your SDR at any time by repeating steps #4 thru #7. You may find after a few weeks of use the OCXO has moved 1/4 to 1/2 Hz. This results from 'ageing in' and usually settles down in 4 to 8 weeks. If required, manually adjust the clock offset using the procedure described above.

If the have any questions, please write me at "k2ws@hotmail.com".
website ---> "<http://www.k2ws.us/K2WS-OCXO.html>"
73, Alan Davis K2WS