

Packaging the Elecraft XG2 Receiver Test Oscillator and 2T-gen 2-Tone Test Oscillator Phil Salas – AD5X

My two recent test equipment additions are the Elecraft XG2 Receiver Test Oscillator, and the Elecraft 2T-gen 2-Tone Test Oscillator. As supplied, both kits are meant to be used unpackaged. I.e., they are printed circuit board assemblies with the switches, controls and connectors mounted directly on the PC boards. The kits even include rubber mounting feet that attach to the pc board assemblies. This is OK for occasional use, but I like more rugged packaging for my units so I don't have to worry about damaging them. It turns out that with a little thought, packaging is not too difficult – and I also wound up with more convenient-to-use pieces of test equipment!

The Elecraft XG2

The Elecraft XG2 is a 3-band receiver test oscillator with accurate switch-selectable 50uV (S9) and 1uV (S3) crystal controlled signals on 3.579 MHz, 7.040 MHz and 14.060 MHz. The pc board mounted controls include a small ON/OFF switch, a small 3-position rotary switch, and a standard-size DPDT slide switch. For packaging, I wanted the entire unit to be mounted within a metal project box - plus I wanted easy access to all controls.

It turns out that this is not that difficult. Basically, you must mount the rotary switch, a new DPDT level-select switch, the power LED and a new transmit power warning LED on the backside of the PC board. And you will also use a chassis-mount BNC connector and miniature toggle switch mounted on the metal box.

The first thing to do is build the pc board assembly MINUS the LEDs, switches and RF connector. If you already have a built-up unit, you will need to remove the existing rotary switch, the DPDT level switch, the LEDs and the RF output connector from the board. You can leave the ON/OFF switch in place, but place the switch in the OFF position. Now file the leads of the new DPDT slide switch called out in the parts list so that the switch contacts slide into the holes on the pc board. The original switch used pc pins, but the new switch has solder-lug pins. Solder this switch flush to the backside of the pc board. Next, solder the small rotary switch to the backside of the board, but elevate the switch above the pc board as much as possible. Finally, mount the power LED and the new round transmit power alarm LED on the backside of the PC board such that the bases of the LEDs are 0.350" above the PC board. The last thing to do is to drill two 1/8" diameter mounting holes on opposite corners of the PC board. When finished, you should have a backside assembly that looks like Photo A.

Now drill clearance holes in the box for the DPDT slide switch, the LEDs, the rotary switch, the pc board mounting screws, the ON/OFF toggle switch, and the BNC output connector. Figure 1 shows the dimensions I used. Dimensions aren't shown for the mounting screws as this varies based on where you drilled these holes in your pc board. Next solder wire leads to the ON/OFF switch position, and wire leads to the pc board for the new BNC output connector. Mount the 3/8" standoffs to the PC board with 1/4"x4-40 hardware, and mount the pc board assembly to the metal box as shown in Photo B. The rotary switch, DPDT level switch and LEDs should protrude through the metal box.

Finally, attach the knob to the switch (note that the switch has a 4mm shaft). Your final assembly should look something like Photos C and D. Incidentally, I called out a BNC cable and a BNC-to-UHF adapter in the part's list for convenience, in case you don't want to build up your own interface cable.

There you have it. Couple this test oscillator with a step attenuator and you now have an extremely useful piece of test equipment for serious receiver testing.

Table 1: Parts List for Electcraft XG2 Receiver Test Oscillator

<u>QTY</u>	<u>Description</u>	<u>Source/Part Number</u>	<u>Price each</u>
1	4x2.13x1.63" AL Box	Mouser 537-00-P	\$6.26
1	BNC Chassis connector	Mouser 530-CP-1094-AST	\$1.13
2	0.375"x4-40 tapped spacer	Mouser 561-L4.375	\$0.53
1	Knob – 4mm shaft	Mouser 45KN050	\$1.09
1	Ultra-bright Red LED	All Electronics LED-94	\$0.55
2	SPDT Sub-Mini Toggle	All Electronics SMTS-4	\$1.35
1	6-foot BNC 50 ohm cable	All Electronics CBL-28	\$3.25
1	BNC-F/UHF-M adapter	All Electronics BNC-UHF	\$2.00

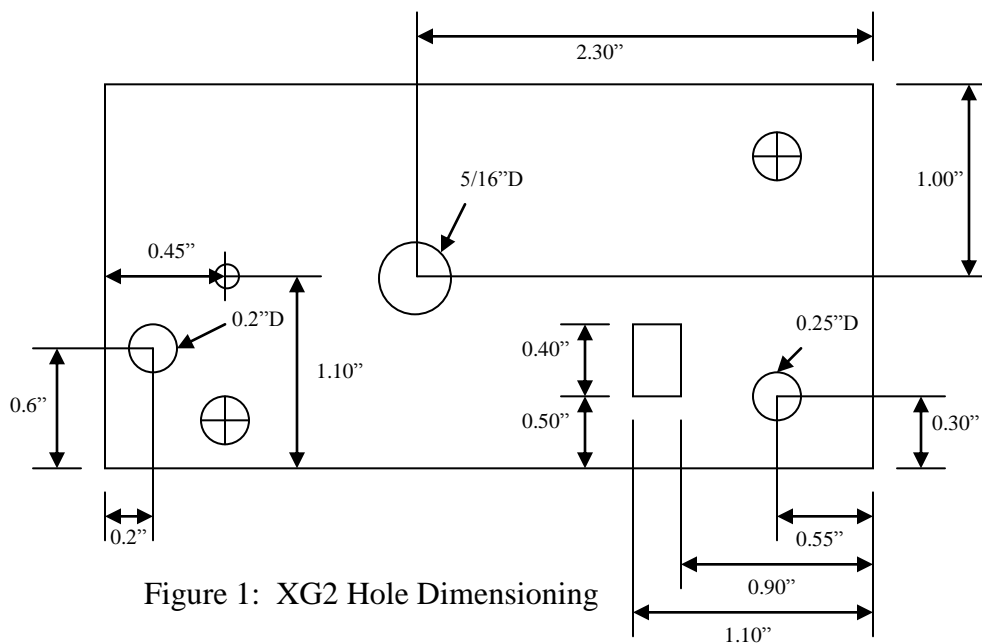


Figure 1: XG2 Hole Dimensioning

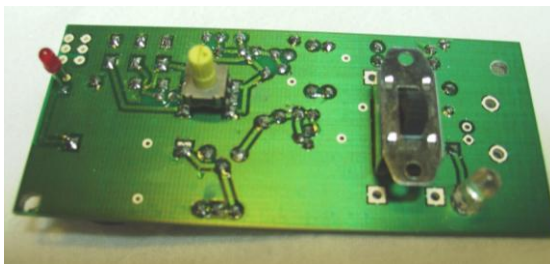


Photo A: Backside mounted components



Photo B: XG2 mounted in box



Photo C: Control side of the new assembly



Photo D: Different view – better shows the BNC connector output.

Now for the Electraft 2T-gen

The 2T-gen provides 700 Hz and 1900 Hz tones for measuring your transceiver's audio distortion and PEP output power. Besides wanting a protected assembly with easy access to all controls, I also wanted to key my transceiver from the 2T-gen. And a range control would be nice as the 300mv p-p output level is too much for easy adjustment of levels into the transceiver (typical microphone drive levels are 5-20mv p-p).

If you have an un-built 2T-gen kit, build it up EXCEPT solder only one end of R18 to the pc board, and do not mount the power switch, RCA jack, LED, and balance and level controls. If you have a built-up unit, you will need to remove the LED and level and balance controls, the RCA jack and lift one end of R18. Now from the backside of the pc board, mount the LED so its base is 0.30 inches above the pc board. Also, mount the balance control on the back of the pc board. The output level control should have the two outer pins bent straight outward before mounting, as these two outer pins must be wired to the opposite mounting holes on the pc board with small pieces of bus wire otherwise the level will adjust backwards. The balance control actually works better (in my opinion) as the level of the higher frequency tone increases as you turn the knob clockwise. When finished, you should have a backside assembly that looks like Photo E.

Now drill clearance holes in the aluminum box for the LED, level and balance controls, mounting holes, and toggle switch holes as shown in Figure 2. Mount the 3/8" standoffs to the PC board with 1/4"x4-40 hardware through the battery holder. Drill holes for a 1/8" stereo jack and another toggle switch on the output side of the metal box in convenient positions. Solder wires to the strap positions, on/off switch, open end of R18, and the audio output on the pc board, and mount the pc board assembly to the metal box using 1/4"x4-40 hardware. Solder the strap, switch, and output wires to the switches and connectors. Solder a wire from open end of R18 and from the pc board to the output range switch, and solder a 270K resistor across the switch's pins as shown in Figure 3. Finally, solder wires from the PTT switch to the ring of the 1/8" output stereo connector and ground (the output connector is a 1/8" stereo jack which has the audio output on the tip, and PTT on the ring). The output range control will switch between 300MV p-p and 30mv p-p maximum. Photos F, G and H show the 2T-gen mounted in the box, the control side, and the output connector/range control side respectively.

Finally, I built-up microphone interface cables for my Yaesu MKV, and ICOM IC-706MIIG/IC-703. I bought a CAT-5 cable, cut off one end and added a 1/8" stereo plug to the cut-off end for the ICOM radios. For the MKV, I used an 8-pin round connector from www.therfc.com for one end of the cable, and a 1/8" stereo plug on the other end. Your radio operating manual will provide specific connector wiring information.

Table 2: Parts List for Electraft 2T-gen 2-Tone Test Oscillator

<u>QTY</u>	<u>Description</u>	<u>Source/Part Number</u>	<u>Price each</u>
1	3.75x3x2.13" AL Box	Mouser 537-135-P	\$8.73
2	0.375"x4-40 tapped spacer	Mouser 561-L4.375	\$0.53
1	270K 1/4-watt resistor	Mouser 660-CF1/4C274J	\$0.10
2	Knob, 0.54"D, 1/4" shaft	All Electronics KNB-187	\$0.85

5	SPDT Sub-Mini Toggle	All Electronics SMTS-4	\$1.35
1	3.5mm stereo jack	All Electronics MJW-20	\$0.50
?	3.5mm stereo cable	All Electronics CB-121	\$1.50
?	3' CAT-5 cable	All Electronics CB-53	\$2.35
?	3.5mm stereo plug	All Electronics SMPM	\$0.65
?	8-pin round mic connector	RF Connection MP8F	\$2.50

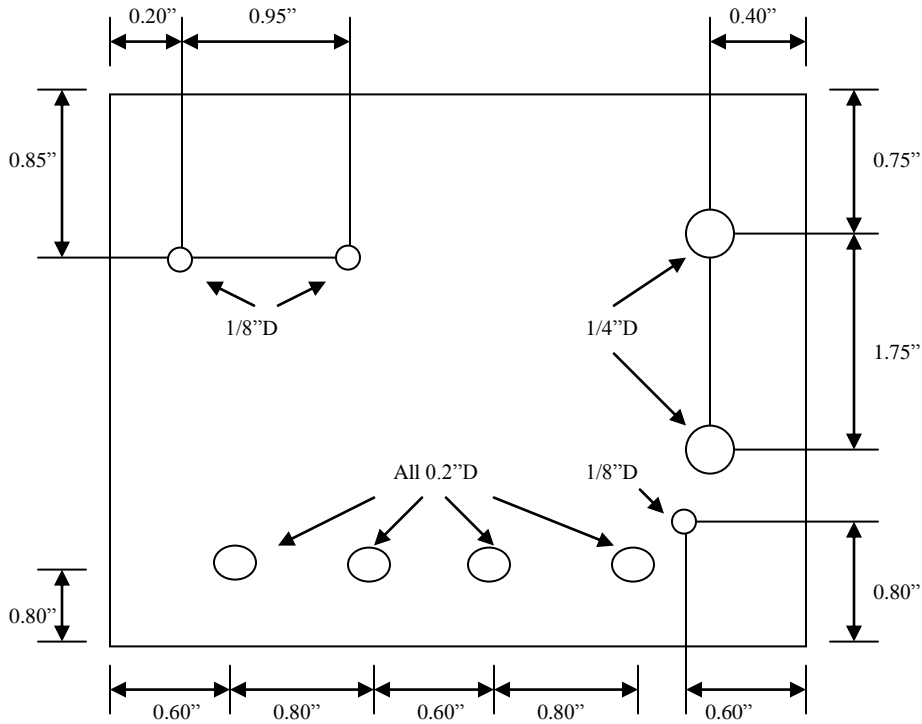


Figure 2: 2T-gen Hole Dimensioning

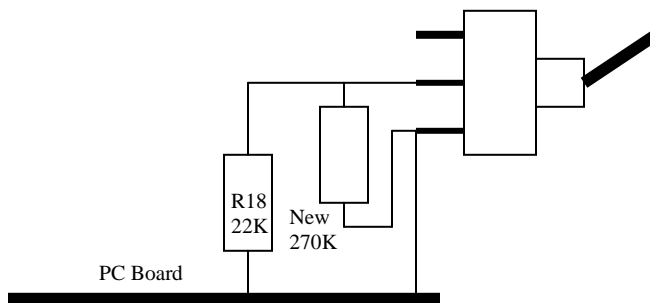


Figure 3: Output Range Control

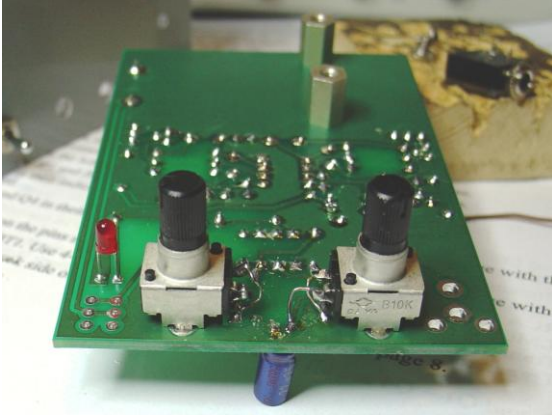


Photo E: Re-mounted backside parts



Photo F: 2T-gen mounted in aluminum box



Photo G: 2T-gen external controls



Photo H: Range control & output connectors