

ELECRAFT KXB30 30-METER ADAPTER

Assembly and Operating Instructions

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Introduction

The KXB30 adds 30-meter capability to the Elecraft KX1 transceiver. It also significantly improves performance in the 49-meter SWL band segment (receive only) by re-resonating the KX1's receive band-pass filter at about 6.2 MHz when the operator tunes below 6.7 MHz (with 40 meters selected). High-performance PIN-diode switches are used to minimize insertion loss and ensure good 30-m sensitivity.

With only a dozen or so parts, the KXB30 is easy to build. The module is installed on the top side of the KX1's main PC board. The KXB30's filters can be aligned from the bottom side of the board through the access holes labeled *30A* and *30B*, so the top cover can be installed prior to alignment.

Specifications

30-m coverage	Transmit/receive: 10100-10150 kHz; receive only: 8000-12500 kHz.
Added current drain	Approx. 3 mA
Size	1.5" (L) x 0.75" (W) (3.8 x 1.9 cm)

Parts Inventory



Caution: Diodes D1 and D2 can be damaged by static discharge. Before handling these parts, put on an anti-static wrist strap or touch any grounded, unpainted metal surface.

The table below lists all parts in the kit. The KX1 Owner's manual has photographs of similar parts.

Ref.	Description	Qty	Part No.
C3	Capacitor, 68 pF ("68" or "680")	1	E530150
C4, C5	Capacitor, 0.1 μ F ("104")	2	E530020
C1, C2	Capacitor, 1-40 pF trimmer	2	E540002
D1, D2	Diode, PIN, precision, 5082-3081 (glass)	2	R560014
R4, R5	Resistor, 1 k, 1/8-W, 5% (brown-black-red)	2	E500116
L1, L2, L3	Miniature RF choke, 47 μ H (yellow-violet-black) Note: L1-L3 may be labeled R1-R3 on the PC board.	3	E690043
MISC	KXAT1 PC board	1	E100184
MISC	Solid, insulated hookup wire, green	1 ft.	E760008
MISC	Rubber bumper, .04" thick x 0.3" square	2	E980017

Parts Placement Drawing

A drawing showing the locations of components on the KXB30 board can be found in Appendix F of the KX1 Owner's Manual.

PC Board Assembly



A fine-point, temperature-controlled soldering iron (700-800 degrees F) is required to assemble this kit. A high-wattage iron or one with a wide tip may damage components, pads, or traces. Use a minimum amount of solder to avoid ground shorts.



All parts must be installed flat against the PC board, with no extra lead length exposed, or the KXB30 will not fit into its position on the RF board. Also, either before or after soldering, all leads must be flush-trimmed to keep them from shorting to the KX1's inside top cover. *Flush-trimmers* are necessary for this, because ordinary diagonal cutters cannot get close enough to the lead to clip it off right at board level.

- Install the two 40 pF trimmer capacitors, C1 and C2. Each trimmer should be oriented as shown by its component outline. Solder and flush-trim the leads of each capacitor.
- Using a tuning tool, adjust C1 and C2 so that their rotor and stator plates are fully meshed. (In this position, the rotor plate will be pointing toward the smaller flat side of the trimmer.)
- Locate capacitors C3 (68 pF) and C4-C5 (0.1 μ F). If these capacitors have bent (formed) leads, straighten them completely using long-nose pliers.
- Install C3 (68 pF) so that its body is as close as possible to the PC board, but **do not solder yet**. When you press the capacitor down flat against the board, the epoxy coating around the leads may crack or chip slightly. This will not affect the capacitor's performance. Clean off any residue if this occurs.
- Using a ruler, make sure that the top of the capacitor is no more than 5/32" (4 mm) above the surface of the board. If it sits higher than this, the KXB30 module will not fit properly.**
- Bend C3's leads outward slightly to hold the capacitor in place. Solder C3, then flush-trim its leads.
- Install C4 and C5 in the same manner as C3. These capacitors must be seated as close to the PC board as possible. Flush-trim the leads after soldering.



D1 and D2 can be damaged by static discharge. Before handling them in the next step, put on an anti-static wrist strap or touch a grounded, unpainted metal surface.

- Locate the two small glass diodes, D1 and D2. One end of each diode has a black band, indicating the cathode end. Install these diodes with the black band oriented toward the banded end of their component outlines. Solder and flush-trim.

- Install R4 and R5 (1 k, brown-black-red). Solder and flush-trim as before.



L1, L2, and L3 may be labeled R1, R2, and R3 on your PC board.

- Install the 47 μ H subminiature RF chokes (yellow-violet-black) at either *L1-L3* or *R1-R3*, depending on how your PC board is labeled. The leads on these chokes are fragile; do not pull them or bend them excessively. Solder and flush-trim.

Pre-Installation Checks



Some components on the KX1 PC board can be damaged by electrostatic discharge. To avoid a difficult or expensive repair, put on a wrist strap, or touch ground before proceeding and often while handling the board.

- Remove the KX1's bottom cover and unplug the battery pack. Remove the VFO knob and the three screws on the top cover. Separate the KX1 PC board from the top cover.



All of the steps below must be completed successfully to ensure that the KXB30 will fit into its position on the KX1 PC board.

- The following components in the area of U6 on the KX1 main board must be mounted flat against the board, with no excess lead length showing: C1, L7, R19.

- Q8, Q2, and Q3 must be mounted as specified in the KX1 assembly instructions, with their rounded sides *down* (touching the KX1 PC board) and their flat (labeled) sides up. Q8 must be mounted exactly as shown by its component outline to prevent interference with one of the RF chokes on the KXB30 board.

- U6 (SA/NE602 or SA/NE612) must be mounted as close to the PC board as possible. Its top surface should be 5/32" (4 mm) or less above the surface of the PC board. If it sits higher than this, it must be removed and re-installed flat against the board as described in the KX1 manual.

- On the bottom of the KX1B30 PC board, locate the pads labeled with single letters *5, D, G, C, B, A,* and *G* in this order from left to right. There's a third "G" pad near the "2003" label that will not be used.

- The KXB30 module will be installed *upside-down* in the position showed in **Figure 1** on the next page, directly on top of U6. To verify that there are no obstructions, temporarily place the KXB30 in this location. The *D* and *5* pads should be to the left. The trimmer capacitors (C1 and C2) must line up with the two large holes in the KX1 board (on either side of U6). Turn the KX1 over to verify this.

- If the module doesn't fit in its intended location, re-check the positions and heights of all components on the KXB30. Also check components installed in the area of the KX1 board shown in the photo.

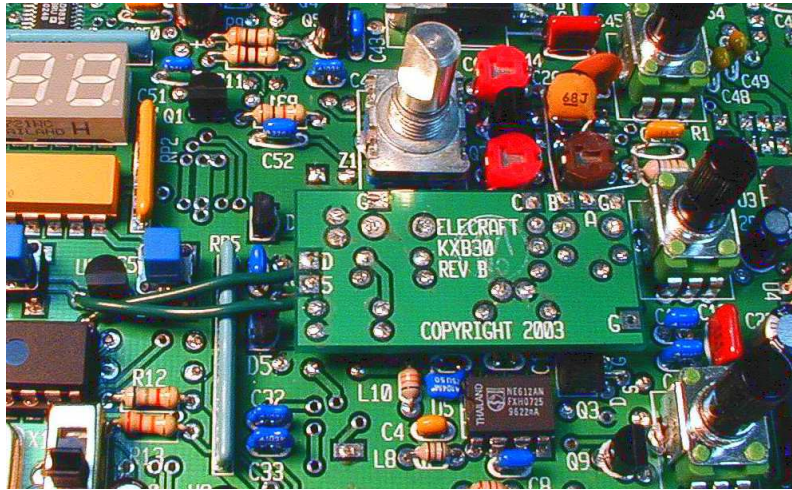


Figure 1

Installation

- Strip off all of the insulation from 5.5 inches (14 cm) of the supplied hookup wire.
- Cut the bare wire into four 1" (2.5 cm) lengths and one 1.5" (4 cm) length.
- From the remaining hookup wire, cut two 1.5" (4 cm) insulated lengths. Strip 1/4" (6 mm) of insulation off each end of both wires.
- Solder the two 1.5" (4 cm) insulated wires into the *D* and *5* pads on the KXB30 board, from the *top* side (the side with all of the components).
- Flush-trim the leads of these two wires on the bottom side.
- Insert the five 1" (2.5 cm) bare wires into the *G*, *C*, *B*, *A*, and *G* pads along the edge of the KXB30 board, from the *top* side. Before soldering, make sure almost the entire length of each wire is extending out from the top side—the wires should be inserted all way into their respective holes, but no farther.

The free ends of the wires will be routed to matching labeled holes on KX1 PC board. Due to space constraints on the top, the holes are labeled on the *bottom* side of the KX1 board (the side that faces the battery pack). The list below shows where to find the labeled holes, based on nearby top-side components:

- 5* Just left of U8 (the 5-volt regulator, which is near the MCU)
- D* Near pin 15 of U1 (MCU)
- G* Between two pins of the encoder (Z1), near the *U6* label (**Note:** C15, on the bottom of the board, must be folded up temporarily to access this hole)
- C* Between C1 and L7, near pin 8 of U6 (NE602)
- B* Immediately below the *C26* label and to the right of trimmer CA
- A* Just to the right of the *CC* label
- G* At the right end of L7, and the left side of the FILTER potentiometer, R2

Insert the *5* and *D* leads (the insulated wires) into their pads on the KX1 board, then solder and trim the leads on the bottom side. (The two wires will cross over each other after installation.)



Do not solder the remaining wires yet.

Insert the remaining leads (bare) into their pads on the KX1 board, then pull them all taut on the bottom side as you position the KXB30.

Verify that all wire leads have been inserted into the correct labeled pads.

Press down on the KXB30 module so that it is as close as possible to the top of U6.

Turn the KX1 over and verify that the adjustment slots on the KXB30's two trim caps are centered inside their access holes (*30A* and *30B*). If not, adjust the position of the board as needed.

Adjust all of the bare wires such that they do not touch each other or adjacent components.

Once you're sure the KXB30 and all of its interconnections are correctly positioned, solder and trim these leads on the bottom of the KX1 board.

Flush-trim the *G* lead between the encoder pins, then fold capacitor C15 back down so it will not hit the battery socket.

Using a magnifying glass, examine all of the trimmed leads on the visible side of the KXB30 board. Flush-trim all leads as short as possible so they can't short to the KX1's top cover. Incorrectly-trimmed leads may also interfere with installation of the two rubber bumpers in the next step.

- Remove the adhesive backing from the rubber bumpers and install them as shown in Figure 2a. If the bumpers don't sit flat on the board, make sure all of the leads have been trimmed.
- Hold the KX1 so you can look at the edge of the installed KXB30 board as shown in Figure 2b. All leads must be trimmed well below the height of the two rubber bumpers.

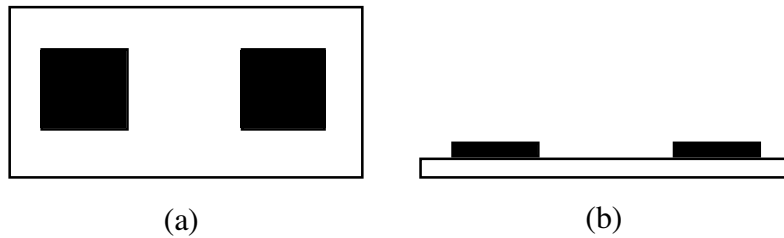


Figure 2

- Re-install the KX1 top cover, 3 screws, and VFO knob. Leave the bottom cover off so the trimmer capacitors can be aligned.

Alignment and Test

- Insert a millimeter, preferably a DMM (digital multimeter), in series with the KX1's external power jack (J1) and a fused, 8 to 14-volt DC power source.
- Select a 200 or 300 mA full-scale range on the meter.
- Turn on the power supply and the KX1. If the KX1 LED display doesn't come on, turn off power immediately and check resistance at the collector of the PA transistor (Q6, 12 V line), as well as pin 1 of the MCU (5 V line) and pin 6 of U3 (TC4427, 6 V line). If any of these reads a low resistance (less than 500 ohms), you may have a short, possibly due to installation of the KXB30.
- The milliammeter should show about 34 to 37 mA with the LED timed out. If the current is much higher than this, it could again indicate a short or component problem on the KXB30. **Note:** If necessary, use the **LED** menu entry to set the timeout below infinite (**INF**) to allow it to turn off for this current measurement. When editing the **LED** menu entry, turning the VFO knob counter-clockwise will reduce the timeout period to as low as 5 seconds (**t05**).
- In the menu, set the **B30** parameter to **ON**, then exit the menu. 30 meters will now appear after 40 meters when you tap **BAND** quickly two or more times.
- The KXB30 introduces some stray capacitance. To account for this, re-align the KX1's receiver on 20 and 40 meters as described in the KX1 Owner's manual (Alignment and Test, Part II).

Switch to 30 meters and align the two trimmers on the KXB30. You can peak them while listening to WWV at 10 MHz, or using signals or noise in the ham band (10100-10150). The peak of either or both capacitors may be somewhat broad since they represent only a portion of the total capacitance.



C1 and C2 on the KXB30 are switched in on 30 meters, and also when you tune below 6.7 MHz (approx.) on 40 meters. This re-peaks the receive band-pass filter near the center of the 49-meter SWL band (about 6.1 MHz), greatly improving sensitivity in this band. The following step will confirm this.

Switch to 40 meters and tune the VFO down toward the midpoint of the 49-meter SWL segment (about 5.9-6.2 MHz). Locate a signal in this vicinity. If the KXB30 was properly aligned, it will now be greatly enhancing sensitivity in this range. Next, temporarily set the **B30** parameter to **OFF**, then exit the menu. As soon as you move the VFO, sensitivity should drop sharply. Re-set the **B30** parameter to **ON** and exit the menu. Sensitivity should increase again.

Turn off the KX1 and re-install the bottom cover. *Be very careful not to pinch the battery wires between the bottom cover and the ATU module or the nearby long standoff.*

Circuit Details

When the KX1 is switched to 30 meters (or tuned below about 6.7 MHz on 40 meters), the MCU places 5 volts DC on point *D*, forward biasing high-performance PIN diodes D1 and D2. This inserts the series combination of C3/C1 in parallel with points *A* and *B*, i.e. in parallel with CA on the KX1; it also inserts C2 from point *C* to RF ground, or across L7 on the KX1. At other times point *D* is at 0 volts, reverse biasing the diodes so they have a minimal effect on the band-pass filter.

