

ELECRAFT KBT1 INTERNAL BATTERY ADAPTER

Installation and Operating Instructions

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Introduction

The KBT1 internal battery adapter allows convenient operation of the Elecraft K1 transceiver in the field, minimizing station size and weight. You can use any AA-cell type, disposable or rechargeable (Alkaline, NiCd, NiMH, etc.). NiMH cells are preferred because of their relatively flat discharge curve and large number of recharge cycles. The replacement top cover provides quick access to the batteries--using just two thumb screws--so it's easy to remove and recharge the batteries using any charger of your choice.

The internal battery can typically handle power settings of 5 watts or more on 80-30 meters, and 4 watts on the higher bands. However, 2-3 watts is recommended for efficient operation from low voltages (9-10 V for eight NiMH or NiCd cells). At 3 watts, you'll get roughly 5-10 hours on one charge with 1.6-AH NiMH or Alkaline cells.

The K1 can operate with complete stability down to an internal battery voltage of about 8.2 volts, thanks to its low-dropout first regulator and double regulation of the VFO. Battery life is extended near end of charge by the KBT1's special reverse-polarity protection diode (95SQ015), which is optimized for low voltage drop (less than 0.2V @ 500 mA).

The kit includes a recessed battery-disable switch, accessible from the top cover. This switch should be set to the OFF position whenever an external battery is used, as well as when the K1 is transported. Also included is a slightly smaller replacement speaker. To provide physical stability, the battery holder and speaker are held firmly in place by a custom aluminum bracket.

Specifications

Battery type ¹	Any type of AA cell; NiMH, NiCd, or Alkaline recommended
Weight ²	Approx. 7 oz. (200 g) for 8 NiMH or Alkaline AA cells
Operating time (1600 mA-hr NiMH or standard Alkaline)	
Receive only	Over 20 hours (using headphones; 60 mA avg. receive current drain)
Transceive	5-10 hours typ. (3 W transmit, transmit duty cycle 20%)

¹ AA-size batteries from some manufacturers may intentionally exceed the standard AA diameter specification (approx. 0.55" or 14 mm) as a means of slightly increasing capacity. Batteries over this size should not be used with the KBT1 because they will not fit in the standard AA-cell holder supplied. Radio Shack NiMH and Alkaline cells (among others) are the correct size.

² The KBT1 bracket and other parts add less than 1 oz. net because the replacement speaker is lighter than the original.

Parts Inventory



Caution: The battery protection diode, D1 (95SQ015), can be damaged by static discharge. Before handling D1, put on an anti-static wrist strap or touch any grounded, unpainted metal surface.



The table below lists all parts in the kit. If anything is missing, contact Elecraft.

Ref.	Description	Part No.	Qty
S1	Switch, SPDT slide	E640008	1
D1	Diode, high-power, ultra-low voltage drop; type 95SQ015	E560009	1
MISC	KBT1 top cover, painted	E100122	1
MISC	KBT1 battery bracket	E100123	1
MISC	Battery holder, 8 AA cells, wire leads, MPD BH48AAW	E980035	1
MISC	Speaker, 8 Ω, 0.5 W, Jameco A0201C	E980036	1
MISC	Dual-conductor wire, #22	E760012	6"
MISC	2-pin female connector housing w/locking ramp	E620021	1
MISC	Female crimp pin	E620022	2
MISC	Hookup wire, stranded, #24, RED	E760015	1 ft
MISC	Hookup wire, stranded, #24, BLACK	E760016	1 ft
MISC	Heat-shrink tubing, 1/8" diameter, Digikey CP018-100-ND	E980037	2"
MISC	Cable tie, 3 inch	E980002	3
MISC	Neoprene washer, 1.25" dia. x 1/8" thick (32 x 3 mm)	E700053	1
MISC	Neoprene spacer w/adhesive, 3/4 x 1/2 x 1/2" (19x12x12 mm)	E700054	2
MISC	ON/OFF label	E980034	1
HDWR	Thumb screw, 4-40 x 5/16", black	E700050	2
HDWR	4-40 screw, 5/16" flat-head phillips, black (1 spare)	E700027	3
HDWR	#4 split lock washer (4 spares)	E700004	10
HDWR	4-40 nut, small-pattern, steel/zinc (2 spares)	E700055	4

Assembly

- Trim the leads of the 95SQ015 diode (D1) to exactly 3/8" (9.5 mm) as shown in Figure 1A.
- Fold D1's leads downward at right angles, keeping them very close to the body of the diode. Then use needle-nose pliers to form the leads as shown in Figure 1B.
- Place D1 across the terminals of the SPST slide switch (S1) as shown in Figure 1C. Adjust the spacing between the diode leads so that they lightly grip the two switch terminals.
- Make sure D1's cathode lead (banded end) is not touching the third switch terminal. Once the switch and diode are positioned as shown in Figure 1C, solder the diode in place.

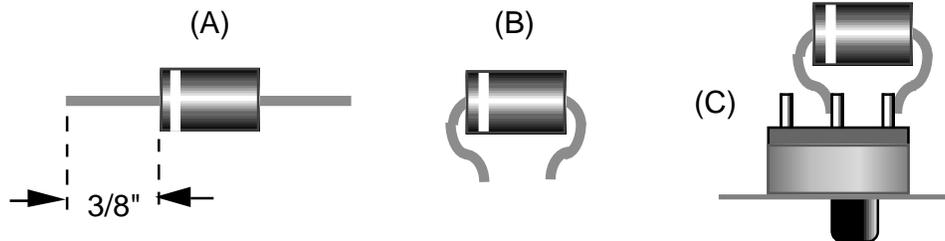


Figure 1

- Orient the 8-cell battery holder as shown in Figure 2. The holder's wire leads exit at the pair of small round holes identified by the arrows.
 - To provide better strain relief for the leads, route them as shown in the drawing. First, insert the leads through the two round holes near the first pair. Then pull the leads out through the rectangular hole.
- Note:** Your holder might have a slightly different hole configuration than the one shown. You should still be able to route the leads in a similar way.
- Cut the battery holder leads to a length of 3" (7.5 cm), measured from the point where they emerge from the rectangular hole. Remove 1/4" (6 mm) of insulation from then end of each lead, then tin the strands very lightly with solder.

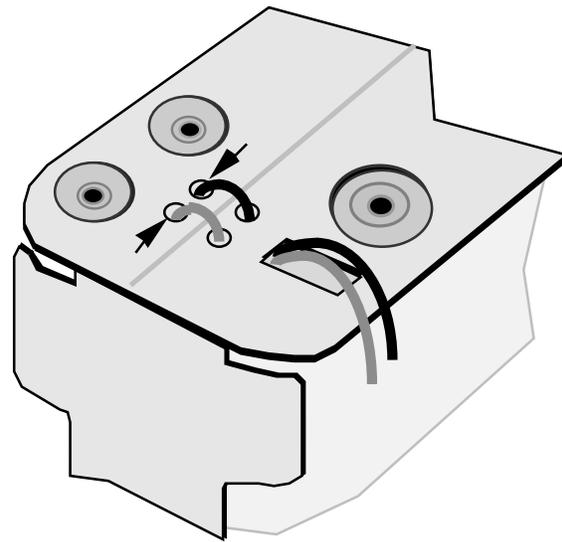


Figure 2

- Locate the battery/speaker bracket and orient it vertically as shown in Figure 3A. The switch (with diode attached) will be installed at the lower end of the bracket. The mounting hardware, shown in detail in Figure 3B, will be installed in the next few steps.
- Insert 5/16" (8 mm) flat-head screws into the countersunk holes at the lower end of the bracket.
- Place **two** #4 split lock washers on each screw. These set the spacing from the switch to the bracket.

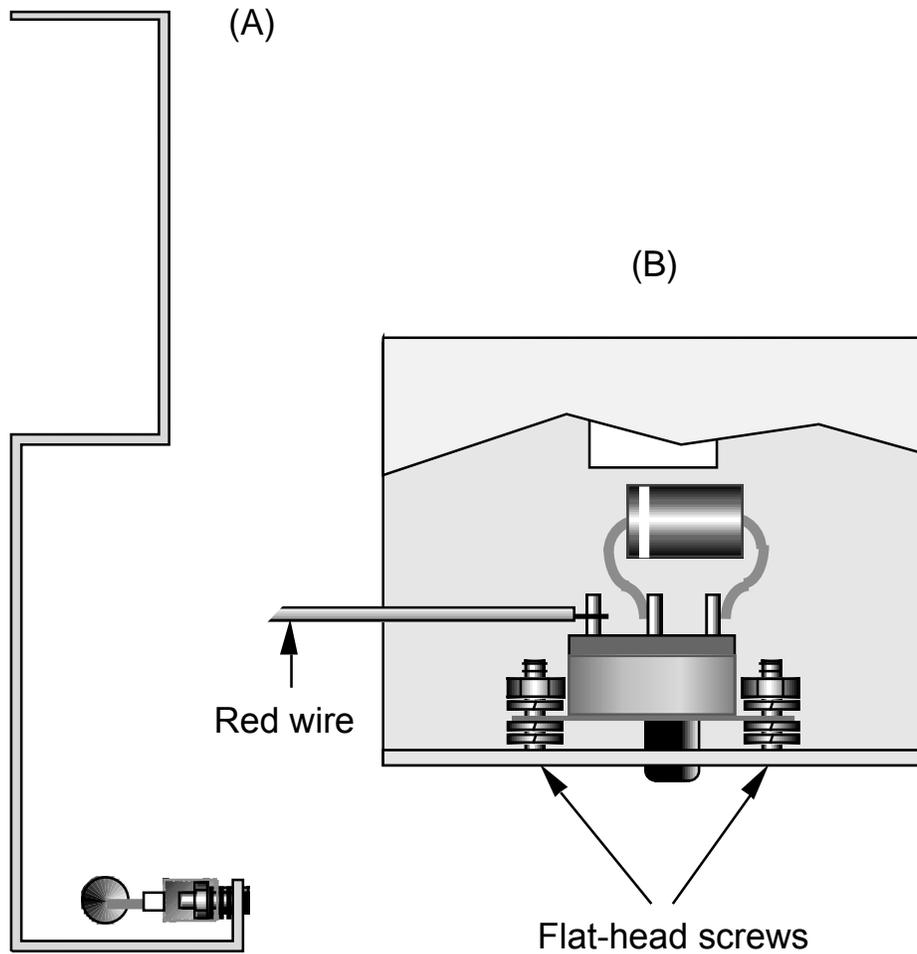


Figure 3

- Install the switch onto the two screws (Figure 3B). **Make sure the two washers which have already placed on each screw stay between the switch frame and the bracket.**
- Secure the switch to the bracket using one additional #4 split lock washer and one 4-40 nut on each screw. Do not over-tighten.
- Cut an 8" (20 cm) length of red hookup wire. Remove 1/4" (6 mm) of insulation from each end. Twist the strands tightly together at both ends, then tin each end using a very small amount of solder.
- Wrap one end of the red wire around the unused switch terminal (Figure 3B). Make sure the wire is not contacting the adjacent switch terminal or diode lead, then solder.
- Cut a 4.5" (11.5 cm) length of black hookup wire. Prepare the ends as you did with the red wire.
- Form one end of the black hookup wire into a small hook. Do the same to the black lead of the battery holder. Attach the two hooks together securely, then solder.
- Cut a 1" (2.5 cm) length of heat-shrink tubing, then slip it over the joint between the two black wires. Shrink it using a heat gun or a soldering iron (**not the tip**--use the thicker part, about 1" from the tip).

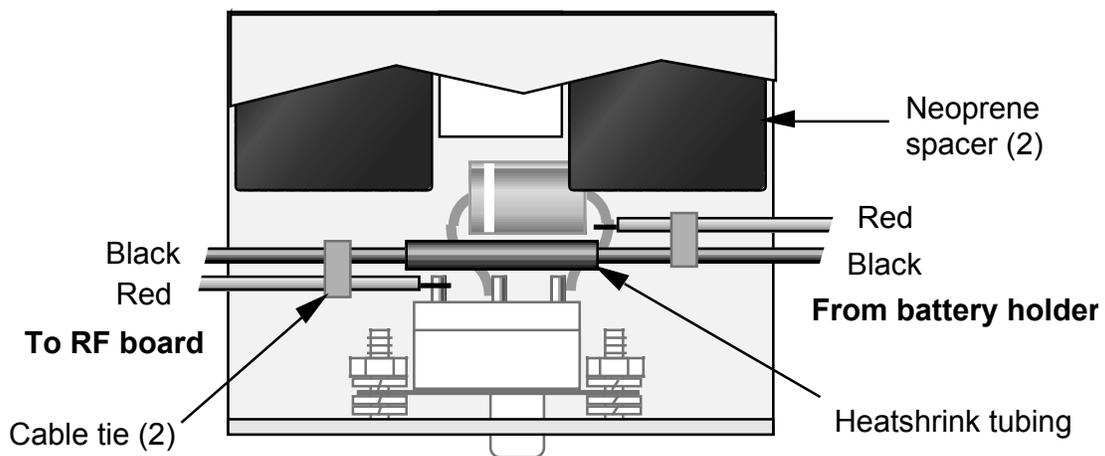


Figure 4

- Solder the battery holder's red wire to the anode (non-banded) end of D1 as shown in Figure 4.
- Position the black wires and heatshrink tubing as shown above. Secure all wires using two cable ties.
- Attach the two self-adhesive neoprene spacers at approximately the locations shown. The spacer on the right may be touching the body of D1.

Cut a 5" (13 cm) length of two-conductor speaker cable. Remove 1/4" (6 mm) of insulation from the wires at both ends. Twist the strands together and tin them using a small amount of solder.

At one end of the speaker cable, solder crimp pins to the two wires as shown in Figure 5.

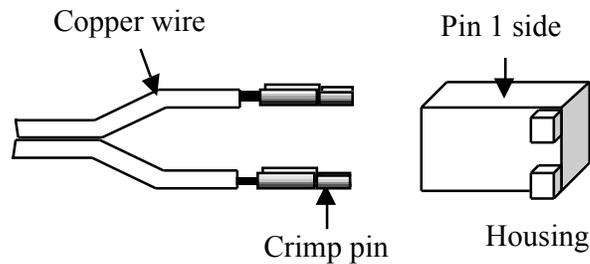


Figure 5

Insert the copper wire into the pin 1 position of the two-pin housing as shown. Insert the other wire into the pin 2 position. **Note:** The crimp pins should snap into place. Each pin has a very small tab on the back that latches into a hole in the back side of the housing when inserted.

Connect the other end of this cable to the two terminals of the round replacement speaker. The copper wire should be connected to the lug marked (+) on the speaker. Solder both wires.

Slide the neoprene washer over the speaker magnet. (See Figure 6, next page.)

Installation

Turn off the K1. Disconnect the antenna, power source, headphones, and key.

Remove the top and bottom covers. Unplug and remove the KAT1 (if applicable) and Filter board.

Plug the new speaker into P2 on the RF board. The 2-pin housing can only be plugged in one way.

Install the battery/speaker bracket as shown in Figure 6. The notches at either end of the bracket slide over the tops of the pressed-in 10-32 nuts located on each K1 side panel.

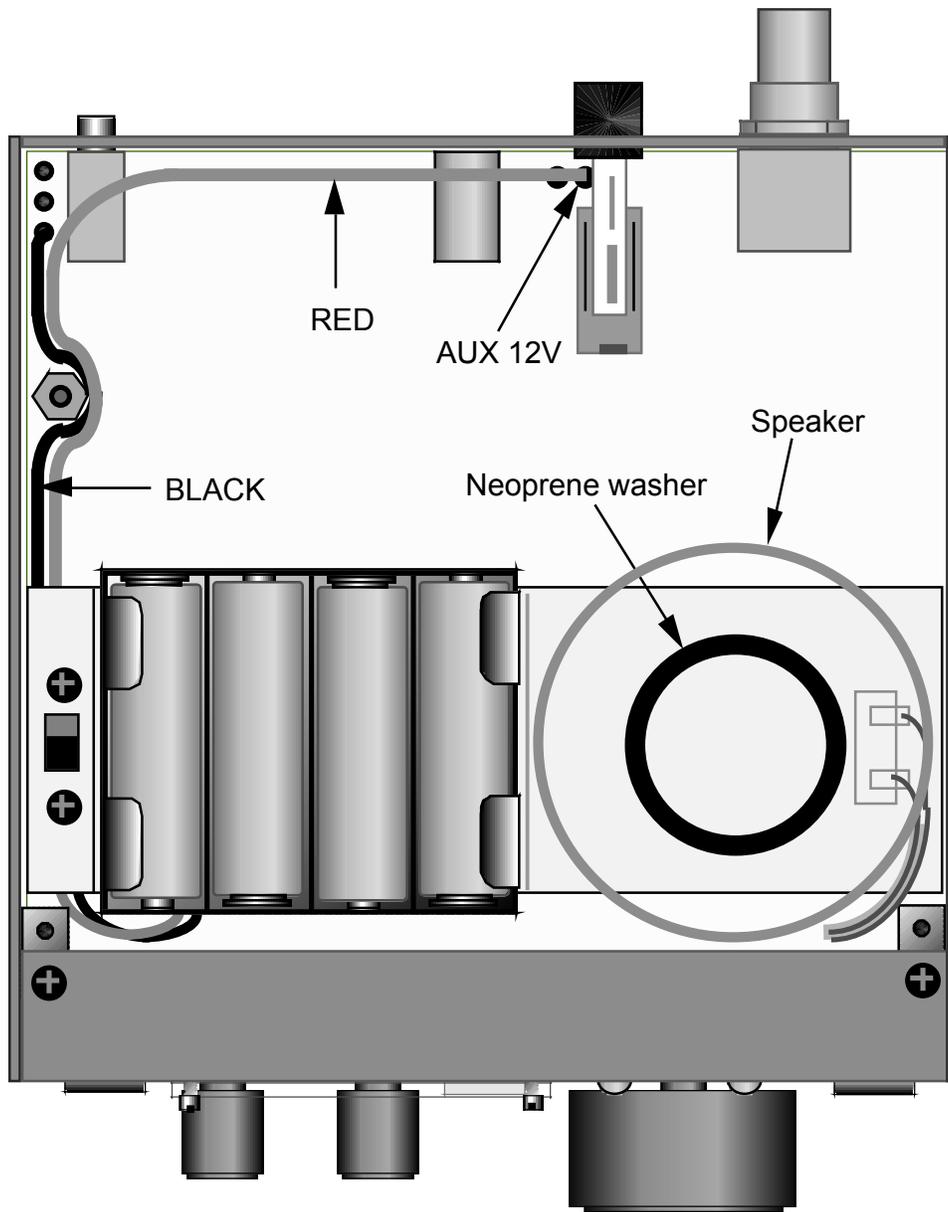
Place the battery holder (**without any batteries**) in the indicated position, with its leads towards the front. Insert the speaker into the large round hole in the bracket. Press the speaker down as far as it will go.

On the RF board near the power switch you'll find a ground pad (⊥), which will **not** be used. To the right is a pad labeled "AUX 12V" (see Figure 6). Insert the free end of the **red** wire into this 12V pad. Set the K1 up on its left side. Solder the wire on the bottom side of the RF board, and trim excess lead length.

Near the key jack are three wire pads labeled "DOT", "DASH", and "GND" on the bottom side of the RF board. Insert the black wire into the GND pad. Solder and trim the wire.

Route the red and black wires as shown in Figure 6. Keep them close as possible to the side panel and the nearby Filter board standoff. Final routing will be done with the Filter board in place.

Figure 6. KBT1 installation (see text).



- Plug in the Filter board, keeping the red and black wires **below** the board. Re-position the wires as needed. **The battery wires must not touch the Filter board or interfere with its insertion or removal.**
- Install the bottom cover (6 screws). Also install the KAT1 module if applicable.
- Connect an external power supply or battery to the K1, then turn the transceiver on. Hold the **DISPLAY** switch to select S-meter mode, then hold it again to select **BAT** voltage display mode. Verify that the voltage displayed is correct for the attached power source. **Note:** The indicated voltage will be about 0.3 V lower than the actual source voltage due to the K1's reverse-polarity protection diode, D16. This diode is in series with the external DC power jack only, not the internal battery. The internal battery protection diode, D1, has a much lower voltage drop of about 0.1 V in receive mode.
- Turn off the K1 and disconnect the external power source.
- Install the new top cover. The cover is bent so that it creates a "hinge" at the front panel. When the cover is correctly installed, the battery on/off switch will be accessible through a hole at the left. To secure the cover, use two 4-40 thumb screws. Tighten them just enough to hold the cover in place.
- Attach the INT. BATTERY ON-OFF label to the left side panel of the transceiver, approx. 1/8" (3 mm) below the top edge. The label should be aligned with the battery's on-off switch.

Using the Internal Battery

- **Install batteries in the K1 only when portable operation is planned. At all other times the batteries should be removed and stored elsewhere.**
- **Do not attempt to charge batteries inside the K1.**
- **When inserting or removing batteries, avoid putting stress on the battery holder leads.**
- **If the K1 is transported with batteries installed, set the internal battery switch to OFF. This will prevent battery discharge if the K1's rear-panel power switch is unintentionally activated.**

Battery Selection and Charging

Alkaline and NiCd batteries can be used with the K1. However, we recommend using high-capacity NiMH cells (1600 mAh), which are replacing older types in many applications. A compatible charger is required, such as the Radio Shack #23-422 8-cell Fast-Charger, which will also work with NiCd batteries

Operating Considerations

To maximize battery life, set power to 3 W or less, use a well-matched antenna, and use headphones when possible. In keeping with good QRP practice, you should *listen* far more than you transmit.

The K1 periodically flashes a **BAT LO** indication if the voltage drops below about 9 volts³. This level was chosen for compatibility with an 8-cell NiMH pack, which will remain above 9 volts during 90% of its charge. You can check the battery voltage at any time using **BAT** display mode (see above).

³ The warning level was 10.5 V in rev 108 and earlier firmware. Upgrading to 109 is recommended.