

Simply Better Manufacturing

Cooler KX Lite™ & Cooler KX Plus™

Aftermarket Elecraft® KX3 Heatsink Upgrade

Installation Guide



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Parts List

- (1) Cooler KX™ heatsink
- (1) Bag containing mounting hardware:
 - (3) 4-40 3/8", 18-8 alloy stainless steel, socket cap screw (shiny)
 - (1) 4-40 5/8", 18-8 alloy stainless steel, socket cap screw (shiny)
 - (2) 4-40 18-8 alloy stainless steel, Keps nuts
 - (1) 3/32" hex key (A.K.A. Allen wrench)
 - (1) 4-40 3/8", black oxide finish, alloy steel, knurled socket-cap screw*

* Included for use as a “try screw”, for testing the threads in the KX3 bottom cover sheet metal; alloy steel being preferable to stainless steel for this task. **WARNING!** Do not leave this screw in contact with your heatsink, as it will cause dissimilar metal corrosion! Especially **DO NOT** permanently install it in either of the accessory mounting holes!

Additional Tools You Will Need

- A quality ESD wrist strap and mat.
- Small Phillips screwdriver.
- Thin-wall 1/4" wrench (or medium-size needle-nose pliers).

Additional Tools You Might Need

- 7X Bausch & Lomb “Hastings Triplet” jeweler’s loupe (or a good magnifying glass).

Preventing Electrostatic Discharge Damage

You must follow proper handling procedures while working inside your radio. Failure to do so can result in damage to sensitive components! Many semiconductor devices can be **damaged or destroyed** by the rapid discharge of the static voltage levels that naturally occur on the human body. This phenomenon – known as Electrostatic Discharge (ESD) – is most commonly associated with a brief spark. However, considerably “smaller” discharges where no spark is discernable, can still cause damage.

ESD damage can be catastrophic or result in a latent defect with one or more of the following properties:

1. Significantly reduced component life, (but otherwise not discernable).
2. Occasional unexplainable behavior (typically applicable to digital logic circuits).
3. Reduced performance (typically applicable to analog devices).

ESD damage can be prevented by adhering to the following guidelines:

1. Ensure that everything (INCLUDING YOU) that comes into contact with ESD sensitive devices is at the same electrical potential as the devices.
2. Correctly wear a “quality” ESD wrist strap that’s grounded through a 1 MΩ current-limiting resistor. **NEVER GROUND YOURSELF DIRECTLY** – i.e. without a 1 MΩ current limiting resistor – as this poses **A POTENTIALLY LETHAL SHOCK HAZARD!**
 - a. A “quality” ESD wrist strap will already have this resistor “built-in”.
 - b. NEVER wear a wrist strap while working on equipment that’s powered on!
3. Ensure that any potential differences are equalized gradually:
 - a. This is the purpose of an ESD mat (described below). Given that most radios have insulating “feet”, be mindful when working inside an assembled radio, to ensure it’s actually grounded while “sitting” on your ESD mat! (You may need to ground the case to your mat with a clip lead to accomplish this.)
 - b. Note that any conductor that isn’t at the same potential as an ESD sensitive device is an ESD hazard to that device, since if the two should come into contact, the current flow to equalize the potential difference between them will be instantaneous. **THIS INCLUDES ALL METAL TOOLS!** Therefore, any metal tools that come into contact with your radio’s circuitry **MUST** first be placed on your ESD mat, or you must first hold the metal portion of the tool (with your bare skin) while wearing a grounded ESD wrist strap.
4. Wear cotton clothing, including socks!
5. Keep materials that readily hold a static charge (synthetic fabrics, synthetic carpets, Styrofoam, your cats, etc.) at least six feet from your ESD workstation. The industry standard is less, but six feet minimizes the likelihood of touching something you shouldn’t. Don’t even sit on a chair that’s has synthetic fabric! Cover it with cotton towels instead!

Choosing & Maintaining an Anti-Static Mat

An anti-static mat is a relatively poor electrical conductor. This property ensures there won’t be a rapid current flow while equalizing the potential difference between the mat and any sensitive devices placed on it.

Suitable ESD mats are readily available from many online sources; just search for “esd supplies mat”. It is best to purchase a mat with certified electrical properties. Note that inexpensive mats (typically the portable roll-up variety) often do not meet the minimum industry resistance requirements and should be avoided!

AN ESD MAT **MUST BE GROUNDED** and must be kept clean (i.e. free of the natural oils in your skin) to function properly. Its surface must also be kept sufficiently moist. The right way to accomplish these latter two objectives is with a product like Tech-Spray “Zero Charge Mat & Table Top Cleaner”.

You should clean / treat your mat whenever the surface reflectivity becomes uneven, as this indicates a build-up of the natural oils from you skin, or other contaminants. As a minimum, this should be done monthly.

Thermal Grease

Some customers have asked if they should apply thermal grease. My position on this subject is **NO, ABSOLUTELY NOT!** I strongly discourage its use because ...

- **... IT'S EXPENSIVE**, More importantly, cheap thermal compounds eventually dry out given sufficiently many thermal cycles, at which point they'll **PERFORM CONSIDERABLY WORSE** than if they had never been applied in the first place!
- **... IT'S MESSY**, although this shouldn't be an issue if it's applied sparingly or the heatsink is never removed. Unfortunately, **SPARINGLY WON'T SERVE ANY PURPOSE**, due to the textured paint on the case.

Before and after performance measurements have shown that the benefit of thermal grease borders on insignificant. Subsequent theoretical analysis by my team confirms that ITS USE IS UNWARRANTED.

My biggest concern is that if you apply a generous amount of a cheap compound which gradually dries out, then eventually you'll find yourself in a situation where you have a thick layer of insulating “crud” between the heatsink and case!

Before You Begin

Unless you assembled your KX3 from a kit, **BE SURE TO READ THE CAUTIONS REGARDING THE FLEX CABLE** in the “Final Assembly” section of Elecraft's KX3 kit assembly manual (rev G2 May 1st, 2013). This includes the comments associated with figures 52, 53, 54, & 56.

Installation

The stainless steel mounting screws included with Cooler KX™ heatsinks are intended for high precision applications (like keyer paddles). I designed my heatsinks around these screws because **THEY ARE STRONGER, MORE ATTRACTIVE, AND EASIER TO INSTALL** than Phillips head screws.

Unfortunately, some KX3 owners have found that this precision hardware won't thread into the two outer mounting holes used to secure the heatsink to the case – due to contamination from minute amounts of black oxide finish that has detached from the original mounting screws. (This issue is only known to affect factory assembled radios.)

The following installation instructions “put off” opening the case until you know for sure whether or not your radio is affected by this issue. That way you'll have less disassembly to undo, while you pause and consider how to proceed.

1. Power off the radio, and disconnect it from any external power supply.
2. **AFTER** referring to the photo below and while using the proper size screwdriver, remove **JUST** the two “outer” screws securing the original heatsink.

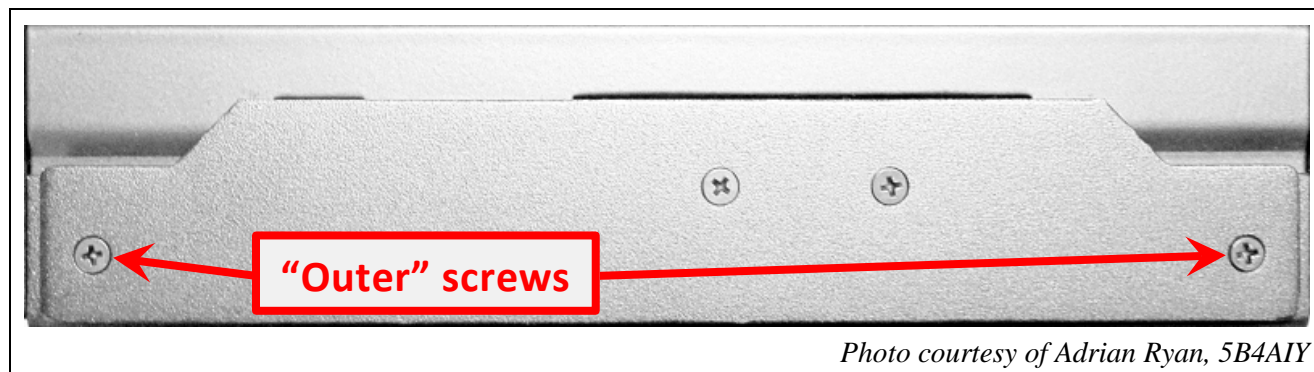
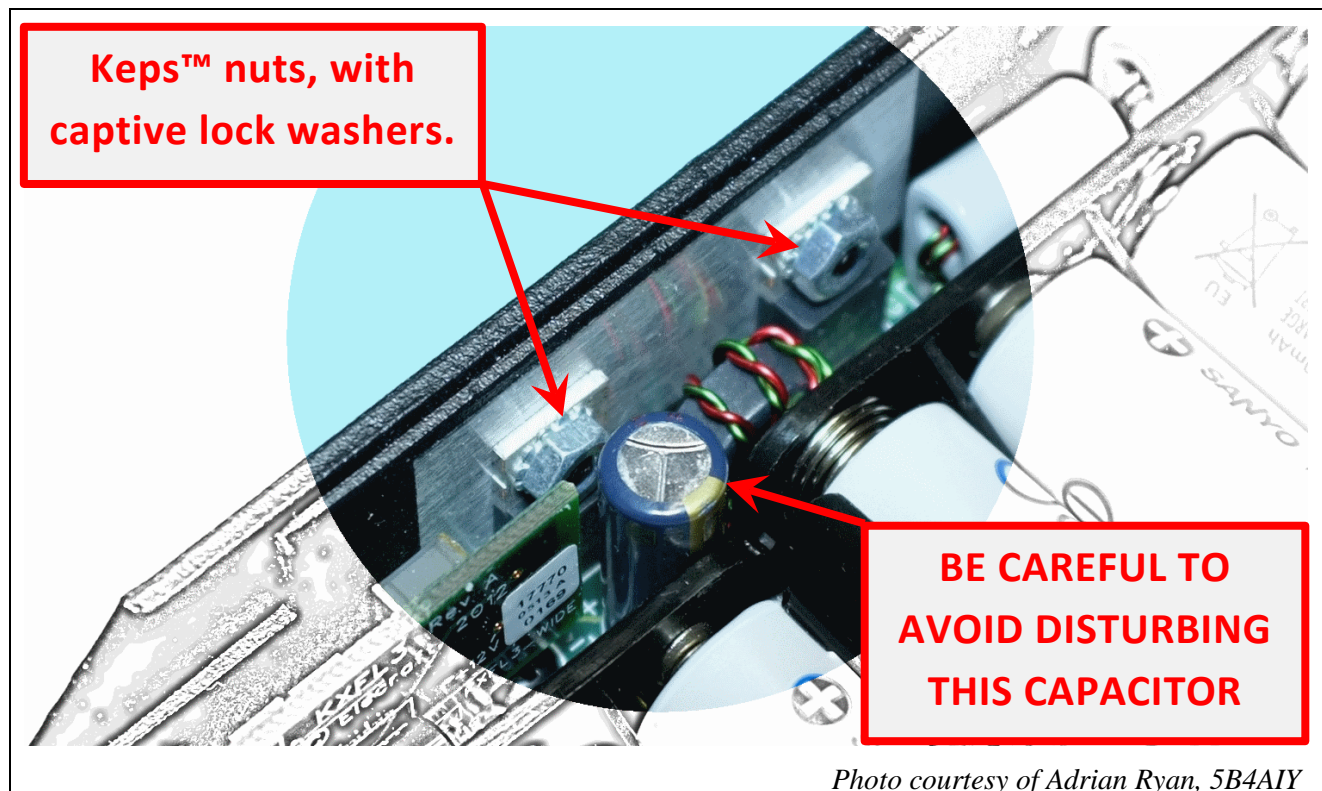


Photo courtesy of Adrian Ryan, 5B4AIY

3. **USING JUST YOUR FINGERS**, thread the black “try” screw into these two outer mounting holes.

IT SHOULD THREAD IN EFFORTLESSLY. IF YOU ENCOUNTER RESISTANCE ... STOP; REMOVE THE SCREW; AND REFER TO <http://www.ve7fmn.ca/notes/> (THE “TECH-NOTES” WEBPAGE) FOR REPAIR INSTRUCTIONS. **ALSO, INSPECT THE ORIGINAL SCREWS** UNDER A BRIGHT LIGHT USING A JEWELER’S LOUPE OR POWERFUL MAGNIFYING GLASS, **BEFORE REINSTALLING THEM**. IF THEY’RE SHINY, IT CONFIRMS THAT THE BLACK OXIDE FINISH HAS SEPARATED FROM THE SCREW AND HAS NO DOUBT CONTAMINATED THE THREADS OF THE PEM NUTS THAT ARE MACHINED INTO THE CASE. (EVEN BARELY VISIBLE AMOUNTS CAN CAUSE PROBLEMS.) IF YOU ENCOUNTER THIS ISSUE, PLEASE SEND ME A NOTE WITH: YOUR CALLSIGN; YOUR KX3’S S/N; WHETHER IT’S A KIT OR FACTORY BUILT; WHETHER YOU USE IT OUTDOORS; AND WHETHER YOU TAKE IT CAMPING OVERNIGHT.

4. If the black screw “worked”, then test the PEM nut threads again, this time using the shiny 3/8" stainless steel screws (which have an even tighter tolerance). They should also thread in effortlessly using just your fingers. Please contact me if these screws won't go in effortlessly. **DO NOT FORCE THEM! DO NOT USE THE HEX / ALLEN WRENCH!** Otherwise you could cause **SERIOUS DAMAGE** to your radio!
5. Once you've verified your KX3 accepts my precision mounting hardware, place it on **a grounded ESD mat** and open the case as if you were going to replace the batteries.
6. If you've installed batteries, remove all eight of them now.
7. While correctly wearing **a grounded ESD wrist strap** and **AFTER** referring to the figure below, remove the two PA transistor retention screws. This is best accomplished by holding each nut in turn with a wrench (preferably) or needle nose pliers. Note that none of the original factory mounting hardware will be reused. Likewise, the original factory heatsink **WILL NOT** be reinstalled.



8. Align the holes in your Cooler KX™ heatsink with their corresponding holes in the KX3 case. The easiest way to do this is to insert a 3/8" screw into both of the heatsink's PA transistor mounting holes before mating it to the case.

THE STAINLESS STEEL MOUNTING HARDWARE PROVIDED WITH COOLER KX™ HEATSINKS IS NOT LUBRICATED AND SHOULD **NEVER BE INSTALLED USING A POWER DRIVER, SINCE DRIVING UNLUBRICATED STAINLESS STEEL SCREWS TOO QUICKLY CAN CAUSE SEIZING!**

9. Thread a (shiny) stainless steel **3/8"** socket cap screw into the outer mounting hole that's **adjacent to the BNC (antenna) connector**. But don't tighten it yet! **BE ABSOLUTELY CERTAIN** you **DO NOT** install the 5/8" screw here!
10. **AFTER** referring to the figure below, thread the 5/8" screw into the mounting hole at the other end of the heatsink. (If you've installed the optional KXFL3, be sure this screw is aligned with and passes through the hole in the KXFL3 circuit board.) Tighten this screw, then go back and tighten the other screw. Hold the short end of the hex key / wrench with your bare hands (i.e. don't use any other tools) while tightening these screws. There's no thermal performance benefit to be gained from over tightening them, and too much torque could break the head right off a screw! That would be very bad!

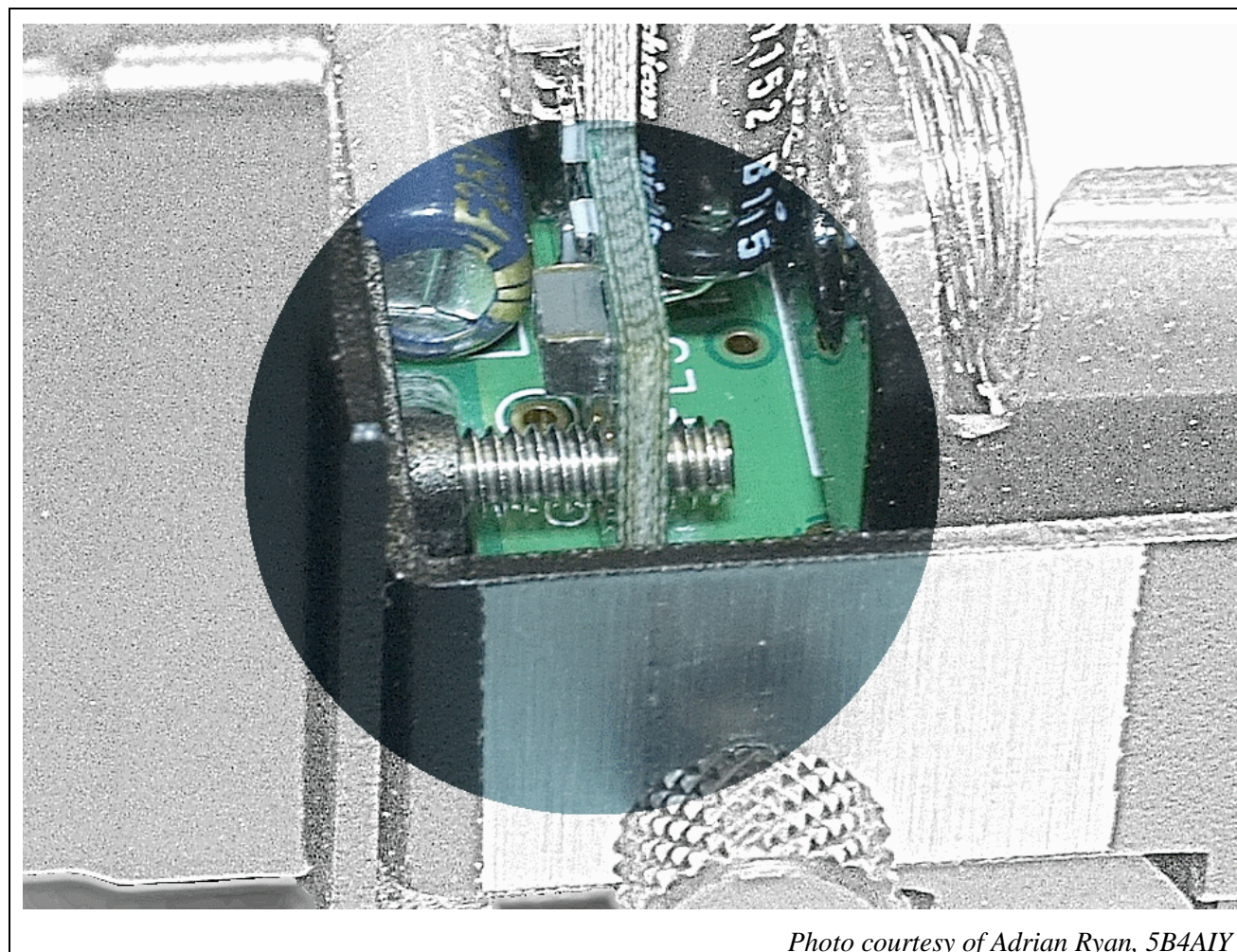


Photo courtesy of Adrian Ryan, 5B4AIY

11. **While following proper ESD handling procedures** and after referring to the figure below – insert the two remaining shiny stainless steel 3/8" socket cap screws through the heatsink and secure them with the two stainless steel Keps™ nuts. As with the factory supplied Keps nuts, these two also have attached lock washers to simplify assembly. Make sure both PA transistor mounting screws are well tightened, again using just your bare hands to turn the wrench!

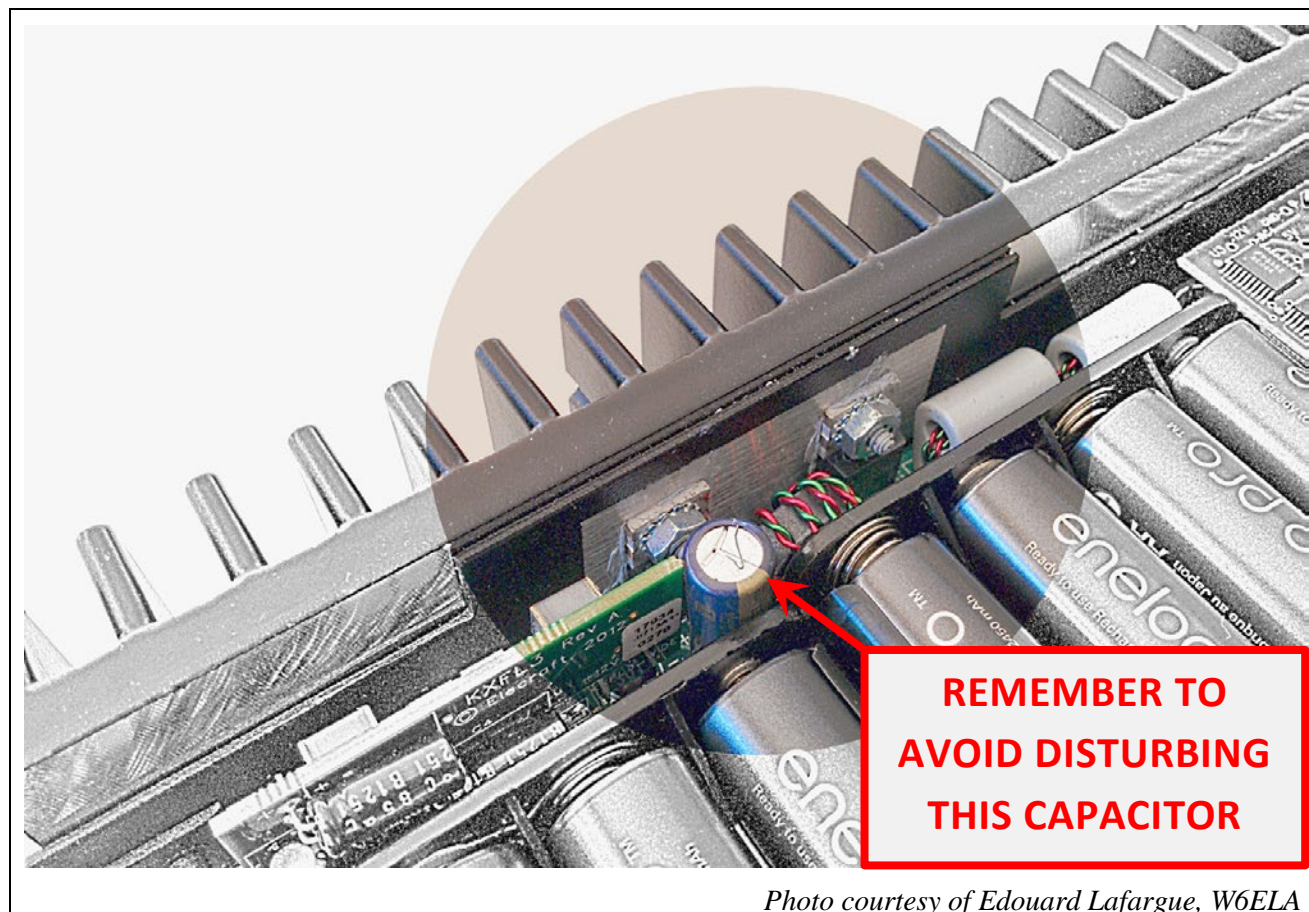


Photo courtesy of Edouard Lafargue, W6ELA

12. Replace the batteries then close the case, being especially careful you don't pinch the fragile flex cable that connects to two halves of the radio.



The two threaded holes in the end bolsters are for mounting possible future accessories. I offer an optional accessory kit of 18-8 alloy stainless steel hardware (screws and washers) if you want to use these mounting holes for your own purpose, or simply prefer not to leave them empty.

WARNING! Over time, dissimilar metal corrosion could **DAMAGE OR DESTROY** the threads in the accessory mounting holes – if you were to make the mistake of using screws made of an incompatible metal.