

ELECRAFT KNB2 NOISE BLANKER

Assembly and Operating Instructions

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Introduction

The KNB2 noise blanker can be used to suppress most wide-band noise, including that generated by automobile ignition systems, power lines, and appliances. In many cases, signals that were completely "buried" in noise will become easy to copy with the blanker turned on.

Various settings are provided to make the noise blanker more versatile. Two blanking pulse widths are available, as well as two noise threshold settings. These selections are made using the K2's front panel **NB** and **LEVEL** buttons, respectively. Refer to **Using The Noise Blanker** for details.

The KNB2 plugs directly into the K2's RF board with no additional wiring. It is controlled by the main processor on the control board via the K2's "AuxBus" network. (Full circuit details can be found on the back cover.)

Note: The information provided here supersedes relevant portions of the K2 Owner's manual.

Specifications

Blanking Widths	NB1, 10 μ S; NB2, 70 μ S
Current Drain	Approx. 13 mA when turned on, 2 mA off
Size	2.3 x 1.4 inches (58 x 36 mm)



Caution: Some components in this kit can be damaged by static discharge. Before handling any transistors or integrated circuits, always put on an anti-static wrist strap or touch any grounded, unpainted metal surface.

Parts Inventory

The table below lists all parts in the kit. If you have trouble identifying any of these items, consult the K2 Owner's manual, which has photographs of similar parts.

Ref.	Description	Qty.
C16	Capacitor, 39 pF, 5%, disc	1
C4	Capacitor, 100 pF, 5%, disc ("101")	1
C3	Capacitor, 820 pF, 5%, disc or monolithic ("821")	1
C9, C11, C13	Capacitor, .001 μ F disc or monolithic ("102")	3
C6	Capacitor, 1500 pF, 5%, disc or monolithic ("152")	1
C7	Capacitor, 1800 pF, 5%, disc or monolithic ("182")	1
C12	Capacitor, .0068 μ F disc or monolithic ("682")	1
C8, C14, C17	Capacitor, .01 μ F disc or monolithic ("103")	3
C10	Capacitor, 0.1 μ F disc or monolithic ("104")	1
C15	Capacitor, electrolytic, 22 μ F	1
D2, D3	Diode, 1N34A (alternates: 1N191, 1N5711)	2
L1, L2	Toroidal inductor, 1.2 μ H, 16 turns #26 on T37-2 core (red)	2
L3	Toroidal inductor, 40 μ H, 15 turns #26 on FT37-43 core (gray)	1
P1	Conn., 8-pin male, 0.1" spcgr., gold, Samtec TSW-108-07-G-S	1
Q1, Q2, Q4, Q7	Transistor, PNP, 2N3906	4
Q3, Q5	Transistor, NPN, 2N2222A	2
Q6	Transistor, MOSFET, 2N7000	1
R8	Resistor, 120 ohms, 1/4 W, 5% (brn-red-blk)	1
R4, R5	Resistor, 220 ohms, 1/4 W, 5% (red-red-brn)	2
R9	Resistor, 300 ohms, 1/4 W, 5% (org-blk-brn)	1
R6	Resistor, 470 ohms, 1/4 W, 5% (yel-vio-brn)	1
R3	Resistor, 1.8 K, 1/4 W, 5% (brn-gray-red)	1
R7, RF-R88	Resistor, 2.7 K, 1/4 W, 5% (red-vio-red)	2
R10	Resistor, 1 megohm, 1/4 W, 5% (brn-blk-grn)	1
R1	Resistor, 100 K, 1/4 W, 5% (brn-blk-yel)	1
RP1,RP2	Resistor network, 3.9 K, 4 resistors (isolated), 8 pins	2
U1	IC, RF amplifier, MC1350P	1
U2	IC, voltage regulator, 78L06	1
U3	IC, Microcontroller, 12C509A (alternate: 12C508A)	1

(parts list continues on next page)

Ref.	Description	Qty.
J12 (RF board)	Conn., 8 pin female, 0.1" spcg., gold, Samtec SSW-108-01-G-S	1
HDWR	Split lock washer, #4 (Note: 2 spares provided)	6
HDWR	Machine screw, 4-40 x 1/4", phillips	2
HDWR	Standoff, 3/16" dia. x 3/8" long, round, 4-40 threaded	1
MISC	Wire, #26 enamel	3 ft.
MISC	KNB2 PC board, Elecraft P/N E100087	1

Assembly



The noise blanker board will be mounted directly above the K2's I.F. amplifier transistor, Q22. To avoid shorts between the bottom of the noise blanker and Q22 (or its heat sink), you must trim all noise blanker component leads to 1/16" or less.

Locate the revision letter on the Noise Blanker PC board. If you have revision E or later, C3's PC board outline correctly shows a fixed capacitor. If you have revision D or earlier, the location for C3 will show a trimmer capacitor. In either case, install C3 (820 pF) at this location. **Note:** In the case of the revision D board, there will also be a second trimmer capacitor, C5, which is not used.

If you have PC board revision E or later, install C17 (.01 μ F, "103") at its indicated position. If you have revision D or earlier, C17 will be installed on the bottom of the board in a later step.

Install all of the remaining small-value fixed capacitors in the order listed (C16, C4, C9, etc., up through C10). Bend the leads of each capacitor slightly to hold them in place. Because of the need to keep all leads short on the bottom of the board, you should trim the leads (to 1/16") *before* soldering.

Install electrolytic capacitor C15 with its positive (+) lead inserted into the hole labeled "+".

Install Diodes D2 and D3. These are glass-bodied diodes and should be handled carefully. Orient the banded end of each diode as indicated by its PC board outline.

Install all of the transistors (Q1-Q7). (**Note:** Be sure not to install a transistor at the location labeled "U2," near the standoff hole.) Transistors should be mounted so that their bodies are approximately 1/8" (3 mm) above the PC board. Re-check each part number against the list before soldering.

If you have PC board revision E or later, go on to the next step. If you have revision D or earlier, the locations for resistors R8, R9, and R10 show incorrect component outlines and reference designators. Install these three resistors as follows:

- ___ R8 at capacitor location "C1" (bend leads as needed)
- ___ R9 at capacitor location "C2" (bend leads as needed)
- ___ R10 at diode location "D1"

Install the remaining resistors, all of which are on the bottom of the board. Pre-trim the leads to the correct length, then solder the resistors on the bottom side. This will simplify assembly and prevent damage to top-mounted components. **Note:** To insure that clearance is maintained for the I.F. amplifier (RF board, Q22), keep the resistors flush against the bottom of the board.

Install resistor networks RP1 and RP2. These networks are symmetrical and can be installed in either of two orientations. **Note:** Don't confuse RP1 with connector P1, which also has 8 pins.



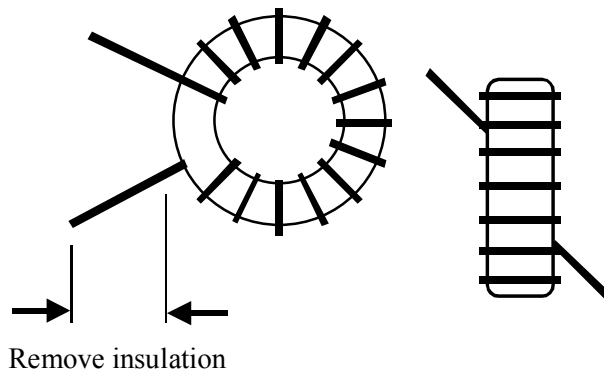
Before handling U3, touch an unpainted, grounded surface. This is a CMOS IC that can be damaged by static discharge.

Install 8-pin ICs U1 and U3. Be sure to align the notched or dotted end of each IC with the notched end of its PC board outline. The labels on the PC board correspond to the labels on the ICs.

Note: Sockets are not supplied and are not needed for these ICs.

Install voltage regulator U2. This device has a plastic body similar to a transistor.

Inductor L1 is wound on a T37-2 core (red) using 12 inches (25 cm) of #26 enamel wire. To wind the inductor, "sew" the long end of the wire through the core exactly 16 times. *Each pass through the core counts as one turn.* The winding should look like the illustration below, except it will have **16 turns**.

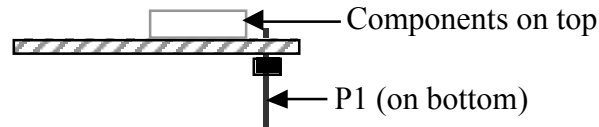


Spread out the turns of L1 so they occupy about 85% of the core's circumference as shown.

Cut L1's leads to about 1/2" (12 mm) long. Completely remove the enamel insulation from the leads to within 1/8" (3 mm) of the core. You can use a "blob" of solder, a solder pot, butane lighter, or sandpaper to remove the insulation. If you scrape the insulation off, be careful not to nick the wire.

Install L1 vertically on the PC board as shown by its component outline, then pull the leads taut on the bottom of the board. Make sure that the exposed part of each lead is shiny and has no insulation.

- Trim and solder the leads of L1. When soldering, make sure that the solder binds well to the leads. If the lead appears to be an “island” in a small pool of solder, chances are it is not making good contact. It’s a good idea to measure from pad to pad using an ohmmeter to be sure the leads are making contact.
- Wind and install L2 in exactly the same way as L1.
- Inductor L3 is wound using 10" (25 cm) of enamel wire on an FT37-43 core (gray). Wind **15 turns** on the core, and prepare the leads as you did with L1 and L2. Install and solder L3 vertically as indicated by its PC board outline.
- Install 8-pin male connector P1 on the *bottom* of the PC board in the position indicated by its component outline. Do not solder yet. The drawing below shows how P1 should appear viewed from the left end of the board, with the component side up.

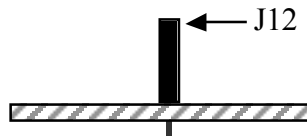


- Solder just one pin of P1, near the middle of the connector. Verify that P1 is now perpendicular to the PC board and is seated completely flat. If not, re-heat the soldered pin and press down on all of P1's pins until the connector drops into place. Once the connector is seated correctly, solder the remaining pins.
- If you have PC board revision D or earlier, solder C17 (.01 μ F, "103") on the bottom of the board between pins 6 and 7 of U1 (MC1350). Use very short leads. Make sure that the capacitor is mounted flat against the board and that its leads are not contacting any adjacent pads or traces.

Installation

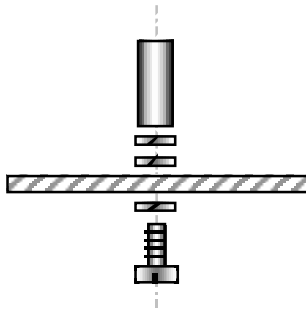
- Turn the K2 off and disconnect any power supply or battery connected to the DC power jack (J3).
- Remove the top and bottom covers. (Do not remove the heat sink panel.)
- Remove jumper W5 on the RF board (near the heat-sinked I.F. amplifier transistor, Q22). It is best to de-solder W5 and remove it completely rather than just cut it at both ends. If the noise blanker must be removed later, W5 can be re-installed, or you can insert a wire between pins 1 and 6 of J12.
- Remove resistors R88, R89, and R90 from the RF board (near J12). Be careful not to damage any pads or traces when you remove these components.
- Install a short jumper wire at R89. You can use a discarded component lead.
- Install a 2.7 k resistor at R88 (this resistor is listed as **RF-R88** in the noise blanker parts list).

- Install the 8-pin female connector on the RF board at J12 as shown by its outline near W5. Do not solder yet. The side view of J12, below, shows how it should appear once properly seated.



- Solder just one pin near the middle of J12, on the bottom of the RF board. Then, if the connector is not sitting completely flat against the RF board (or is not vertical), reheat this pin and carefully press the connector down. You may hear it snap into place. Then solder the remaining pins of J12.

- Install the 3/8" (9.5 mm) standoff on the top of the RF board as shown below, using a total of three split lock washers and a 1/4" (6 mm) machine screw. The mounting hole for the standoff is just to the right of I.F. amplifier transistor Q22. **Use two split lock washers between the standoff and the top of the RF board in order to position the module at the correct height.**



- If Q22 on the RF board is not seated flat against the board, re-heat all three pins alternately and push it down until it is flush. Make sure that Q22's heat sink is pushed down as far as it will go and is not loose.
- Plug the noise blanker module into J12 (above Q22), being careful to line up all pins of P1 with J12. Secure the module to the standoff provided using a 1/4" (6 mm) screw and one split lock washer.
- Re-install the bottom cover (6 screws).

Initial Test

Turn on the K2 and verify that you see the usual **ELECRAFT** display. If you see **INFO 080** or no display, you may have the noise blanker plugged into J12 incorrectly (offset by one or more pins). If it appears to be installed correctly, check for a short on the 12 V or AuxBus lines (pins 3 and 7 of P1, respectively).

Tap the **NB** button on the front panel. As you tap this button, you should see **NB1**, **NB2**, and **OFF** on the display. Leave the noise blanker in the **OFF** position for now. If you see **NOT INST** (not installed), you may have U3 soldered in backwards or the noise blanker may not be plugged in correctly.

Using The Noise Blanker

The KNB2 works best on wide-band pulse noise, such as that created by power lines, auto ignition, and some appliances. Like other pulse-type noise blankers, it will not suppress atmospheric (random) noise or noise that occurs only at specific frequencies.

You should leave the noise blanker OFF unless noise is present. If signals become degraded with the noise blanker turned on, try a different setting, or try turning off the preamp.

The **NB** button controls the noise blanker mode, which is **OFF** on power-up. If you hear pulse-type noise, first tap **NB** to select **NB1** (narrow pulse width). The "NB" annunciator on the LCD will turn on. If this does not improve the signal to noise ratio, tap **NB** again to select **NB2** (wide pulse width). **Note:** The wider pulse width can result in audible modulation of strong signals (especially in CW mode).

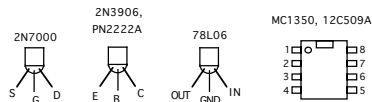
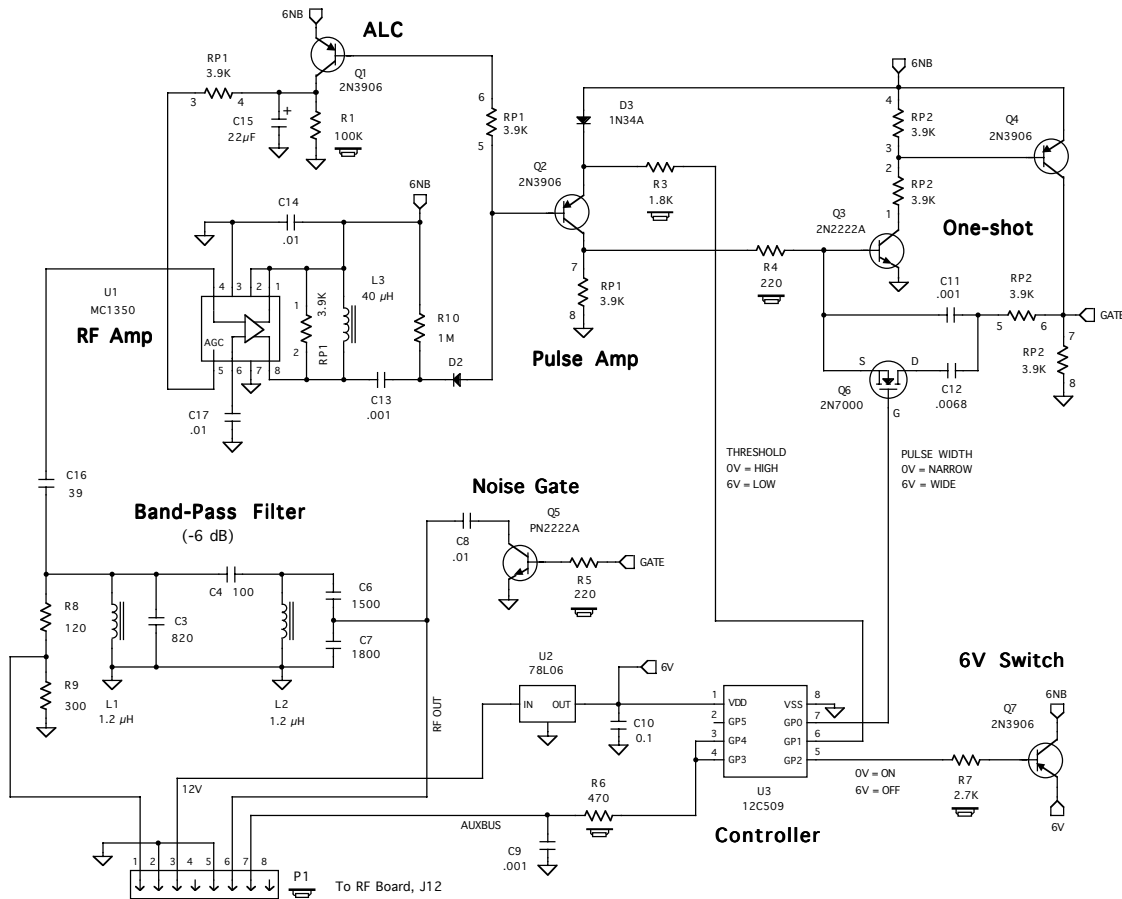
The **LEVEL** button controls the blanking threshold. When you turn on the K2, the threshold will be set to **HI THR**. This means that only strong noise pulses will activate the blanker, which minimizes received-signal degradation. However, on a quiet band or when using low-efficiency antennas, you may find the **LO THR** setting more effective. This is especially true when operating mobile, since a whip antenna may be inefficient yet still pick up ignition noise. **LO THR** is selected by holding **LEVEL**, and holding it again switches back to **HI THR**. The "NB" annunciator will blink whenever **LO THR** is in use. This serves as a reminder that any signal degradation that you hear may be due to the low blanking threshold.

Optional Modification for use with the Low Threshold Setting

If you use **LO THR** frequently and find that it causes receiver modulation products to appear, it may be helpful to solder a small capacitor between pins 7 and 8 of the MC1350 IC. A value of 33 pF is recommended, but it isn't critical. Be sure that adding this capacitor doesn't cause problems with the **HI THR** setting. If possible, test the noise blanker before and after the modification using a controlled noise source.

Circuit Details

U1 amplifies the I.F. signal, which is then detected by D1 and D2. Q1 reduces the gain of U1 in proportion to overall signal strength, keeping the signal at D1 and D2 relatively constant. Negative-going pulses that are above the threshold established by D3 and R3 turn Q2 on, triggering the one-shot (Q3/Q4). Q6 can be used to switch in a larger-value capacitor, increasing the blanking time. The pulse output of the one-shot (GATE) saturates Q5, attenuating the signal at the output of the band-pass filter. The band-pass filter creates a small delay between input and output, so that the GATE signal arrives just ahead of the noise pulses. The controller, U3, decodes auxBus commands from the main processor. It then controls power to the blanker (via Q7), pulse width (via Q6), and blanking threshold (via R3).



Elecraft KNB2 Noise Blanker			
By W. Burdick E. Swartz	Rev. C	Date 2-1-00	Sh. 1 of 1