

# ELECRAFT KNB1 NOISE BLANKER

## Assembly and Operating Instructions

Revision C, Jan. 18, 2001. Copyright © 2001, Elecraft; All Rights Reserved

### Introduction

The KNB1 noise blanker can be used to suppress most pulse-type 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.

The noise blanker mode (**OFF**, **HI**, **LO**) is selected using the K1 transceiver's **NB** menu entry. The two blanking thresholds provide more versatility in dealing with band and noise conditions. Refer to **Using the Noise Blanker** for details.

The KNB1 plugs directly into the K1's RF board with no additional wiring. It is controlled by the main processor on the control board via the K1's "AuxBus" network. Full circuit details can be found at the end of this manual.

### Specifications

Blanker Type	I.F. pulse detector with wide-range AGC; two threshold levels
Current Drain	Approx. 8 mA when turned on, < 1 mA off
Size	2.0 x 1.4 inches (51 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 K1 Owner's manual, which has photographs of similar parts.

Ref.	Description	Qty	Part No.
C3, C12	Capacitor, disc, 10 pF, 5%	2	E530006
C1	Capacitor, disc, 180 pF, 5% ("181")	1	E530075
C9, C13	Capacitor, mono, .001 $\mu$ F ("102")	2	E530074
C4-7	Capacitor, mono, .01 $\mu$ F ("103")	4	E530019
C11	Capacitor, mono, 0.1 $\mu$ F ("104")	1	E530020
C2	Capacitor, ceramic trimmer, 8-50 pF	1	E540000
C10	Capacitor, electrolytic, 2.2 $\mu$ F	1	E530023
C8	Not used	--	--
D1, D2	Diode, 1N4148	2	E560002
D2 Alt.	Diode, Green LED (alternate for D2; see text)	1	E570006
L1	Inductor, 25 $\mu$ H, 22 T #26 on <b>FT37-61 core (gray)</b>	1	E680002
L2	Inductor, 75 $\mu$ H, 20 T #26 on <b>FT37-43 core (gray w/orange dot)</b>	1	E680003
P1	Conn., 8-pin male, 0.1" spcg., gold, Samtec TSW-108-07-G-S	1	E620004
Q1-2, Q4, Q7	Transistor, NPN, 2N4124	4	E580006
Q3, Q8	Transistor, PNP, 2N3906	2	E580000
Q5-6	Transistor, MOSFET, 2N7000	2	E580002
R1	Resistor, 180 ohms, 1/4 W, 5% (brown-gray-brown)	1	E500014
R2	Resistor, 3.9 k, 1/4 W, 5% (orange-white-red)	1	E500009
RP1	Resistor network, 470 ohms, 5 resistors (isolated), 10 pins	1	E510015
RP2	Resistor network, 27 K, 4 resistors (isolated), 8 pins	1	E510019
U1	IC, Microcontroller, 12C509A	1	E610008
<b>RF-J1</b>	Conn., 8 pin female, 0.1" spcg., gold, Samtec SSW-108-01-G-S	1	E620005
HDWR	Lock washer, #4, internal tooth (1 spare)	3	E700010
HDWR	Machine screw, 4-40 x 3/16", pan-head phillips	1	E700015
HDWR	Hex nut, 4-40	1	E700011
HDWR	Standoff, 3/16" dia. x 7/16" long, hex M-F, 4-40 threaded	1	E700017
MISC	Wire, #26 enamel	4 ft.	E760002
MISC	KNB1 PC board	1	E100106

## Assembly



A fine-point, temperature-controlled soldering iron is required to assemble this kit. Excessive heat and/or large iron tips may damage pads and traces on the PC board.



During assembly, we'll refer to the **top** and **bottom** sides of the PC board. The top side has most of the components. The bottom side has the model number and PC board revision.

(**Note:** The model number is KNB1. The revision C board is incorrectly labeled KBN1.)

Install resistors R1 (180 ohms, brown-gray-brown) and R2 (3.9k, orange-white-red) on the bottom of the board. Solder them on the top side.

Install Diode D1 on the top side of the board. Orient the banded end of the diode as indicated by its PC board outline. (D2 will be installed in a later step.)

Install resistor networks RP1 (470 ohms, 10 pins) and RP2 (27 k, 8 pins). (Be careful not to confuse RP2 with connector P1, which also has 8 pins.) These networks are symmetrical and can be installed in either of two orientations.

Locate the outline for transistor Q5. Adjacent to Q5 is a capacitor that may be labeled "C6" (rev. C PC board) or "C9" (rev. D and later). Install C9 at this location (.001  $\mu$ F, "102").

**Note:** Do not pull on the leads of small capacitors, which can be fragile.

Install the following capacitors:

__ C3 (10 pf)	__ C1 (180 pF, "181")	__ C11 (0.1 $\mu$ F, "104")
__ C4 (.01 $\mu$ F, "103")	__ C5 (.01 $\mu$ F, "103")	
__ C6 (.01 $\mu$ F, "103")	__ C7 (.01 $\mu$ F, "103")	

**Note:** The revision C PC board has a location for C8. This capacitor is not used.

If your PC board is revision D or later, install: \_\_ C12 (10 pF) and \_\_ C13 (.001  $\mu$ F, "102").

Install trimmer capacitor C2, with its flat side oriented as indicated by its PC board outline.

Install the 2N3906 transistors, Q3 and Q8. Orient the flat side of each transistor as shown by its PC board outline. Keep lead length above the board no longer than about 1/8" (3 mm).

Install the 2N4124 transistors, Q1, Q2, Q4, and Q7.

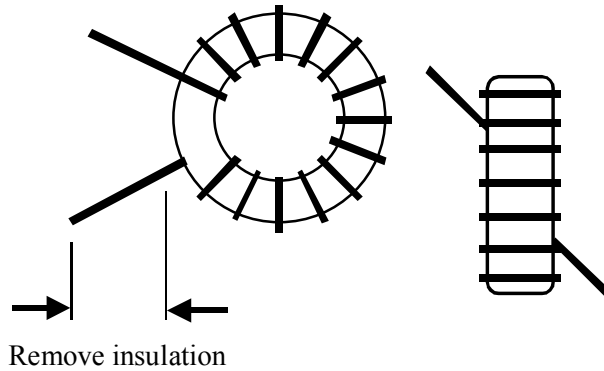
Install the 2N7000 transistors, Q5 and Q6.

Install electrolytic capacitor C10 (2.2  $\mu$ F), noting the orientation of the [+] lead. (**Note:** The rev. C board has a disc capacitor outline at this location, with no [+] mark. Pre-form the leads of C10 to fit the wider pad spacing. Orient the [-] lead toward Q8 and the [+] lead toward RP1.)



The toroid core for inductor L2 is marked with an orange dot to differentiate it from L1. Be sure to use the correct cores in the following steps.

Inductor L1 is wound on the FT37-61 core (**gray, with NO orange dot**) using 16 inches (40 cm) of #26 enamel wire. To wind the inductor, “sew” the long end of the wire through the core exactly 22 times. *Each pass through the core counts as one turn.* The winding should look like the illustration below, except it will have **22 turns** (the drawing shows only 14 turns).



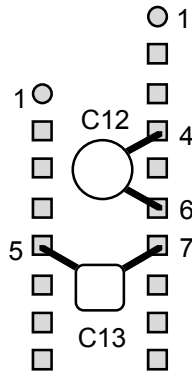
- Spread out the turns of L1 so they occupy about 80-90% of the core’s circumference.
- Cut L1's leads to about 1/2" (12 mm) long. Completely remove the enamel insulation from the leads to within 1/8" (3 mm) of the core. The enamel wire provided can be easily heat-stripped using a small amount of solder on the tip of your iron. Stripping using this method takes 4-6 sec.
- Install L1 vertically on the PC board as shown by its component outline, then pull the leads taut on the bottom of the board.
- 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. Measure from pad to pad using an ohmmeter to verify the connection.
- Inductor L2 is wound on the FT37-43 core (**gray, with orange dot**) using 15 inches (38 cm) of #26 enamel wire. To wind the inductor, sew the long end of the wire through the core exactly 20 times. The winding should look like the illustration above, except with **20 turns**.



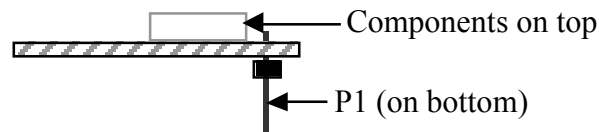
In the following step, you'll install a 1N4148 diode at D2, even though the PC board has an outline for an LED at this location. The LED (D2A) may be substituted later (see page 7).

Install a 1N4148 diode vertically at D2. The anode lead (non-banded end) should be inserted into the hole nearest Q6 (round pad). The cathode lead (banded end) should be folded down and inserted into the hole nearest Q7 (square pad). Bend the leads to hold D2 in place, then solder.

If your PC board is revision C, solder C12 (10 pF) and C13 (.001  $\mu$ F, "102") on the bottom of the board as shown below, between the two resistor networks. Use short leads. Trim the leads of the components in this area so the capacitors can be installed close to the bottom of the board.



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. Refer to the drawing below.



Solder only pin 4 or 5 of P1. 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.

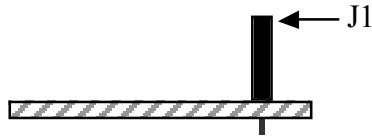


U1 is static-sensitive. Before handling it, touch an unpainted, grounded surface.

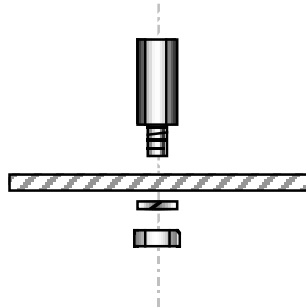
Install 8-pin IC U1. Be sure to align the notched or dotted end of the IC with the notched end of its PC board outline. **Note:** A socket is not supplied and is not needed for U1.

## Installation

- Turn the K1 off and disconnect the power source.
- Remove the top and bottom covers.
- Remove C22 on the K1 RF board (at the right edge, near J1, the noise blanker connector).
- Install the 8-pin female connector on the RF board at J1 as shown by its outline. Do not solder yet. The side view of J1, below, shows how it should appear once properly seated.



- Solder just pin 4 or 5 of J1, 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 J1.
- Install the 7/16" male-female standoff on the top of the RF board as shown below, using a #4 internal-tooth lock washer and 4-40 nut.



- Plug the noise blanker module into J1 on the RF board, being careful to line up all pins of the connectors. Secure the module to the standoff using a 3/16" (4.7 mm) screw and one internal-tooth lock washer.
- Re-install the bottom cover.

## Initial Test

Turn on the K1 and verify that you see the usual frequency display. If you see **E27** or no display, you may have the noise blanker plugged into J1 incorrectly (offset by one or more pins). If it appears to be installed correctly, check for shorts to ground on P1 pins 1, 2, 3, 4 and 8.

Tap the **MENU** button on the front panel and scroll to the **NB** entry. To see the noise blanker mode, hold **EDIT**. Tap **WPM+** or **WPM-** to select the **HI** and **LO** modes, then return to **OFF**. Leave the noise blanker in the **OFF** position for now. If you see three dashes (---), the K1 firmware has not detected the noise blanker. You may have U3 soldered in backwards.

Connect an antenna and switch to the lowest-frequency band. While listening to band noise or a weak station, peak trimmer C2 on the noise blanker for maximum signal strength.

## Using the Noise Blanker

The KNB1 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 in the band.

The **NB** menu entry controls the noise blanker mode, which will be **OFF** on power-up. With **HI** threshold selected, only strong noise pulses will activate the blanker, which minimizes possible received-signal degradation. However, in many cases the **LO** setting will be more effective.

### *Assigning the Noise Blanker to the Programmable Function Switch*

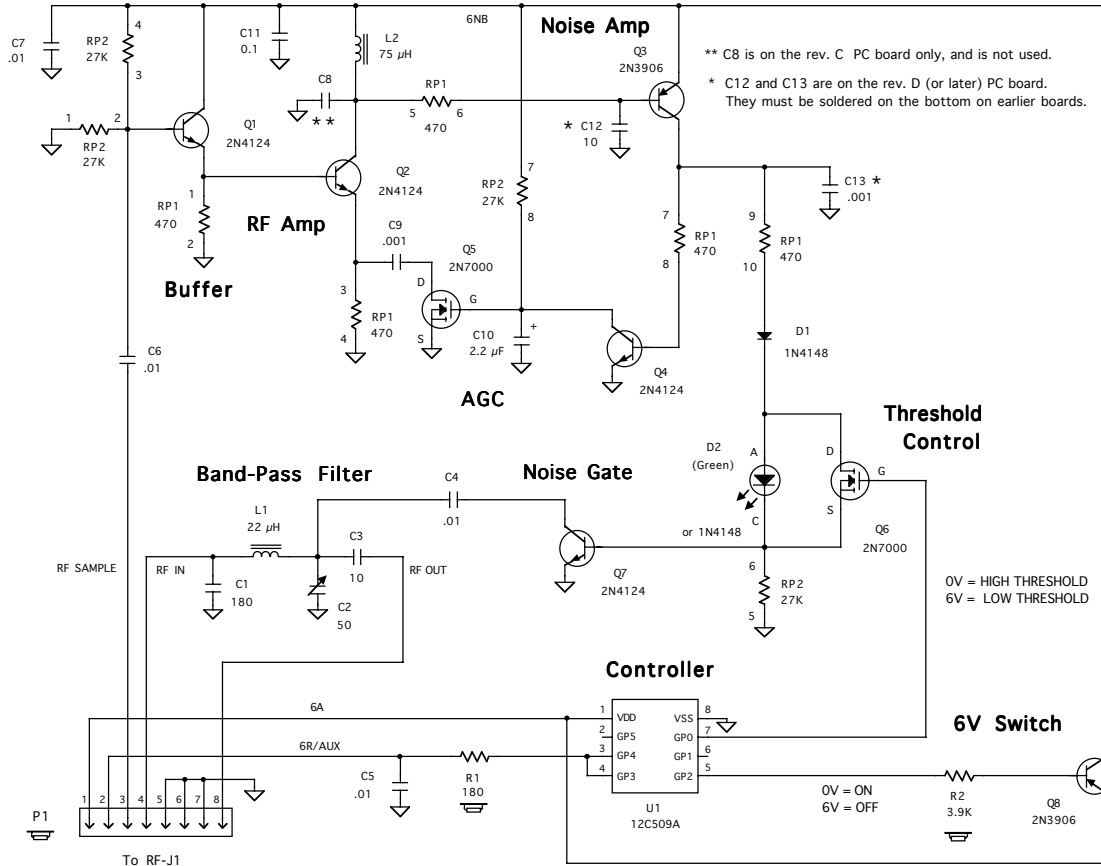
If you use the noise blanker frequently, you can assign **NB** to the programmable function switch (XIT/PFn). To do this, select the **PFn** entry in the menu, then hold **EDIT** and change the parameter to **NB**. Exit the menu. Holding the XIT/PFn switch will now activate the noise blanker mode display, and you can change the mode using **WPM+** / **WPM-** as explained earlier. Tap any other switch to return to normal operation. Note: If you want to use XIT, you'll need to re-program **PFn** as **nor** (normal).

### *Increasing the HI Threshold Level (using an LED at D2)*

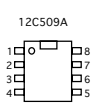
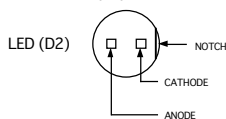
If you have extremely high noise levels, or if nearby broadcast stations cause received-signal degradation even at the **HI** setting, you can raise the **HI** threshold by replacing D2 (1N4148) with D2A (the green LED). The longer of the two leads on the LED is the anode, which should be inserted into the round pad (near Q6). To verify that the LED is installed correctly, try transmitting into a dummy load with the NB set for **HI** threshold: the LED should illuminate (dimly) during key-down periods because the transmitted signal activates the noise detector.

## Circuit Details

Q1 buffers the output of the K1's receive mixer. Q2 amplifies the I.F. signal, then Q3 amplifies negative-going pulses. The resulting positive-going pulses from Q3 drive the AGC amplifier, Q4/Q5, which holds Q2's gain constant over a wide range of I.F. levels. Pulses that exceed the forward bias voltage of D1, or D1+D2 (in the **HI** threshold case) drive Q7 into saturation, effectively shorting out the I.F. path at the output of the band-pass filter (C1, L1, C2). The band-pass filter delays the I.F. signal to allow the blanking signal to arrive at Q7 at about the same time as the noise pulse. MCU U1 is controlled via the 6R/Aux data line. It turns the KNB1's power on/off and selects **HI** or **LO** threshold.



BOTTOM VIEW



☐ = On bottom of PC board.

Elecraft <b>KNB1</b> Noise Blanker			
By W. Burdick E. Swartz	Rev. C	Date 12-20-00	Sh. 1 of 1