ELECRAFT K2 REVISION 2 FIRMWARE

Installation and Reference Manual

Rev. H, Feb 3, 2004

Summary of Changes, Firmware Revision 2.04 (see full details on page 4)

NOTE: REVISION 2.04 K2 FIRMWARE REQUIRES I/O CONTROLLER FIRMWARE REV. 1.09 or later.

- **Significant CW Keying Bandwidth Reduction:** Requires K2KEYMODKT in addition to this firmware revision.
- **Instant RXANT Switching, and Preamp/Attenuator State Saved:** RXANT on/off with one keypress when assigned to PF1 or PF2. Also, the preamp and attenuator states are stored independently for RXANT on and off.
- **AF-On Scanning:** In this mode, the receiver is not muted, and scanning continues until you tap a switch.
- **Channel Scanning:** Especially useful on 60 meters. "Channel hops" using memories set up for the present band.
- **More Transverter Bands:** There are now 6 fully-programmable transverter band displays.
- **Multiple Bands per Transverter:** "ADR" field allows several bands to select the same XV-series transverter.
- **Low-Power Transverter I/O:** 0.01-1.27 mW output with split RX/TX path (requires K60XV option).
- **100's of MHz Digit Always Displayed on Transverter Bands:** Even with 10 Hz VFO steps selected.
- **60-meter Band:** Full 60-m coverage, with channel scanning and manual hopping (requires K60XV option).
- **SCAN Mode Fix**: The VFO now correctly jumps 0.5 kHz on scan resume.
- **Simplified KDSP2 Use:** Shortcut key combinations added to turn NR and NOTCH on/off.
- **RS232 Command Improvements:** RC command usable in TX mode; new TQ (transmit query) command, UP and DN now work in menu (one application for this: a utility that automates filter and BFO alignment).

Summary of Changes, Firmware Revision 2.03

NOTE: REVISION 2.03 K2 FIRMWARE REQUIRES I/O CONTROLLER FIRMWARE REV. 1.07 or later.

- **KAT100:** Support for the KAT100 external 150-watt automatic antenna tuner.
- **SPLIT/RIT/XIT INDICATOR LED:** The builder can add an optional LED.
- **New Defaults:** The sidetone source selection now defaults to **U8-4**, and **8R** defaults to **Hold** (see page 3)

Summary of Changes, Firmware Revision 2.02

- **K2/100:** Support for the 100-watt K2/100 transceiver, including final stage T-R and band switching, safety monitoring, and automatic switching between low and high-power modes via the POWER knob.
- **More Responsive QSY:** The VFO knob can be spun much more quickly now without losing counts.

Summary of Changes, Firmware Revision 2.01

- **Computer Control (KIO2):** Support for the KIO2 Aux. I/O option
- **Transverter Bands:** Up to three bands for use with transverters, each independently programmable.
- **RTTY/Data Mode and Fine RIT:** User-selectable RTTY/Data mode; FINE RIT feature for PSK31, etc.
- **"Fast Play" CW Message Buffers:** Fast Play (one-button) CW message playback.
- **More Accurate VFO Calibration:** VFO dial calibration is now much more accurate.

Firmware Installation

You'll need to replace the old **main microcontroller** and possibly **the I/O controller** with the supplied new ICs.

1. Turn on the K2 and write down all of your menu and filter settings before removing the old firmware (use **CAL FIL** to obtain all of the filter and BFO parameters). (Those using transverter bands should be sure to write down the values from all fields of the **TRNx** secondary menu entries.) In a later step, you may need to re-enter all or some of these settings, depending on how old your I/O controller was.
2. Turn the K2 off and remove the top cover or KPA100 module. **CAUTION: Touch an unpainted, grounded metal surface frequently while handling PC boards and ICs.**
3. Take out the two screws that hold the control board to the front panel (remove the KAF2 or KDSP2 option first, if applicable). Remove the Control board using the long-handled Allen wrench (supplied with the K2).
4. Carefully remove the old microprocessor, U6 (Control board), using a small screwdriver to pry it gently out of its socket at both ends. Store U6 in a safe place as a backup.
5. Straighten the leads of the new microcontroller (PIC18C452). See Figure 4-9 of the Owner's Manual.
6. Install the new microcontroller, being careful not to bend any pins. Orient the notched or dimpled end of the IC with the notched end of its component outline.
7. Plug in the control board and secure it to the front panel.
8. If your I/O controller firmware is revision is 1.08 or earlier, remove U1 on the RF board (16C72) and install the new I/O controller at this location (16F872).
9. Turn on the K2. You may see **INFO 201** (for about 11 seconds) depending on what revision of I/O controller you had previously. Otherwise, you should see **ELECRAFT** followed by the normal frequency display.
10. **Edit** the **ST L** menu entry. If you don't hear the sidetone, tap **DISPLAY** to change the sidetone source. Use **U8-4** if you have ever installed a KPA100 or KIO2, or if your K2 s/n is over 2999. Otherwise use **U6-25**.
11. The normal setting for the **D19** menu entry (in the secondary menu) is **N**. If you have the K60XV 60-meter option installed, set it to **Y** (see K60XV manual for details).
12. Some configuration settings may have to be re-entered, such as transverter band set-ups, even if you did not see **INFO 201**. If you did see this message, you'll need to re-enter *all* of your menu and filter parameters.

VFO Calibration

You must recalibrate the K2's VFO if your original K2 firmware was rev. 2.01 or earlier.

1. **Allow the K2 to warm up at normal operating room temperature for at least five minutes.**
2. Plug the K2 frequency counter cable into the control board. Connect the probe end to test point TP1 (VCO).
3. Switch to 40 meters and set the VFO anywhere between 7000 and 7100 kHz.
4. Tap **MENU** and locate the **CAL** entry (using **BAND+** / **BAND-** or by turning the VFO knob). Hold **EDIT**, then change the parameter to **PLL**.
5. Hold **EDIT** again to begin the calibration procedure. You'll see a frequency in the 12 MHz range displayed, and the letter "d" will flash as the firmware records calibration data. After approximately 5-10 minutes, you'll hear a short tone, and **END** will be displayed. Tap any switch to clear this message. This completes VFO calibration.

 If you see **INFO 232**, tap any switch to clear the message. Verify that you're on 40 m with the counter cable is plugged into TP1, then repeat steps 4 and 5 above. If you still get this message, see Troubleshooting (K2 manual).

6. ***Optional VFO Accuracy Check:*** You may wish to check the VFO's accuracy by tuning in a signal at a known frequency. This procedure is described in the K2 Owner's Manual, page 98 (Using a Calibrated Signal Source). **Note:** In the Revision C K2 manual, steps 8 and 11 of the procedure on page 98 are incorrect for the new firmware. **CAL PLL is now run only one time, and only on 40 meters**.
7. Move the K2 counter cable to the BFO test point, TP2 (or remove the cable and store it).
8. Re-install the top cover.

Primary and Secondary Menus

All K2 menu entries are listed below for reference, and reflect the latest firmware changes. Items marked with an asterisk (*) are accessed with **DISPLAY**, as explained under *Additional Edit-Mode Options*, below. For further details on menu functions, see the K2 Owner's Manual, page 83 (primary menu) and page 100 (secondary menu).

Menu Access: Tap **MENU** to see the K2's *primary* menu. To access the *secondary* menu, tap **DISPLAY** (after tapping **MENU**). As you go back and forth between the two menus with **DISPLAY**, you'll see **PRI** and **SEC**.

Primary		Secondary	
ST L	Sidetone level, ***TONE pin**	**SLCH**	Squelch level
ST P	Sidetone pitch	**RATES**	**RATE** switch selections, ***Channel-Scan Mode**
T-R	QSK delay, ***8R mode**	**DOT**	Dot/space ratio (keying weight)
RPT	Auto-repeat delay	**FPLY**	Fast Play switch selections
INP	Keying device, ***Auto-detect**	**PORT**	RS232 interface on/off, ***Port Test**
IAB	Iambic keying mode	**SPLT**	**SPLIT**, **RIT**, **XIT** configuration
SSBA	Mic gain	**Po28**	10 / 12 meter SSB power output limit
SSBC	Compression level	**RTTY**	RTTY (data) mode control
LCD	Backlight control	**RTC**	Real-time clock control
GRPH	Bargraph mode	**RIT**	RIT/XIT offset range (up to +/- 4.8 kHz)
OPT	Optimization (batt/perf.)	**ACC**	Accessory output control
ATU	KAT2 or KAT100 mode	**d19**	Set to **Y** if K60XV installed, ***60-m PA Control**
RANT	RX antenna selection	**PA**	K2/100 final stage mode selection
CAL	Calibration menu	**TRN1-3/4-6**	Transverter band setup, ***Field**
PF1 / **PF2**	Programmable Functions		

** Additional Edit-mode Options*

The following menu entries provide extended options in edit mode. These options are selected or changed by tapping **DISPLAY** when you are editing the menu entry's parameter. The **TRN1-6** entries also use **ANT1/2** (see below).

Menu Entry	**DISPLAY** Function
ST L	Selects the sidetone source, **U6-25** or **U8-4**. Use **U8-4** with the KIO2 (see KIO2 manual)
T-R	Specifies 8-volt receive signal behavior, **8r nor** or **8r hold**. "Hold" mode is intended for use with external amplifiers or transverters: in CW mode, it holds the 8V rcv line low for the duration of the QSK delay. **8r hold** mode can be used at all times, even if you don't use an external amplifier or transverters, and will not affect performance in any way.
INP	Selects auto-detect mode, **ADET On** or **ADET Off**. If you plan to connect both a keyer paddle and hand-key or other keying device to the K2's KEY jack, use **ADET On**. (See Owner's manual.)
RATES	Selects scanning mode: **nor** (normal), **Ch Sc** (channel scan), **Ch Sc-tn** (channel scan/tune)
PORT	Sends an "FA" (VFO A frequency) response to the computer if **PORT** is set to **On**.
d19	Selects PA low-pass filter for 60 m: **PA60=80** (80 m filter) or **PA60=40** (40/30 m filter).
TRN1-6	Cycles through the six transverter parameters (on/off, RF, IF, offset, power level, address). Tap **ANT1/2** to toggle between **TRN1-3** and **TRN4-6** configuration.

Programmable Function Buttons (PF1, PF2)

PF1 and **PF2** can be assigned to any entry in either menu, including **SCAN** or **FPon** (Fast-Play on/off), which are located in the primary menu. First, select **PF1** or **PF2** in the menu, then **EDIT** the parameter to change the assigned function (**RANT** is a special case: toggles instantly.). To assign one of the secondary menu functions, tap **DISPLAY**. Tapping **DISPLAY** again will return to the primary menu entries. Exit the menu when finished.

Details on Recent Changes (Rev. 2.04)

1. **Significant CW Keying Bandwidth Reduction:** Requires K2KEYMODKT. (If you install the mod kit, you *must* use rev 2.04 firmware, whereas the 2.04 firmware will still be usable without the mod kit.)
2. **Instant Receive Antenna Switching:** When assigned to **PF1** or **PF2**, the **RANT** menu entry now switches instantly. Also, the preamp and attenuator states are stored independently for **RANT** on and off.
3. **AF-On Scanning:** In this mode, the receiver is not muted, and scanning continues until you tap a switch or transmit (useful for weak-signal work). Start scan as usual, but hold the numbered memory button until you see **AF ON** (2 sec.). Scan rate is 50 kHz/min. with 10-Hz steps. Scan resume can re-start normal or AF-ON scanning.
4. **Channel Scanning:** Scans frequency memories set for the present band, rather than VFO A-VFO B. Also allows manual channel-hopping using the VFO knob. Selectable on a per-band basis; primarily intended for use on 60 meters. To set up channel scanning: (1) set up all desired "channels" for the target band by setting them up (VFO A) and **STOR**ing them; (2) choose one of the stored memories as the "initializer" to be used when starting channel scan, and **RCL** it; (3) edit the **RATES** menu parameter; (4) tap **DISPLAY** to select **CH SC** (channel scan) or **CH SC-TN** (channel scan plus manual channel hopping); (5) exit the menu; (5) **STORE** this memory. Now you can **RCL** this memory and start scanning in the usual way. The channel-scanning rate is 0.2 seconds per channel with normal scanning, and 0.5 seconds per channel with AF-ON scanning (see above). **Note:** Channel hopping and scanning is based on the frequency of VFO A. VFO B can be set up differently on a per-channel basis for split operation, if desired, or you can fine-tune channels when necessary by turning on *both* **RIT** and **XIT**.
5. **More Transverter Bands:** There are now 6 transverter band displays. To set them up, the **TRN1**-**TRN3** menu entries become **TRN4**-**TRN6** by tapping **ANT1/2**. Any of the six can be enabled/disabled.
6. **Multiple Bands per Transverter:** Using the new **ADR** (address) field of the **TRN1**-**TRN6** menu entries, you can specify which Elecraft XV-series transverter to enable on a per-transverter-band basis. This is especially useful with the XV144, which is often used as an I.F. for multiple microwave bands.
7. **Low-Power Transverter I/O:** The **TRNx** menu entry's **OUT** parameter now has a dual range: **L.01-L1.27** (milliwatts) and **H0.1-H12.7** (Watts). In both cases these are upper limits, and the **POWER** knob can be used to go down from there. Low-power (.01-1.27 mW) settings require the K60XV option. The low-power **TUNE** display shows, for example, **P1.00 LP**, where **1.00** is the power in mW and **LP** indicates that the low-power output on the K60XV is selected (high-power path disabled). Full-scale on the bargraph is 1.0 mW in LP mode.
8. **100's of MHz Digit Always Displayed (Transverter Bands):** If you select 10 Hz VFO steps on a transverter band whose RF parameter is set for 100 MHz or higher, the 10-Hz digit is only shown for 1 second, then the display shifts to the right. This allows the hundreds of MHz digit to always be displayed.
9. **60-m Band:** (All of the following is covered in the K60XV manual.) The 60 m will be available if (1) the K60XV option is installed, (2) the IOC MCU is rev 1.09 or higher, (3) varactor diodes D19 and D20 are installed in the VCO circuit, and (4) the **D19** menu entry set to **Y**. **KPA100 Considerations:** Tapping **DISPLAY** while editing the **D19** menu entry will select which low-pass filter to use on the KPA100 on 60 meters (**PA60=40** or **PA60= 80**). The **PA60=80** selection should be used if the KPA100 has been modified to make the 80-m LPF into an 80/60 meter LPF. The **PA60=40** option selects the 40/30 m low-pass filter. This will still provide adequate harmonic suppression on 60 meters due to the excellent balance of the KPA100's final amp transistors.
10. **Faster QSK:** If **T-R** is set to **0.00**, the MUTE line is forced high immediately on key-up, with no delay due to C23 on the Control board. This results in somewhat faster CW break-in. Some operators may find the audio sound during keying to be choppier with **T-R** = **0.00**, in which case **T-R** = **0.01** should be used.
11. **SCAN Mode Fix**: The VFO now correctly jumps 0.5 kHz on scan resume.
12. **DSP Noise Reduction and Notch On/Off Shortcuts:** There are two new switch combinations that allow NR and notch filtering to be turned on/off more easily. Use **AFIL** + **REC** to turn NR on/off. Use **AFIL** + **SPLIT** to turn notch on/off. (Note: New KDSP2 firmware is required to use these shortcuts; you'll see NOT INST otherwise.)
13. **RS232 Control:** (1) The RIT Clear (**RC**) command is now usable in TX mode. It will take effect the instant that the K2 returns to receive mode. (2) The new **TQ** command (Transmit Query) can be used to determine whether the K2 is in transmit mode (1) or receive (0). (3) **SW80** and **SW81** switch-press commands activate DSP NR and notch on/off shortcuts described above. (4) The **UP** and **DN** VFO commands can now be used in the menu to do scroll or parameter change. In **CAL FIL**, they can be used to change the BFO/filter values.