
# ELECRAFT® K3

## HIGH-PERFORMANCE
## 160 – 6 METER TRANSCEIVER

## OWNER'S MANUAL

Revision C1, November 18, 2007

# Contents

# A Note to K3 Owners

On behalf of our entire design team, we'd like to thank you for choosing the Elecraft K3 transceiver.

The K3—like its predecessor, the K2—reflects our desire to go beyond what other high-performance transceivers have offered. It isn't just a home-station rig; at about 8 pounds, it can accompany you wherever you go, whether it's out to your back porch or halfway around the world. And of course it's the only rig in its class that you can build yourself. But above all, we want the K3 to be ready for any operating situation you may encounter, *and* be more fun to use than any desktop transceiver you've ever owned.

73,

Wayne, N6KR
Eric, WA6HHQ

# Key to Symbols and Text Styles

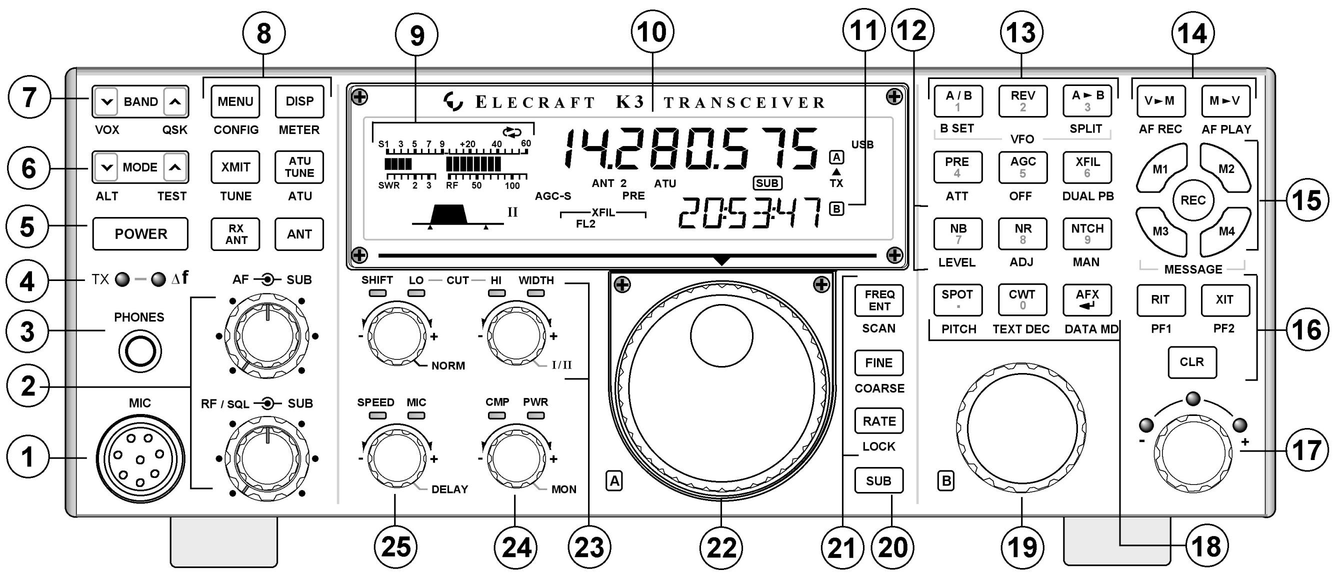
| | |
|---|---|
| | **Important – read carefully** |
| | Operating tip |
| **LSB** | LCD icon or characters |
| | LED |
| | ***Enter*** keypad function |
| XMIT | ***Tap*** switch function (labeled *on* a switch) |
| TUNE | ***Hold*** switch function (labeled *below* a switch; hold for 1/2 sec. to activate) |
| **SQL** | Rotary control without integral switch |
| PWR | ***Tap*** switch function of rotary control (labeled *above* a knob) |
| MON | ***Hold*** switch function of rotary control (labeled *below* a knob; hold for 1/2 sec.) |
| ***MAIN:VOX GN*** | Typical MAIN menu entry |
| ***CONFIG:KAT3*** | Typical CONFIG menu entry |

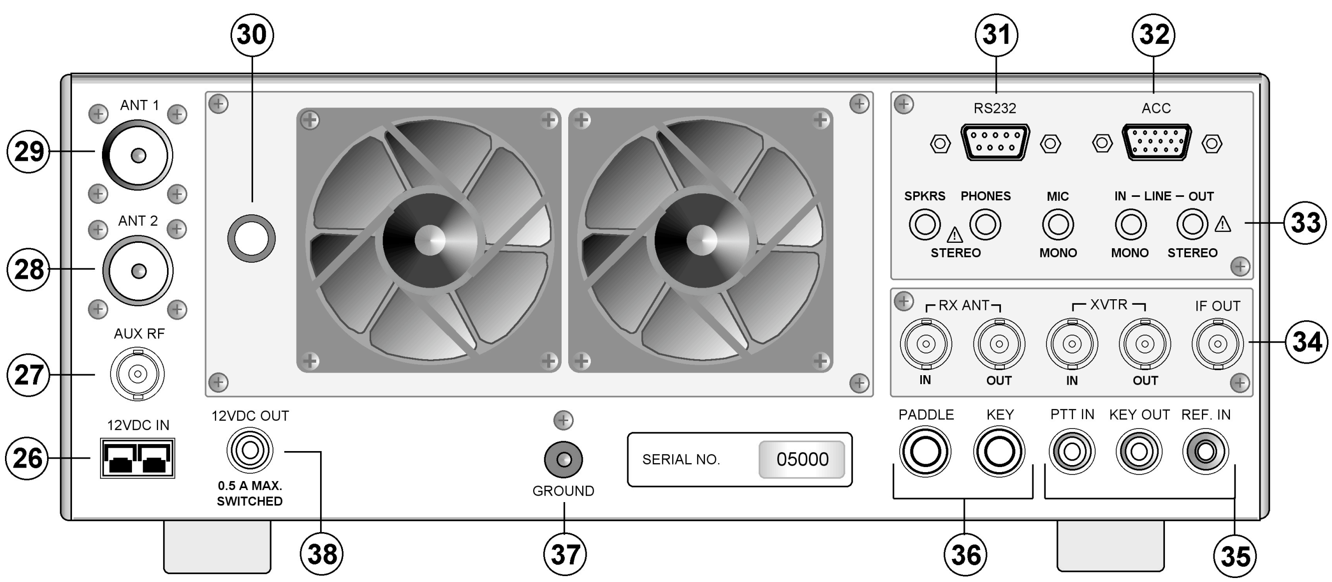
# Quick-Start Guide

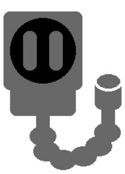
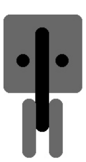
To get started using your K3 right away, please read this page and the two that follow, trying each of the controls. The text uses braces to refer to numbered elements in the front- and rear-panel illustrations below. For example, **{1}** refers to 1, the mic jack. Later sections provide greater detail on all aspects of K3 operation.

**The first thing you need to know about the K3** is that most switches have two functions. *Tap (press briefly)* to activate the function labeled *on* a switch. *Hold* to activate the function labeled *below* the switch. In the text, tap functions are shown like this: **MAIN** . An example of a hold function is **CONFIG** . Additional typographical conventions are shown on the previous page.

Try tapping **MENU** **{8}**. This brings up the **MAIN** menu. Rotating VFO B **{19}** selects menu entries, while rotating VFO A **{22}** changes their parameters. Tap **MENU** again to exit the menu.



| | |
|---|---|
| **Connections**<br> | • Connect a power supply to the DC input jack **{26}** (see Specifications, pg. 8).<br>• On the K3/100, a circuit breaker is provided on the fan panel for the 100-W stage **{30}**.<br>• You can power an accessory device from the switched DC output jack **{38}** (0.5 A max).<br>• Connect an antenna to ANT1 **{29}**. If you have an ATU installed (pg. 22), you can connect a second antenna to ANT2 **{28}**. If the KXV3 is installed, you can connect a separate RX antenna to RX ANT IN **{34}**. The AUX RF connector **{27}** is optional; see pg. 17. |
| **The Basics**<br><br> | • Press **POWER** **{5}** to turn on the K3. If there are any error indications, refer to pg. 58.<br>• **TAP** and **HOLD** Functions: ***Tapping*** briefly activates the function labeled *on* a switch. ***Holding*** for about 1/2 second activates the function labeled *beneath* a switch.<br>• Tap either end of **BAND** **{7}** to select a band, and tap **MODE** **{6}** to select the mode. Set the AF gain using **AF** **{2}**. Set **RF** to max. **SUB** controls are discussed on pg. 12.<br>• The large knob **{22}** controls VFO A (upper display, **{10}**). The medium knob **{19}** controls VFO B (lower display, **{11}**). VFO A is main RX/TX except in SPLIT (pg. 34).<br>• **CMP / PWR** is one of four **multifunction controls {24}**. Each has two primary functions, indicated by green LEDs. The knob has a built-in switch; ***tap*** it to select either **CMP** (compression level) or **PWR** (power output). ***Hold*** the knob in to access its secondary function, **MON**itor level. Tap again to restore the primary function. |
| **Filter**<br>**Controls**<br> | • Rotate the **SHIFT / LOCUT** and **HICUT / WIDTH** controls **{23}** to adjust the filter passband. Crystal filters **FL1-FL5** are automatically selected as you change the bandwidth. Tap either knob to alternate between shift/width and hicut/locut.<br>• Hold **SHIFT / LOCUT** to **NORM**alize the bandwidth (e.g., 400 Hz CW, 2.8 kHz SSB).<br>• Hold **HICUT / WIDTH** to alternate between two filter setups, **I** and **II** (per-mode).<br>• Tap **XFIL** **{13}** to select crystal filters manually; this also removes any passband shift. |
| **Voice Modes**<br><br>**{1}** | • Hold **METER** **{8}** to see **CMP** / **ALC** levels. While talking, set **MIC {25}** for 4-7 bars of ALC, and **CMP** for the desired compression. Then return to **SWR** / **PWR** (Pg. 26).<br>• **Optional:** Hold **TEST** **{6}** for **TX TEST** mode. Allows off-air TX adjustments (pg. 13).<br>• Hold **CMP / PWR {24}** to set speech **MON**itor level; tap to return to **CMP** / **PWR**.<br>• Hold **VOX** **{7}** to select PTT or **VOX**. Hold **SPEED / MIC** to set VOX **DELAY**.<br>• **Additional details:** VOX, pg. 27; TX EQ, pg. 33; MIC, pg. 49; SSB/AM/FM, pg. 26. |
| **CW Mode**<br><br>**{36}** | • **SPEED {25}** sets the CW keyer speed. Hold this knob to set semi-break-in **DELAY**. Hold **QSK** **{7}** to select full break-in (**QSK** icon on) or semi-break-in. (Pg. 28.)<br>• Hold **PITCH** **{18}** to set sidetone pitch. Hold **CMP / PWR** to set sidetone **MON** level.<br>• Tap **CWT** **{18}** to enable tuning aid **{9}**. With **CWT** on, **SPOT** auto-tunes (pg. 28).<br>• To select CW text decode/display mode, hold **TEXT DEC** **{18}**; rotate VFO B (pg. 28).<br>• CW keying is converted to DATA in **FSK D** and **PSK D** modes (below and pg. 32).<br>• Hold **DUAL PB** **{13}** to turn CW dual-passband filter (pg. 28). |
| **Data Modes**<br><br>**{31}** | • Tap **MODE** **{6}** until you see the **DATA** icon turn on (see Data Modes, pg. 29).<br>• Hold **DATA MD** **{18}**. Use VFO B to select from: **DATA A** (PSK31 & other soundcard-based modes), **AFSK A** (soundcard-based RTTY), **FSK D** (RTTY via data input or keyer), or **PSK D** (PSK via data input or keyer). VFO A selects data baud rate for internal encoder/decoder, if applicable. **DUAL PB** turns on RTTY filter (DTF, pg. 30).<br>• Hold **PITCH** **{18}** to select mark tone and shift (for encoder/decoder and RTTY filter).<br>• Hold **TEXT DEC** **{18}** to set up text decode. **CWT** shows tuning aid (pg. 32). |

| | |
|---|---|
| **VFOs and RIT/XIT** | • RATE {21} selects 10 or 50 Hz VFO/RIT tuning (pg. 22). See VFO menu entries, pg.22.<br>• FINE {21} selects 1-Hz steps. COARSE selects large tuning steps (per-mode; pg.22).<br>• Tap FREQ ENT {21} to enter frequency in MHz using numeric keypad & decimal point. Tap return ( ↵ ) to complete the entry, or tap FREQ ENT again to cancel. (Pg. 15.)<br>• Hold SCAN to start/stop scanning. SCAN must be preceded by a memory recall (pg. 37).<br>• The RIT and XIT offset knob {17} has LEDs that show -/0/+ offset (pg.16). Tap CLR {16} to zero the offset. ***Hold*** CLR for > 2 sec. to add the offset to VFO A, then zero it. |
| **Transmit, ATU, and Antenna Controls** | • The **TX** LED {4} indicates that the K3 is in transmit mode. The Δ**f** LED turns on if the RX and TX frequencies are unequal (SPLIT, RIT/XIT, cross-mode, etc.). (Pg. 13.)<br>• XMIT {8} is equivalent to PTT {35}. Hold TUNE to put out full CW power in any mode.<br>• Tap ATU TUNE {8} to initiate antenna matching. Hold ATU to enable or bypass the ATU.<br>• ANT selects **ANT1** or **ANT2**. RX ANT selects main or **RX** antenna (KXV3). |
| **NB, NR, and Notch** | • Tap NB {12} to enable DSP and I.F. noise blanking. Hold LEVEL to set NB levels using VFO A (DSP) and VFO B (I.F.). Fully CCW is OFF in both cases. (Pg. 15.)<br>• Tap NR {12} to turn on noise reduction. Hold ADJ to tailor noise reduction for the present band conditions (pg15).<br>• Tap NTCH {12} once to select auto-notch (**NTCH** icon), and a second time to select manual notch (adds ◄► icon). Hold MAN to adjust manual notch frequency. (Pg. 24.) |
| **SPLIT, BSET, and SUB** | • Hold SPLIT {13} to enter split mode (RX on VFO A, TX on VFO B). If VFOs A and B are on different frequencies in SPLIT mode, the Delta-F LED (Δ**f**) will turn on (pg. 13).<br>• Hold BSET {13} to adjust VFO B settings independently of VFO A (pg.35).<br>• Tap SUB {20} to turn on the sub receiver (pg. 42). VFO B controls its frequency.<br>• The sub receiver can use its auxiliary input or share antennas with the main receiver. Which antennas are available to main and sub receivers depends on installed options (pg. 42). |
| **Memories, Messages, and DVR** | • To store a frequency memory, tap V ► M {14}, then: tap M1-M4 {15} to save a per-band quick memory; or tap 0-9 to save a general-purpose quick memory; or rotate VFO A to select from memories 0-99, then tap V ► M again to save. Tap M ► V to recall. (Pg. 16.)<br>• REC and M1-M4 {15} are also used to record & play voice/CW/DATA messages. The KDVR3 option is required for voice messages and AF REC / AF PLAY (pg. 16). |
| **Menus** | • MENU & CONFIG {8} access the MAIN and CONFIG menus. VFO B selects entries; VFO A changes parameters. In general, CONFIG menu entries are used less often.<br>• Tapping DISP {8} within menus shows information about each entry on VFO B (pg 49).<br>• Up to 10 menu entries can be assigned to programmable function switches. PF1 and PF2 {16} are dedicated programmable functions. Any of M1-M4 {15} can be used as Tap and/or Hold programmable functions if they're not being used for message play (pg 49). |
| **Other Features** | • RX and TX EQ (MAIN menu) provide 8 bands of receive/transmit equalization (pg. 33).<br>• Tap AFX {18} to enable the selected audio effect (see AFX MD menu entry. pg. 49).<br>• Tap DISP {8} and use VFO B to show time, supply voltage, etc. on VFO B (pg. 34).<br>• The ALARM function (MAIN menu) can be used to remind you about a contest, net, or QSO schedule, and can even turn the K3 on at alarm time (pg. 34).<br>• The KIO3 module provides a rich set of AF {33} and digital {32} I/O (pg. 16). |

# Introduction

This comprehensive manual covers all the features and capabilities of the Elecraft K3 transceiver. We recommend that you begin with the **Quick-Start Guide** (pg. 4). The **Front Panel** (pg. 11) and **Rear Panel** (pg. 17) sections are for general reference, while **Basic Operation** (pg. 21) and **Advanced Operation** (pg. 31) fill in the details.

⚠ Your K3, including any installed crystal filters and option modules, should already be configured. Anytime you add new filters or options, refer to **Configuration** (pg. 43).

## K3 Features

The K3 offers a number of advanced features that simplify operation and enhance versatility. These are listed below. Refer to the indicated pages for further details.

### *Receiver*

- Up to five crystal roofing filters; bandwidths as narrow as 200 Hz (pg. 23)
- High-performance, fully independent sub receiver, also with up to five crystal filters (pg. 35)
- Variable-bandwidth crystal filters that track DSP filter settings
- Narrow ham-band front-end filters, plus wider band-pass filters for general-coverage receive (pg. 42)

### *DSP*

- 32-bit I.F. DSP for advanced signal processing, including full stereo and other binaural effects (pg. 33).
- Passband tuning and programmable DSP/crystal filter presets (pg. 14)
- 8-band transmit and receive EQ (graphic equalization) (pg. 33)
- Dual-passband effects for use in contest/pileup conditions (pg. 28)
- Versatile digital voice recorder (DVR) for incoming/outgoing audio streams (pg. 27)

### *CW and Digital Modes*

- Built-in digital-mode demodulation with text displayed on the K3's LCD (CW, RTTY, PSK31) (pg. 7)
- Internal CW-to-TTY or PSK31 conversion for casual digital-mode QSOs without a computer (pg.32)
- CW text can be decoded and displayed as you send – great for improving CW skills (pg. 31)
- Automatic CW/data signal spotting and manual fine-tuning display (pg. 28)

### *User Interface*

- Dual VFOs with independent modes, bands, and filter settings (pg. 14)
- 100 memories with alphanumeric labels, plus 4 quick-memories per band (pg. 16)
- Dedicated message play controls for use in CW, data, and voice modes (pg. 28)
- Real-time clock/calendar with programmable alarm times and automatic power-on (pg. 34)
- Utility displays show voltage, current drain, front panel temperature, PA heatsink temperature, and other data
- Instructions for menu entries available with one switch tap

### *Connectivity*

- Enhanced, high-speed remote control interface with many new commands and direct DSP access
- Firmware upgradeable via the internet (pg. 41)
- Isolated PC audio input and stereo outputs (pg. 16)
- Front and rear mic and headphone jacks
- Full stereo audio drives two speakers
- Optional RX antenna in/out, transverter in/out, and buffered IF outputs (KXV3)

# Specifications

Some specifications apply only if the corresponding option modules are installed (see ***Options***, pg. 42).

## *GENERAL*

| | |
|---|---|
| **Frequency Range** | Main and Sub Receivers, 500 kHz - 30 MHz and 48-54 MHz. (Reduced sensitivity in region of 8.215 MHz IF. KBPF3 required for full general-coverage receive.) Transmitter: Amateur bands between 1.8 and 54 MHz; transmit limits vary by country. |
| **Tuning Step Sizes** | 1, 10, 20, and 50 Hz; user-configurable coarse tuning steps (per-mode). Direct keypad frequency entry in either MHz or kHz |
| **Memories** | 100 general purpose; 4 scratchpad memories per band |
| **Frequency Stability** | +/- 5 ppm (0-50 C) TCXO standard; +/- 0.5 ppm TCXO optional |
| **Antenna Jacks** | 50 ohms nominal. One SO-239 supplied (2nd SO-239 jack supplied with KAT3 ATU). BNC jacks for RX antenna in/out and transverter in/out (KXV3 Option). |
| **Modes** | USB, LSB, AM, FM, CW, and DATA. In DATA mode: FSK-D (Direct), AFSK-A (Audio), PSK-D (Direct) and DATA-A (Audio; PSK, etc.). Built in PSK,RTTY, and CW text decode/display. |
| **VFOs** | Dual VFOs (A and B) with separate weighted tuning knobs |
| **Remote Control Port** | EIA-232 standard DE-9F; USB adapter option. Full control of all radio functions |
| **Audio I/O** | Line-level isolated TX/RX audio interface (stereo outputs); front and rear stereo headphone jacks; stereo speaker jack |
| **Low Level Transverter Interface** | 0 dBm typ.; BNC connectors (KXV3 Option) |
| **Buffered IF output** | BNC connector (KXV3 Option); see pg. 36 for interface recommendations |
| **Other I/O** | Key/Keyer/Computer, Paddle, PTT In, and KEY Out. Band information output via binary interface and AUXBUS on ACC connector. |
| **Real-Time Clock/Calendar** | Accuracy: Approx. +/- 20 ppm (+/- 2 seconds/day). U.S. and E.U. date formats. Battery: 3 V coin cell (see pg. 45 for replacement instructions). |
| **Supply Voltage /Current** | 13.8 V nominal (11 V min, 15 V max). 17-22 A typical in TX for K3/100, 3-4 A typical in TX for K3/10. 0.9A typical RX (sub receiver off). Recommended supply: 13.8VDC @ 25A, continuous duty for K3/100; 13.8VDC @ 6A for K3/10. |
| **Weight** | 8.5 lbs. (3.85 kg) max., all options installed |
| **Size** | Enclosure only, 4.0 x 10.7 x 10.0 in., HWD (10.2 x 27.2 x 25.4 cm); with projections, 4.4 x 11.1 x 11.8 in. (11.2 x 28.2 x 30.0 cm) |

## *RECEIVERS (Main and Sub)**

| | |
|---|---|
| **Sensitivity** | -136 dBm (typical), preamp on, 500Hz b/w |
| **IMD3 Dynamic Range** | >100 dB typical at 5, 10, and 20 kHz spacing. |
| **Blocking Dynamic Range** | 140 dB typical at 5, 10, and 20 kHz spacing |
| **Image Rejection** | > 70 dB |
| **IF Rejection** | > 70 dB |
| **S-Meter** | Nom. S9 = 50 µV, preamp on; user-adjustable |
| **Noise Blanker** | Adjustable, multi-threshold/multi-width hardware blanker plus DSP blanker |
| **8-Band RX graphic EQ** | +/- 16 dB/octave |
| **Filter Controls** | IF Shift/Width & Lo/High Cut with automatic crystal filter selection |

***** Dynamic range measurements based on 400-Hz, 8-pole filter. Other available filters have very similar performance; see www.elecraft.com for full list. Receive specifications are guaranteed only within ham bands.

## *TRANSMITTER*

| | |
|---|---|
| **Output Power** | 200 mW –100 W (12 W, K3/10) typ., ALC controlled (reduced power in AM mode) |
| **Duty Cycle** | CW and SSB modes, 100% 10-min. 100W key-down at 25 C ambient |
| **True RF Speech Processor** | Adjustable compression |
| **8-Band TX audio graphic EQ** | +/- 16 dB/octave |
| **SSB TX Bandwidth** | 4 kHz max (> 2.8 kHz requires 6 kHz AM filter) |
| **SSB TX Monitor** | Post-DSP filtering/processing |
| **VOX** | DSP-controlled, adjustable threshold, delay, and anti-VOX |
| **Full and Semi CW Break-In** | Adjustable delay; diode T/R Switching |
| **SSB Carrier Suppression** | > 50 dB |
| **Harmonic and Spurious Outputs** | > 50 dB below carrier (100W) |
| **CW Offset/Sidetone** | 300-1000 Hz, adjustable. Filter center frequency follows sidetone/offset. |
| **Mic** | Front 8 pin microphone connector, rear 3.5 mm microphone connector, wide mic gain adjustment range. PTT IN (RCA jack) usable in all modes. Switchable DC bias voltage available for electret mics. |

## Customer Service and Support

### *Technical Assistance*

You can send e-mail to ***k3support@elecraft.com*** and we will respond quickly - typically the same day Monday through Friday. Telephone assistance is available from 9 A.M. to 5 P.M. Pacific time (weekdays only) at 831-662-8345. Please use e-mail rather than calling when possible since this gives us a written record of the details of your problem and allows us to handle a larger number of requests each day.

### *Repair / Alignment Service*

If necessary, you may return your Elecraft product to us for repair or alignment. (Note: We offer unlimited email and phone support, so please try that route first as we can usually help you find the problem quickly.)

**IMPORTANT: You must contact Elecraft before mailing your product** to obtain authorization for the return, what address to ship it to and current information on repair fees and turn around times. (Frequently we can determine the cause of your problem and save you the trouble of shipping it back to us.) Our repair location is different from our factory location in Aptos. We will give you the address to ship your kit to at the time of repair authorization. *Packages shipped to Aptos without authorization will incur an additional shipping charge for reshipment from Aptos to our repair depot.*

## Elecraft 1-Year Limited Warranty

This warranty is effective as of the date of first consumer purchase. It covers both our kits and fully assembled products. For kits, before requesting warranty service, you should fully complete the assembly, carefully following all instructions in the manual.

**What is covered:** During the first year after date of purchase (or if shipped from factory, date product is shipped to customer), Elecraft will replace defective or missing parts free of charge (post-paid). We will also correct any malfunction to kits or assembled units caused by defective parts and materials. Purchaser pays inbound shipping to us for warranty repair, we pay shipping to return the repaired equipment to you by UPS ground service or equivalent to the continental USA and Canada. Alaska, Hawaii and outside U.S. and Canada actual return shipping cost paid by owner.

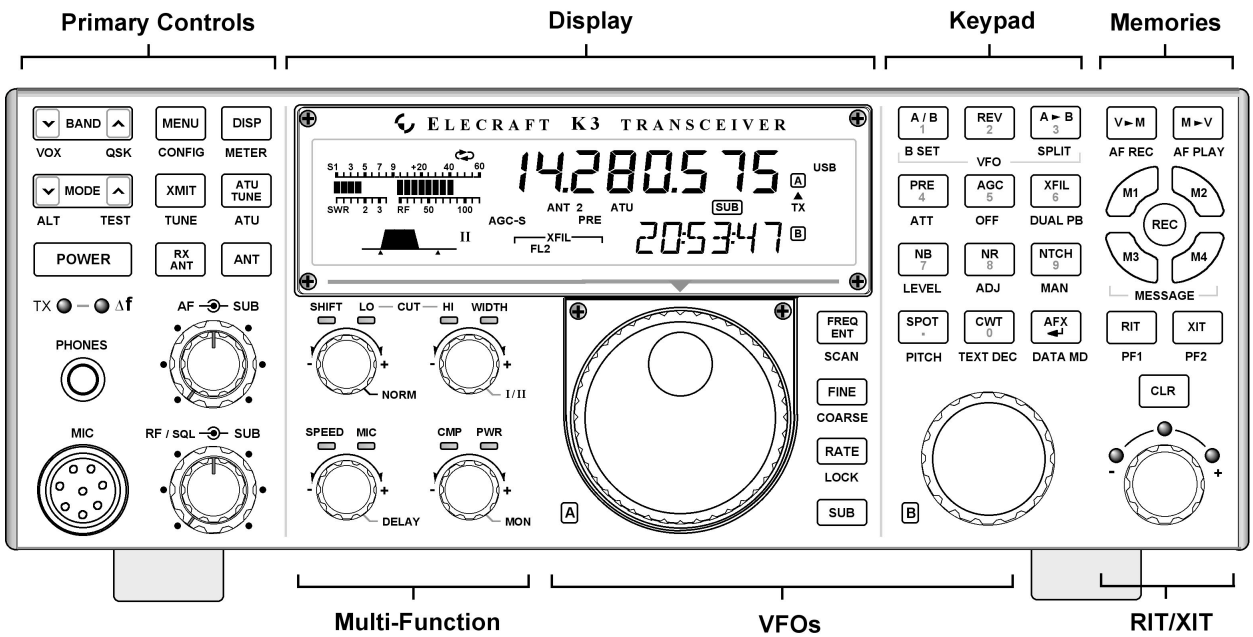
**What is not covered:** This warranty does not cover correction of kit assembly errors. It also does not cover misalignment; repair of damage caused by misuse, negligence, or builder modifications; or any performance malfunctions involving non-Elecraft accessory equipment. The use of acid-core solder, water-soluble flux solder, or any corrosive or conductive flux or solvent will void this warranty in its entirety. Also not covered is reimbursement for loss of use, inconvenience, customer assembly or alignment time, or cost of unauthorized service.

**Limitation of incidental or consequential damages:** This warranty does not extend to non-Elecraft equipment or components used in conjunction with our products. *Any such repair or replacement is the responsibility of the customer. Elecraft will not be liable for any special, indirect, incidental or consequential damages, including but not limited to any loss of business or profits.*

# Front Panel

This reference section describes all front panel controls, the liquid crystal display (LCD), LEDs, and connectors. Operating instructions are covered in later sections.

## Control Groups




**Primary Controls (pg 13):** These controls provide basic transceiver setup, including power on/off, band, operating mode, AF and RF gain and squelch, ATU and transmit controls, display modes, and menus.

**Display (pg 12):** The LCD shows signal levels, VFO A and B frequencies, filter bandwidth, operating mode, and the status of many controls. The VFO B display is alphanumeric, so it can show decoded text from digital modes (CW, RTTY, PSK31), as well as menus, time and date, help messages, etc.

**Multi-Function Controls (pg. 14):** The upper two knobs set up receiver DSP filtering. The lower two control transmit parameters, including keyer speed, mic gain, speech compression, and power output level. LEDs above each knob show which function is active; tapping the knob alternates between them. Pressing and holding these knobs (1/2 second or longer) provides access to secondary functions.

**Keypad (pg. 15):** This group of switches is numbered for use during memory store/recall and direct frequency entry, but each switch also has normal tap and hold functions. The upper row of switches are VFO controls. The remaining rows control receive-mode and miscellaneous functions, such as noise reduction and text decode/display.

**Memories (pg. 16):** These switches control frequency memory store/recall, message record/play, and audio record/playback (with the DVR). M1-M4 can also be used as up to eight tap/hold programmable function switches.

**VFOs (pg. 14):** The large knob controls VFO A; the smaller knob controls VFO B. The four switches between the VFO knobs select tuning rates and control related functions.

**RIT/XIT (pg. 16):** Three switches control RIT and XIT on/off and clear (offset zero). The knob below the RIT/XIT switches selects the offset.

## Display

**Multi-character displays:** The 7-segment display (upper) shows the VFO A frequency. The 13-segment display (lower) shows VFO B.

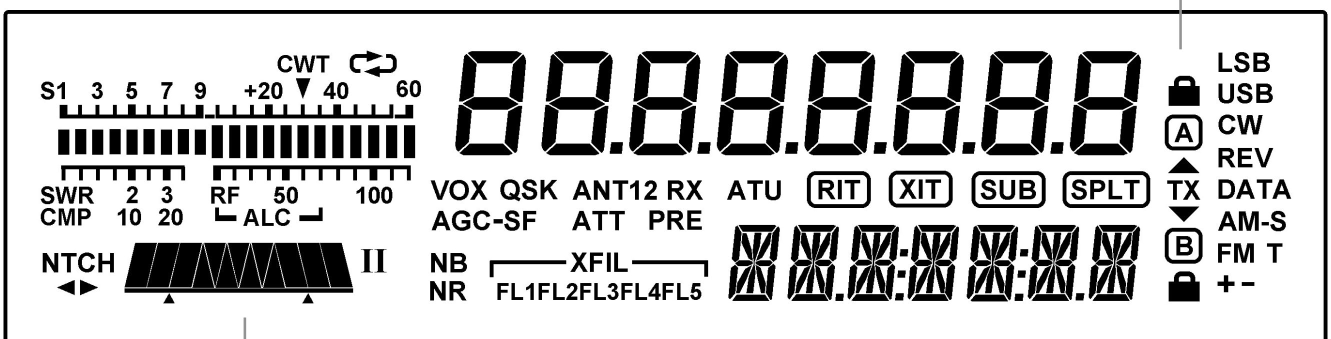
**Bargraph, receive mode:** The bargraph normally acts as an S-meter. If CWT is turned on, the right half of the S-meter becomes a tuning aid (pg. 32).

**Bargraph, transmit mode:** The bargraph normally shows **SWR** and **RF** power output. The **RF** scale will be either **5** and **10** (low power) or **50** and **100** (high power). In voice and data modes, transmit scales can be changed to compression (**CMP**) and **ALC** using METER.

**VFO Icons:** The **TX** icon and two arrows indicate which VFO is selected for transmit as shown below. In TX TEST mode, **TX** flashes (see TEST).
Shows that VFO A or B is locked (see LOCK).

A ▲ TX — *VFO A is the transmit VFO*

TX ▼ B — *VFO B is the transmit VFO; see* SPLIT




**Filter Graphic:** This shows the approx. bandwidth and position of the receiver's I.F. passband. See **Using DSP and Crystal Filtering** (pg. 23).

**Filter Icons:**

| | |
|---|---|
| **NTCH** | Notch filtering on (NTCH, pg. 24) |
| ◄► | Manual notch (MAN, pg. 24) |
| **I / II** | Shows selected preset (I/II, pg. 14) |
| **XFIL** | Crystal filter selection (**FL1**-**FL5**) |

**Mode Icons:**

Basic operating modes (**LSB**, **USB**, **CW**, **DATA**, **AM**, or **FM**) are selected by tapping either end (Up/Down) of MODE.

Alternate modes (**CW REV**, **DATA REV**, **AM-S**, **FM +/-**) are selected by holding ALT. **T** indicates FM/tone, or CW/data text decode.

**Other Icons:**

| | |
|---|---|
| **CWT** | CW/data tuning aid on (CWT, pg. 32) |
| (DVR icon) | DVR in use (AF REC / AF PLAY, pg. 16) |
| **VOX** | VOX enabled (VOX, pg. 26) |
| **QSK** | Full break-in CW enabled (QSK, pg. 28) |
| **NB** | Noise blanker on (NB, pg. 24) |
| **NR** | Noise reduction on (NR, pg. 24) |
| **ANT** | Antenna **1** or **2** (ANT, pg. 13) |
| **RX** | RX antenna in use (RX ANT, pg. 13) |
| **ATT** | Attenuator on (ATT, pg. 24) |
| **PRE** | Preamp on (PRE, pg. 24) |
| **ATU** | ATU enabled (ATU, pg. 13) |
| **RIT** | RIT on (RIT, pg. 16) |
| **XIT** | XIT on (XIT, pg. 16) |
| **SUB** | Sub receiver on (SUB, pg. 35) |
| **SPLT** | Split mode in effect (SPLIT, pg. 34) |

## LEDs

**TX** **[Red]** Turns on in transmit mode.

**Δ F** **[Yellow]** The "Delta-F" LED turns on if transmit and receive frequencies or modes are different due to the use of SPLIT, RIT, or XIT.

**[Green]** Eight LEDs show which functions are in effect for the **Multifunction Controls** (pg. 14).

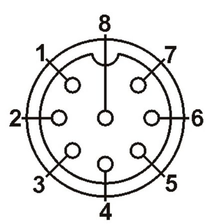
(-) (+) **RIT/XIT OFFSET** If the offset control is centered, or you tap CLR, the **green** LED turns on (offset = 0). Otherwise, the **yellow** (-) or (+) LED will be on, indicating the direction of the offset. See RIT, XIT, and CLR.

## Front Panel Connectors

**PHONES** You can use either mono or stereo headphones at either the front- or rear-panel headphone jack. Also see AFX (pg. 33).

**MIC** An Elecraft MH2, MD2, Proset-K2, or other compatible mic can be used (see pinout below). To select the front- or rear-panel mic, and to turn bias on/off, use the *MAIN:MIC SRC* menu entry.

Bias must be turned on for the MH2, MD2, and Proset-K2. It must be off for Heil mics using the HC4 or HC5 elements.




**Mic jack, viewed from front of K3**

1 Mic audio, low-Z (~600 ohms)
2 PTT
3 DOWN button*
4 UP button*
5 FUNCTION button*
6 8V (10 mA max)
7, 8 Ground

*If applicable (not used on MH2 or MD2)

**FP ACC** This connector (RJ-45, 6 pins) is located on the bottom of the transceiver, near the VFO B knob. It is used with accessory devices.

## Primary Controls

**BAND** Tap the left / right end of this switch to move to the next lower / higher ham band (pg. 11).

**VOX** Selects voice-operated or keying-activated transmit (**VOX** icon on), or PTT-controlled transmit. Also see DELAY (pg.26).

**QSK** Selects either full break-in (**QSK** icon on) or semi break-in keying, if VOX is selected in CW mode. Also see DELAY (pg. 26).

**MODE** Tapping the left or right end of this switch selects one of the primary operating modes. When **DATA** is selected, the DATA MD switch is used to specify FSK-D, AFSK-A, PSK-D, and DATA-A. (pg. 29).

**ALT** Selects alternate modes: **CW REV**, **DATA REV**, **AM-S** (pg. 26) , and **FM +/-** (pg. 26).

**TEST** Selects TX NORM or TX TEST (**TX** LCD icon flashing). TX TEST allows you to test keying, mic level, etc., without actually transmitting.

**POWER** Turns the K3 on or off. Also see Alarm and Auto Power-On (pg. 34) and forced firmware load (pg. 42).

**MENU** Displays the MAIN menu. Use VFO A to change parameters, and VFO B to move to the next entry. Tap DISP to get help with the current menu entry (default value shown in parentheses). Also see **Programmable Switch Functions** (pg. 21).

**CONFIG** Displays the CONFIG menu.

**XMIT** Manually-operated transmit. Places the K3 into transmit mode (same as PTT, pg. 24).

**TUNE** Keys the transmitter in CW mode at the present power level. See **Using the ATU** (pg. 22).

**RX ANT** Selects the receive antenna (**RX**, pg. 12).

**DISP** Shows an alternate display on VFO B, including time, date, voltage, etc. Use the VFO B knob to select the desired display (pg. 34).

**METER** Selects voice transmit bargraph modes: **SWR** and **RF**, or **CMP** and **ALC** (pg. 26).

**ATU TUNE** Places the K3 into low-power CW transmit mode and matches the antenna using the KAT3 automatic antenna tuner (pg. 22).

**ATU** Puts the ATU into normal mode (**ATU** icon on) or bypass mode (pg. 22).

**ANT** Selects **ANT 1** or **2** and recalls the last ATU settings used for that antenna (saved per-band).

### *Dual-Concentric Potentiometers*

⏲ **AF** — **SUB** AF gain controls for main receiver (inner, or smaller knob) and sub receiver (outer ring, or larger knob).

⏲ **RF** / **SQL** — **SUB** RF gain (and/or squelch) controls for main and sub receiver.

Two menu entries are provided to control squelch directly: *CONFIG:SQ MAIN*, and *SQ SUB*. They can also be used to reconfigure the RF gain controls as squelch for either receiver. See the **Config Menu** listing for details (pg. 50).

## Multi-Function Controls

The upper two multi-function controls set up receiver filtering. The lower two controls adjust transmit settings. Each control has two primary functions (white labels) and a secondary function (yellow). **Tap** a control knob to alternate between its primary functions, indicated by two LEDs. **Hold** a knob (~1/2 second or longer) to select its secondary function.

### *Filter Controls*

The primary functions of the filter controls are:

⏲ SHIFT Shift passband either direction
⏲ LO CUT Adjust low-frequency response
⏲ HI CUT Adjust high-frequency response
⏲ WIDTH Adjust width of the passband

As these settings change, so does the filter graphic. Crystal filters are selected automatically. See ***Using DSP and Crystal Filtering*** (pg. 23).

The secondary functions of these controls are:

NORM Normalize passband

Normalizing the passband sets the bandwidth to a fixed, per-mode value (e.g. 400 Hz in CW mode) and centers the passband. (Also see XFIL, pg. 23.)

I/II Select preset **I** or **II** (per mode)

Presets **I** and **II** each hold a complete DSP/crystal filter setup (pg. 23).

### *Transmit Controls*

The primary functions of the transmit controls are:

⏲ SPEED Keyer speed in WPM, 8-50
⏲ MIC Mic gain
⏲ CMP Speech compression level, dB
⏲ PWR RF output power in watts (pg. 25)

The present transmit mode determines which primary functions normally apply; for example, in CW mode, the ⏲ SPEED / MIC control defaults to SPEED . You can always tap a knob to override the present selection.

The secondary functions of these controls are:

⏲ DELAY VOX delay (voice/data) or CW semi-break-in delay, in seconds
⏲ MON Voice or data monitor level or CW/data sidetone level

## VFO Tuning Controls

The VFO A knob controls the upper frequency display. This is normally the RX and TX frequency. In SPLIT mode, VFO B controls the transmit frequency (pg. 34). VFO B also controls the sub receiver when it is installed and turned on (pg. 35).

The controls to the right of VFO A include:

FREQ ENT Direct frequency entry (pg. 15)
SCAN Start or stop scanning (pg. 37)
FINE Select 1 Hz tuning for both VFOs and RIT/XIT offset
COARSE Select coarse tuning rate pg. 22)
RATE Select one of two normal tuning rates (10/50 or 10/20 Hz; pg. 22)
LOCK Lock VFO A (use BSET to lock B)
SUB Turn sub receiver on/off (pg. 35).

ℹ VFO A can optionally be coarse-tuned using the RIT/XIT offset control if both **RIT** and **XIT** are off . See *CONFIG:VFO OFS*.

### *Direct Frequency Entry*

To jump to any frequency within the tuning range of the K3, tap **FREQ ENT**, then enter 1 to 3 MHz digits, a decimal point, and 0 to 3 kHz digits. Follow this with ***Enter*** ( ↵ ) to accept or **FREQ ENT** to cancel. The decimal point is optional if no kHz digits are entered, making it very easy to get to the low end of most ham bands.

**Examples:**

1.825 MHz: **FREQ ENT** **1** **.** **8** **2** **5** ↵

1.000 MHz: **FREQ ENT** **1** ↵

50.100 MHz: **FREQ ENT** **5** **0** **.** **1** ↵

If four or more digits are entered without a decimal point, a value in kHz is assumed.

## Keypad

Each keypad switch has tap and hold functions, listed below. These switches are also used for direct frequency entry; to select quick memories 0-9; and for selecting fields in certain menu entries, such as time, date, filter, and transverter setup.

### *VFO Controls (Upper row)*

The upper row of numeric keypad switches is used to set up VFOs A and B. Their functions are:

| | |
|---|---|
| **A / B** | Exchange VFO A and B contents |
| **BSET** | Set up VFO B and sub receiver |
| **REV** | Exchange VFO A and B temporarily |
| **A ► B** | Copy VFO A to VFO B (also see *CONFIG:VFO B->A*) |
| **SPLIT** | Enable SPLIT receive/transmit |

Holding **BSET** allows VFO B (and the sub receiver, if on) to be set up directly (pg. 35). As long as **BSET** is displayed, all VFO-related controls and display elements apply to VFO B. An alternative is to set up VFO A, then **A ► B**.

### *Receiver Control & Misc. (Lower Rows)*

Receiver control functions normally apply to VFO A. If **BSET** is in effect, they apply to VFO B. The sub receiver, when turned on, uses the VFO B settings.

| | |
|---|---|
| **PRE** | Preamp on/off |
| **ATT** | Attenuator on/off |
| **AGC** | AGC slow/fast |
| **OFF** | AGC off/on |
| **XFIL** | Select next available crystal filter (see *CONFIG:FLx ON*) |
| **DUAL PB** | Dual-passband CW or dual-tone RTTY filtering (pg. 28) |
| **NB** | Noise blanker on/off (pg. 24) |
| **LEVEL** | Noise blanker levels (pg. 24); use VFO A knob to select DSP blanker, and VFO B to setup I.F. blanker |
| **NR** | Noise reduction on/off (pg. 24) |
| **ADJ** | Noise reduction parameter adjust; use VFO B knob (pg. 24) |
| **NTCH** | Notch filter auto/manual/off (pg. 24) |
| **MAN** | Manual notch frequency (pg. 24); use VFO B knob |
| **SPOT** | Spot tone on/off (manual), or auto-spot (if CWT is on; pg. 32) |
| **PITCH** | CW sidetone **PITCH**, PSK center pitch, FSK / AFSK MARK tone and shift (pg. 29), or FM tone setup (pg. 27) |
| **CWT** | CW/data tuning aid on/off (pg. 12); turn on to use auto-spot |
| **TEXT DEC** | **Text decode,** CW or DATA (pg. 31); use VFO B knob to select mode |
| **AFX** | Audio effects on/off (pg. 33); use *CONFIG:AFX MD* to set mode |
| **DATA MD** | DATA mode selection (pg. 29); use VFO B knob |

# Memory Controls

### *Frequency Memories*

The K3 has 100 general-purpose memories (00-99), plus up to 80 per-band memories (M1-M4 on each of 11 regular bands and 9 transverter bands). Each memory holds VFO A and B frequencies, modes, filter presets, antenna selection, and other settings.

Memories can have a text label of up to 5 characters (A-Z, 0-9, and various symbols). For example, you might want to label memories associated with nets, callsigns of broadcast stations, or your favorite scanning ranges.

**To store a general-purpose memory** (**00-99**): First tap V ► M (**V**FO to **M**emory), then locate the desired memory using the VFO A knob. The VFO A frequencies stored in each memory will be shown as you scroll through them. When you reach the desired memory number, tap V ► M again to store, or tap M ► V to cancel the operation.

**To recall a general-purpose memory:** Tap M ► V , then select memory **00-99** using VFO A. Tap M ► V again to confirm, or V ► M to cancel.

Memories 00-09 are **quick memories**, accessible with just two switch taps. These could be used to get to a starting point in each of 10 ham bands. Memories M1 – M4 are ***per-band*** **quick memories**. For example, you might set up M1 for each band's CW segment, M2 for the SSB segment, etc.

**To store or recall quick memories:** Tap V ► M or M ► V as before, but instead of rotating VFO A, tap 0 - 9 or M1 - M4 .

**To add or change a memory's text label:** First tap M ► V , then select a memory (**00-99**) using VFO A. Next, rotate VFO B to select each label position in turn as indicated by the flashing cursor. Use VFO A to change characters. After editing, tap M ► V again. (Labels can be edited at any time, including when you initially store a memory using V ► M .)

**An asterisk (*) used as the first character of a label designates a channel-hopping memory** (pg. 37).

### *Digital Voice/Audio Recorder*

Two switches are dedicated to the DVR (KDVR3 option). See page 27 for additional information.

| | |
|---|---|
| AF REC | Start / stop audio record |
| AF PLAY | Start / stop audio playback |

When record or playback is active, the icon appears. It flashes during playback.

The DVR is also used for message record and play in voice modes.

# Message Record/Play Controls

Five switches provide record and playback of outgoing messages: M1 , M2 , M3 , M4 and REC. These switches provide single-tap play, hold-to-repeat, and other functions that are convenient for contests and for sending often-repeated text or voice messages during QSOs.

For details on CW message record/play, see pg. 28. The same messages can be used with CW-to-DATA (pg. 32). For voice message record/play, see **Digital Voice Recorder** (pg. 27).

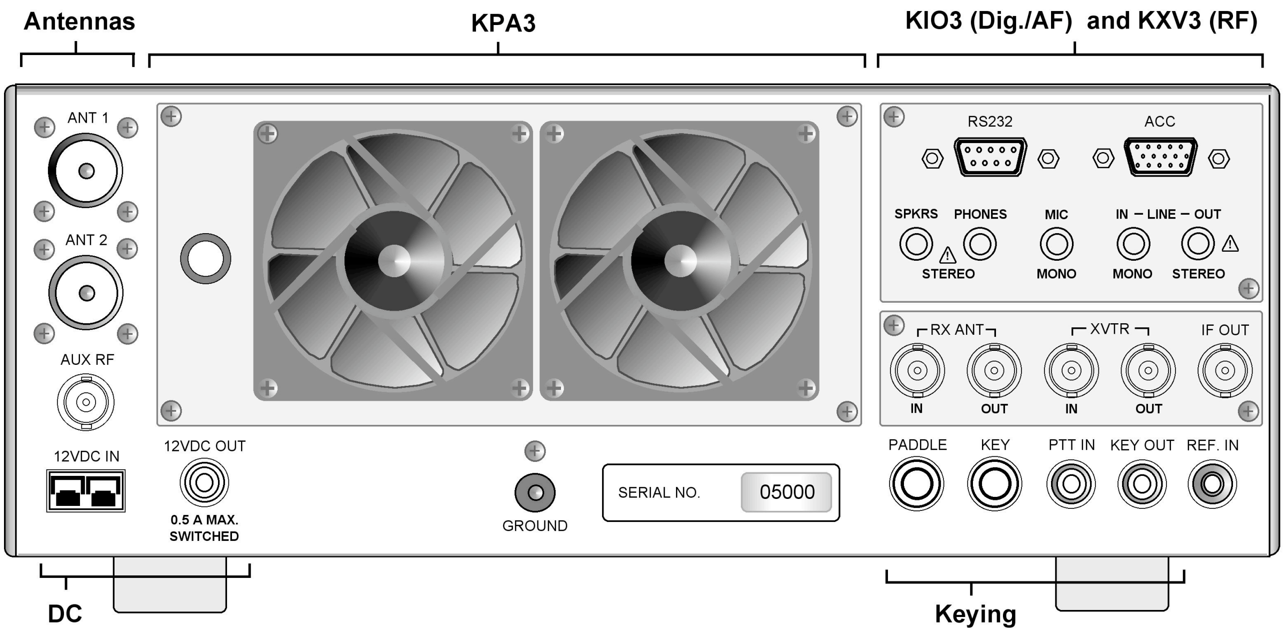
# RIT and XIT Controls

| | |
|---|---|
| RIT | RIT (receive incremental tuning) on/off. |
| PF1 | Programmable function switch (pg. 21) |
| XIT | XIT (transmit incremental tuning) on/off. |
| PF2 | Programmable function switch (pg. 21) |
| CLR | Sets RIT/XIT offset to 0; tap again to restore offset to previous value. Hold for 2 seconds to copy present RIT offset to VFO A before clearing. |

The RIT/XIT offset control sets the offset for RIT and XIT. Three LEDs above the control show at a glance whether an offset is in effect (pg. 11).

# Rear Panel

## Connector Groups




**⚠ The appearance of your rear panel may vary depending upon the options installed.**

**Antennas: ANT1** (SO-239) is standard. **ANT2** (SO-239) is supplied with the KAT3 automatic antenna tuner option, which includes an antenna switch controlled from the front panel. Both jacks are nominally 50 ohms when the ATU is bypassed or not installed. The AUX RF connector **{27}** is for use with the KRX3 option; see pg. 38.

**DC: 12 VDC IN** jack is an Anderson PowerPole connector rated at 30 amps. (See ***Specifications***, pg. 8, for detailed power requirements.) **12 VDC OUT** (RCA/Phono) provides up to 0.5 A (switched) for use with accessory devices. **Ground Terminal:** A good station ground is important for safety and to minimize local RFI.

**KPA3:** This option panel is blank in the K3/10. In the K3/100, the blank panel is replaced with the fan panel shown, which includes a 25 A circuit breaker.

**KIO3 (pg. 63):** The KIO3 is an upgradeable digital and audio I/O module providing computer and auxiliary control signals, single or dual (stereo) speaker outputs, line level in/out, and supplemental headphone and mic jacks.

**KXV3:** The KXV3 provides a variety of RF I/O signals, including receive antenna in/out (pg. 38), transverter in/out (pg. 36), and a buffered I.F. output (pg. 36).

**Keying: PADDLE** (1/4" phone jack) is the keyer paddle input (see CONFIG MENU, CW PDL, pg. 49). **KEY** (1/4" phone jack) can be used with a hand key, external keyer, computer, or other keying device. **PTT IN** (RCA/Phono) is for use with a footswitch or other external transmit control device. **KEY OUT** (RCA/Phono) is the amplifier T-R relay keying output, capable of keying up to +200VDC @ 5A.

**REF IN** (SMA): Input for external standard frequency reference (KREF3-EXT option, pg. 64).

## KIO3 Module

The KIO3 module provides serial communications, digital control I/O, audio I/O for use with sound cards, dual speaker output, and auxiliary headphone and mic jacks.

### *RS232*

The K3 can send and receive data simultaneously at up to 38,400 baud. You can use a standard, straight-through 9-conductor cable, or a cable wired for an Elecraft K2 or K2/100 transceiver.

If you're building your own cable, you can use as few as three wires (RXD, TXD, and ground; see table below). DTR and RTS are optional.

**The table uses EIA standard descriptions, which are from the perspective of the computer. These differ from some K2 documentation, even though the connections are functionally identical.**

| Pin # | Description |
|---|---|
| 1,8,9 | Not used |
| 2 | RXD IN (data **to** PC **from** K3) |
| 3 | TXD OUT (data **to** K3 **from** PC) |
| 4 | DTR (see **PTT and Keying**, below) |
| 5 | Ground (RF isolated) |
| 6 | RTS (see **PTT and Keying**, below) |

**Serial Port Setup:** Set *CONFIG:RS232* for the desired baud rate. Software should be set up at the same rate; 8 data bits, no parity, 1 stop bit.

**PTT and Keying:** The DTR and RTS signals are **not** used as RS232 hardware handshaking lines. Instead, the K3 can be configured to use either of these signals as PTT IN or KEY IN via the *CONFIG:PTT-KEY* menu entry. No external level translation is required, since these are RS232-compatible inputs. The default for both signals is *inactive* (unused). Refer to your software documentation to see if PTT or keying via RS232 lines is available.

**If a PC or other device asserts RTS or DTR *while* you're in the *PTT-KEY* menu entry, the K3 will enter TEST mode as a precaution.**

### *AUX I/O*

Aux I/O connector pinouts are listed below.

**Aux I/O is *not* a VGA video connector. The K3 does not provide video output.**

| Pin # | Description |
|---|---|
| 1 | FSK IN (see **FSK Input**) |
| 2 | AUXBUS IN/OUT (see KRC2 or XV-Series transverter instruction manual) |
| 3 | BAND1 OUT (see **Band Outputs**) |
| 4 | PTT IN (in parallel with MIC PTT) |
| 5 | Ground (RF isolated) |
| 6 | DIGOUT0 (see **Transverter Control**) |
| 7 | XVTR ON (out) or TX INH (in)<br>(see **Transverter Control**, **TX INH**) |
| 8 | POWER ON (see **Remote Power-On**) |
| 9 | BAND2 OUT (see **Band Outputs**) |
| 10 | KEYOUT-LP (10 mA keying output) |
| 11 | DIGOUT1 (see **DIGOUT1**) |
| 12 | Ground (RF isolated) |
| 13 | BAND0 OUT (see **Band Outputs**) |
| 14 | BAND3 OUT (see **Band Outputs**) |
| 15 | EXT ALC input (0 to +5V MAX; see *CONFIG:TX ALC*) |

**FSK Input**

This is a TTL input with a pull-up resistor to 5V, so it's compatible with TTL-level PC control outputs. When used with an RS232 control line from the PC, a level translator is required (refer to your software manual). For use with FSK D and PSK D modes.

**Remote Power On**

A remote-control system can pull this line to ground to turn the K3 **ON**. To turn it **OFF**, the controller must send the K3 a "**PS0;**" command via the RS232 interface, then deactivate the Power On signal.

**DIGOUT 1**

DIGOUT1 is a general-purpose open-drain output controlled by the *CONFIG:DIGOUT1* menu entry. It can be controlled from a computer; refer to the K3 Programmer's Reference. A 220-ohm series resistor is included to protect the output driver.

**Band Outputs (BAND0-BAND3)**

The BAND0-3 pins can output HF-6 meter band data as well as transverter selection data. The exact behavior is determined by the *CONFIG:KIO3* menu entry. (See tables below.)

BAND0-3 are open-drain outputs. The attached device must use pull-up resistors (typ. 2.2-10K) to its own supply voltage (24 VDC max). In the tables below, **0** = 0 VDC, and **1** = device supply voltage.

With *CONFIG:KIO3* **set to NOR**, the BAND0-3 outputs are mapped based on the selected HF-6 m band as shown below. This mapping matches that of some third-party band decoders. On Transverter bands, BAND0-3 will all be set to zero.

| Band | BAND3 | BAND2 | BAND1 | BAND0 |
|---|---|---|---|---|
| 160 m | 0 | 0 | 0 | 1 |
| 80 m | 0 | 0 | 1 | 0 |
| 60 m | 0 | 0 | 0 | 0 |
| 40 m | 0 | 0 | 1 | 1 |
| 30 m | 0 | 1 | 0 | 0 |
| 20 m | 0 | 1 | 0 | 1 |
| 17 m | 0 | 1 | 1 | 0 |
| 15 m | 0 | 1 | 1 | 1 |
| 12 m | 1 | 0 | 0 | 0 |
| 10 m | 1 | 0 | 0 | 1 |
| 6 m | 1 | 0 | 1 | 0 |

If *CONFIG:KIO3* is set to **TRNS**, BAND0-3 reflect the parameters of *CONFIG:XVn ADR* as shown below. On HF-6 m they're set to 0.

| *ADR* | BAND3 | BAND2 | BAND1 | BAND0 |
|---|---|---|---|---|
| TRN1 | 0 | 0 | 0 | 1 |
| TRN2 | 0 | 0 | 1 | 0 |
| TRN3 | 0 | 0 | 1 | 1 |
| TRN4 | 0 | 1 | 0 | 0 |
| TRN5 | 0 | 1 | 0 | 1 |
| TRN6 | 0 | 1 | 1 | 0 |
| TRN7 | 0 | 1 | 1 | 1 |
| TRN8 | 1 | 0 | 0 | 0 |
| TRN9 | 1 | 0 | 0 | 1 |

With *CONFIG:KIO3* set to **HF-TRNS**, the BAND0-3 outputs follow the **NOR** table when HF-6 m bands are selected, and the **TRNS** table when a transverter band is selected.

**Transverter Control**

Whenever the K3 is on a transverter band (one for which *CONFIG:XVn ON* is set to **YES**), 5 volts will appear on AUX I/O pin 7 (XVTR ON). Otherwise this pin will be at 0 V. This can be used with Elecraft XV-series transverters as an enable signal, on pin 8 of J6 ("CONTROL").

**AUX I/O Pin 7** can alternatively be used as a transmit inhibit signal in multi-transmitter stations. See **TX INH**, below.

For transverter keying, you can use KEYOUT-LP signal (pin 10 of the AUX I/O connector) or the KEY OUT jack (RCA).

Also, with *KIO3* = **TRNS** or **HF-TRNS**, the DIGOUT0 line (AUX I/O, pin 6) will output 0 V when low power mode is selected for the current transverter band (*CONFIG:XVn PWR*). At all other times, DIGOUT0 will be floating (Hi-Z).

The K3's BAND0-2 outputs emulate the Elecraft K60XV's XVTR0-2 signals when *CONFIG:KIO3* is set to **TRNS** or **HF-TRNS**. However, BAND0-2 on the K3 are open-drain signals, while XVTR0-2 on the K60XV are TTL.

**TX INH (Transmit Inhibit Signal)**

Pin 7 of the AUX I/O connector can be configured as a transmit inhibit input signal by setting *CONFIG:TX INH* to **ON**. Holding pin 7 low will then prevent the K3 from transmitting. An external 2.2 to 10 K pull-up resistor (to 5 VDC) is required.

If *TX INH* is set to **OFF**, pin 7 reverts to its default function, **XVTR ON**, for which it is configured as an output. The K3 has a 220-ohm resistor in series with this signal to minimize current in the event of a conflict with external equipment.

### *SPKRS*

STEREO or MONO; 4 to 8 Ω

Plugging in external speaker(s) cuts off the internal speaker. A stereo plug is recommended; tip is left speaker, ring is right. If you only have a mono plug, set *CONFIG:SPKRS* to **1** to disable right-channel audio. **(Also see note below.)**

### *PHONES*

STEREO or MONO; 16 Ω min. recommended

The front and rear-panel headphone jacks are both isolated with series resistors. This allows you to use mono phones on one jack and stereo on the other, if required. You'll need stereo phones for AFX (audio effects) and stereo dual receive (with sub receiver).

You can plug in headphones and speaker(s) at the same time, and hear audio in both, if you set *CONFIG:SPKR+PH* to **YES**. However, if you set *CONFIG:SPKRS* to **1**, setting *SPKR+PH* to **YES** will force mono headphone as well as speaker output. You can set *SPKRS* to 2 if you use a stereo plug at the external speaker jack, or if no external speaker is plugged in.

### *MIC*

MONO; hi- or low-Z

This jack accommodates an electret or dynamic mic. Use *MAIN:MIC SEL* to select the rear panel mic (**RP**). Tap **1** to turn on Low or High mic gain range. Tap **2** to turn bias on/off (see pg. 26 for recommendations based on mic type). The mic's PTT signal, if used, must be routed to either the PTT IN jack or the PTT line on the Aux I/O connector (pg. 18).

### *LINE IN*

MONO, transformer-isolated; 600 Ω (nominal)

This input should be connected to your computer's soundcard output. The **MIC** gain control sets the line input level when the *MAIN:MIC SEL* menu entry is set to **LINE IN**.

### *LINE OUT*

STEREO, transformer-isolated; 600 Ω (nominal)

These outputs should be connected to your computer's soundcard inputs. The left channel is main receiver audio; the right channel is sub receiver audio (if applicable). The outputs are post-AGC but pre-AF-gain; use *CONFIG:LIN OUT* to set the level.

**Some laptop computers have only very high-gain, high-impedance mic inputs, not line-level inputs. This can make it difficult to adjust the K3's LINE OUT level, and can also worsen noise pickup.** If your laptop has only a mic input, you may want to add a resistive attenuator between the the K3 and the laptop to keep the signal-to-noise level high. Use very short leads on all components, and place them at the laptop end of the cable.

# Basic Operation

This section covers the fundamentals of K3 receive and transmit operation. It'll also get you started using each of the major operating modes.

Once you're familiar with the K3, please go on to **Advanced Operating Features** (pg. 31).

## *Using Tap/Hold Switches*

Most K3 switches have two functions. ***Tapping*** (pressing for less than 1/2 second) activates the function labeled on the switch. ***Holding*** (pressing for more than 1/2 sec.) activates the function labeled beneath the switch.

## *Initial Power-Up*

- Connect a power supply (pg. 8); antenna or dummy load; key, if used (pg. 16); mic, if used, and station ground (pg. 16).
- Tap **POWER** to turn the K3 on. The LCD should illuminate and show VFO A/B frequencies. (Tapping **POWER** again turns power off.)
- The VFO B display can show a variety of useful parameters in addition to the normal frequency display. To see these, tap **DISP** (left of the display), then rotate the VFO B knob. The VFO B display will cycle through time, date, supply voltage, current drain, etc. (pg. 12). You can use these displays to make sure the supply voltage is in range (11-15 V), and that current drain is about 1 amp (1.3 amps with sub receiver installed and turned on). Tap **DISP** to return to the normal VFO B frequency display.

## *Using the Menus*

There are two menus: **MAIN** and **CONFIG**. Most entries in the CONFIG menu are used for test, configuration, and alignment, and are used infrequently.

In both menus, entries appear in alphanumeric order.

### MAIN Menu

- Tap **MENU** to access the main menu. (Tapping **MENU** again exits the menu.)
- Use VFO B to scroll through the menu entries, referring to the list on page 49 for details.
- Change the value (or *parameter*) of any menu entry using VFO A.

### CONFIG Menu

- Hold **CONFIG** (***hold*** function of the **MENU** switch) to access the CONFIG menu.
- Use VFO B to scroll through the CONFIG menu entries, referring to the list on page 50.

### Menu Help

Tap **DISP** to show help information about the present menu entry. For most entries, the default parameter value is shown in parentheses at the start of the help text.

### Programmable Functions

Menu entries that you'd like quick access to can be assigned to any of the 10 programmable function switches, **PF1** , **PF2** , and **M1** – **M4** (tap or hold). **Function** menu entries can *only* be used via such a switch assignment. (Examples, from the CONFIG menu: *VFO B->A* and *TTY LTR*.)

To set up a programmable function switch, first locate the target menu entry. Next, hold **PF1** or **PF2** ; ***or,*** tap or hold **M1** – **M4** . For example, if you tap **M2**, you'll see **M2T SET** (T for tap)**,** while holding **M2** would show **M2H SET** (H for hold). The assigned switch can then be used as a shortcut to access that entry. **M1** – **M4** can each be assigned a tap and/or hold programmable function.

Any **M1** – **M4** switch that is used for programmable functions will not be available for message play. However, they will always be usable as per-band quick-memories (pg. 16).

ℹ To cancel a programmable switch assignment and restore a previously-stored message buffer, tap **REC**, then tap the buffer to restore (**M1** – **M4**), then tap **REC** again.

### *Band and Mode Selection*

Tap either end of the BAND switch to select the desired ham band (160 through 6 meters). You can also go directly to any desired frequency using direct frequency entry (pg. 15), or recall a frequency memory (pg. 16).

Tap either end of MODE to select the operating mode. Hold ALT to select an alternate mode, if required. This include **CW REV** (pg. 28), **DATA REV** (pg. 29), **AM-S** (synchronous detection, pg. 27), and **FM +/-** (FM repeater split, pg. 27).

### *Antenna Selection and Matching*

**ATU (KAT3)**

If you have the KAT3 antenna tuner installed, you can select **ANT1** or **ANT2** by tapping ANT.

If the **ATU** icon is on, the antenna can be matched for best SWR by tapping ATU TUNE. Hold ATU to alternate between **AUTO** (autotune enabled) and **BYPASS**.

*Holding* ANT allows a name to be assigned to the present antenna (e.g., **YAGI**). While editing the name, VFO B selects the character position to change; VFO A cycles through available characters (A-Z, 0-9, symbols).

**RX Antenna (KXV3)**

With the KXV3 installed, you can tap RX to select a receive-only antenna (RX ANT IN). The K3 also has an RX ANT OUT jack for use with in-line filters, low-noise preamps, etc.; see pg. 36.

**Sub Receiver Antenna (KRX3)**

For sub receiver antenna selection, see **Main and Sub Receiver Antenna Routing** page 38, and *CONFIG:KRX3*. Sub receiver antenna sources vary depending on installed options.

### *Using the VFOs*

VFO A is both the main receive and transmit frequency, unless you're in SPLIT mode, in which case VFO B controls the transmit frequency (pg.34). VFO B also controls the sub receiver (pg. 35).

Tap RATE to select 10 or 50 Hz per step. The fast rate can be changed using *CONFIG:VFO FST*. The number of counts (or steps) per VFO knob turn can be changed using *CONFIG:VFO CTS*. Tapping RATE will briefly flash either the 10-Hz or 100-Hz digit to indicate slow or fast tuning, respectively.

For 1-Hz steps, tap FINE ; for wider steps, use COARSE (see *CONFIG:VFO CRS*). When FINE is in effect, a 1-Hz digit will appear in the VFO A display. When COARSE is in effect, the 10-Hz digit is not shown.

Tap A ► B once to copy VFO A's frequency to VFO B. Tap A / B to exchange VFO A and B. Pressing REV exchanges the VFOs for as long as you hold REV. (Also see *CONFIG:VFO B->A*.)

VFO B (and the sub receiver, if turned on) can be set up directly by holding BSET. As long as **BSET** is displayed, display icons and VFO-related controls all apply to VFO B (pg. 35).

### *RIT and XIT*

The RIT/XIT offset control, at the far right, sets the offset for RIT and XIT. The offset is shown on the VFO B display as you adjust the control. Three LEDs show whether the offset is 0, (-) or (+).

Tap CLR to zero the RIT/XIT offset. Tapping it a second time restores the offset.

If you wish to copy the present RIT offset to VFO A, hold CLR for 2 seconds or longer. VFO A will be moved to the new frequency before the offset is zeroed.

If RIT and XIT are both turned off, the RIT offset can coarse-tune VFO A (*CONFIG: VFO CRS*). For example, you can select 5, 9, or 10 kHz steps in AM mode.

# Receiver Setup

This section explains how to use basic receiver controls. Setup for specific operating modes is described in later sections; see ***Voice Modes*** (pg. 26), ***CW Modes*** (pg. 28), and ***Data Modes*** (pg. 29).

Also see ***Text Decode and Display*** (pg. 28) and ***Audio Effects*** (pg. 33).

## *Receiver Gain Controls*

Use **AF — SUB** (pg. 11) to set the desired main and sub receiver volume level. There are two overall audio volume ranges, LO and HI, which can be selected using *CONFIG:AF GAIN*.

Usually, both **RF — SUB** controls will be set fully clockwise (main and sub receiver RF gain). You may wish to reduce RF gain to optimize receiver response to high signal levels or noise.

If either RF gain knob has been reconfigured as squelch, turn it fully *counterclockwise* to hold the squelch open. See *CONFIG:SQ MAIN* and *CONFIG:SQ SUB*.)

To improve weak-signal reception, turn on the preamp using **PRE**. In the presence of extremely strong signals, you may wish to use the attenuator (**ATT**), or reduce the RF GAIN setting.

## *Crystal Filter Selection*

You can install as many as five crystal roofing filters in the K3's main receiver, and another five in the sub receiver (KRX3, pg. 35).

Bandwidths as narrow as 200 Hz and variable-bandwidth filters are available, thanks to the K3's low first I.F. (intermediate frequency) of 8.215 MHz. See Appendix A for recommended crystal filter bandwidths for each mode.

To select a crystal filter manually, tap **XFIL**. The **FL1-FL5** icons show the current selection. This sets the DSP passband to match the crystal filter, and removes any passband shift or lowcut/hicut.

The K3 will also select the most appropriate crystal filters automatically as you adjust the **SHIFT**, **WIDTH**, **LO CUT**, and **HI CUT** controls.

## *Filter Passband Controls*

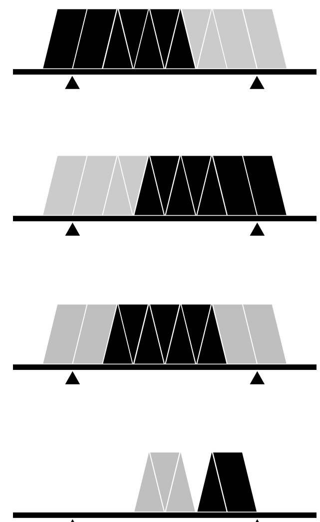
As you rotate the filter controls (shift, width, hicut, locut), the associated parameter value is shown on VFO B. The ***filter graphic*** shows the width and location of the passband, as illustrated below. In these specific examples, segments that turned off as a result of control movement are shown in gray.

**High Cut**

**Low Cut**

**Width**

**Shift**



Each DSP control has an integral switch. *Tapping* the control alternates between the two primary functions for that control, for example HI-CUT and WIDTH. This is indicated by the two LEDs above each control. *Holding* a control activates its secondary function, e.g. **I/II**, described below.

## *Filter Presets and Per-Mode Normalization*

Each operating mode provides two filter **presets**, **I** and **II**, which store DSP filter settings and crystal filter selections. You can alternate between the two by holding **I/II**. The presets for VFOs A and B are independent.

Whichever preset is in effect will be updated as you adjust the filter controls. The current settings will be saved for later recall anytime you change modes, VFOs, or bands, or recall a memory.

To get quickly to a standard per-mode bandwidth and reset any passband shift or cut, hold **NORM** (normalize). The normalized bandwidth is 400 Hz in CW and DATA modes, 2.8 kHz in SSB modes, and 6 kHz for AM. Presets are not used in FM mode.

## Reducing Interference and Noise

The K3 provides a number of ways to cut interference, including DSP noise reduction, manual and auto notch, and noise blanking. Also see **Audio Effects** (AFX, pg. 33).

There are actually two noise blankers: one at the first I.F. (KNB3 module), and the other at the 2nd I.F. (DSP).

Noise reduction, noise blanking, and notch filtering should only be used when necessary. These *signal processing* techniques are extremely effective, but can introduce side effects. In some cases, simply reducing the crystal filter or DSP bandwidth may be the most effective interference-reduction strategy. This is especially true in CW and DATA modes, where the bandwidth can often be reduced to as low as 50 Hz.

### *Noise Blanking*

First, tap NB to enable I.F. and/or DSP noise blanking.

Next, hold LEVEL to set NB levels using VFO A (DSP level) and VFO B (I.F. level). You'll initially see **DSP OFF** and **IF OFF** on the VFO A and B displays. Rotating VFO A clockwise will turn on the DSP NB, showing **DSP t1-1** through **DSP t3-7**. The first number shows the relative pulse integration time, and the second shows the blanking level. The higher the numbers, the more aggressive the DSP blanking action.

Rotating VFO B clockwise will turn on the IF NB, showing **IF NARn**, **IF MEDn**, or **IF WIDn**, where **n** varies from **1-7**. **NAR**/**MED**/**WID** refers to narrow/medium/wide blanking pulse widths, and **n** is the blanking level. The higher the value of **n**, the more aggressive the blanking action. Use **NAR** blanking pulse width when possible to minimize strong-signal interaction effects.

Both the DSP and IF blanking settings are saved on a per-band basis. If *CONFIG:NB SAVE* is set to **YES**, the on/off status of NB will be also be saved for each band.

Always try the DSP blanker first. It's in the 2nd I.F., where it can't be activated by signals outside the crystal filter passband. It can be used with high-duty-cycle and complex-waveform noise generated by computers, switching power supplies and other peripherals, light dimmers, florescent lamps, etc. The IF blanker, in contrast, is in the 1st I.F., where it can use very narrow blanking widths. It is most effective at blanking AC line noise, lightning, and other very broadband noise.

### *Noise Reduction*

Noise reduction is quite different from noise blanking. It attempts to mathematically eliminate *random* background noise while preserving "meaningful" signals.

Tap NR to turn on noise reduction. (Only applicable if AGC is on.)

Hold ADJ to tailor noise reduction for the present band conditions using the VFO B knob. In general, the higher the NR parameter value, the more background noise will be removed. If it is set too high, it may degrade weak signals.

### *Notch Filtering*

Notch filtering can remove interfering carriers while leaving the desired signal relatively unaffected. The K3 provides automatic and manual notch tuning.

Auto notch will find and remove one carrier, and in some cases more than one; it is available in voice modes. (AGC must also be on to use auto-notch.)

Manual notch removes one carrier at a specified pitch, and can be used in CW and DATA modes as well as voice. Since manual notching sets up a fixed (rather than adaptive) notch, it can even suppress a keyed carrier, i.e. a CW signal.

Tap NTCH to select auto-notch (**NTCH** icon). Tap a second time to select manual notch (adds ◄► icon). Tap again to turn notch filtering off.

Hold MAN to adjust the manual notch frequency using VFO B. This also selects manual notch.

# Transmitter Setup

### *Transmit Crystal Filter Considerations*

For each operating mode, you must specify which I.F. crystal filter to use for transmit using the *CONFIG:FLTX* menu entry. See page 44 for recommended per-mode transmit filter bandwidths.

⚠ Transmit signals are generated on the RF board, so the set of filters installed on the RF board must meet the transmit bandwidth requirements of all modes you plan to use. (Filters installed on the sub receiver board are used only in receive mode.)

### *Transmit Status LEDs and Icons*

Before putting the K3 on the air, you should be familiar with the LEDs and LCD icons that pertain to transmit operation (identified on pages 11 and 12). The most important of these are reviewed here.

The **TX** LED turns on during transmit. The **ΔF (**Delta-F**)** LED turns on if the transmit and receive frequencies differ (SPLIT / RIT / XIT).

The **TX** LCD icon and associated arrows show which VFO is being used for transmit. If you plan to use SPLIT mode, see page 34.

### *Multifunction Transmit Controls*

There are two multifunction transmit controls. Their primary functions (mode-dependent) are:

| | |
|---|---|
| SPEED | CW keyer speed in WPM |
| MIC | Mic gain |
| CMP | Speech compression level in dB |
| PWR | RF output power in watts |

The secondary (hold) functions of these controls are:

| | |
|---|---|
| DELAY | VOX or CW semi-break-in delay |
| MON | Voice/Data monitor or CW sidetone level. |

### *VOX, PTT, and QSK*

In voice and data modes, use VOX to select VOX (pg. 13) or PTT (push-to-talk). PTT can still be used even with VOX selected. Set VOX gain and anti-vox level using *MAIN:VOX GN* and *ANTIVOX*.

In CW mode, use VOX to select either VOX or PTT transmit. VOX enables "user-activated" (hit-the-key) transmit, while PTT requires the use of PTT IN (pg. 17) or XMIT before CW can be sent.

When the **VOX** icon is on in CW mode, you can use QSK to select full (**QSK** icon on) or semi break-in. For more on break-in keying, see pg. 28.

### *Transmit Metering*

Normally, the transmit bargraph shows **SWR** and **RF** (power output). The **SWR** range is 1:1 to 3:1. The **RF** range is 0 to 12 W in 1-W units, or 0 to 120 W in 10-W units. The power scale changes from watts to watts x10 between 12 and 13 watts.

In voice modes, you can use METER to switch to compression (**CMP**) and automatic level control (**ALC**) metering. See page 26 for information on adjusting the MIC and CMP controls.

If you have a KXV3 installed, you can use **milliwatt-level** power output. This is intended for use with transverters, but it can also allow the K3 to act as a very stable, very low-noise signal generator. To route RX and TX through the XVTR jacks on all bands, set *CONFIG:KXV3* to **TEST**.

When milliwatt-level output is in effect, rotating PWR will show milliwatts on VFO A, and dBm (dB relative to 1 milliwatt) on VFO B.

### *Off-Air Transmit Testing*

The K3 allows you to listen to your CW keying, test your mic and compression settings, or monitor DATA tones, *without* transmitting an on-air signal. To do this, hold TEST (right end of the MODE control). While you're in TEST mode, the **TX** icon will flash slowly as a reminder that you're off air.

Hold TEST again to return to normal operation.

# Voice Modes

## *Mode Selection*

Tap either end of **MODE** to select **LSB**, **USB**, **AM**, or **FM** mode. Holding the left end of this control, **ALT** , selects an alternate mode. The alternate for **AM** is **AM-S** (synchronous AM on receive, pg. 27). In FM mode, **ALT** enables a per-band repeater offset.

## *Microphone Selection*

The K3 provides both front- and rear-panel mic jacks. Some operators prefer to use the rear-panel jack to minimize cable clutter around the front panel. Use *MAIN:MIC SEL* to select the front panel (**FP**) or rear-panel (**RP**) jack. This menu entry can also be used select a mic gain range, as well to apply a bias voltage for electret microphones.

The front-panel mic jack is compatible with the Elecraft MH2, MD2, Proset-K2, and some other 8-pin mics (see pg. 13 for pinout and bias settings).

The rear-panel mic jack accommodates a 3.5-mm (1/8") phone plug, and can be used in conjunction with the rear-panel PTT IN jack. An 8-pin to 3.5-mm adapter cable is available (pg. 42).

## *Voice Monitoring*

The K3's voice monitor allows you to hear the way your voice will sound at your selected mic gain, compression, and transmit audio EQ settings (**TX EQ**, pg. 33). Headphones are recommended.

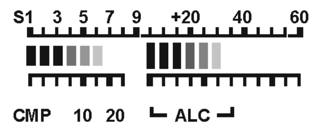
To set up voice monitoring:

- Hold **TEST** to put the K3 in TX TEST mode, so you won't be transmitting (pg. 13).
- Set **MIC** to 10-20 to ensure that you'll hear your voice. You can fine-tune this level later.
- Press your mic's PTT switch or tap **XMIT** .
- While speaking into the mic, adjust **MON** for a comfortable listening level.
- Exit transmit (release PTT, or tap **XMIT** again).
- You can either leave the K3 in TX TEST mode or go back to normal transmit (hold **TEST**) as you follow the instructions in the next section.

## *Mic Gain, Compression, and ALC*

Use the following procedure to properly set up MIC gain and compression level:

- Set the monitor level as described above.
- Optionally select TEST mode (pg. 13) or set power to zero. This will not affect your CMP/ALC bargraph readings.
- Set **CMP** to **0**.
- Hold **METER** to select **CMP**/**ALC** metering.
- While speaking into the microphone in a normal voice, adjust **MIC** for a peak ALC meter indication of about 4-7 bars (see below).




- Adjust **CMP** for the desired speech compression level while speaking. The **CMP** scale shows compression level.
- Hold **METER** to return to SWR/PWR metering.
- If you were in TX TEST mode, return to normal operation by holding **TEST**.
- If you had **PWR** set to 0, set it for the desired level in watts. Key the rig again and verify that you have about the right power output level.

Once you've set up the MIC and CMP levels as described, you should only need to adjust them if you switch mics or if band conditions change.

Voice-mode power output may be slightly higher or lower than the CW power output you see in TUNE mode. If so, you can compensate using the *CONFIG:TXG VCE* menu entry (voice transmit gain balance).

## *Voice Mode VOX Setup*

**VOX** selects PTT (push-to-talk) or voice-operated (VOX) transmit (**VOX** icon on).

The VOX delay can be set from 0.05 seconds (50 mS) to 2.00 seconds. The lower the setting, the faster the K3 will return to receive mode after a pause in speech. See ⏲ **DELAY** (pg 14).

The *MAIN:VOX GN* menu entry (VOX gain) should be set so that the K3 enters transmit mode when you speak at a normal level. Setting *VOX GN* too high will result in the K3 switching into transmit mode in response to incidental noise.

*MAIN:ANTIVOX* adjusts VOX immunity to signals received through the K3's speaker or headphones. While listening to a loud received signal, and with the mic closer to the speaker than it would be in normal operation, adjust ANTIVOX upward until the K3 doesn't switch to transmit mode.

## *Digital Voice Recorder (DVR)*

If you have the KDVR3 option installed, you can record and play voice messages as well as capture received audio. This option also provides voice annunciation for all K3 controls.

### Message Record and Playback

To start recording, tap **REC**, then tap any of **M1** - **M4**. The remaining buffer time in seconds will be displayed as you speak. Tap **REC** again to stop.

Tap **M1** – **M4** to play. To cancel, tap **REC**. You can also hit the keyer paddle, key, or any switch besides **M1** – **M4** to cancel play.

To auto-repeat a message, *Hold* (rather than *tap*) **M1** – **M4**. *MAIN:MSG RPT* sets the message repeat interval (1 to 255 seconds).

### Receive Audio Recording

Hold **AF REC** to start / stop audio record. The icon will appear. Recording starts at the beginning of available space each time it is started, and will stop at the end if not terminated sooner.

Hold **AF PLAY** to start / stop audio playback. During playback, the icon flashes. This serves as a reminder that you're hearing recorded rather than live audio.

## *AM Operation*

A 6 kHz crystal filter is required on the RF board for AM transmit and receive (pg. 44).

When listening to AM signals, you have a choice of synchronous or envelope detection (**AM** or **AM-S**). You can alternate between the two using **ALT**.

ℹ You can also listen to AM using LSB or USB modes. If you have a 6-kHz filter installed, voice as well as music will have excellent fidelity.

## *FM Operation*

An FM-bandwidth crystal filter is required on the RF board for FM transmit and receive (pg. 44). The filter bandwidth is fixed in this mode; presets and filter controls are not used.

FM defaults to simplex (transmit and receive on the same frequency). The following controls and menu entries are used for repeater setup:

- Holding **ALT** switches between simplex, TX (+), and TX (-). This is indicated by the + and - icons (near the FM icon).
- Repeater offsets can be programmed on a per-band basis. See *MAIN:RPT OFS*.
- Tone encode is set up by holding **PITCH**. Rotate VFO A to select a CTCSS tone frequency (or the European repeater access tone, 1750 Hz). Use VFO B to turn tone encode on or off.

All of the settings described above are saved in frequency memories.

## CW Mode

### CW Normal and Reverse

Select CW mode by tapping either end of MODE .

Hold ALT to alternate between CW **normal** and CW **reverse** (**REV** icon). CW reverse differs from CW normal only in receive mode, using the upper rather than lower sideband.

If you SPOT (or auto-spot) a CW signal (pg. 32), then switch between CW normal and reverse, the pitch of the received signal should stay the same.

### Basic CW-Mode Controls

In CW mode, ⏲ MON sets the sidetone volume.

Hold PITCH to adjust the sidetone pitch. The peak in response of all crystal filters will track the sidetone pitch; no filter adjustments are needed.

Hold QSK to select **full break-in** (**QSK** icon on) or **semi break-in** operation.

⚠ VOX must be turned on in CW mode to enable both full and semi break-in operation. If PTT is selected (**VOX** icon off), transmit must be activated using PTT or by tapping XMIT.

**QSK**, or full break-in, allows you to better keep track of on-frequency activity even while you're sending. It allows others to "break" your CW transmission by sending one or two characters.

With **semi break-in** selected (**QSK** icon off), the K3 returns to receive mode after a time delay you set using ⏲ DELAY. This is a compromise between full break-in and fully manual operation using PTT or XMIT .

Hold TEST to place the K3 into TEST mode. This allows you to send CW without transmitting a signal on the air. This is helpful for practicing your sending or for off-the-air checking of pre-recorded CW messages.

### CW-Mode Menu Entries

Configuration menu entries are provided to set up CW iambic keying mode (CW IAMB), paddle normal/reverse selection (CW PADL), and keying weight (CW WGHT).

### SPOT and Auto-Spot

When calling another station, you should try to match your frequency to theirs. To facilitate this, the K3 provides both manual and automatic spotting for use with CW and DATA signals. See ***Tuning Aids: CWT and SPOT*** (pg. 32).

### CW Text Decode/Display

The K3 can decode transmitted and received CW signals, displaying the text on VFO B (pg. 31). This feature is especially useful when you're learning CW, or if someone who doesn't know CW is looking over your shoulder while you make CW QSOs. It's also indispensable for CW-to-DATA operation (pg. 32).

### Dual Passband CW Filtering (DUAL PB)

Turning on DUAL PB in CW mode allows you to listen to a narrow filter bandwidth (the "focus"), set within a wider, attenuated filter bandwidth (the "context"). See page 33.

### CW Message Record/Play

⚠ Messages can only be recorded using the internal keyer, not a hand key or external keyer.

ℹ If **text decode** is on (pg. 31), CW text sent using the internal keyer is shown on VFO B (pg. 31). Use TEST to check messages off-air (pg. 13).

There are 8 message buffers, arranged in two banks of 4. Buffers hold 250 characters each. To switch banks, hold REC.

**Message Record:** To start recording, tap REC , then M1 - M4 . The remaining buffer space will be displayed as you send. Tap REC again to stop.

**Message Play:** Tap M1 – M4 to play. To cancel, tap REC . You can also hit the keyer paddle, key, or any switch besides M1 – M4 to cancel play.

**Auto-Repeat:** To auto-repeat a message, *Hold* (rather than *tap*) M1 – M4. *MAIN:MSG RPT* sets the message repeat interval (1 to 255 seconds).

**Chaining:** *Tapping* M1 – M4 during playback chains another message onto the message being played. *Holding* a message switch during playback chains a repeating message.

# Data Modes

You don't necessarily need a computer to get started with data modes on the K3: the **text decode** feature can decode and display received RTTY and PSK31 on the LCD (pg. 31). You can also transmit in data modes using your keyer paddle (see **CW-to-DATA**, pg. 32).

Using a computer for data modes is also very convenient on the K3, as described below.

## *Data Mode Connections*

You can transmit and receive data with a computer in three ways:

- Connect your soundcard I/O to the K3. Use *MAIN:MIC SEL* to use LINE IN/OUT, front-panel mic jack, or rear-panel mic jack. You can use VOX or PTT to control transmit.
- Use the soundcard in receive mode, but use a PC I/O line to do direct FSK (or PSK) modulation. Connect the PC's I/O line to the "FSK IN" line on the K3's AUX I/O connector. (If this signal originates from an RS232 port, it will require RS232-to-TTL level conversion.)
- Send and receive ASCII text via the RS232 interface. To send, insert text into a "KY" command (e.g., "KY CQ DE N6KR;"). To receive, send "TT1;" (text-to-terminal). "TT0;" turns it off. See the K3 Programmer's Reference, available at www.elecraft.com.

## *Data Mode Selection*

Soundcard-based data communications can be done using LSB or USB mode. However, DATA mode offers several benefits not available in SSB modes.

If you prefer to use LSB or USB, you'll need to manually set ⏲ CMP to **0** to prevent data signal distortion. Refer to your data communications software manual to determine how to set up the VFO and computer for accurate frequency display.

To use DATA mode, tap MODE until the **DATA** icon appears. Next, hold DATA MD. The present data mode is shown on VFO B, and can be changed by rotating the VFO B knob.

ℹ 1-Hz tuning ( FINE ) is strongly recommended when tuning in PSK31 signals.

The following data modes are available:

- **DATA A** can be used for all **A**udio-shift transmit modes, including **PSK31**, **MFSK**, **AFSK**, etc. The VFO displays the suppressed-carrier frequency, just as when SSB modes are used for data. However, compression is automatically set to 0, and the K3's dual-tone RTTY filter (DTF) can be selected (pg 30). USB is "normal" for DATA A.
- **AFSK A** also uses **A**udio-shift transmit, but is optimized for RTTY. The VFO displays the RTTY mark frequency, and LSB is "normal". The built-in text decoder can be used in this mode (pg. 31), as well as the dual-tone RTTY filter (DTF, pg. 30).
- **FSK D** is identical to AFSK A, except that **D**irect modulation is used, via DIG 0, ASCII, or the keyer paddle (pg. 32). The text decoder can be used in this mode (pg. 31), as well as the dual-tone RTTY filter (DTF, pg. 30).
- **PSK D** is a **D**irect-transmit mode for **PSK31**. It's the only mode that decodes and displays PSK31 signals with the text decoder (pg. 31). Like FSK D, PSK D lets you transmit via DIG 0, ASCII, or the keyer paddle (pg. 32). You can also use auto-spot with PSK D if the tuning aid is displayed (CWT, pg. 32).

The DATA MD display shows the data speed in bps on VFO A. This is relevant only if the text decoder is on. Depending on the mode, other data speeds may be available; select them by rotating VFO A.

Also shown is the current sideband (**LSB** or **USB**). If this sideband is considered "data reverse" for the present mode, then **REV** also appears. You can use ALT to switch to the other sideband if required.

## *Mark/Shift and Pitch Selection (PITCH)*

Hold PITCH to view and change the received mark tone and shift (AFSK/FSK) or center pitch (PSK).

In AFSK/FSK modes, you have a choice of several mark tone/shift combinations. These apply to both the text decoder and the RTTY dual-tone filter. Use VFO A to change the selection.

ℹ When using a computer, select a tone/shift combination that's compatible with your software. If you're using the K3's text decoder, you may find that a lower mark pitch makes signal tuning easier.

### *RTTY Dual-Tone Filter (DTF)*

Hold **DUAL PB** to turn on the RTTY dual-tone filter (DTF). This creates two filters, one centered on the mark tone, the other on space, which can often improve RTTY copy. The filter graphic changes to reflect this (see below).

When DTF is on, the range of the ⏲ **WIDTH** control is adjusted to better match the characteristics of the filter. SHIFT, LOCUT and HICUT are disabled.

The dual-tone filter can be used in any mode that works with AFSK or FSK, including **DATA A**, **AFSK A**, and **FSK D**. The on/off state of DTF is saved independently for each of these modes.

### *FSK Transmit Polarity*

You can invert the logic level of the FSK IN line (pg. 50) in FSK D mode using *CONFIG:FSK POL*.

### *Mic Gain, ALC, and Monitor Level*

If you're using an audio-shift transmit mode (**LSB**, **USB**, **DATA A**, or **AFSK A**), you'll need to set the ⏲ **MIC** level while watching the ALC meter. You can use the same procedure outlined for voice modes (pg. 26), except that speech compression should not be used.

In all cases (SSB modes as well as DATA), you can optionally use ⏲ **MON** to monitor your data signals. The procedure given for voice modes can be used (pg. 26).

ℹ The ⏲ **MIC** setting does not apply to direct-modulation data modes (**FSK D** and **PSK D**), since no audio is used for transmission.

# Advanced Operating Features

## Text Decode And Display

The K3 can decode transmitted and received CW, as well as received PSK31 and RTTY. Decoded text is displayed on VFO B. In data modes, you can use the K3's internal keyer to transmit PSK31 and RTTY signals (pg. 32).

When text decode is enabled, turning the RIT/XIT offset control does not flash the offset value. This would disrupt the text display.

### *CW Text Decode Setup*

To set up CW text decode:

- Set **MODE** to CW.
- Hold **TEXT DEC** , then select **CW 5-40** (lower WPM range) using VFO B. Below the **CW** icon you should see a **T**, showing that text decode is enabled. The **TX ONLY** setting decodes only CW you send (internal keyer); the **T** does not appear in this case.
- Adjust the threshold (**THR**) using VFO A. Start with **AUTO**. Manual settings (**1-30**) improve copy in many cases (see below). Tap **CWT** to exit text-decode setup.
- You'll probably want to turn on **CWT** as a tuning aid (pg. 28). This also enables auto-spot.

**CW Text Decode Tips:**

- **SPOT** (or **auto-spot**) a signal first, then tune slowly until recognizable words appear.
- In difficult conditions, reduce ⏲ **WIDTH** to as low as 50 Hz (100-200 Hz for faster CW).
- To optimize text decode, use manual threshold settings. Start with **THR 5**. With **CWT** on, adjust the threshold so that the **CWT** bar flashes in sync with the received CW signal.
- To decode very fast CW, use **CW 30-90**.

The K3 uses slow AGC during CW text decode, overriding the selected AGC setting.

### *DATA Text Decode Setup*

To set up text decode for DATA modes:

- Set **MODE** to DATA. Then hold **DATA MD** and select either **AFSK A**, **FSK D**, or **PSK D** mode using VFO B. Tap **AFX** to exit the data-mode display.
- For **AFSK A** or **FSK D**, hold **PITCH** and select the desired mark/shift setting. The lowest mark tone selection (915 Hz) may be more pleasant to listen to than higher tones. (The pitch for **PSK D** mode is fixed at 1000 Hz.) Tap **SPOT** to exit the pitch display.
- Hold **TEXT DEC** , then select **ON** using VFO B. Below the **DATA** icon you should now see a **T**, showing that text decode is enabled.
- Adjust the threshold (**THR**) using VFO A. Start with **THR 0**. Higher settings prevent text decode on weak signals or noise. Tap **CWT** to exit text-decode setup.
- You'll probably want to turn on **CWT** as a tuning aid (pg. 28). This also enables auto-spot.

**DATA Mode Text Decode Tips:**

- Use **FINE** tuning with **PSK D**. **SPOT** (or **auto-spot**) a signal first, then tune slowly in 1-Hz steps until recognizable words appear.
- In difficult conditions, reduce ⏲ **WIDTH** to the per-mode minimum.
- In **AFSK A** and **FSK A** modes, the RTTY dual-tone filter may help (DTF, pg. 30).
- RTTY text may shift to *figures* due to noise. If you assign *CONFIG:TTY LTR* to a programmable function switch, you can tap it to quickly shift back to *letters*.

## CW-to-DATA

You can use data modes completely stand-alone (i.e., without a computer). Just turn on **text decode** (pg. 31), and send CW using the internal keyer.

CW message buffers can also be used for CW-to-DATA. This makes it easy to drop your callsign in after a CQ, send a contest exchange, or play a "brag tape" during QSO.

To set up for CW-to-DATA operation:

- Referring to page 11, use MODE, DATA MD, TEXT DEC, and PITCH to set up **text decode**. Select either **FSK D** or **PSK D** mode. A small **T** should appear below **DATA** icon.
- If you haven't used text decode before, try tuning in a few stations (turn on CWT; pg. 31). Tips for improved copy in tough band conditions are provided on page 31.
- Plug a keyer paddle into the PADDLE jack. The first time you try CW-to-DATA, set PWR to 0 watts or use TX TEST mode (pg. 13).
- All CW you send will be transmitted as data and displayed on VFO B. You'll hear a CW sidetone, as well as PSK or FSK tones. Adjust the data monitor volume using MON. To adjust the CW sidetone monitor level, temporarily switch back to CW mode.
- Whenever you pause, the K3 will remain in a data *idle* state for about four seconds before automatically dropping. To extend the timeout, send the CW double-dash ("-...-", or BT prosign), which is not transmitted as data.
- To cut short the idle transmit period and exit to receive mode, send "..--" (**IM**mediately exit). This character is not transmitted as data.
- When recording CW messages for use during CW-to-DATA, you can add "..--" at the end to cut the idle time when they're played back.

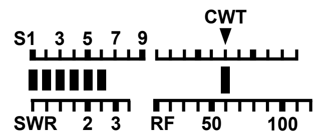
The CW abbreviation for "and" (ES) is not used in data modes and might lead to confusion. Other prosigns can be used, including KN, SK, and AR.

If you set VFO B for CW mode rather than DATA mode and use cross-mode SPLIT (pg. 34), your CW will not be converted to DATA.

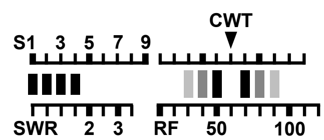
## Tuning Aids: CWT and SPOT

Tapping CWT turns the upper half of the S-meter into a CW/DATA tuning aid. If no bar appears in the tuning area, the threshold may be set too high; hold TEXT DEC and select a lower **THR** value.

When a received CW or PSK31 signal is centered in the passband, the CWT display will appear as shown below.




In RTTY modes (**AFSK A** and **FSK D**), mark and space tones are represented by three bars each, with mark to the left of the CWT pointer, and space to the right. When only weak signals are present in the mark/space filters, 1-3 bars will flicker on either side, leading to a "ghosting" effect, as shown here.




As you tune the VFO close to an RTTY signal, the number of bars will initially increase on one side or the other. Keep tuning until you see a rough balance between left and right bars. (Also see **DTF**, pg. 30, and *CONFIG:TTY LTR*.)

### *Manual SPOT*

If CWT is off, you can tap SPOT, then manually tune the VFO until the received signal's pitch matches the sidetone. If you find pitch matching difficult to do, try auto-SPOT (below).

### *Auto-SPOT*

To use auto-spot, first turn on CWT. Use a narrow bandwidth (200 to 500 Hz). Tapping SPOT will then automatically tune in a received signal that falls within the CWT display range.

Auto-spot may not be usable if more than one signal is in the CWT range, if the signal is extremely weak, or if the code speed is very slow.

Auto-spot coarse-tunes PSK31 signals, but you'll need to fine-tune them in 1-Hz steps (FINE).

## Audio Effects (AFX)

If you have stereo headphones or stereo external speakers, you can take advantage of the K3's DSP audio effects. These create an illusion of greater space, similar to stereo. For many operators, AFX provides a less-fatiguing receiver sound, and it can even improve weak-signal copy.

*MAIN:AFX MD* is used to select the desired AFX setting. Available selections include **DELAY 1-5** (quasi-stereo), and **BIN,** which is similar to *Binaural I-Q* (see *QST* magazine, March, 1999).

Tap AFX to turn the selected effect on or off. This can be done even within the *AFX MD* menu entry.

Stereo audio effects may not be available when the sub receiver is turned on. Main/sub dual receive is already a stereo mode, with different material routed to each audio channel.

## Dual Passband CW Filtering

Dual-passband filtering allows you remain aware of off-frequency CW signals while listening to one signal centered in the passband. This can be useful during contesting or DXing, as well as when searching a band for weak signals.

Hold DUAL PB to turn on dual-passband filtering. This sets up a narrow filter (**focus**), set within a wider passband (**context**) that is attenuated by about 20 dB. The filter graphic reflects this:

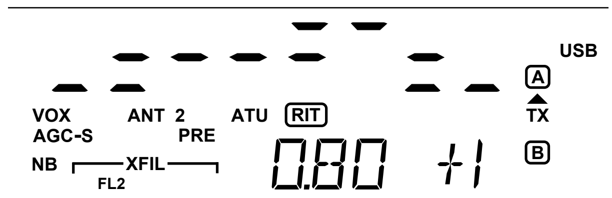
The width of the context filter can be varied over a wide range using WIDTH, while the focus filter bandwidth is fixed. The current preset will keep track of both the state of DUAL PB and the context width.

Hold DUAL PB again to return to normal filtering.

## Receive Audio Equalization (EQ)

The K3 provides 8 bands of receive audio equalization via the *MAIN:RX EQ* menu entry. You can use receive equalization to compensate for the physical acoustics of your station (the room, headphones, speakers, etc.), or just to tailor the audio to your personal preference.

In the *RX EQ* menu entry, the VFO A display shows 8 individual vertical bargraphs. The example below shows various amounts of EQ applied to the 8 bands.




The center frequencies of the 8 audio EQ bands are 50, 100, 200, 400, 800, 1200, 2400, and 3200 Hz. To select a band to change, tap 1-8 on the keypad. For example, tapping 1 selects the 50-Hz band.

Next, rotate VFO A to specify an amount of boost or cut (+/- 16 dB). The illustration above shows the 800 Hz EQ band (**0.80** kHz) being set to **+1** dB of boost.

You can tap CLR to reset all of the *RX EQ* bands to **0** dB (no cut or boost).

## Transmit Audio Equalization (EQ)

Transmit audio equalization is provided to compensate for variations in microphones and your voice. *MAIN:TX EQ* works exactly the same as *RX EQ*, and can be used during transmit.

If you're using ESSB (pg. 34), a separate set of transmit EQ settings is provided. When ESSB is on, the *TX EQ* menu entry name changes to *TX*EQ* as are reminder of which *TX EQ* set you're changing.

While adjusting *TX EQ*, you can listen to the voice monitor signal using headphones (use MON to set the level), or listen to the K3's transmitted signal on another receiver.

## SPLIT Operation

Normally, VFO A is used for both receive and transmit. When **SPLIT** mode is selected, VFO B becomes the transmit VFO. The **SPLT** icon turns on, and the **TX** arrow points to **B** (pg. 12).

In addition, the Delta-F LED ($\Delta$**f**) turns on (yellow). This will alert you at a glance that your receive and transmit frequencies and/or modes are not be the same.

## Extended Single Sideband (ESSB)

ESSB refers to the use of a wider transmit audio bandwidth than is traditionally provided by SSB transceivers. An increase in bandwidth may improve fidelity in voice communications, and may be less fatiguing to listen to.

The K3's normal SSB receive bandwidth is about 2.7 to 2.8 kHz. If you have a 6 kHz filter installed, you can listen to ESSB stations up to approximately this bandwidth by adjusting the **WIDTH** control.

ESSB transmit is set up as follows:

- Locate the *CONFIG:TX ESSB* menu entry, and change the value from **OFF** to one of the provided selections (**3.5**, **4.0**, etc.). **See cautions below.**
- With ESSB enabled, the transmit EQ menu entry name changes to *MAIN:TX*EQ* to allow you to independently adjust EQ at the selected wider bandwidth. The amount of adjustment required at each EQ band may vary significantly depending on the selected ESSB transmit bandwidth.
- If you assign *TX ESSB* to a programmable function switch, pressing it will alternate between ESSB TX **OFF** and the last bandwidth you selected using the menu.

**Carrier suppression, passband shape, delay characteristics, fidelity, and other aspects of ESSB performance are not specified. Use ESSB only after carefully monitoring your signal.**

**Settings above 3.5 kHz may have flatter passband response and better fidelity, but there may also be an increase in low level transmit spurious responses (typically < 80 dBc).**

## General-Coverage Receive

If you wish to tune the full 0.5 to 30 MHz range with low loss, you can install a KBPF3 module. This module includes eight band-pass filters that cover all of the areas between the ham bands. The K3 will automatically switch between the narrow ham-band filters to the KBPF3 filters as you tune the VFOs.

A KBPF3 module can be installed on the RF board (for use with the main receiver) and/or on the sub receiver module (KRX3).

The *CONFIG:VFO CRS* menu entry can be used to select coarse VFO tuning rates for AM and SSB modes. AM coarse tuning rates include 5, 9, and 10 kHz, matching the requirements for various broadcast band segments.

Sensitivity below 1.8 MHz will be reduced due to the high-pass response of the T-R switch, which protects the PIN diodes.

## VFO B Alternate Displays

The VFO B display can show time, date, supply voltage, current drain, KPA3 heatsink temperature, front panel compartment temperature, and other useful information. Tapping **DISP** turns the selected alternate display on or off. Rotate the VFO B knob to select the desired display.

If *CONFIG:TECH MD* is **ON**, additional VFO B alternate displays will be available for alignment and troubleshooting. These are described in the K3 Service Manual.

## Alarm and Auto Power-On

Once you've set the K3's real-time clock *(CONFIG:TIME)*, you can use *MAIN:ALARM* to set an alarm. This can be used to remind you of a schedule, net, or start of a contest.

When an alarm is set, an asterisk (*) appears in the time display. (Time can be displayed by tapping **DISP**.)

The K3 will turn **ON** automatically if it was off at alarm time. It will be set for the same band and mode that was in effect when power was turned off.

# Using the Sub Receiver

The KRX3 option adds a fully independent, high-performance second receiver, or *sub receiver* to the K3.

With the sub receiver installed, you can monitor two different frequencies or even two different bands, using different modes, filter bandwidths, or other settings as required. It's even possible to do *diversity receive*. In this case, the VFOs for the two receivers would be linked together, and you'd use two different antennas.

The sub receiver (or "sub" for short) has the same specifications and performance as the main receiver. This sets the K3 apart from most other transceivers in its class; others may provide only a simple "dual watch" function – with no independent crystal filtering – or an independent sub receiver with mediocre performance.

The sub receiver also has the same filter options as the main receiver. Up to five crystal filters can be installed in the sub receiver, as well as a general-coverage L-C band-pass filter module (KBPF3, pg. 42). The sub also includes an I.F. noise blanker.

There are three main modules associated with the KRX3 option: the sub receiver itself; a KSYN3 synthesizer; and a second I.F. DSP. All three must be installed and enabled before the sub receiver can be used. For information on installing and configuring the sub receiver, refer to the KRX3 option installation manual.

## Sub Receiver Controls

There are several controls directly related to the sub receiver: the **SUB** switch, VFO B (and its associated display), SUB AF GAIN, and SUB RF GAIN (which can be assigned to either main or sub squelch instead using *CONFIG:SQ SUB*). Other sub receiver settings can be viewed or changed using **BSET**, described later.

**SUB** turns the sub receiver (and **SUB** icon) on.

If you're using stereo headphones or speakers, you'll hear the sub receiver on the right side, and main receiver on the left. With a single speaker or mono phones, the two will be added together, and the MAIN and SUB AF GAIN controls will adjust the relative amount of signal from each.

## BSET: Direct Sub receiver Control

Normally, all receive-mode controls (including **PRE**, **ATTN**, **NB**, ⏲ SHIFT, ⏲ WIDTH, etc.) pertain to VFO A and the main receiver. To view or change the settings for the sub receiver (VFO B), hold **BSET**. VFO A will show **BSET**.

While in BSET mode, the S-meter will reflect the sub receiver's signal level. You can change the sub receiver control settings, as well as the **MODE**. You can also change the sub receiver's band using BSET if *CONFIG:VFO IND* (VFO A and B independent) is set to **YES**.

Tap **A/B** or hold **BSET** again to exit BSET.

## Split Mode with the Sub receiver

When operating split, VFO A is the receive frequency and VFO B the transmit frequency. If the sub receiver is on, you'll be able to listen to both your receive and transmit frequencies in receive mode. Hold **SPLIT** to turn split mode on or off.

In many cases you may want to set up the two receivers differently. For example, if you're working DX split, you can listen to the DX station in a very narrow bandwidth on the main receiver (VFO A), while using a wider bandwidth for VFO B so you can look for a clear calling frequency.

## Sub Receiver RF Input Sources

The sub receiver gets its RF input either from the main receiver (sharing the main antenna jacks or RX ANT IN), or from its auxiliary antenna input.

There are four possible ways to wire the sub receiver's auxiliary RF input, as explained in the KRX3 option installation manual. *CONFIG:KRX3* is used to specify which of these you've used (see pg. 50).

For a full description of sub receiver RF input sources, please see **Main and Sub Receiver Antenna Routing** (pg. 37).

## Receive Antenna In/Out

The **RX ANT IN/OUT** jacks, supplied with the KXV3 option, have various uses:

- **Low-noise receiving antenna:** Some operators use a Beverage, tuned loop, or other low-noise receiving antenna. You can connect such antenna to the RX ANT IN jack, then tap **RX ANT** to select it. The **RX** icon will turn on.
- **Narrowband filters or preamps:** You can "patch in" a specialized filter or preamp between RX ANT IN / OUT. Tap **RX ANT** to switch the filter in (per-band). It will be in-line only during receive, so you can use crystal filters or amplifiers with low power ratings.
- **Test signal injection:** The RX ANT IN jack is ideal to inject a test signal, because the generator won't be damaged if you transmit.
- **Receiver comparisons:** If you connect the RX ANT OUT jack to a second receiver, and leave the RX ANT IN jack open, you can A/B test the K3 against the other receiver. When the **RX ANT** is not selected (**RX** icon off), the K3 will be receiving on its main antenna jack, and the other receiver will have no input. If you then tap **RX ANT**, the K3 will have no receive antenna, while the other receiver will be operating from the K3's main antenna.

If you're comparing the K3 to a transceiver and using its transmit/receive antenna, be sure to set its power to 0 so you won't damage the KXV3 when you transmit.

## Buffered I.F. Output

The KXV3 provides a buffered (isolated) first I.F. signal at the IF OUT jack. This signal is at approximately 8.215 MHz, compatible with some panadapters (also known as spectrum scopes).

**You must use a short, very high-quality coax cable between the K3 and the panadapter. Additional isolation may also be required. If signals are allowed to leak into the buffered I.F. output, they will be audible on quiet bands and can degrade K3 receiver performance.**

## Using Transverters

Nine user-definable bands are provided for use with transverters. Once enabled individually, these bands will appear in the band rotation following 6 meters. You can use Elecraft XV-Series transverters and most other transverter types with the K3.

### *Transverter Band Setup*

Transverter bands are set up using the *XV* menu entries. In all cases, tap **1** – **9** within the menu entry to select a transverter band to configure.

- *XVn ON* must be set to **YES** to enable transverter band **n**.
- *XVn RF* selects the transverter operating frequency in MHz.
- *XVn IF* specifies a K3 band to use as the transverter I.F. (7, 14, 21, 28, or 50 MHz).
- *XVn PWR* sets the K3 power output range to be used with this transverter band. **L0.01-L1.27** specifies a power level in milliwatts, which requires the KXV3 option (use the XVTR IN and OUT jacks). **H00.0-H12.0** specifies power in watts, and selects the K3's main antenna jack(s) for output.
- *XVn OFS* is used to compensate for any frequency offset in the transverter's oscillator/multiplier chain. The value shown is in kHz.
- *XVn ADR* specifies an Elecraft XV-Series transverter selection address (see transverter manual).

Further details on these menu entries can be found in the CONFIG menu listings. For information on transverter control connections and band data, see pg. 19.

**CAUTION: We recommend the use of milliwatt-level drive with transverters (via the XVTR IN and OUT jacks). If you use the K3's main antenna jack(s), you could accidentally transmit into a transverter at high power.**

## Scanning

The K3's scanning features let the K3 tune any band segment continuously, with or without the receiver muted (Some bands may be excluded from scanning for regulatory reasons.) Scanning can be used to monitor any portion of a band, from a 1-2 kHz range where a station or net is expected to appear, to an entire band.

Sometimes a band that appears "dead" may actually have several stations present. You can use scanning to find these stations for you while accomplishing other tasks.

Scanning while muted allows the K3 to ignore stable carriers (key-down signals with no modulation), unmuting only when "interesting" signals are found. Scanning with the receiver "live" (not muted) is especially useful when listening for weak signals on very quiet bands.

### *Scanning Setup*

To use scanning, you first need to store the desired tuning range in a memory. After that, you'll be able to simply recall the memory, then start scanning. You can set up scanning ranges for various bands, modes, etc.

To set up a scanning memory:

- Set VFO A to the starting frequency, and VFO B to the ending frequency.
- Select the operating mode, preamp/attenuator settings, and filter bandwidth. Also select the tuning rate, which affects speed of scanning.
- Store this setting in any memory (pg. 16).
- To start scanning:
- Recall the memory using M ► V.
- Hold SCAN to start scanning. To scan with the receiver live (unmuted), continue to hold SCAN until you see **AF ON** (about 2 seconds).

You can stop scanning by manually rotating VFO A, tapping any switch, hitting the key or keyer, or pressing PTT. To restart, hold SCAN.

### *Channel Hopping*

Scanning over a numbered *memory* range, rather than a *frequency* range, is referred to as **channel hopping**. This is included in the K3 primarily for use on 60 meters and on transverter bands.

ℹ The U.S. 60-meter channel assignments correspond to VFO settings of 5330.5, 5346.5, 5366.5, 5371.5, and 5403.5 kHz. USB is the only mode allowed on this band.

Memories to be used for channel hopping must be consecutive, and must be assigned a text label that starts with an asterisk (*).

To set up channel hopping:

- Set VFO A to the first frequency in the intended channel-hopping range.
- Tap M ► V , then select a memory (**00-99**) using VFO A.
- Rotate VFO B to select each label position in turn as indicated by the flashing cursor.
- Use VFO A to change characters. The first character must be an asterisk (*); other label characters are optional.
- After editing, tap M ► V again.
- Set up all other memories to be used for channel hopping.

Channel-hop scanning is started, stopped, and restarted in the same way as normal scanning (details at left).

# Main and Sub Receiver Antenna Routing

The simplified block diagrams in this section show how antennas are routed to the main and sub receivers. The heavy line shows the default RF path. All antennas are protected from electrostatic discharge by surge arrestors. Receive-only antenna inputs include carrier-operated relay circuitry (C.O.R.), indicated by asterisks (*).

## Basic K3 (no KAT3 or KXV3)

As shown in Figure 1, the basic K3 is supplied with one antenna jack (ANT1, SO239). The signal from ANT 1 is routed through the **antenna input module** to the main receiver (as well as to the transmitter). The KRX3 sub receiver, if installed, can share the ANT 1 signal via a passive splitter and relay K1. When the sub receiver is off or is switched to its auxiliary RF input, K1 bypasses the splitter so it will have no effect on either receiver.

An extra RF I/O connector location is provided (AUX RF, BNC). The sub receiver's auxiliary input can optionally be routed to this connector. K1 then selects either the main RX path or AUX RF as the sub receiver's RF source. The sub receiver has its own full set of ham-band and optional general-coverage band-pass filters (KBPF3), but its image rejection will be best when sharing the main path, which includes the receive/transmit low-pass filters.

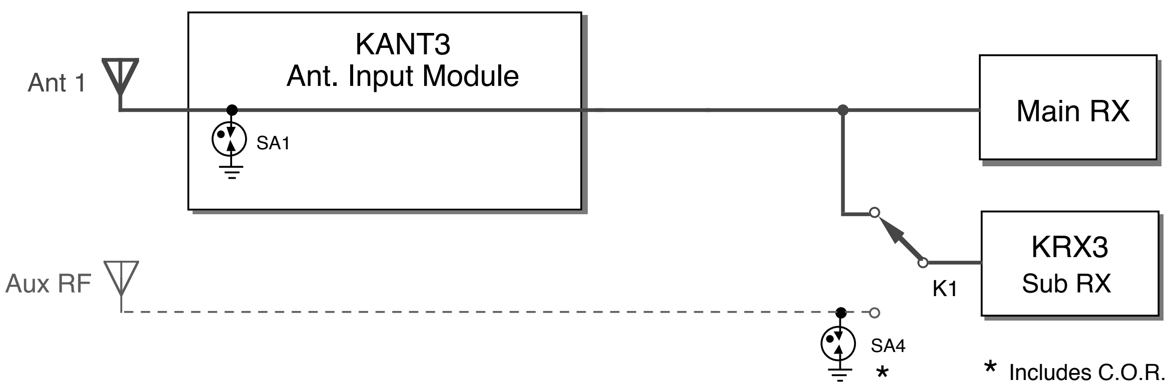



**Figure 1. Basic Main/Sub Receiver Routing (no KAT3 or KXV3)**

## K3 with KXV3 RF I/O Module

If the KXV3 option is installed (Figure 2), a separate receiving antenna can be connected to the RX ANT IN jack. Relay K2 then selects either ANT1 or RX ANT for the main receiver. (**Note:** The low-pass filters will not be in the path when RX ANT is selected. This will rarely be an issue, since the main receiver has a full set of ham-band band-pass filters. You can use external filters with RX ANT IN if required.)

Relay K1 allows the sub receiver to share the main receiver's RF source, *or* use its auxiliary RF input. This means that two receiving antennas could be used. But it's also possible to route a single receiving antenna to both the RX ANT IN and AUX RF jacks using a "Y" adapter. This would allow the sub receiver to use the antenna connected to RX ANT IN even if the main receiver were using ANT 1. No external splitter is required because only one of the receivers will be connected to the receiving antenna at a time.

Not shown is the RX ANT OUT jack. The RX ANT IN/OUT jacks can be used together to "patch in" an external band-pass or low-pass filter or low-noise preamp for the main (shared) RF path; see pg. 17.

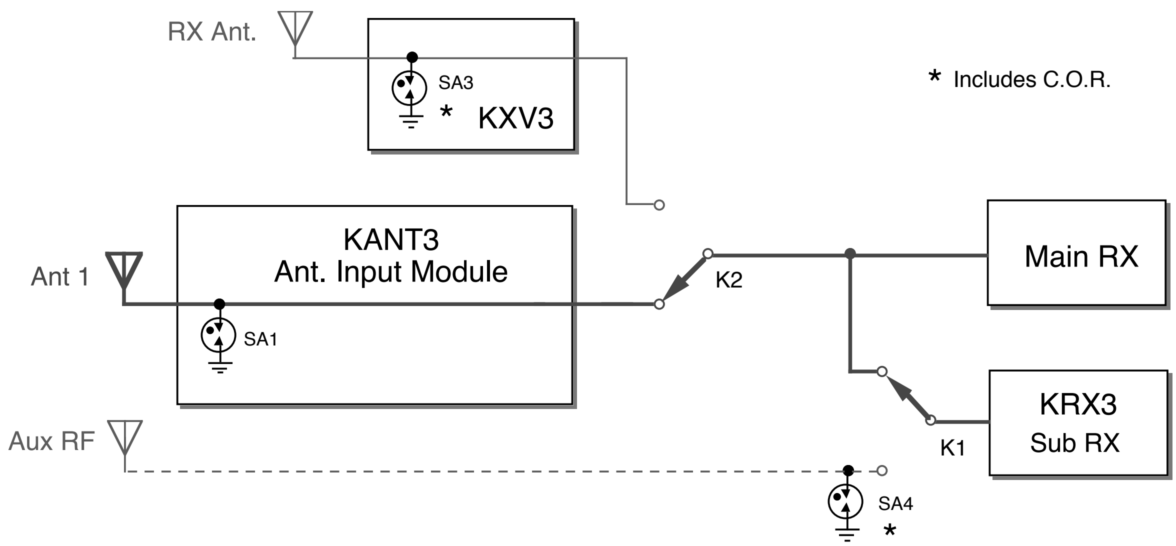



**Figure 2. Main/Sub Receiver Routing with KXV3 Installed**

## K3 with KAT3 ATU

The KAT3 internal ATU, replaces the KANT3 antenna input module, provides a second SO239 antenna jack (ANT 2). As shown in Figure 3, relay K3 routes either ANT 1 or ANT 2 to the main RF path. The antenna *not* routed to the main path (the *non-transmit* antenna) is available for the sub receiver. Relay K1 selects either the main RX path (show here), or the non-transmit antenna.

The sub receiver's auxiliary input can optionally be routed to the AUX RF connector rather than to the non-transmit KAT3 antenna. The sub receiver would be able to use either the main path (transmit antenna) or AUX RF.

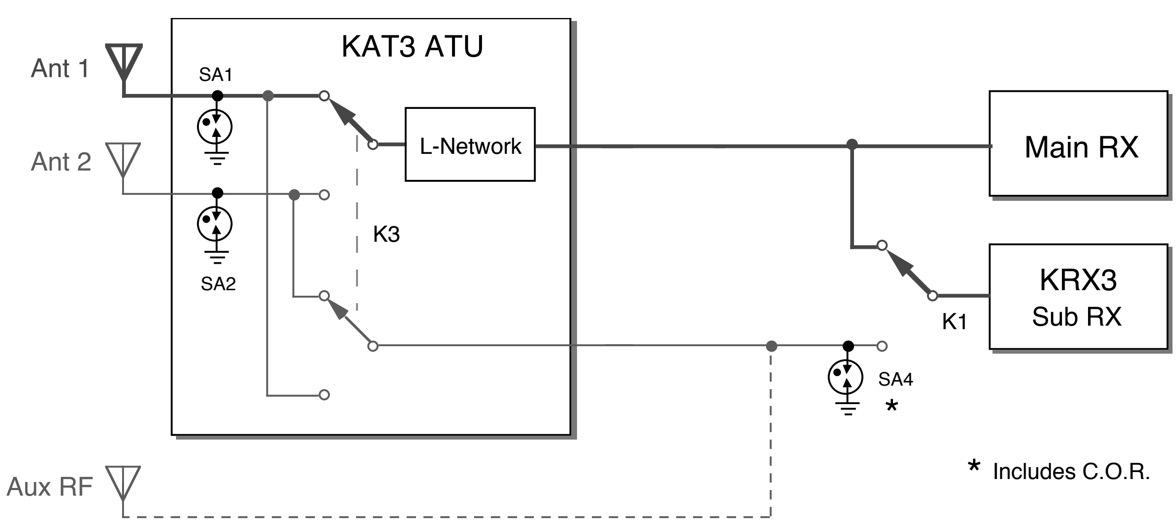



**Figure 3. Main/Sub Receiver Routing with KAT3 Installed**

## K3 with KAT3 and KXV3

Figure 4 shows the antenna possibilities with both the KAT3 and KXV3 installed. The main receiver can use ANT 1, 2, or RX ANT IN. The sub receiver can either share the main receiver's RF source, or use its auxiliary input, meaning either the non-transmit KAT3 antenna or AUX RF. In the latter case, you could use two receive-only antennas – one for each receiver – or wire RX ANT IN to AUX RF as described previously.

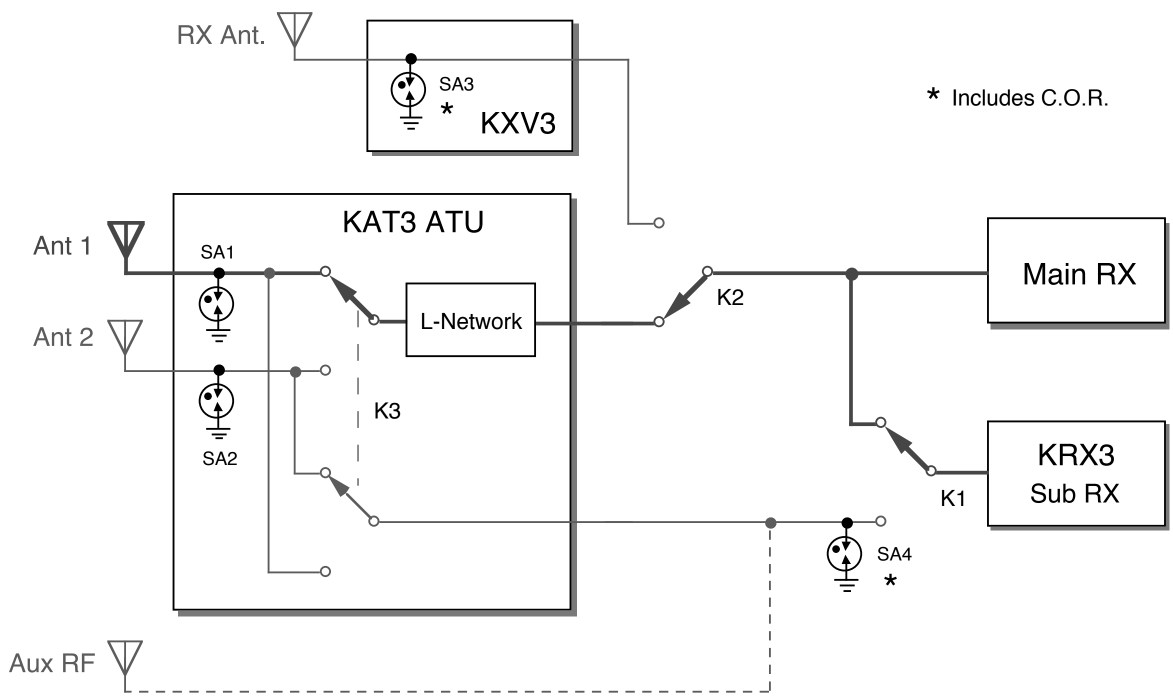



**Figure 4. Main/Sub Receiver Routing with KXV3 and KAT3**

## Antenna Selection Controls

### *Main Receiver*

Tap **ANT** to select **ANT 1** or **ANT 2**. To select the receive antenna (RX ANT IN), tap **RX ANT**. The **RX** icon will turn on. In this case, you'll still be able to tap **ANT** to select **ANT 1** or **2** for use with the transmitter.

### *Sub Receiver (if Installed and Turned On)*

First, hold **BSET** (VFO B/subreceiver direct control). **BSET** will appear on the VFO A display. While in **BSET** mode, tapping **ANT** switches the sub between the main RF path and its aux input.

**If the sub is sharing the main RF path,** the antenna icons will be the same for main and sub.

**If the sub is using its aux input,** the antenna icons will reflect the sub's aux RF source (*CONFIG:KRX3*):

| Antenna Icons | Sub Receiver Auxiliary RF Source |
|---|---|
| **ANT 1** or **2** (opposite of main) | KAT3 ATU non-transmit antenna |
| **ANT** | AUX RF jack |
| **ANT RX** | AUX RF in parallel with RX ANT IN on KXV3 |

# Remote Control of the K3

With appropriate software, any computer with an RS232 port (or a USB-to-RS232 adapter) can be used to control the K3. K3 to computer connections needed for RS232 communications and control functions are covered on page 18.

Third-party logging and contesting software is available for various computers and operating systems. Most applications written for the K2 should work with the K3, and some provide K3-specific features.

For a list of K3-compatible software applications, including configuration requirements, please visit

www.elecraft.com/K3/software.

## Remote-Control Commands

The K3 has a rich set of remote-control commands, including over 150 commands that directly control the two DSPs. With appropriate software, various extensions to DSP functionality can be made available to the operator, including customized filters, fine control over noise reduction, per-mode parametric EQ, absolute level metering in dB, and unique tuning aids.

K3 remote-control commands use ordinary ASCII text, so they can be easily tested using a terminal emulator.

For example, the command "**FA;**" returns the current VFO A frequency. Using the same command, you can *set* the VFO A frequency, e.g. "**FA00007040000;**" sets the VFO to 7.040 MHz.

Many new commands are provided in addition to the core set of commands supported by the K2. A few examples:

"**DB;**" returns the contents of the VFO B display, while "**DBxx;**" (xx=00-13) selects a VFO B alternate display mode (time, supply voltage, etc.).

"**TT1;**" (text-to-terminal) routes decoded CW/DATA text to the PC terminal program, in addition to the K3's VFO B display.

"**RVM;**" and "**RVD;**" retrieve MCU and DSP firmware revisions.

"**SW**" and "**MN**" commands provide access to all switch and menu functions.

This is a small sample of the commands available to both professional software developers and those who might wish to experiment with simple remote control applications.

Please refer to the ***K3 Programmer's Reference*** for further details.

# Options

K3 option modules and crystal filters add significant new capabilities to the transceiver. They can be installed at any time (see pg. 43). All modules are plug-in, requiring no soldering or cable assembly.

The presently available options are described briefly below; please refer to our web site for further details on these as well as our full range of 5- and 8-pole crystal filters.

**KAT3:** Wide-range internal 100-W automatic antenna tuner with dual antenna jacks.

**KPA3:** Internal 100-W upgrade for the K3/10, with two large fans and separate circuit breaker.

**KDVR3:** Digital voice recorder, usable both for message record/playback and general audio recording.

**KRX3:** High-performance, fully-independent sub receiver with its own set of 5 crystal filter slots, 32-bit DSP module, noise blanker, optional general-coverage band-pass filter array (KBPF3 – see below), and auxiliary antenna input.

**KBPF3:** General-coverage band-pass filter array that allows the K3 main or sub receiver to cover the entire LF and HF range of 0.5 to 30 MHz. (If you want general coverage in both main and sub receivers, two KPBF3 modules are required.)

**KXV3:** RF I/O module, including receive antenna in/out jacks (see pg. 36), transverter interface (pg. 36), and a buffered I.F. output (pg. 36). The RX ANT in/out jacks can be used to patch-in external per-band filters or low-noise preamps.

**KTCXO3-1:** High-stability TCXO; 1 PPM, firmware correctable to better than 0.5 ppm (see calibration instructions, pg. 47).

# Firmware Upgrades

New features and improvements are available to all K3 owners via firmware upgrades. Upgrades may also be required when you install new option modules.

Please visit the Elecraft K3 software page (www.elecraft.com/K3/software) to obtain our free firmware download utility.

⚠ **The K3 firmware download utility may not be available on all common computer platforms.**

### *Checking your Firmware Revision*

Use the CONFIG menu's *FW REVS* menu entry to determine your firmware revision. The serial number of your transceiver, if needed, can be obtained using the *SER NUM* menu entry.

### *K3 Firmware Self-Test*

If the K3 detects an error in its firmware (an incorrect **checksum**), it will flash the **TX** LED and show **MCU LD** on the LCD (with backlight off).

If this occurs, connect the K3 to your computer and reload firmware. While firmware is loading, the Delta-F LED ($\Delta$**f**) will flash. When the download is complete, the K3 should reset and run normally.

### *Forcing a Firmware Download*

If you accidentally load an old or incompatible firmware version and find the K3 unresponsive, do the following: (1) unplug the K3 from the power supply and wait 5 seconds; (2) plug the power supply back in; (3) hold the K3's **POWER** switch in; after about 10 seconds, you'll see the **TX** LED flash (you'll also see **MCU LD** on the LCD); (4) load the correct firmware version.

### *Other Ways to Upgrade Your Firmware*

If you don't have Internet access, you can purchase a firmware upgrade on CD.

If you don't have a computer, you can send your K3 to Elecraft to be upgraded. See **Customer Service and Support**, pg. 10.

# Configuration

Configuring your K3 involves installing options and crystal filters, as well as customizing menu settings based on your personal preferences.

Option modules come with their own installation manuals. Once they're installed, they must be enabled using their associated menu entries (see pg. 50).

## Crystal Filter Setup

Crystal filter installation is covered in detail in Appendix A (pg. 67). Once filters have been installed (or moved), all of the steps described below must be completed.

### *Filter Bandwidth*

- Turn the K3 on.
- Hold **CONFIG** (the **hold** function of the **MENU** switch) to access the CONFIG menu group.
- Locate the *FLx BW* menu entry, which will be used in the next step to set up filter bandwidths. "*x*" will be replaced with *1* through *5*, corresponding to crystal filters FL1-FL5.
- Tap **SUB** to set up sub receiver filters. Otherwise, make sure the **SUB** icon is OFF.
- Tap **1** or use **XFIL** to select **FL1**.
- Using VFO A, adjust the bandwidth parameter so that it matches the filter installed at the FL1 position. Use the filter information table you filled out in Appendix A.
- Select the remaining filters by tapping **2** thorugh **5** or **XFIL**, adjusting their bandwidth parameters according to the table.
- Stay in the menu as you continue on to the next filter setup step.

### *Filter Frequency Offset*

- Use VFO B to find the *FLx FRQ* menu entry.
- Tap **SUB** to set up sub receiver filters. Otherwise, make sure the **SUB** icon is OFF.
- Tap **1** or use **XFIL** to select **FL1**.
- Adjust VFO A so that the parameter matches FL1's marked frequency offset (as recorded in the filter information table, Appendix A). The default value, **0.00**, corresponds to the nominal filter center frequency of 8215.0 kHz. Most 5-pole filters will have an offset, e.g. "-0.91". (This has no effect on performance; firmware compensates for the offset.)
- Select the remaining filters and adjust their frequency offsets as required.

### *Receive Filter Enables (Per-Mode)*

You must specify which of the five crystal filters is enabled for receive in each mode.

- Use VFO B to locate the *FLx ON* menu entry.
- Tap **SUB** to set up sub receiver filters. Otherwise, make sure the **SUB** icon is OFF.
- Tap **MODE** until the **LSB** icon appears.
- Tap **1** or use **XFIL** to select **FL1**.
- Set *FL1 ON* to **YES** or **NO** using VFO A. You should enable both narrow and wide filters for use in SSB modes, since they may be used during copy of data, SSB, or AM signals.
- Use **XFIL** to go to FL2-FL5 in turn, and enable or disable these filters for LSB mode.
- Tap **MODE** to select each of the other modes in turn (USB, CW, DATA, AM, and FM). For each mode, set up the FL1-FL5 enables.

### *Filter Loss Compensation*

Narrow crystal filters tend to have more passband loss than wide filters. You can compensate for this effect by specifying an amount of added gain to use for each filter in receive mode.

- Use VFO B to find the *FLx GN* menu entry.
- Tap **SUB** to set up sub receiver filters. Otherwise, make sure the **SUB** icon is OFF.
- Tap **1** – **5** or **XFIL** to select a filter to modify.
- Use VFO A to set the gain in dB. In general, you'll want to add 1-2 dB for 400-500 Hz filters, and 3-4 dB for 200-250 Hz filters.
- Select the remaining filters and adjust their gain parameter as required.

### *Transmit Crystal Filter Selection (Per-Mode)*

This step applies only to filters on the RF board.

- Select CW mode by tapping **MODE** .
- Use VFO B to find the *FLTX CW* menu entry.
- Rotate VFO A to select a CW transmit filter (2.7 or 2.8 kHz). **Note:** Key clicks may result if a narrower filter is selected for CW transmit.
- Tap **MODE** to select **LSB**. The menu entry will change from *FLTX CW* to *FLTX SB*.
- Select the filter to be used during SSB and DATA transmit (2.7 or 2.8 kHz). This setting is overridden automatically for ESSB (pg. 44).
- If applicable, select a 6-kHz filter for AM *(FLTX AM)*, and 12.5 kHz for FM *(FLTX FM)*.

ℹ If you're using a 2.7-kHz 5-pole filter for SSB transmit, you can optionally fine-tune its *FLx FRQ* parameter to equalize LSB and USB transmit characteristics. Monitor with a separate receiver and use headphones, or have another station listen.

## Option Module Enables

K3 options can be installed at any time. Once an option has been installed, use the associated CONFIG menu entry to enable it (see list below). **Then turn the K3 off and turn it back on.** This allows the K3 to find and test the module.

- **KAT3** ATU module: set *KAT3* to **BYP**.
- **KBPF3** general-coverage band-pass filter module: set *KBPF3* to **NOR** (if you're installing a KBPF3 on the sub receiver, tap **SUB** while in the menu entry).
- **KXV3** RF I/O module: set *KXV3* to **NOR**.
- **KRX3** sub receiver: set *KRX3* to **NOR-ANTx** where **x** is your selected wiring for the sub receiver's auxiliary antenna (**1** = unused KAT3 ATU antenna, **2** = AUX RF jack, **3** = AUX RF in parallel with the RX ANT IN jack on the KXV3). For details on sub receiver antenna sources, see pg. 22. You may also need to set up crystal filters for the sub receiver.
- **KDVR3** voice recorder: set *KDVR3* to **NOR**.
- **KPA3** amplifier module: set the *PA MODE* menu entry to **PA NOR**. See menu entry listings for information on other settings.

## Miscellaneous Setup

We suggest setting up at least the menu entries below. You may wish to review the other menu entries as well, starting on pg. 49.

### *Mic Gain / Bias*

*MAIN:MIC SEL* is used to select either the front- or rear-panel mic, or **LINE IN**. If a mic is selected, you can also tap **1** to select **L**o or **H**i mic gain range, and tap **2** to toggle mic bias on/off. See pg. 13 for Elecraft mic bias recommendations.

### *AF Gain Range*

*CONFIG:AF GAIN* specifies **LO** or **HI** AF gain range. The default is **HI**. The **LO** setting should be adequate for many stations, and is less likely to result in speaker distortion at max volume.

### *Time and Date*

*CONFIG:TIME* sets the 24-hour real-time-clock (RTC). Tap **1** / **2** / **3** to adjust HH/MM/SS using VFO A. This URL shows UTC as well as all U.S. time zones: tycho.usno.navy.mil/cgi-bin/timer.pl

*CONFIG:DATE MD* selects US (**MM.DD.YY**). or EU (**DD.MM.YY**) date format using VFO A.

*CONFIG:DATE* is used to set the date. Tap **1** / **2** / **3** to adjust MM/DD/YY or DD/MM/YY.

### *VFO Setup*

Several CONFIG menu entries are provide to control VFO behavior:

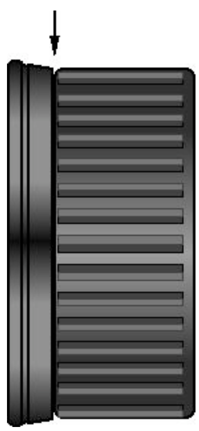
- *VFO CRS* sets up the per-mode **COARSE** tuning rate
- *VFO CTS* is used to specify the number of counts per knob turn (VFO A and B): **100**, **200**, or **400**
- *VFO FST* selects the normal VFO fast tuning rate (**20** or **50** Hz)
- *VFO IND*, if set to **YES**, allows VFO B to be set to a different band than VFO A (only applies if the sub receiver is installed)

## VFO A Knob Friction Adjustment

The VFO A knob's spin rate can be adjusted by moving the knob in or out slightly. The rubber finger grip on the VFO A knob covers the knob's set screw, so it must be removed first.

**In the following procedure, use only your fingernails; a tool may scratch the knob.**

Using your fingernails at the point identified below, pull the finger grip forward slightly. Rotate the knob and repeat until the grip can be pulled off.



Use the supplied 5/64" (2 mm) Allen wrench to loosen the set screw.

Between the knob and front panel are two felt washers which, when compressed, reduce the spin rate. Move the knob in or out in small increments until the desired rate is obtained. Then re-tighten the set screw and replace the finger grip.

## VFO B Knob Friction Adjustment

Use the supplied 5/64" (2 mm) Allen wrench to loosen the VFO B knob's set screw.

Between the knob and front panel is a felt washer which, when compressed, reduces the spin rate. Move the knob in or out in small increments until the desired rate is obtained. Then re-tighten the set screw.

## Real Time Clock Battery Replacement

**K3 components or modules can be easily be damaged by ESD (electrostatic discharge). To avoid this, put on a grounded wrist strap (with 1 megohm series resistor) or touch a grounded surface before touching anything inside the enclosure. An anti-static work mat is strongly recommended.**

The battery for the real time clock/calendar is located on the left side of the RF board. To access it, turn power off, then remove the top cover as described in Appendix A.

Remove the old battery. Replace it with the same type of 3-V lithium coin cell (CR2032, BR2032, equivalent). The (+) terminal is clearly marked on the battery; it must be oriented as indicated by the (+) symbol on the RF board. Re-install the top cover.

To set the time, date, and date format, refer to the following CONFIG menu entries: *TIME*, *DATE*, and *DATE MD*.

# Calibration Procedures

**All calibration procedures are firmware-based. Please do not adjust any of the trimmer capacitors or potentiometers inside the K3; they been carefully aligned at the factory.**

Most calibration procedures use **Tech-Mode** menu entries. To enable these, set *CONFIG:TECH MD* to **ON**. Set *TECH MD* to **OFF** afterward.

## Synthesizer

This procedure is normally done at assembly time or by the factory.

- Hold CONFIG and find the *CONFIG:VCO MD* menu entry. Set the parameter fully clockwise to **CAL.** Exit the menu. The synthesizer will be tested and calibrated.
- To calibrate the 2nd synthesizer (for the sub receiver), locate *CONFIG:VCO MD* and set the parameter to **CAL**, tap SUB to turn on the **SUB** icon, then exit the menu.

## Wattmeter

If desired, power readings shown during TUNE can be adjusted to match an external wattmeter. To account for all K3 circuitry involved, this must be done at 5.0 W, at 50 W (K3/100 only), and at 1.00 mW if the KXV3 option is installed.

### *Low-Power (5 W) Wattmeter Calibration*

- Switch to 20 meters.
- Put the ATU into bypass mode (hold ATU).
- Connect a 50-W capable dummy load (5 W for K3/10) and an accurate wattmeter to ANT1.
- Switch to ANT1 by tapping ANT .
- Set power to exactly 5.0 watts.
- Hold CONFIG and locate the *CONFIG:WMTR LP* menu entry.
- Hold TUNE; adjust menu parameter for a reading of 5.0 W on the external wattmeter. Then tap XMIT to exit TUNE.
- Tap MENU to exit the menu.

### *High Power (50 W) Wattmeter Calibration*

This applies to the K3/100 only. Use the same procedure as shown for 5 watts, but set power to 50 W. The wattmeter calibration menu entry name will change to *CONFIG:WMTR HP*.

### *1.0 Milliwatt Meter Calibration (KXV3)*

This applies only if you have the KXV3 option installed (RF I/O module).

- Set the *CONFIG:KXV3* menu entry to **TEST**, which forces all bands to use the KXV3's transverter output jack, and output to be limited to 0-1.5 mW. The wattmeter calibration menu entry name will change to *CONFIG:WMTR MW* .
- Connect a dummy load and an accurate RF voltmeter to XVTR OUT.
- Set power to exactly 1.00 milliwatts (0 dBm).
- Hold TUNE; adjust the *WMTR MW* menu parameter for a reading of 0.224 Vrms on the external voltmeter. Then tap XMIT to exit TUNE.
- Set *CONFIG:KXV3* back to **NOR**.

## Transmitter Gain

This procedure is normally done at assembly time or by the factory. It compensates for per-band transmit gain variation, providing accurate power control. **It must be done on every band.**

### *Low-Power (5 W) TX Gain Calibration*

- Switch to 160 meters.
- Put the ATU into bypass mode (hold ATU).
- Connect a dummy load to ANT1.
- Switch to ANT1 by tapping ANT .
- Set power to exactly 5.0 watts.
- Hold TUNE ; the power reading shown on VFO B should be about 5 watts.
- Tap XMIT to exit TUNE.
- **Repeat this procedure on 80-6 meters.**

### *High Power (50 W) TX Gain Calibration*

This applies to the K3/100 only. Use the same procedure as shown for 5 watts, but set power to 50 W, and use a 50-W dummy load. The **TUNE** power output indication should be about 50 watts. **Calibrate TX gain at 50 W on ALL bands.**

### *Milliwatt TX Gain Calibration (KXV3)*

This applies only if you have the KXV3 option installed (RF I/O module).

- Switch to 160 m.
- Set the *CONFIG:KXV3* menu entry to **TEST**, which forces all bands to use the KXV3's transverter output jack, and output to be limited to 0-1.5 mW.
- Set power to exactly 1.00 milliwatts (0 dBm).
- Hold **TUNE**; the power output indication on the VFO B display should be about 1 mW. Then tap **XMIT** to exit TUNE.
- **Repeat the above procedure on 80-6 m.**
- Set *CONFIG:KXV3* back to **NOR**.
- Tap **MENU** to exit the menu.

## Reference Oscillator

The K3's reference oscillator is a TCXO, or *temperature-compensated crystal oscillator*. It is normally calibrated at assembly time or by the factory. There are two types: 5 ppm and 1 ppm.

⚠ **Before attempting reference calibration, allow the transceiver to warm up at room temperature for about 15 minutes (cover on).**

The **5 ppm** TCXO (standard) can be calibrated using an accurate frequency counter (**Method 1**), or by zero-beating the sidetone against a reference signal or broadcast station (**Method 2**).

The **1 ppm** TCXO (optional) can also be calibrated using **Method 1** or **2**. However, its accuracy can be improved to better than 0.5 ppm by directly entering supplied calibration data (**Method 3**). Be sure to keep the data sheet that was supplied with the oscillator.

### *Method 1 (Frequency Counter):*

- Locate the *CONFIG:REF CAL* menu entry. (If the menu entry name is *REF xxC*, tap **1** to change it to *REF CAL*).
- Connect a frequency counter with +/-***1 Hz or better*** accuracy to J1 on the reference oscillator module. Measure the exact frequency in Hz.
- Using VFO A, set the *REF CAL* parameter to match this frequency. Then exit the menu.

### *Method 2 (Zero-Beating):*

- Select CW mode. Set ⟲ **WIDTH** to about 2.8 kHz. (A wide filter passband is necessary since you may need to move the REF CAL parameter a significant amount.)
- Tune the K3 to a strong commercial AM broadcast station (e.g. WWV), or another known-accurate reference signal. *Set the VFO to the exact, known frequency of the signal.*
- Using ⟲ **MON**, set the sidetone monitor level to roughly match the volume level of the received broadcast or reference signal.
- Locate *CONFIG:REF CAL*. (If the menu entry name is *REF xxC*, tap **1** to select *REF CAL*).
- Tap **SPOT** to enable the sidetone.
- Adjust the *REF CAL* parameter, using VFO A, until the sidetone is zero-beated with the signal. As you approach the correct frequency, you'll hear an undulating "beat note" between the two signals. The slower the beat note, the closer they are. If it pulses at a rate of once per second or slower, you're within 1 Hz of the signal.
- Cancel **SPOT** and exit the menu.

### *Method 3 (1 ppm TCXO Option):*

- Locate the *CONFIG:REF CAL* menu entry. Tap **1** to change the name to *REF xxC*.
- Locate the calibration data sheet, which shows frequency vs. temperature over a wide range.
- For each data point, tap **2** or **3** to select the calibration temperature, then use VFO A to set the specified oscillator frequency in Hz.
- Tap **MENU** to exit the menu.

## Front Panel Temperature Sensor

- Turn the K3 OFF. Allow about 15 minutes for the radio to cool to room temperature.
- Turn the K3 ON.
- Locate the *CONFIG:FP TEMP* menu entry. Adjust the parameter to match the reading of a room thermometer. **Note:** Deg. C = (deg. Fahrenheit - 32) * 0.555.

⚠ Front panel compartment temperature can be monitored continuously. Tap **DISP** , then use VFO B to select the **FP xxC** alternate display.

## PA Temperature Sensor

- Turn the K3 OFF. Allow about 15 minutes for the PA heatsink to cool to room temperature. **Do not turn the K3 ON during this period.**
- Turn the K3 ON.
- Locate the *CONFIG:PA TEMP* menu entry. Adjust the parameter to match the reading of a room thermometer. **Note:** Deg. C = (deg. Fahrenheit - 32) * 0.555.

⚠ PA heat sink temperature can be monitored continuously. Tap **DISP** , then use VFO B to select the **PA xxC** alternate display.

## S-Meter

S-meter calibration is normally quite accurate using the default settings.

Calibrating the S-meter requires a 50-ohm, 50-microvolt signal (an accurate signal generator such as an Elecraft XG1 or XG2 is recommended). In most cases the default parameter values will provide adequate S-meter accuracy.

- If you're calibrating the sub receiver's S-meter: (1) tap **SUB**; (2) hold **BSET** to switch the S-meter and controls over to the sub receiver; (3) tap **ANT** if necessary to set up the sub to share the main RF path (pg. 40).
- Switch to 40 m (or a band applicable to your signal generator) and select CW mode.
- **Set transmit power to 0.0 W** using ⟲ **PWR**.
- Turn preamp on (**PRE**), attenuator off (**ATT**).
- Tap **AGC** to select slow AGC (**AGC-S**).
- Bypass the ATU, if installed, by holding **ATU** .
- Set ⟲ RF GAIN to maximum (**fully clockwise**). (**Note:** If you've assigned the RF gain control for the present receiver to **squelch**, its RF gain will default to maximum unless you're controlling RF gain from a remote-control computer application.)
- Normalize the DSP filtering (hold **NORM**; pg. 11).
- Connect the signal generator to ANT1 and set it for 50 microvolts RF output.
- Tune to the frequency of the signal generator (tune for peak audio response). You can also use **auto-spot** (pg. 28) to accurately match the pitch of the signal, ensuring that it is centered in the passband.
- Locate the *CONFIG:SMTR PK* menu entry; set it to **OFF**.
- Locate the *SMTR SC* menu entry (S-meter scale). Use the VFO A knob to set it to the default value (14).
- Adjust *SMTR OF* (S-meter offset) for an S-9 reading.
- Switch the signal generator to 1-μV output; the S-meter should now indicate about S-2 to S-3. If not, change *SMTR SC* by 1 unit (try 15 first, then 13, then 16, then 12). After each *SMTR SC* change, re-adjust the *SMTR OF* setting for an S-9 indication.
- When you have completed this procedure, disconnecting the signal generator should now show NO bars on the S-meter.

# Menu Functions

There are two groups of menu functions: **MAIN** and **CONFIG**. Tap **MENU** to access the MAIN menu; hold **CONFIG** to access the CONFIG menu. You can hold **MENU** to Menu entries that you'd like quick access to can be assigned to programmable function switches (pg. 13).

Tapping **DISP** while viewing the menu shows help information about the present menu entry in the VFO B display area. For most entries, the default parameter value is shown in parentheses at the start of the help text. Long help text strings can be interrupted by tapping any switch.

## MAIN Menu

| Entry | Default | Description |
|---|---|---|
| | | |
| AFX MD | Delay 5 | Audio Effects. Available selections: **DELAY 1-5** (quasi-stereo), and **BIN** (similar to Binaural I-Q). |
| ALARM | OFF | Set alarm/Auto-Power-On time. Tap **1** to turn alarm on/off; tap **2** / **3** to set **HH** / **MM**. |
| LCD ADJ | 8 | LCD viewing angle and contrast. Use higher settings if the radio is used at or above eye level. If adjusted incorrectly, bargraphs will be too light or heavy during keying. |
| LCD BRT | 6 | LCD backlight brightness. Use **DAY** in bright sunlight, **2** to **8** for indoor lighting. |
| LED BRT | 4 | LED brightness (relative to LCD backlight brightness). Exception: if *LCD BRT* is set to **DAY**, LEDs are set to their maximum brightness. |
| MIC SEL | FP, low range, bias on | Mic/line transmit audio source, mic gain range, and mic bias. Source selections: **FP (**front panel 8-pin **MIC** jack), **RP** (rear panel 3.5 mm **MIC** jack), and **LINE IN** (rear-panel **LINE IN** jack). Tap **1** to toggle between .**L**ow and .**H**igh mic gain range for the selected mic. Tap **2** to turn mic **BIAS** on/off (turn on for electret mics). |
| MSG RPT | 6 | Message repeat interval in seconds (**0** to **255**). To repeat a message, ***hold*** **M1** – **M4** rather than ***tap***. A 6 - 10 sec. interval is about right for casual CQing. Shorter intervals may be needed during contests, and longer for periodic CW beacons. |
| RPT OFS | 2400 | Sets the transmit offset (in kHz) for repeater operation, from –2560 kHz to +2540 kHz. Per VHF band or band segment. |
| RX EQ | +0 dB, each band | Receiver audio graphic equalizer. VFO A is used as an 8-band bargraph, where each character shows the boost or cut **(-16** dB to **+16** dB in 1 dB increments) for a given AF band. The 8 bands are 0.05, 0.1, 0.2, 0.4, 0.8, 1.2, 2.4 and 3.2 kHz. Tap **1**-**8** to select an AF band. VFO A selects boost/cut. Tap **CLR** to reset all bands to +0 dB. |
| TX EQ<br>TX*EQ | +0 dB, each band | Transmit audio graphic equalizer (voice modes only). Functions the same as *RX EQ*, above, and can be adjusted while in transmit mode. *TX*EQ* indicates *TX ESSB* in effect, which has its own set of transmit equalization settings. |
| VOX GN | 0 | Adjusts the sensitivity of the VOX to match your mic and voice. |
| ANTIVOX | 0 | Adjusts immunity of the VOX circuit to false triggering as a result of audio from the speaker or 'leaked' from headphones. |

## CONFIG Menu

### *Tech Mode Entries*

Menu entries that include **[T]** are ***tech mode*** entries. These are only visible if *CONFIG:TECH MD* is set to **ON**. They are are normally left at their defaults. Entries further described as "**Advanced**" or "**Troubleshooting**" should be changed with caution. The default values are strongly recommended for "Advanced" functions; tap **DISP** to see the default value, which appears in parentheses at the start of the help text.

### *Sub Receiver Settings*

Menu entries that include SUB have two different settings: one for the main receiver, and one for the sub receiver. Tapping **SUB** within a menu entry will turn the SUB icon on (if the KRX3 option is installed), indicating that the sub receiver parameter is displayed. When you first enter the menu, SUB will always be off.

| Entry | Default | Description |
|---|---|---|
| 2 TONE **[T]** | OFF | **(Troubleshooting.)** Turns on built-in 2-tone generator for SSB transmit tests. The internal 2-tone generator only works if LSB mode is selected. |
| AF GAIN | LO | Sets AF GAIN range. Available selections are **HI** or **LO**. |
| AFV TIM **[T]** | 1000 | **(Advanced.)** Integration time for **AFV** and **dBV** displays in ms. See VFO B alternate displays and K3 Service Manual. |
| AGC HLD **[T]** | 000 | **(Advanced.)** AGC "hold" time for voice modes. Specifies the number of milliseconds that the SLOW AGC value is held after the signal drops below the level that set the AGC. This is often helpful for SSB voice operation. |
| AGC PLS **[T]** | NOR | **(Advanced.)** **NOR** enables AGC noise pulse rejection. |
| AGC SLP **[T]** | 10 | **(Advanced.)** Higher values result in 'flatter' AGC (making signals at all amplitudes closer in AF output level). |
| AGC THR **[T]** | 5 | **(Advanced.)** Sets AGC onset point; a higher number moves the onset up. |
| AGC-F **[T]** | 120 | **(Advanced.)** Sets fast AGC decay rate; a higher number means faster decay. |
| AGC-S **[T]** | 20 | **(Advanced.)** Sets slow AGC decay rate; a higher number means faster decay. |
| BAT MIN | 11.0 | Low-battery warning threshold; **11.0** recommended. The parameter flashes if it is set higher than the present supply voltage. |
| CW IAMB | A | Iambic keying mode (**A** or **B**). Both modes produce self-completing dots and dashes. Mode B is more efficient for operators who practice "squeeze" keying (pressing both paddles at once), because an extra dot or dash is inserted on squeeze release. Mode A lacks this feature, and may be more appropriate for those who only press one paddle at a time (often called "slap" keying). |
| CW PADL | Tip=dot | Specifies whether left keyer paddle ("tip" contact on the plug) is **DOT** or **DASH**. |
| CW WGHT | 1.00 | CW keying weight. Adjusts element/space timing ratio for the internal keyer. |
| DATE | N/A | Real-time-clock date, shown as in the format selected by *CONFIG:DATE MD* (MM.DD.YY or DD.MM.YY). Tap **1** / **2** / **3** to select month / day / year. |
| DATE MD | US | Select **US** (MM.DD.YY) or **EU** (DD.MM.YY) date formats. |
| DDS FRQ **[T]** | {DDS freq} | **(Troubleshooting.)** Controls DDS tuning directly to check DDS XFIL range for synthesizer troubleshooting purposes. Rotate VFO A CCW and CW to find limits where **L** (lock) changes to **U** (unlock). Correct DDS frequency is restored after exiting the menu and rotating either VFO. |

| | | |
|---|---|---|
| DIGOUT{n} | LO | Directly controls two general-purpose digital output lines on the AUX I/O connector. {n} = **0** or **1**. Tap 1 to alternate between the two. These are TTL-level signals with a nominal output voltage of 0 V (**LO**) or 5 V (**HI**). Recommended max. load is 15 mA (enough to power one LED, for example). |
| FLx BW<br>SUB | 2.70 (FL1) | Crystal filter **FL1-5** bandwidth in kHz, where x=**1** to **5** (FL1-FL5). Tap 1-5 or XFIL to select filters. |
| FLx FRQ<br>SUB | 0.00 (FL1) | Crystal filter **FLx** center freq as offset from nominal (8215.0 kHz). Use the offset value specified on the crystal filter's label or PC board, if any. For example, if an Elecraft 5-pole, 200-Hz filter were labeled "-0.91", adjust VFO A for **–0.91**. |
| FLx GN<br>SUB | 0 dB (FL1) | Crystal filter **FLx** loss compensation in dB. **0 dB** recommended for wide filters; **2 dB** for 400 or 500 Hz filters, and **4 dB** for 200 or 250 Hz filters. |
| FLx ON<br>SUB | ON (FL1), per-mode | Used to specify which filters are available during receive. Each filter must be set to **ON** or **OFF** in ***each*** mode. You can tap MODE within the menu entry. |
| FLTX{md} | FL1 (all modes) | Used to specify which crystal filter to use during TX. {md} = **CW**/**SB**/**AM**/**FM**. Choose filers with bandwidths as follows: SSB, 2.7 or 2.8 kHz (also applies to data); CW, 2.7 or 2.8 kHz; AM, 6 kHz; FM, 12 kHz or higher.<br>**Note:** If you're using a 2.7-kHz 5-pole filter for SSB transmit, you can optionally fine-tune its FLx FRQ parameter to equalize LSB / USB transmit characteristics. Monitor your signal on a separate receiver, using headphones. |
| FP TEMP | N/A | Used to calibrate the front panel temperature sensor. It must be calibrated if you wish to use the *REF xxC* menu entry to calibrate the optional 1 PPM TCXO. You must convert °F to °C in order to enter the value. Deg. C = (deg. F - 32) * 0.555. |
| FSK POL | 1 | **0** = Invert FSK transmit data polarity, **1** = Normal data polarity. |
| FW REVS | N/A | Rotate VFO A to see firmware revisions of the MCU (**uC**), main DSP (**d1**), aux DSP (**d2**), flash parameters (**FL**), and KDVR3 controller (**dr**). |
| KAT3 | Not Inst | KAT3 ATU mode; normally set to **BYP** or **AUTO** (you can alternate between these settings using the ATU switch). Modes **L1-L8**, **C1-C8**, and **Ct** are used to test KAT3 relays. Mode **LCSET** allows manual adjustment of L/C/net settings. When in this mode, tapping ATU TUNE shows the L & C value; C is changed with VFO A, L is changed with VFO B, and ANT toggles between **Ca** and **Ct**. |
| KBPF3<br>SUB | Not Inst | If KBPF3 option is installed: set to **ON**, exit menu, and turn power off/on. |
| KDVR3 | Not Inst | If KDVR3 option is installed: set to **ON**, exit menu, and turn power off/on. |
| KIO3 | NOR | Determines function of BAND0-3 outputs on AUX I/O connector. See pg. 19. |
| KNB3<br>SUB | Not Inst | If KNB3 option is installed: set to **ON**, exit menu, and turn power off/on. Note: the K3 can't be used without a KNB3; **Not Inst** is for troubleshooting only. |
| KPA3 | Not Inst | Set to **PA NOR** if KPA3 100-W amp installed. Set to **PAIO NOR** if KPA3 is not installed, but the KPAIO3 transition PC board is. Other settings include **PA BYP** (disables KPA3 if installed), PA fan test settings (**PA FN1**-**FN4** or **PAIO FN1-FN4**), and **PAIO BYP** (if transition board is installed, but not the KPA3 module, this setting can be used to test the high power bypass relay). |
| KRC2 | - - | Controls the KRC2 band decoder's accessory output settings. Shows **OFF** or **ACC1-3** if a KRC2 is detected; **- -** if not. |

| | | |
|---|---|---|
| KRX3 | Not Inst | If KRX3 option (sub receiver) is installed, set parameter to **NOR-ANTx** where **x** is your selected wiring for the sub receiver's auxiliary antenna (**1** = unused KAT3 ATU antenna, **2** = AUX RF jack, **3** = AUX RF in parallel with the RX ANT IN jack on the KXV3). For details on sub receiver antenna sources, see pg. 22.<br>**Note:** the sub receiver option includes three modules: receiver, synthesizer, and DSP. All three must be installed, or the K3 will report an error on power-up. |
| KXV3 | Not Inst | If KXV3 option is installed: set to **ON**, exit menu, and turn power off/on. This option is required for use of **RXANT** and low-level transverter I/O. |
| LCD TST | OFF | Changing the parameter turns on all LCD segments. |
| LIN OUT | 30 | Sets the LINE OUT level. LINE OUT connections go to PC soundcard inputs. |
| NB SAVE | NO | Set to **YES** to save noise blanker on/off state per-band. Noise blanker levels, both DSP and I.F., are always saved per-band regardless of this setting. |
| PA TEMP | N/A | If a KPA3 (100-W PA module) is installed, shows KPA3 heatsink temperature and allows it to be adjusted. See calibration procedure on page 48. |
| PTT-KEY | OFF-OFF | Allows selection of **RTS** or **DTR** RS232 lines to activate PTT or key the K3. See pg. 18. **Note:** If a computer or other device asserts RTS or DTR *while* you're in this menu entry, the K3 will switch to **TEST** mode (zero power output) as a precaution. The **TX** icon will flash as a reminder. To avoid this, make sure software applications have flow control and/or keying options turned OFF while you're changing the *PTT-KEY* selection. |
| REF CAL or REF xxC<br>**[T]** | 49380000 Hz | Used to precisely calibrate the K3's reference oscillator,. VFO A is used to set the reference oscillator frequency in Hz. Tap **1** to alternate between *REF CAL* and *REF xxC*. **xx** is a data entry point from **–20** to **+70**.<br>*REF CAL* can be used with either TCXO (see **Method 1** or **2**, pg. 47). *REF xxC* is used with the 1 ppm TCXO (**Method 3**). Tap **2** or **3** to move the data entry point up or down. See calibration procedure, pg. 47. |
| RS232 | 4800 b | RS232 communications rate in bits per second (bps). During firmware download (via the K3FW PC program), the baud rate is set automatically to 38400 baud, but it is then restored to the value selected in this menu entry. |
| SER NUM | N/A | K3 serial number, e.g. **02000**. Cannot be edited from the menu. |
| SMTR OF<br>**SUB** | 024 | S-Meter offset; see calibration procedure (pg. 48). |
| SMTR SC<br>**SUB** | 014 | S-Meter scale; S-9 = 50 uV, S=3 = 1 uV with Preamp = ON, and AGC ON. See calibration procedure (pg. 48). |
| SMTR PK | OFF | Set to **ON** for peak-reading S-meter. |
| SPLT SV | NO | If set to **YES, SPLIT** state is saved per-band. |
| SPKRS | 1 | Set to **2** if using two external speakers. This enables binaural effects in conjunction with the **AFX** switch, as well as stereo dual-receive if the sub receiver is installed. For further details, see pg. 33. |
| SPKR+PH | NO | YES = Speaker is ON, even when headphones are plugged into PHONES jack. See detailed discussion on pg. 19. |
| SQ MAIN | 0 | Main receiver squelch value ***or*** RF gain potentiometer assignment. If set to **RF INNER**, the inner (smaller) RF/SQL knob controls main squelch rather than RF gain. If set to **RF OUTER**, the outer ring (larger) RF/SQL knob controls main squelch rather than sub receiver RF gain. |
| SQ SUB | 0 | Sub receiver squelch value ***or*** RF gain pot assignment. If set to **RF OUTER**, the outer ring (larger) RF/SQL knob controls sub squelch rather than sub RF gain. |

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|---|---|---|
| SW TEST **[T]** | OFF | Changing the parameter displays **SCN ADC**. Hold any switch to see scan row and switch ADC reading. Used for troubleshooting only. |
| SW TONE | OFF | Sets up switch tones or audio Morse feedback on any control activation. |
| TECH MD | OFF | Set to **ON** to enable ***Tech Mode*** menu entries (those marked with **[T]** in this list). |
| TIME | N/A | Real-time-clock view/set. Tap 1 / 2 / 3 to set HH / MM / SS. To see the time and other displays during normal operation, tap **DISP** (see pg. 34). |
| TTY LTR | Function | Performs an RTTY FIGS to LTRS shift when the text decoder is enabled in RTTY modes. Cannot be changed within the menu itself; must be assigned to a programmable function switch. |
| TX ALC **[T]** | ON | **(Troubleshooting.)** Set to **OFF** to disable transmit ALC in CW mode. This is required when adjusting band-pass filters and can also be used for troubleshooting, but should not be used during normal operation. (Be sure to set parameter to **ON** afterward.) |
| TX ESSB **[T]** | OFF | Extended SSB transmit bandwidth (**3.0**, **3.5**, **4.0** kHz, etc.) or **OFF**. See pg. 44. |
| TXGN{pwr} **[T]** | 00 | **(Troubleshooting.)** Shows transmit gain constant for the present band and power mode, where {pwr} = **LP** (0-12W), **HP** (15-120W), or **MW** (0-1.5 mW). The gain constant is updated whenever the **TUNE** function is activated on a given band *at one of three specific power levels:* 5.0 W, 50 W, and 1.00 milliwatt. See transmit gain calibration procedure, pg. 46.<br><br>If *TX ALC* (above) is **OFF**, the *TXGN* parameter can be set manually, at very fine resolution. This should only be done for troubleshooting purposes. |
| TXG VCE **[T]** | 0.0 dB | Balances voice transmit peak power in relation to CW peak power in TUNE mode. Typically left at 0.0. |
| VCO MD **[T]** SUB | 064 | **(Troubleshooting.)** VCO L-C range view/change/calibrate. Once the VCO is calibrated (pg. 46), the parameter which appears here will include **NOR** at all times. You can change the setting to troubleshoot VCO L-C ranges. When finished, set the parameter back to **NOR 127**, then exit the menu and change bands to restore the original setting. |
| VFO B->A | Function | Copies VFO B's frequency to VFO A. Cannot be used within the menu itself; must be assigned to a programmable function switch. |
| VFO CRS | Per-mode | Per-mode coarse tuning rate (hold **COARSE** and tune VFO A or B). Also applies to the RIT/XIT tuning knob if *CONFIG:VFO OFS* is set to **ON**, and both RIT and XIT are turned OFF. |
| VFO CTS | 200 | VFO counts per turn (**100**, **200**, or **400**). Smaller values result in easier fine-tuning of VFO; larger values result in faster QSY. |
| VFO FST | 50 Hz | Specifies the faster of the two VFO tuning rates (**RATE**). The faster rate is **50** Hz per step by default, but can be set to **20** Hz if desired. In this case, *VFO CTS* = **400** is recommended to ensure adequate fast-QSY speed. |
| VFO IND | NO | If set to **YES**, VFO B can be set to a different band than VFO A, which allows listening to two bands at once (main/sub). This menu entry is not available unless the subreceiver is installed. |
| VFO OFS | OFF | If **ON**, the RIT/XIT offset control can be used to tune VFO A in large steps when both **RIT** and **XIT** are turned off. The step sizes vary with mode (see *VFO CRS*), and are the same as the **COARSE** VFO tuning rates. |
| WMTR {pwr} | 100 | Wattmeter calibration parameter. {pwr} is the power mode: **LP** (0-12W), **HP** (15-120W), or **MW** (0-1.5 mW). See calibration procedure (pg. 46). |
| XVx ON | NO | Set to **YES** to turn on transverter band x (**1-9**); tap 1 – 9 to select xvtr band. |
| XVx RF | 144 | Lower edge for xvtr band x (**1-9**); **0-999** MHz. Tap 1 – 9 to select xvtr band. |

| | | |
|---|---|---|
| XVx IF | 28 | Specify K3 band to use as the I.F. for transverter band x (**1-9**). Tap 1 – 9 to select xvtr band. I.F. band selections include **7**, **14**, **21**, **28**, and **50** MHz. |
| XVx PWR | H 0.1 | Allows fixed or variable power level for XVTR band x. Tap 1 – 9 to select xvtr band. **H x.x** (**H**igh power level) specifies a value in watts, and use of the main antenna jack(s). This should be used with caution, as you could damage a transverter left connected to these antenna jacks accidentally. **L x.x** (**L**ow power level) species a value in milliwatts, which requires the KXV3 option. |
| XVx OFS | 0.00 | Offset (**–9.99** to +**9.99** kHz) for transverter band x (**1-9**). Tap 1 – 9 to select xvtr band. Compensates for oscillator/multiplier chain errors. |
| XVx ADR | TRN1 | Physical decode address (**1** to **9**) assigned to transverter band x (**1-9**). Tap 1 – 9 to select xvtr band. Applies to attached Elecraft XV-series transverters and Elecraft KRC2. Also see *CONFIG:KIO3*. **Note:** Decode address range may vary depending on the type of attached device. |

# Troubleshooting

The K3 is a highly modular transceiver. With the information provided here, you'll be troubleshooting to the module level, not to the component level. In many cases, problems can be resolved by changing a menu setting, loading new firmware (pg. 42) or initializing parameters to factory defaults (see below).

Hardware troubleshooting procedures, including detailed module substitution, voltage checks, signal tracing, etc., can be found in the K3 Service Manual. **Due to the use of fine-pitch ICs (integrated circuits) in the K3, most signal tracing must be done very carefully using fine-tip probes.** Please do not attempt this unless you have experience in troubleshooting surface-mount assemblies; otherwise, you could damage your K3.

⚠ **DO NOT ADJUST ANY TRIMMER CAPACITORS OR POTENTIOMETERS** unless you have access to the test gear specified in the Service Manual. These settings have been aligned at the factory, and if mis-adjusted, could degrade performance. Elecraft support can suggest alternative procedures in some cases.

## Parameter Initialization

Menu parameters are stored in non-volatile memory (EEPROM and/or FLASH). It is possible, though rare, for parameters to become altered in such a way as to prevent the firmware from running correctly. If you suspect this, you can reinitialize parameters to defaults, then restore a previously-saved configuration (or re-do all configuration steps manually; no test equipment is required).

- If you have a computer available to do configuration save and restore, run the **K3 Utility** program, then use the **Configuration** function to save your present firmware configuration.
- If you don't have access to a computer, you should write down your menu parameter settings. The most important are *CONFIG:FLx BW* and *CONFIG:FLx FRQ* (for each installed filter x; also tap **SUB** to obtain sub receiver crystal filter settings, if applicable). You should also note the settings of option module enables (all CONFIG menu entries starting with 'K', e.g. *CONFIG:KAT3*) . If you don't record your crystal filter and option settings, you may have to remove the K3's top cover (and sub receiver, if installed) to verify which options as well as crystals filters are installed, as well as the frequency offsets noted on the crystal filters (depends on filter type).
- Turn the K3 OFF (using the K3's POWER switch, not your power supply).
- While holding in the SHIFT/LO knob (which is also labeled **NORM** below), turn power ON by tapping the K3's POWER switch. Let go of the SHIFT/LO knob after about 2 seconds. You should now see **EE INIT** on the LCD.
- When **EE INIT** completes after a few seconds, you may see **ERR PL1** or other error messages due to reinitialization. Tap **DISP** to clear each message.
- If you have a computer, restore all parameters using the **Configuration** function of the K3 Utility program.
- If you don't have a computer, manually re-enter all menu parameters that you wrote down, above, then re-do firmware configuration and calibration (starting on pg. 43). You can omit any steps pertaining to parameters you've already restored manually.
- See if the original problem has been resolved.

## General Troubleshooting

The most common symptoms and their causes are listed below. Most are related to firmware or control settings. If the problem persists, please contact Elecraft support (see pg. 10). Outside normal business hours, you may be able to get advice by posting a message to our email reflector.

- **TX LED is on all the time:** In any mode, this symptom could indicate that PTT is being held on by external equipment. Disconnect anything connected to the AUX I/O and RS232 connectors. In voice modes, this could be caused by having the VOX gain set too high. Disconnect the microphone, then set the VOX menu parameter lower.
- **"NEW K3UTIL SOFTWARE REQUIRED" message appears on the LCD:** This indicates that you must install a new version of the K3's firmware upgrade program (K3 Utility) in order to load the latest K3 firmware. After installing the new version of K3 Utility, reload all new firmware (MCU, DSP, etc.).
- **Error message appears on the LCD (ERR PL1, etc.):** refer to **Module Troubleshooting** (below) for troubleshooting steps. Some error messages result from turning on option modules that are not actually installed (see *CONFIG:KAT3*, *KBPF3*, etc.).
- **N/A shown on the LCD (Not Applicable)**: The switch or knob function you're trying to use does not apply in the present mode or context.
- **HI CUR** or **HI SWR warning (K3/100):** Check load impedance and power supply voltage. If supply voltage is low and/or load impedance is lower than 50 ohms, current can go up for a given requested power level. Reduce power if necessary.
- **HI TEMP warning (K3/100):** PA heatsink temperature has exceeded 84C (PA drops into bypass mode). Check fans, power supply voltage and current, and load impedance. Allow heatsink to cool. Reduce power if necessary. Make sure the *CONFIG:PA TEMP* menu entry is calibrated (allow heatsink to cool to room temperature, then compare menu reading to actual).
- **ALC OFF** is displayed on VFO A: Set *CONFIG:TX ALC* to **ON**. ALC should only be turned off during band-pass filter alignment (see Service Manual).
- **VFO B is blank:** You may have CW or DATA text decode display turned on (TEXT DEC, pg. 28) with the **THR** (threshold) control set too high for text decode to proceed.
- **VFO A or B display doesn't change when the corresponding knob is rotated:** You probably have the affected VFO locked (pg. 11).
- **Can't transmit in CW mode:** (1) Make sure the key or keyer paddle is plugged into the correct jack. (2) You must have VOX selected (**VOX** icon on) in order to use full or semi break-in CW. (3) You may be in SPLIT mode, with VFO B set for a voice or data mode rather than CW. Tap A/B or use BSET to check VFO B's mode.
- **Key clicks in CW mode:** You may have a narrow crystal filter selected for CW transmit. Use 2.7-2.8 kHz. See the *CONFIG:FLTX CW* menu entry.
- **Can't use the mic in voice modes:** You may be in SPLIT mode, with VFO B set for CW or data mode rather than a voice mode. Tap A/B or use BSET to check VFO B's mode.
- **No power output:** You may have routed RF through the KXV3's XVTR IN/OUT jacks, either by switching to a transverter band, or by setting *CONFIG:KXV3* to **TEST**. Another possibility is that power has not been calibrated on the present band (pg. 46).
- **No received signal:** Possibilities include (1) receiver being squelched (if RF/SQL controls are assigned to squelch via *CONFIG:SQ MAIN* or *SQ SUB*, rotate squelch controls fully counter-clockwise); (2) RF GAIN too low (set RF gain controls fully clockwise); (3) filter bandwidth too narrow (set ⏲ WIDTH or tap

**XFIL**, and also verify filter configuration settings); (4) switching to an open receive antenna on the KXV3 (RX ANT IN); (5) switching the KAT3 to an open antenna jack; (6) *CONFIG:REF CAL* parameter not adjusted properly.

- **Received signal too low in amplitude:** (1) Try setting *CONFIG:AF GAIN* to the **HI** range; (2) check headphone and speaker plugs and cables; (3) make sure that *CONFIG:RX EQ* settings are either flat or have not been set for a large amount of cut; (4) recheck all filter configuration settings, particularly the *CONFIG:FLx BW*, *FLx GN*, and *FLx FRQ* menu entries; (5) verify that *CONFIG:REF CAL* is properly adjusted.
- **General problem with transmit and/or receive performance:** Many problems can be caused by the power supply voltage being too low or by a noisy or intermittent supply. Check your power supply's on/off switch, voltage, fuses (if applicable), and DC cabling. The K3 provides both voltage and current monitoring (pg. 34).
- **General problem with firmware behavior:** (1) Check all relevant menu settings (see MAIN and CONFIG menu listings in the previous section). In addition to the information in the manual, each menu entry provides help text by tapping **DISP**. (2) Try loading the latest microcontroller and DSP firmware. Review the release notes for changes that may be related to your symptoms. (3) If the above suggestions don't help, you can try reinitializing the firmware (pg. 55). **Be sure to save important parameter settings first.**

## Module Troubleshooting

### Error Messages (ERR xxx)

An error message may be displayed on VFO B at power-up or during normal operation. In most cases error messages are due to a problem with a single option module, and may be due to incorrect firmware configuration.

**If you see an error message on VFO B (ERR XXX):** Write down the error message, as well as any associated error data shown on the VFO A display (e.g. **E 00005**). Then tap any switch to clear the error code. Multiple errors may occur; in this case, write down each of the messages and VFO A data, if any, before you clear them.

**See Error Msg table (below) for details on specific ERR messages and their associated data values.**

### Module Removal

⚠ **TURN OFF THE POWER SUPPLY OR DISCONNECT THE POWER SUPPLY CABLE before removing or installing modules. If you drop a metal tool inside the K3 with power still applied, you can short a power supply or control line, resulting in damage to the RF board or other modules.**

*** Module de-installation procedure:** To see if an option module is the cause of an error message, you must *de-install* it as described below, or you may not be able to tell if removing the module had any effect:

- Turn off power
- Remove the module
- Set the associated CONFIG menu entry to **NOT INST.** (See *CONFIG:KAT3*, etc.) **Note:** If the affected module is on the KRX3 (sub receiver), you must tap **SUB** to display its configuration setting. Otherwise the setting shown applies to the main receiver. This applies to the KBPF3 and KNB3 modules, as well as crystal filters, all of which are duplicated on the RF and sub receiver boards.
- Turn power off and wait at least 5 seconds
- Turn power back on

## Error Message List

| Error Msg | Problem | Troubleshooting steps |
|---|---|---|
| ERR 12V | The circuit breaker on the KPA3 module may be open. PA drops into bypass mode, fans switch to level 2, and PA temp display mode is not available. | Check for short from PA module's 12V line to ground. If there's no short, try resetting the circuit breaker. If there is a short, remove the KPA3 module. Set *CONFIG:KPA3* to **PAIO NOR**. While waiting for a replacement, you can use the K3 at reduced power. |
| ERR AT3 | KAT3 not responding | ***De-install** the KAT3 module (see above). If this eliminates the error message, the KAT3 may be defective. You can substitute a KANT3 antenna input module temporarily, if available. |
| ERR BP1 | No response from RF board BPF shift registers | * **De-install** option modules one at a time |
| ERR BP2 | No response from KBPF3 option shift registers | ***De-install** KBPF3 on RF board |
| ERR BP3 | No response from sub RX BPF shift registers | ***De-install** the KRX3 module |
| ERR BP4 | No response from sub RX KBPF3 option | ***De-install** the KBPF3 module on KRX3 |
| ERR DS1 | No main DSP SPI echo | Reload DSP1 firmware |
| ERR DS2 | Main DSP SPI echo not inverted | Reload DSP1 firmware |
| ERR DS3 | No AUX DSP SPI echo | Reload DSP2 firmware. Note: *CONFIG:KRX3* must be **OFF** unless the KRX3 option is installed, which includes the aux DSP module (DSP2). |
| ERR DS4 | AUX DSP SPI echo not inverted | Reload DSP2 firmware. Note: *CONFIG:KRX3* must be **OFF** unless the KRX3 option is installed, which includes the aux DSP module. |
| ERR DSE | Missing echo from a DSP command | Reload DSP1 firmware (and DSP2 firmware, if applicable). |
| ERR DSX | Extended DSP command timeout | Reload DSP1 firmware (and DSP2 firmware, if applicable). |
| ERR EE1 | On-chip EEPROM read/write test failed | MCU may be defective (front panel). Try re-loading MCU firmware first; then try initializing parameters (pg. 55) |
| ERR EE2 | External EEPROM read/write test failed | EEPROM may be defective (front panel). Try re-loading MCU firmware first; then try initializing parameters (pg. 55) |
| ERR FW2 | General firmware problem | Try re-loading MCU firmware first; then try initializing parameters (pg. 55) |
| ERR IF1 | RF board IF **GROUP** not responding (A6810 or KNB3-U2) | ***De-install** the KNB3 module on RF board. **Note:** The K3 cannot be operated without a KNB3, because this module includes T-R switching circuitry. Do not attempt to bypass it using jumpers. |

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|---|---|---|
| ERR IF2 | Sub RX IF GROUP not responding (A6810 or KNB3-U2) | ***De-install** the KNB3 module on KRX3 first (tap SUB when in the KNB3 menu entry). If that doesn't eliminate the error message, de-install the KRX3 module. **Note:** The sub receiver cannot be operated without a KNB3, because this module includes T-R switching circuitry. Do not attempt to bypass it using jumpers. The main receiver can still be used. |
| ERR IO1 | MISO line stuck low (asserted) | * **De-install** option modules one at a time. If no failing option module can be found, there may be a problem on the RF board. |
| ERR IO3 | KIO3 not responding | The KIO3 may be defective. **Note:** The K3 ***can*** be operated temporarily without the KIO3 installed. You'll need to use headphones, and there will be no computer or AF I/O available on the rear panel. |
| ERR LPF | No response from LPF shift registers | * **De-install** option modules one at a time. If no failing option module can be found, there may be a problem on the RF board. |
| ERR PA1 | KPAIO3 module not responding | Remove the KPA3 module and set *CONFIG:KPA3* to **PAIO NOR**. If this eliminates the error message, the problem is likely to be on the KPA3 module. If not, the problem may be on the KPAIO3 module; remove it as well, and set *CONFIG:KPA3* to **NOT INST**. |
| ERR PL1/2<br><br>ERR SY1/2<br>ERR SY3/4<br>ERR SY5/6<br><br>ERR VCO<br>ERR VC4 | VPLL out of range on band change (to view actual PLL voltage, set *CONFIG: TECH MD* to **ON**, then tap **DISP** and use VFO B to locate the **PLL1** and **PLL2** voltage displays).<br><br>General problem with PLL, VCO, or other circuitry on a synthesizer module.<br><br>VCO calibration errors. VFO A will show error data, e.g. **E 00039**; report this value to Elecraft customer support. | Verify that the oscillator can on the KREF3 is fully plugged in and is not in backwards. Make sure all internal cables are plugged in, specifically the cables between the KREF3 and KSYN3 modules (synthesizers). Try re-calibrating the applicable VCO (*CONFIG:VCO MD*) (tap SUB within the menu entry if you saw ERR PL2, to make sure you're calibrating the sub receiver's synthesizer). If this doesn't work, try removing the 2nd synthesizer (for the sub receiver), and set *CONFIG:KRX3* to **NOT INST**. If this eliminates the error, the sub synth may be defective. You can also try swapping it with the main synth to see if it can be calibrated in this slot. |
| ERR REF | Missing KREF3 module | Verify that the oscillator can on the KREF3 is fully plugged in. Make sure all internal cables are plugged in between the KREF3 and other modules. If this doesn't help, the problem may be on the KREF3 module or the RF board. Note: The K3 cannot be used without a KREF3 module. |

| | | |
|---|---|---|
| ERR TXG | Transmit gain constant out of range | This usually indicates a problem with band-pass filter alignment or one of the low-pass filters. In either case it could affect one or two bands. See service manual. |
| ERR XV3 | KXV3 not responding | ***De-install** KXV3 module |

# Theory Of Operation

Please refer to the block diagram of the K3 shown at the end of this section. Schematics and additional details can be found in the K3 Service Manual.

## RF BOARD

The RF PCB (Printed Circuit Board) is the heart of the K3 transceiver, both physically and electrically. During assembly, it serves as an attachment point for other PCBs as well as chassis panels, acting as the glue that holds things together. During operation, the RF board provides signal routing to and from all modules.

Over two-thirds of the RF board's components are surface mount devices (SMDs), located on the bottom side of the board. These are pre-installed and tested at the factory. The use of SMDs minimizes stray coupling in RF circuits, reduces system cost, and allows the K3 to fit in a modest-size enclosure, compatible with home or field operation.

The RF board is divided into several functional areas, which are described below.

### *Low-Pass Filters (LPFs)*

The relay-switched low-pass filters, used during both transmit and receive, are located in the back-right corner of the RF board. These filters can easily handle 100 watts, and are common to both the K3/10 and K3/100. Some LPFs cover one band, while others cover two bands that are close in frequency. The input to the LPF section comes from the KPA3 100-W amplifier module, if installed; if there's no KPA3, the input comes from the 10-W amplifier (see below). The output of the low-pass filters is routed through the forward/reflected power bridge, then on to either the antenna input module (KANT3), or the KAT3 automatic antenna tuner, which plugs in at far right.

### *Low-Power Amplifier (LPA) and T/R Switching*

The large hole near the back-middle area of the RF PCB is where the 10-W low-power amplifier module plugs in. The LPA has three connectors that mate with the RF board, and its power transistors attach to the rear bottom cover, which serves as a heat sink. This construction method allows the 10-W module to be tested separately during production. Also in this area is the T/R (transmit/receive) switch, but you'll need to turn the RF board upside down to see most of the components. The K3's T/R switch uses high-power, high-isolation PIN diodes rather than relays, resulting in no switching noise during keying.

### *Low Power Amplifier (LPA)*

The low-power amplifier module is capable of up to 12 W power output, and in the case of the K3/10, is the final amplifier stage. In the K3/100, it provides drive to the KPA3 module. The LPA has three gain stages, the last two of which use high-power MOSFET transistors to allow coverage up through 6 meters. At the input to the first gain stage is a 5-dB attenuator, which is switched in under firmware control at certain power levels to optimize transmit gain distribution.

### *Band-Pass Filters (BPFs)*

At back-left is the bank of ham-band BPFs. These filters are just wide enough to cover each ham band, so they provide good rejection of IMD products during both transmit and receive. Hi-Q components, including large toroids, ensure low loss and high signal-handling capability. General coverage receive capability can be added to the K3 with the KBPF3 option, which includes another 8 band-pass filters that cover all of the areas from 0.5 to 28 MHz that are not covered by the filters on the RF board. The KPF3 module mounts directly above the main BPF array, and due to very short connections, has no effect on the performance of the main BPFs during ham-band operation.

### First I.F. Stages

The front-left portion of the RF board is dedicated to the receive/transmit first I.F. (intermediate frequency) circuitry, most of which is on the bottom of the board. The first I.F. is 8.215 MHz, which is low enough to permit the construction of high-quality, narrow-band crystal filters, but high enough to offer good image rejection. The I.F. stages are reversible; i.e., they're used in one direction in receive mode, and the other during transmit. In receive mode, the filtered signal from the BPFs is first routed through a relay-switched attenuator, then to a low-noise diode-switched preamp, high-level switching mixer, and post-mixer amp. The signal next encounters the noise blanker (KNB3), then the crystal filters (see below),

### Crystal Filters and 2nd I.F.

In either receive or transmit mode, the I.F. signal is routed to one of up to five plug-in, 8.215-MHz crystal filters (FL1-FL5). These can be fixed-bandwidth, or in the case of FL3-FL5, optionally variable-bandwidth. Following the crystal filters is the receive I.F. and second mixer, which mixes the 8.215 MHz down to an I.F. of 15 kHz for use by the digital signal processor module (DSP). Excellent 2nd-I.F. image rejection is obtained by cascading an additional crystal filter just ahead of the second mixer. There's also a 15 kHz transmit I.F., which is mixed up to 8.215 MHz on the KREF 3 module, which plugs in near the front-middle of the RF board.

### Support Circuitry

Several other modules plug into the RF board. The KPAIO3, located at the back edge of the RF board, is a vertically mounted board used as an interface between the RF board and the KPA3 100-W amp module. It provides current sensing, bypass relay, and other functions for the KPA3, and eliminates the need for any interconnecting cables. The KIO3 and KXV3, in the back left corner, provide RF, audio, and digital I/O. The main synthesizer, used for the main receiver as well as the transmitter, plugs in at front left and is attached to the front shield. To the right of this is the reference oscillator module (KREF3), as well as the second synthesizer, used for the sub receiver. These also attach to the front shield. The Front Panel/DSP module plugs in at the very front of the RF board. Finally, at the far right you'll find two low-noise linear voltage regulators, one for 5 volts and the other 8 volts. Both are heat-sinked to the right side panel.

### Noise Blanker

There are two noise blanker subsystems in the K3: the KNB3 module, and a DSP-based blanker (see *DSP* on page 64). The KNB3 is a narrow I.F. pulse blanker that plugs into the RF board. Its broad input bandwidth ensures minimum stretching of fast noise pulses, so it's ideal for suppressing noise from power lines, thunderstorms, and auto ignitions. The DSP blanker can be used on many other types of noise, including radar and other noise with complex waveforms that might cause heavy intermodulation if an I.F. blanker were engaged. Using the two blankers in combination is often extremely effective.

The KNB3 includes a triple-tuned bandpass/time-delay filter, wide-range AGC, and a noise gate. You can think of the noise gate as a switch that is normally closed, allowing received signals to pass unimpeded. When a noise pulse appears, it is amplified to a high level and used to trigger a *one-shot* circuit. This opens the noise gate very briefly (from 5 to about 100 microseconds) to blank the noise pulse. Both the threshold at which blanking action occurs and the length of time the gate is opened are under control of the operator.

### 1st Mixer

The 1st mixer combines signals from the input band-pass filters with the output of the synthesizer to obtain the 1st I.F., at 8.215 MHz. The mixer is based on a video switching IC with very low ON resistance, resulting in low loss and high signal-handling capability. Since this type of mixer requires low drive, there's very little leak-through of the local oscillator (synthesizer) signal. The mixer also incorporates a balanced VHF low-pass filter to suppress both internally and externally generated VHF/UHF spurs. This keeps the K3's HF spur complement extremely low, despite the use of a down-conversion system architecture.

## KANT3 and KAT3

The basic K3/10 includes a KANT3 antenna input module. If you've ordered a KAT3 antenna tuner, the KANT3 is not required and will not be supplied with the kit. In either case, the module plugs into the RF board at the back-right corner. Both the KANT3 and KAT3 provide antenna surge protection, as well as resistors for bleeding off static DC charge. The KAT3 provides a wide-range, switchable C-in/C-out L-network for matching a variety of antennas with SWR as high as 10:1 (100 W) or 20:1 (10 W). There are 8 inductors and 8 capacitors in the L-network, each switched with a DPDT relay for high reliability. The KAT3 also includes a second antenna jack and associated switching relay. There's an additional jack on the board for routing the unused (non-transmit) antenna to the KRX3 sub receiver module.

## KIO3

All audio and digital/computer I/O is routed through the KIO3. The KIO3 is made up of three PC boards: Main, Audio IO and Digital IO.

The Main KIO3 board plugs directly into the RF board. It includes a relay to disconnect the right speaker channel in case a mono speaker is plugged into the external speaker jack, isolation transformers for Line In and Line Out signals, a connection point for the internal speaker, a low-noise oscillator to provide voltages for the RS232 serial interface, and various control line inputs and outputs for external transverters, band decoders, and the like. This board also contains a differential output microphone amplifier to equalize the gain between the front and rear microphone jacks, as well as to provide noise immunity for the microphone signal from the rear panel area.

Circuitry to allow use of the serial port RTS or DTR signal lines as PTT and/or KEY inputs is also located on this board. This feature is to support logging and control programs which may use these lines for controlling transmit/receive switching or CW keying.

The Digital IO board plugs into the KIO3 Main board. It includes a DE-9 serial port connector for use with an external PC, and a DE-15 accessory connector for external band decoders (such as the KRC-2), transverters (such as the Elecraft XV-series), and similar devices. It is also the connector to which direct FSK or PSK signaling is applied.

The Audio IO board includes three stereo outputs: headphone jack, speaker jack, and a transformer-isolated Line Out jack. It also provides two monophonic inputs: microphone and an isolated Line In. The Microphone jack can provide bias for an electret microphone when enabled via the *MAIN:MIC SEL* menu entry.

Both Digital and Audio IO boards include extensive bypassing and decoupling to help prevent RF signals getting into the radio through cables attached to their respective connectors.

## Front Panel and DSP

The Front Panel is a large plug-in module that includes both the Front Panel and DSP boards, as well as the Aux DSP (if a sub receiver is installed) and digital voice recorder module (if the KDVR3 option is installed).

### *Front Panel Board*

This board provides the K3's user interface: 35 custom-labeled switches; two dual-concentric potentiometers for gain and squelch control; seven shaft encoders; custom, 240-segment, high-contrast LCD; and 13 discrete LED indicators. Mic and headphones can be plugged into the front panel, or optionally at the rear panel (see KIO3 description, pg. 63).

The Front Panel PCB also includes the microcontroller unit (MCU), which manages the operation of the K3. All inputs, whether from a switch, knob or external PC, are recognized and acted on by the MCU. All control outputs – such as switching from transmit to receive, sending a CW code element, adjusting the transmitter power, controlling LED brightness, etc. – are produced by the MCU.

The Front Panel also contains a large amount of EEPROM memory for parameter storage, and FLASH memory for program storage. This allows the K3 to be re-programmed with the newest firmware by a simple download from the Internet. It also enables the K3 to remember your favorite settings, particular configuration preferences, and the last setting of controls when power is removed from the radio.

### *DSP Board*

The K3's Digital Signal Processing (DSP) capabilities provide a rich set of features to help combat QRM and QRN while generating some of the cleanest signals to be found in Amateur radio today. A 32-bit floating point DSP is used for highest performance.

In receive, a 15 kHz IF signal from the RF board is buffered and then digitized by a 24-bit Analog to Digital Converter (ADC). This provides over 100 dB of dynamic range within the passband of the selected crystal (roofing) filter. After the ADC, the DSP converts the signal into a floating point value so dynamic range is not compromised during further processing. Noise blanking and limiting, AGC, amplification, IF and AF filtering are all done within the DSP. Several noise blanking algorithms (methods) are available in the DSP, and a sophisticated AGC system is employed. AM, FM, SSB and CW detectors are also implemented by the DSP. Various audio effects, such as Quasi-Stereo and Binaural, are provided here as well as combining the audio signals from the KRX3 (if installed).

After processing, the resulting audio signals are generated in a stereo 24-bit Digital to Analog Converter (DAC) and applied to separate amplifiers for headphones (front and rear) and speaker. A separate 24-bit DAC and amplifier provide Line Out signals that are not affected by the AF Gain control. This output is typically used by sound card digital mode software.

In transmit, Line In, rear or front Microphone signals are sent to a 24-bit ADC and then processed by the DSP. In speech modes (SSB, AM and FM) and soundcard-based data modes, VOX is derived from these signals as well as receive audio. Microphone equalization, bandpass limiting, conversion to 15 kHz IF, envelope clipping and filtering (if applicable) are all done in DSP, then the signal is passed to another 24-bit DAC and presented to the RF board as a 15 kHz IF signal. Direct FSK, direct PSK and CW signals are generated within the DSP for those modes.

Thus, the DSP is responsible for all signal processing between audio and the 15 kHz IF for both receive and transmit. Like all other modules in the K3, the DSP is managed by the MCU.

The DSP board is piggybacked onto the Front Panel board as part of the Front Panel assembly. The Auxiliary DSP (used if the KRX3 Second Receiver Option is installed) and the KDVR3 option plug into the DSP board.

## KREF3

The KREF3 module's 49.380-MHz temperature-compensated crystal oscillator (TCXO) is the common signal source for the K3's synthesizers. This signal is also divided by 6 to provide the 8.230-MHz signal used by the second receive and transmit mixers. Firmware is used to compensate for any small drift in the TCXO and its derived signals, resulting in excellent stability (with the high-stability option, better than +/- 0.5 PPM over the 0 to 50 C temperature range). In addition to the TCXO and dividers, the KREF3 provides the 2$^{nd}$ transmit I.F. mixer, which converts the DSP's 15-kHz transmit I.F. output to 8.215 MHz. This signal passes through a wide crystal filter to ensure good rejection of the carrier and other mixer products before being routed to the RF board. The KREF3 obtains its DC and low-frequency I/O signals via an 8-pin connector on the RF board, but its RF outputs are fed to the RF board (and sub receiver, if applicable) via coax cable assemblies.

## KSYN3

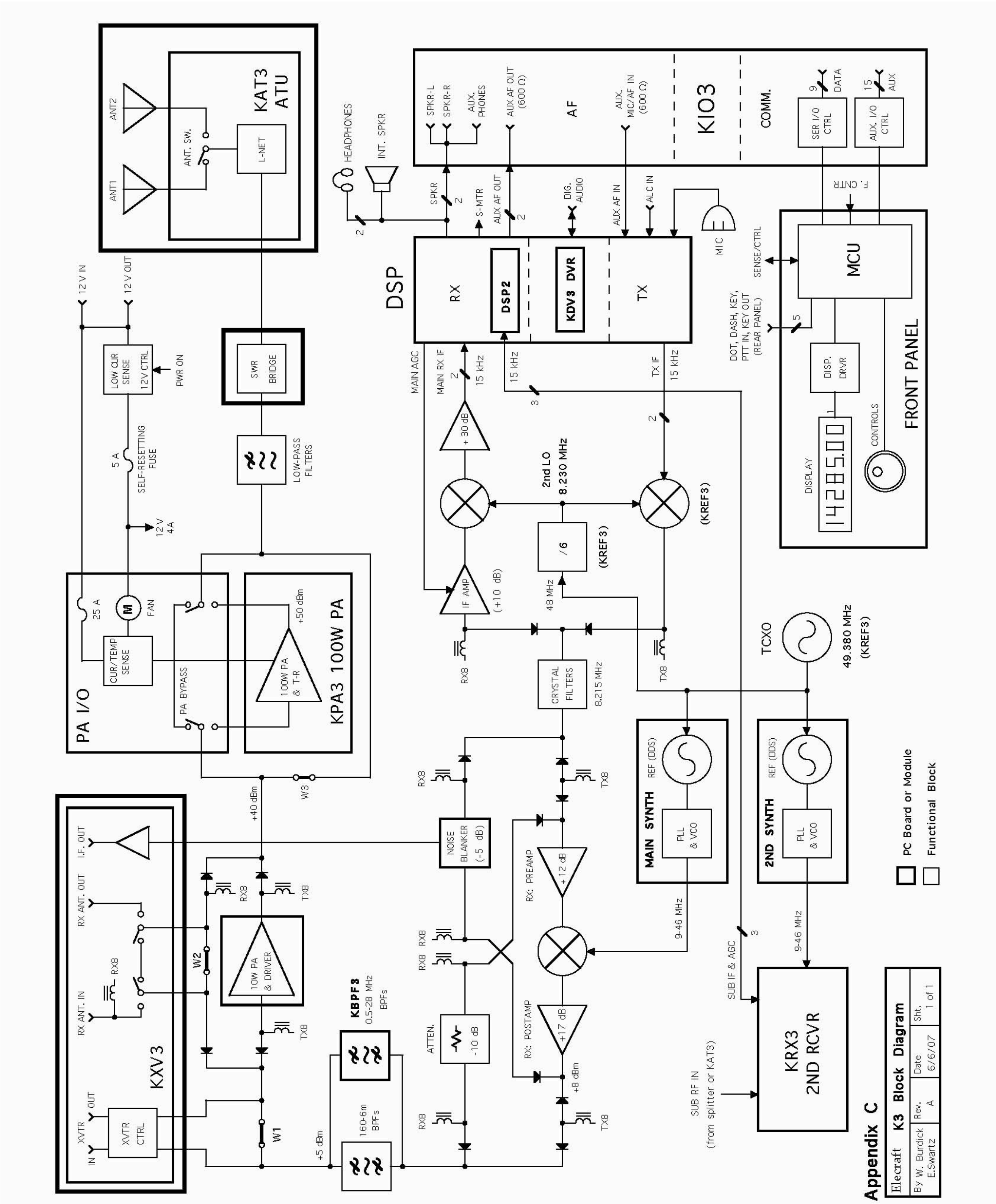
Low phase noise is key to both receiver and transmitter performance. In the K3's synthesizer module (KSYN3), we start with a clean, wide-range voltage-controlled oscillator (VCO). The VCO frequency is placed near the desired band of operation using 128 carefully-selected L-C combinations, which keep the ratio of fixed capacitance to tunable capacitance (varactor diodes) as high as possible.

The VCO is held exactly on frequency by a phase-locked-loop IC (PLL), which samples the VCO output continuously and compares it to its high-stability reference input. The PLL's reference input is obtained from a direct-digital-synthesis (DDS) IC, which is tunable in about 0.2-Hz steps. The reference for the DDS itself is the 49.380-MHz signal from the KREF3 module.

To keep the synthesizer's output signal virtually spur-free, the DDS is followed by a 4-pole crystal filter. This eliminates both directly-occurring spurs and the Nyquist sampling spurs that normally accompany a DDS-driven PLL system.

The combination of all of these noise-minimization techniques results in very low phase noise and negligible discrete spur content.

# K3 Block Diagram



# Appendix A: Crystal Filter Installation

**Damage to your K3 due to electrostatic discharge (ESD) can occur if you don't take proper precautions. <u>Such damage is *not* covered by the Elecraft warranty, and could result in costly repairs.</u> We recommend that you use an anti-static mat and wear a conductive wrist strap with a series 1-megohm resistor. An alternative is to touch an unpainted, grounded metal surface frequently while you are working. Do this only when you are not touching any live circuits with your other hand or any part of your body.**

**To avoid marring the finish, place a soft cloth under cabinet panels; do not lay them directly on your work surface. Also, do not use a power screwdriver of any kind, as it can slip and gouge the paint.**

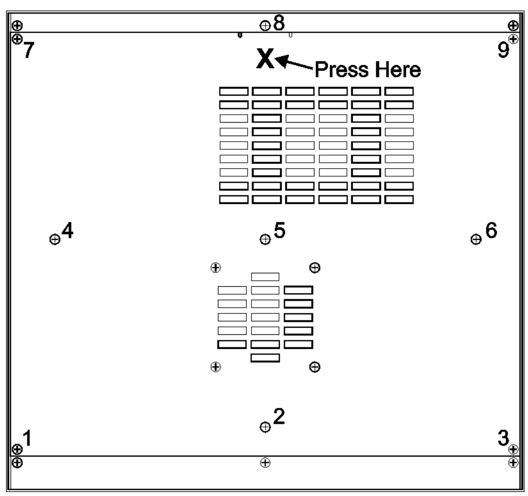
### *Installation Procedure*

☐ Disconnect the power cable and all other external cables from the K3.

☐ Remove ***only*** the top-cover screws identified in the drawing below.

☐ Press gently at the indicated point near the back edge (**X**), then lift off the top cover at the front. Unplug the speaker, then set the top cover aside in a safe place.

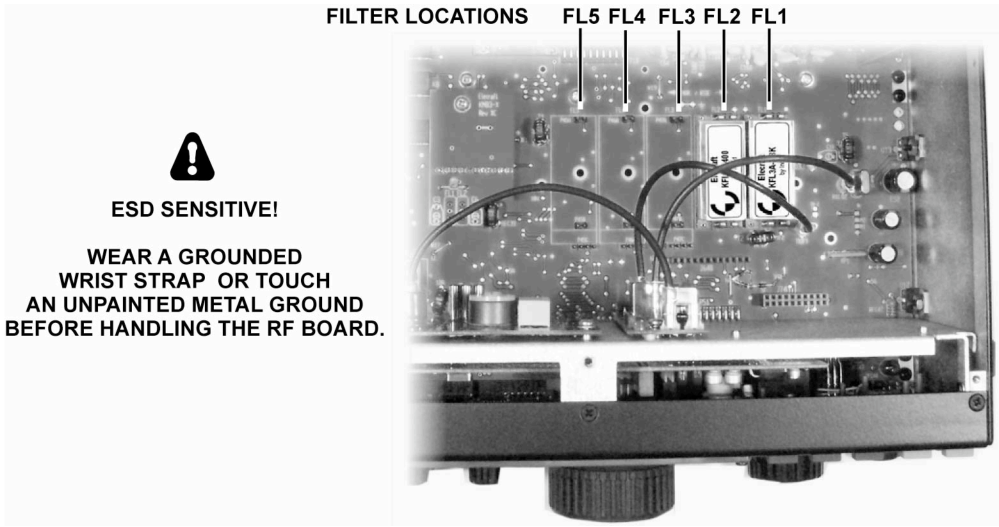
The screws that hold the top cover in place are an important part of the K3's structural design. Please be sure to re-install all of them afterward.



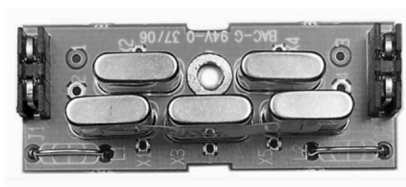

**Put on your wrist strap or touch a grounded surface before touching any K3 components or modules in the following steps.**

☐ If you have the KRX3 option installed, refer to its manual for instructions on removing the sub receiver module.

☐ Locate the crystal filters you presently have installed in slots FL1 - FL5 on the RF board (or sub receiver).




ℹ There may be a mix of 5-pole filters (below left) and 8-pole filters (right).




☐ Review the information below to ensure that your crystal filter setup conforms to K3 requirements.

You can install up to five crystal filters (FL1-FL5) on the RF board, and five on the sub receiver (KRX3). FM operation requires a 12.5 kHz or wider filter. AM transmit requires a 6 kHz filter, and SSB/DATA/CW transmit requires a 2.7 or 2.8 kHz filter; other bandwidths can be used for receive in these modes. Filters as narrow as 200 Hz can be used for CW and narrow-band data receive. A mix of 5-pole and 8-pole filters can be used.

**There are two rules regarding where these filters can be installed in the K3 and how they're used:**

**Rule #1:** If you plan to use a particular filter for both ***transmitting*** and ***receiving*** (main receiver), you'll need to install it on the ***RF board***. You can optionally install a filter of the same or similar bandwidth on the sub receiver for receive-only use. (This is recommended since it will keep the receivers identical.)

**Rule #2:** You can install any filter in any slot, and can leave any slot empty in anticipation of installing a crystal filter there later. However, you should install the ***widest*** filter closest to ***FL1***, the ***next widest*** to its ***left***, etc. Here are two examples that could each apply to either receiver, assuming you follow the rules above:

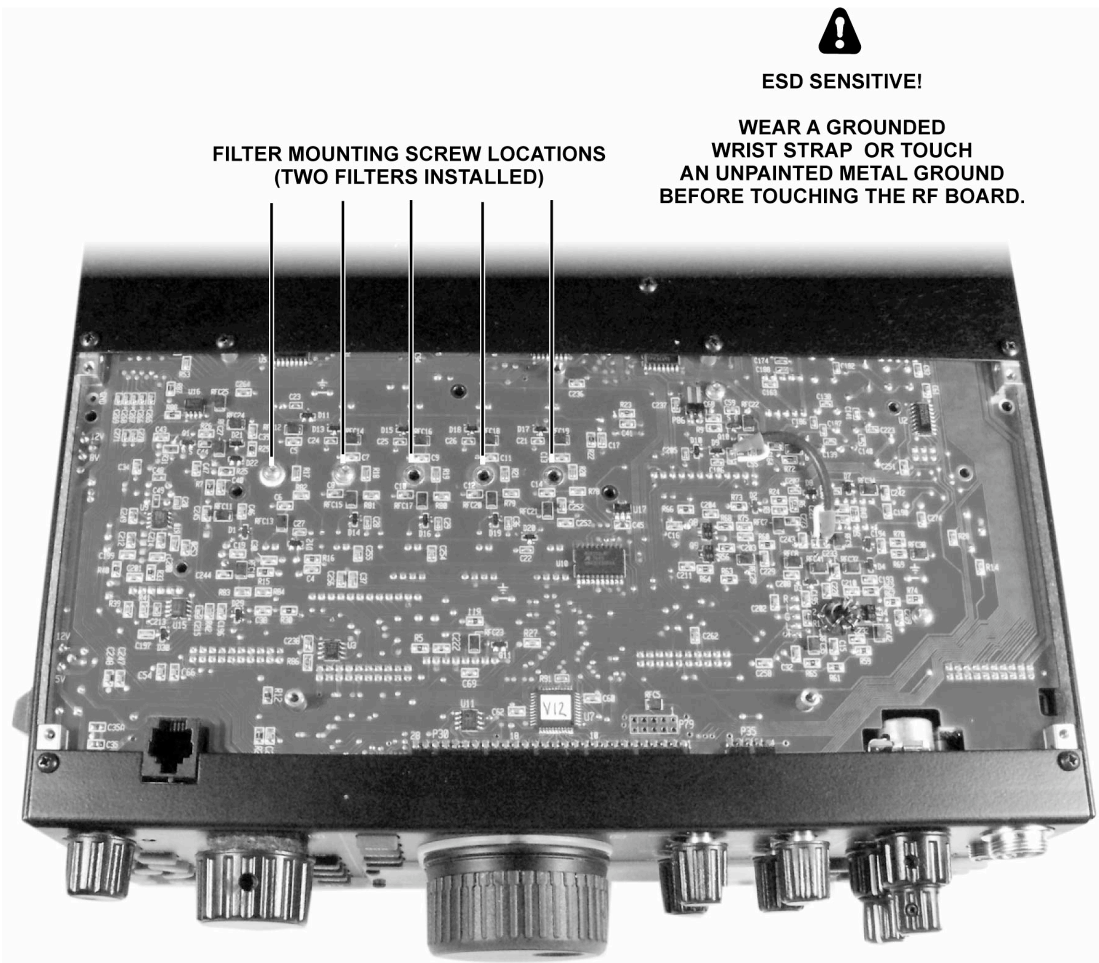
| | | | |
|---|---|---|---|
| FL1 | 6 kHz (AM) | FL1 | {saved for FM filter} |
| FL2 | 2.7 kHz (SSB/CW/DATA) | FL2 | 6 kHz (AM) |
| FL3 | 1.8 kHz (SSB/CW/DATA) | FL3 | 2.8 kHz (SSB/CW/DATA) |
| FL4 | 500 Hz (CW/DATA) | FL4 | {saved for variable-bandwidth filter} |
| FL5 | 200 Hz (CW/DATA) | FL5 | 400 Hz (CW/DATA) |

☐ Fill in the table below (include sub receiver info, if applicable). Use pencil, since you may change the configuration later. **BANDWIDTH** can be obtained from the model number of each filter. 5-pole filters have a **FREQ OFFSET** marked on the side of one of the crystals, e.g. "-0.85". The offset for all 8-pole filters is 0.00.

| RF BOARD (MAIN RX & TX) | | | SUB RECEIVER (RX ONLY) | | |
|---|---|---|---|---|---|
| **POSITION** | **BANDWIDTH** | **FREQ OFFSET** | **POSITION** | **BANDWIDTH** | **FREQ OFFSET** |
| **FL1** | | | **FL1** | | |
| **FL2** | | | **FL2** | | |
| **FL3** | | | **FL3** | | |
| **FL4** | | | **FL4** | | |
| **FL5** | | | **FL5** | | |

☐ **If you'll be changing RF board filters:** Turn the K3 upside down, placing a soft cloth beneath it. Remove the seven black pan head screws retaining the front bottom cover, then lift the cover off.

☐ Remove the screws holding any existing filters that you'll need to move to obtain the order listed above (on both the RF board and sub receiver).



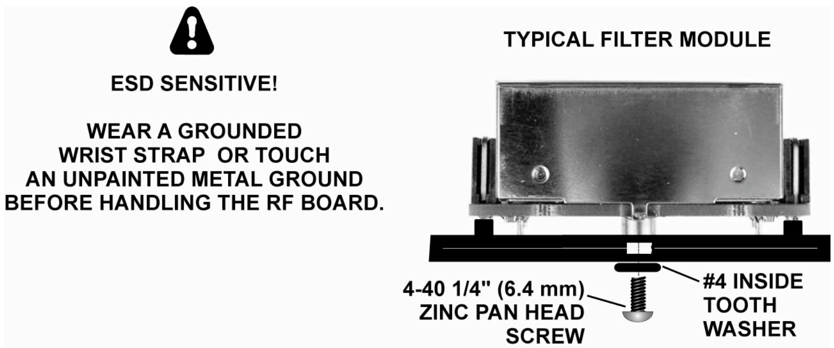
☐ Turn the K3 right side up. Unplug all filters to be repositioned ***(those whose mounting screws have been removed***). Lift the filters at each end carefully, first one end then the other, until the connectors separate.

☐ Reposition the filters as required. They will only fit one way. If you put one in backwards, it will not fit within its outline, and the standoff will not line up with the screw hole in the RF board (or subreceiver board).

☐ Turn the K3 (or sub receiver module) upside down again. Install the mounting hardware shown below.

⚠ **Filters may be supplied with either a black 3/16" or bright-plated 1/4" pan-head screw. A screw longer than 1/4" may extend into the 8-pole filter unit and damage it.**

⚠ **Do not over-tighten the screws. Excess torque may pull out the threaded standoff.**



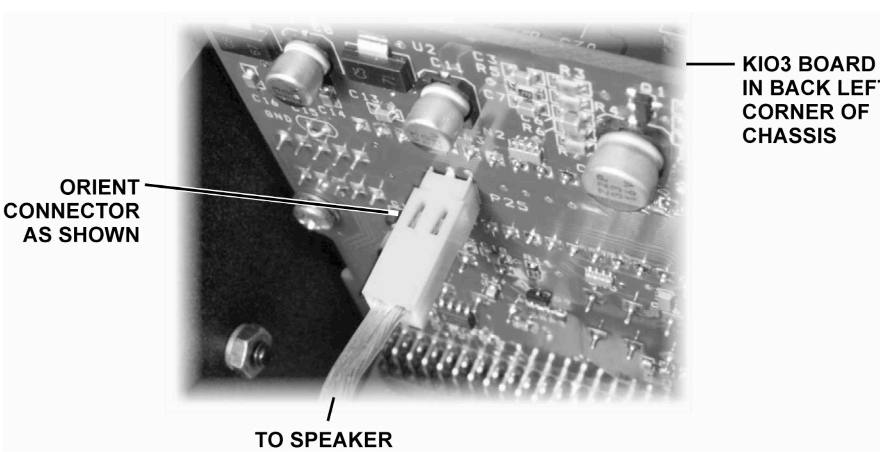

☐ Re-install the bottom cover (if applicable) using seven 4-40 x 3/16" black pan head screws. Replace the screws securely, but do not over tighten them. All screws must be used to maintain shielding performance.

ℹ The top cover and sub receiver (if applicable) will be re-installed in at later step.

☐ Turn to **Crystal Filter Setup** (pg. 43). Follow all instructions for the main receiver and transmitter.

☐ If you have the KRX3 option, re-install the sub receiver module as described in the KRX3 manual. Then turn to **Crystal Filter Setup** and follow all instructions for the sub receiver.

☐ Position the top cover on the K3, with its rear tab inserted *under* the top edge of the rear panel. Then plug the speaker wire into P25 on the KIO3 board at the left rear of the K3.




☐ Secure the top cover with 4-40 x 3/16" flat head screws at all locations.

***This completes crystal filter installation.***