ELECRAFT® KPA1500

1500-WATT AMPLIFIER

OWNER'S MANUAL

Introduction

On behalf of our entire design team, we'd like to thank you for choosing the Elecraft KPA1500 amplifier.

The KPA1500 offers a unique combination of features. It's one of the smallest 1500-W amplifiers available. The power supply is in a separate enclosure for ease of station layout.

The KPA1500 is capable of fully automatic operation, yet has an alphanumeric display and a full complement of front panel switches for precise manual control. A comprehensive remote-control command set is also included.

The KPA1500 can be used with nearly any transceiver, thanks to its instantaneous RF-based band switching, advanced protection circuitry, adjustable ALC, and extensive parametric monitoring. It also has inputs that allow direct band switching from many popular transceivers. T/R is completely noise-free thanks to the use of PIN-diode switching.

The KPA1500 comes with a built-in Automatic Antenna Tuner (ATU) that can handle a load SWR up to 3:1 at the full 1500 watt output in any mode.

Of course the KPA1500 is an ideal companion for the Elecraft K3S and K3 transceivers, both physically and electrically. The Elecraft K3S or K3 can sense whether the amp is in standby or operate mode, then select the appropriate per-band power settings. This allows you to set up the K3S or K3 for "barefoot" operation at one power level on each band, and then switch the amp to operate and set up optimal drive levels for full 1500-W output. The K3/KPA1500 combination is also capable of extremely fast break-in, especially when the K3S or K3 is placed in QRQ (high-speed CW) mode. The two are so well-integrated that you can use the per-band switches on the amplifier to change bands at the transceiver.

If you use the KPA1500 with both the K3S or K3 transceiver and P3 panadapter – our new "K-Line" – you'll enjoy a high degree of operating convenience, along with world-class performance *and* the power to get the job done.

73,

Wayne, N6KR

Eric, WA6HHQ

Contents

⚠ Elecraft manuals with color images may be downloaded from www.elecraft.com.

⚠ WARNING

Dangerous Voltages are Present Inside the KPA1500 and its Power Supply

Do not turn on or operate the amplifier or power supply with the covers off.

Before opening the KPA1500 RF Deck or Power Supply enclosures:

1. **Turn off the KPA1500 by tapping the front panel ON switch and wait until the fan stops. (The fan drains the power supply to a safe voltage.)**

2. **Turn off the power supply breaker switch (on the rear panel).**

3. **Disconnect the two Power Supply cables at RF Deck rear panel before opening the RF Deck enclosure.**

4. **Disconnect the Power Supply from the mains before opening the cover.**

Key to Symbols Abbreviations and Text Styles

⚠	**Important – read carefully**
ⓘ	Operating tip
TEMP	*Tap* switch function (labeled *above* a switch; press for less than 1/2 second)
PK HOLD	*Hold* switch function (labeled *below* a switch; press for at least 1/2 sec. to activate)
INHIBIT	Typical text appearing on the LCD.
LED	Light Emitting Diode
LCD	Liquid Crystal Display

⚠ CAUTION

Follow the instructions under a Caution to avoid damage to the equipment.

⚠ WARNING

Follow the instructions under a Warning to avoid serious personal injury.

FCC-Mandated Part 15 Notice for the Computer Interface Ports:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a different circuit from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Regarding the computer interface: changes or modifications not expressly approved by Elecraft could void the user's authority to operate the equipment.

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Watsonville, CA 95076
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In the Box

Included

ITEM	ELECRAFT PART NUMBER
RF Deck	E850767
Power Supply with AC Line Cable	E850766
DC Power Cable	E770024
DA-15 "Umbilical" Cable	E770017
Phono-Phono Key Line Cable	E100416
USB A-B Cable	E980299
Owner's Manual	E740301

Optional

ITEM	ELECRAFT PART NUMBER
KPAK3AUX Cable set for K3s or K3	KPAK3AUX
KXUSB Serial Cable for KX2 or KX3	KXUSB

Installation

Installation consists of the following:

- Positioning the KPA1500 RF Deck and Power Supply to provide for proper cooling (page 7).
- Connecting the KPA1500 RF Deck and Power Supply (page 7)
- Cabling the KPA1500 RF Deck to your other station equipment (page 8).

The KPA1500 RF deck rear panel is shown in Figure 1. The connectors and controls are described following the figure.
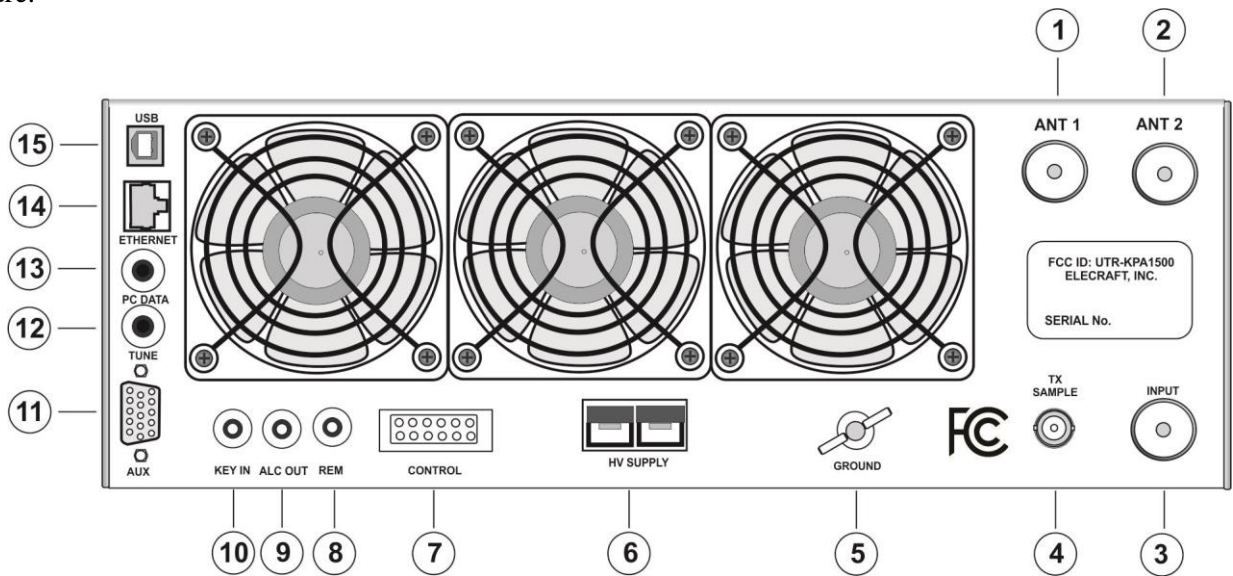

Figure 1. KPA1500 RF Deck Rear Panel

① and ② SO-239 RF connectors to antenna system or dummy load.

③ SO-239 connector for RF input from the driving transceiver.

④ Low level KPA1500 transmit signal output.

⑤ Station ground attachment.

⑥ High voltage connection to the KPA1500 power supply.

⑦ Control circuit connection to the KPA1500 power supply.

⑧ Accepts a 12V input for remote control applications to power the KPA1500 on or off.

⑨ Negative-going voltage for transceivers that require ALC. (Elecraft transceivers do not require this connection.

⑩ Key Line: enables the KPA1500 by a short to ground. When grounded the source must sink 5 mA. 5 Vdc open circuit inhibits the KPA1500.

⑪ For interconnecting cable to fully integrate the KPA1500 with an Elecraft K3 or K3s for enhanced mode operation.

⑫ Input signal to the internal KPA1500 automatic antenna tuner (ATU) that emulates an Icom remote ATU when the KPA1500 is used with Icom transceivers.

⑬ Serial Control: Selectable Cl-V for Icom radios or RS232 level information for transceivers such as the K2, KX2, KX3, some Kenwood and Yaesu transceivers. Radio type is selected in the menu.

⑭ Ethernet connection for local or remote operation applications.

⑮ USB connection to virtual COM port for use with the KPA1500 Utility and other computer-based programs.

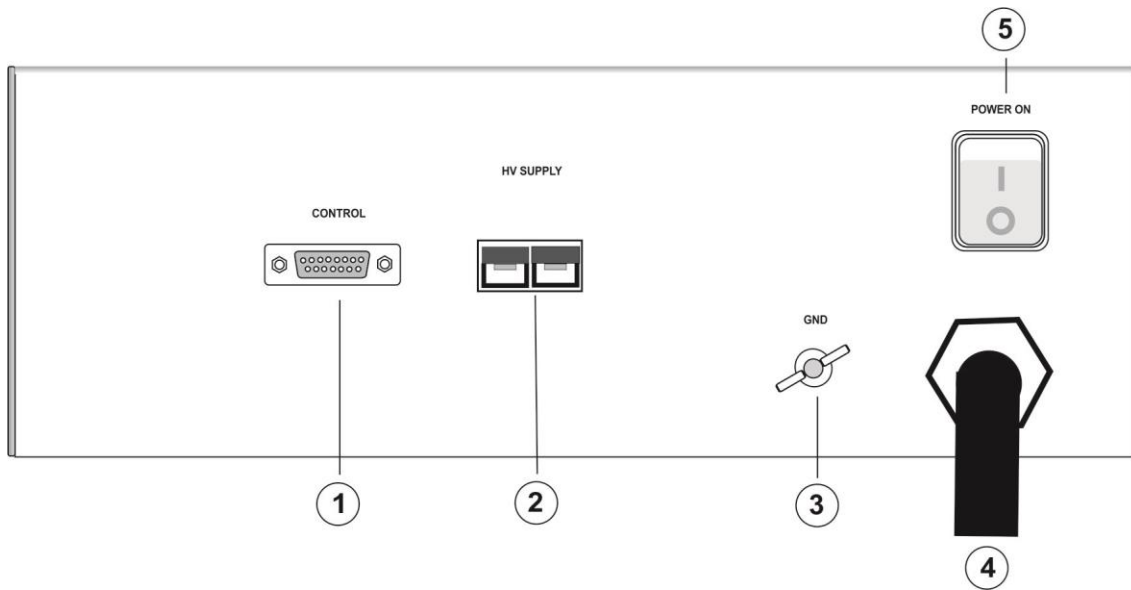The KPA1500 Power Supply Deck is shown in Figure 2.The connectors and controls are described below the figure.

Figure 2. Power Supply Rear Panel.

① Control: DA-15 cable with control and low voltage supplies to the RF deck.

② HV Supply: Main DC power output for the RF deck

③ Ground: Connection to the station ground.

④ AC Power Cable: Supplied with a NEMA 6-20 molded plug. If needed, replace it with a suitable 20A connector for your installation.

⑤ Power ON Switch and Circuit Breaker: Must be in the ON position for the RF deck power switch to function.

Positioning the KPA1500 RF Deck and Power Supply

Provide at least 4 inches (10 cm) clearance behind the RF deck fans and above the Power Supply top cover. Allow at least 1 inch (2.5 cm) clearance around the top and sides if the RF deck and around the sides of the Power Supply for normal cooling air flow.

The supplied cables allow the power supply and RF deck to be placed up to 66 inches (167 cm) apart. The Power Supply can be operated remotely and so need not be positioned within reach of the operator. The fans operate whenever the KPA1500 is on, so you can place the power supply under the operating desk or elsewhere to minimize the sound of the fans.

Cabling – Power Supply

Be sure the POWER ON switch (⑤ . Figure 2) is off before connecting any cables to the Power Supply or RF deck.

An AC power cable with the popular NEMA 6-20 connector is supplied attached to the Power Supply, The NEMA 6-20 connector is compatible with NEMA 6-20R receptacles. Replace the connector if you need a different connection to your mains supply

Connect the Power Supply to the RF deck with the supplied 66-inch (167 cm) cable that has an Anderson PowerPole® connector and a 15-pin connector at each end. Plug the PowerPole connector into the HV Supply connector (⑥) on the RF Deck rear panel (see Figure 1) and the corresponding connector on the Power Supply (②, Figure 2). Observe the polarity; match the colors on the plug with the connectors. *Note that the 75A PowerPole connectors click twice when inserted. There is no electrical connection until the second "click".*

Connect the 15-pin connector to the Power Supply and the Control connector (⑦, Figure 1) on the RF Deck rear panel.

Cabling – RF Deck

⚠ **Always turn the KPA1500 off via the circuit breaker on the power supply before attaching or removing cables.**

The KPA1500 may be used with the Elecraft K3s, K3, K2 or any HF/6 meter transmitter and that has a keying output meeting the requirements shown under note 4 below. Interconnections with the transceiver are shown in Figure 3. The driving transceiver must provide at least 50 watts of RF drive for full output and the output power must be adjustable as described under *Transmitting* on page 15.

Enhanced Mode Operation with a K3 or K3s

The optional KPAK3AUX cable provides closer integration with a K3 or K3S by sharing band information between the KPA1500 and the transceiver. (see Figure 4, page 11). The KPAK3AUX cable provides all the operational features described under Operation (page 13), including coordinated band-switching (page 14). Note that the KPAK3AUX cable also incorporates the KEY IN line. If you need access to this line so that other equipment can bypass the amplifier, you can install the Key Line Interrupter supplied with your KPAK3AUX cable and use a separate key line as shown in Figure 5 on page 12.

⚠ **You must use the Key Line Interrupter when using a separate key line with the KPAK3AUX cable set. Otherwise any external equipment inserted into the key line will not be able to inhibit the amplifier**. You can make cables for use with Yaesu and Icom transceivers that also provide closer integration with the KPA1500. For details of those cables and the KPAK3AUX cable set see *AUX and XCVR Serial Connector Interfaces* on page 32.

⚠ IMPORTANT

1. Connect your station ground to the GND wing-nut ⑤ (see Figure 1 on page 6). A good station ground is important for safety and to minimize local radio frequency interference (RFI).

2. Attach the RF INPUT ③ to the output of your driving transceiver or transmitter using a 50 ohm coaxial cable with a PL-259 male connector on the KPA1500 end.

3. Attach the ANT 1 ① or ANT 2 connector ② to a suitable load with an SWR of less than 1.5:1. A 50Ω 1500W dummy load is strongly recommended for initial testing. Be sure to select the correct ANT connector using the front panel ANTENNA switch before transmitting.

4. The driving transmitter must ground the KEY IN line circuit during transmit while sinking up to 5 mA. This is compatible with virtually all amateur transmitters and no key line buffer is required. If the transmitter Key Output is not a contact closure or equivalent, it must be at a level between +4 and +16 VDC during receive.
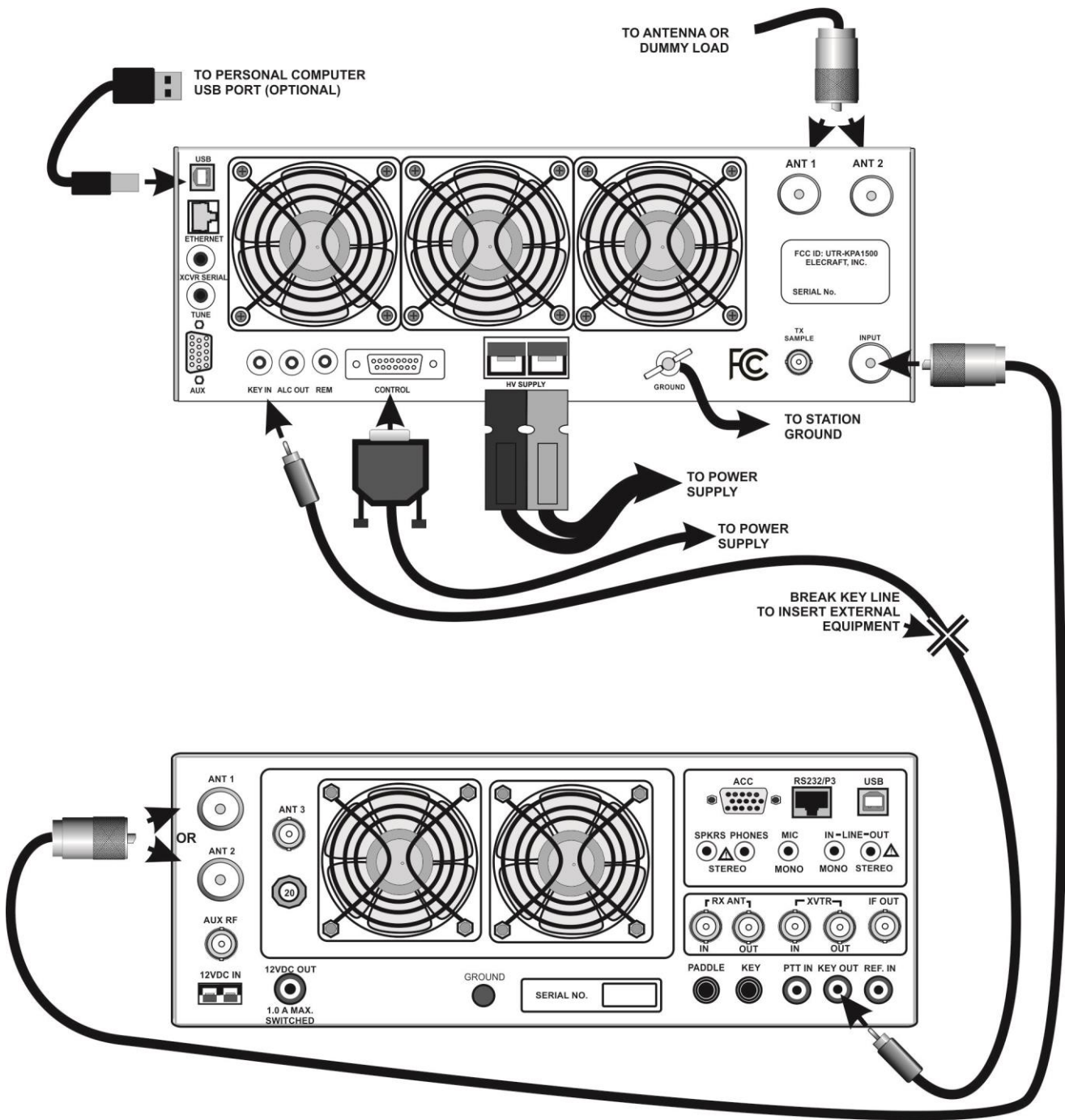
Figure 3. Basic Cabling Diagram for Any Transceiver.
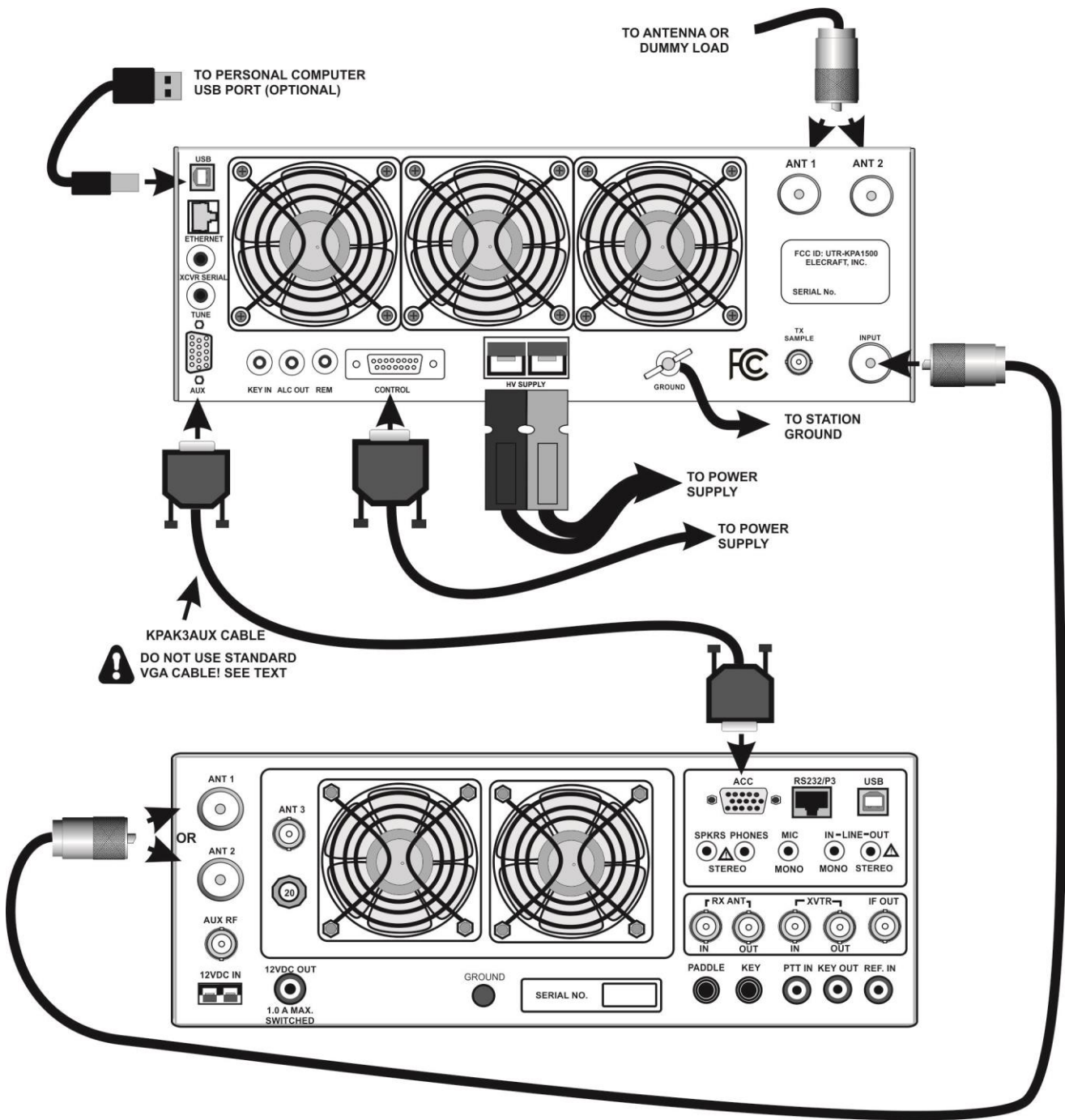
Figure 4. K3s Enhanced Cabling Using KPAK3AUX Cable.

TO PERSONAL COMPUTER
USB PORT (OPTIONAL)

TO ANTENNA OR
DUMMY LOAD

USB

ETHERNET

XCVR SERIAL

TUNE

AUX

KEY IN ALC OUT REM

CONTROL

HV SUPPLY

ANT 1   ANT 2

FCC ID: UTR-KPA1500
ELECRAFT, INC.

SERIAL No.

TX
SAMPLE

INPUT

GROUND

TO STATION
GROUND

TO POWER
SUPPLY

TO POWER
SUPPLY

KPAK3AUX CABLE

DO NOT USE STANDARD
VGA CABLE! SEE TEXT

BREAK KEY LINE
TO INSERT EXTERNAL
EQUIPMENT

ACC   RS232/P3   USB

SPKRS PHONES   MIC   IN─LINE─OUT

STEREO   MONO   MONO STEREO

┌RX ANT┐   ┌XVTR┐   IF OUT

IN   OUT   IN   OUT

PADDLE   KEY   PTT IN KEY OUT REF. IN

ANT 1

OR

ANT 3

ANT 2

20

AUX RF

12VDC IN   12VDC OUT

1.0 A MAX.
SWITCHED

GROUND

SERIAL NO.

Figure 5. K3s Enhanced Cabling Using KPAK3AUX Cable and Separate Key Line.

Operation

RF Deck Front Panel Controls

Figure 6. KPA1500 RF Deck Front Panel Controls and Indicators.

The front panel controls and indicators are referred to in the following operating instructions by the numbers shown in Figure 6. Below is a brief summary of the function of each control and indicator.

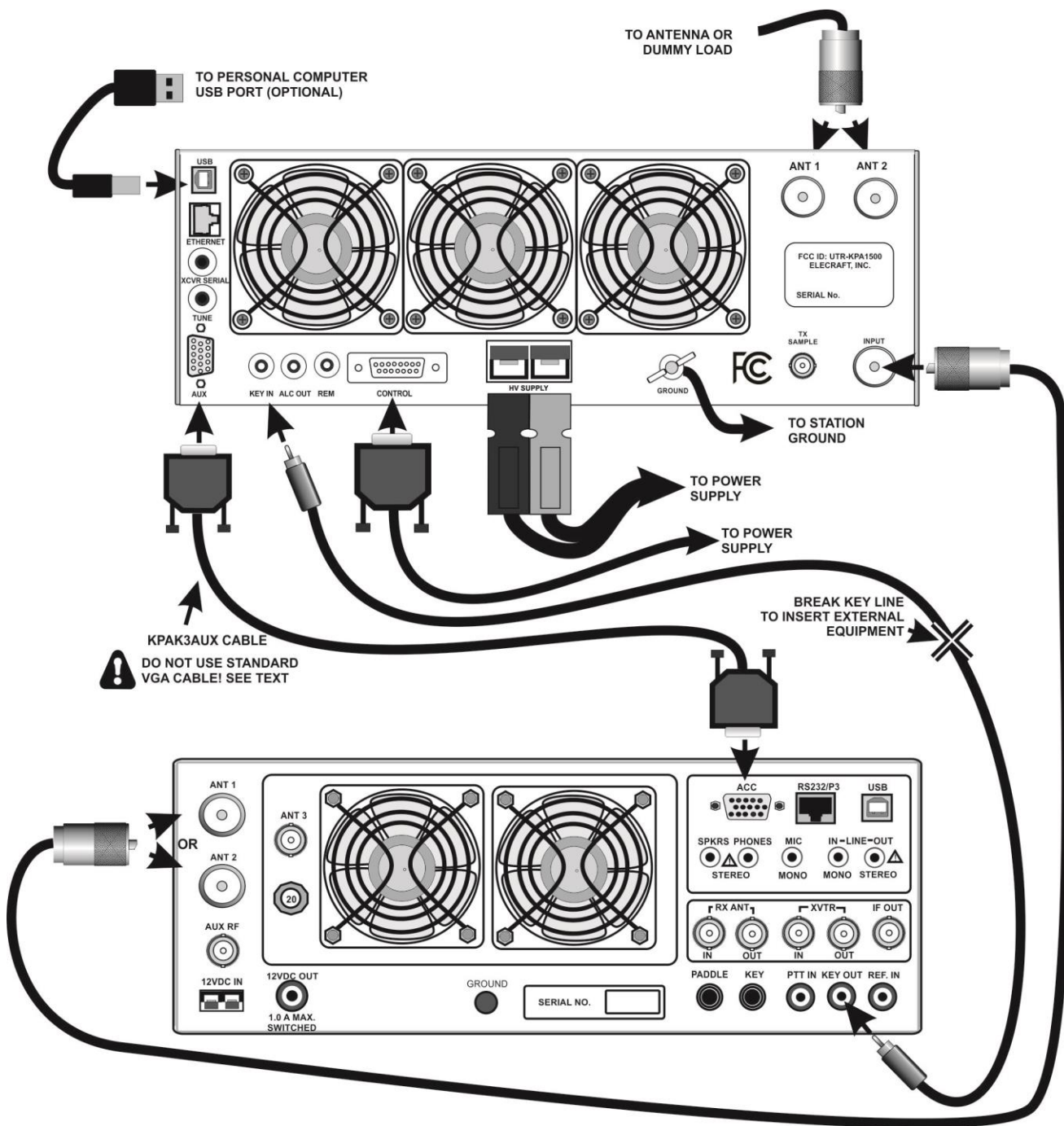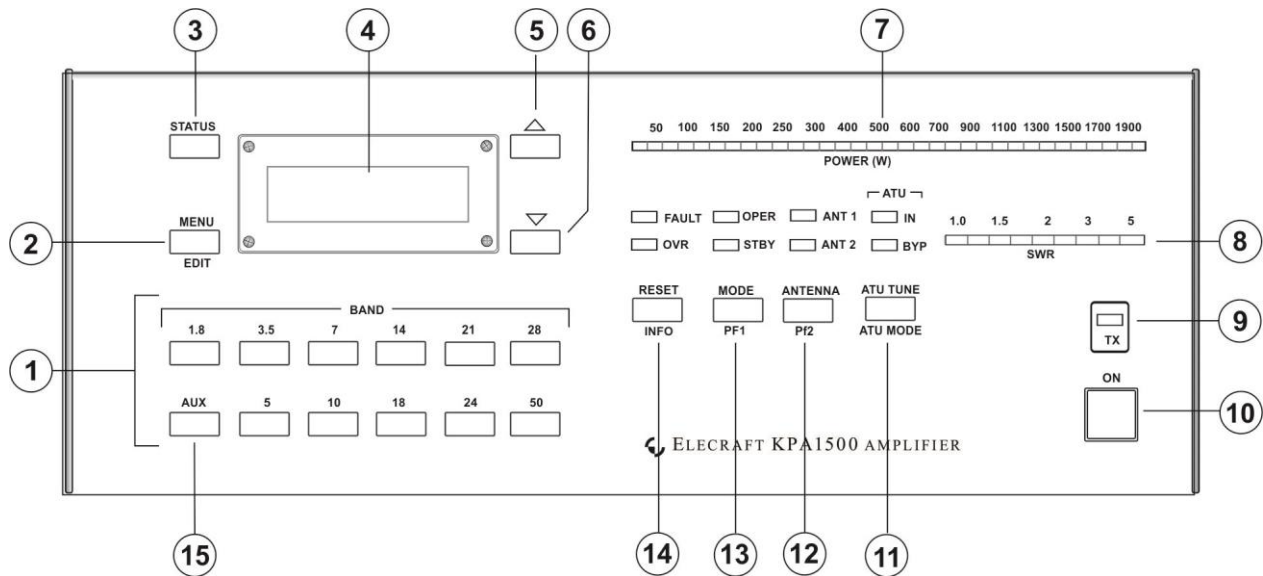⚠ **Switches with a legend above and below the pushbutton have two functions.** *Tap (press briefly)* **to activate the function labeled above a switch.** *Hold* **to activate the function labeled** *below* **the switch. In the text,** *tap* **functions are shown like this: MENU. An example of a** *hold* **function is** `EDIT`.

① Band select switches: Tap to manually select a new band at the KPA1500 (see page 14)

② Menu/Edit switch: Tap to display the KPA1500 menu. Hold to edit a menu parameter.

③ Status switch: Tap to display Status pages showing amplifier operating parameters (see page 19).

④ Liquid Crystal Display (LCD).

⑤/⑥ Up/Down Switches: Press to scroll through the Status or Menu screens.

⑦ Power Output wattmeter bargraph.

⑧ SWR bargraph.

⑨ TX LED. Lights whenever the amplifier is in operate mode and the KEY in is pulled low (enabled).

⑩ ON pushbutton switch; Toggles the amplifier power on or off.

⑪ ATU TUNE/ATU MODE switch: Tap to initiate a tune operation. Hold to toggle the internal ATU in our out of the signal path.

⑫ ANTENNA/PF2 switch: Tap to toggle between the ANT1 and ANT2 outputs. Hold to select user-programmable function 2.

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⑬ MODE/PF1 switch: Tap to switch between operate (OPER) and standby (STBY) modes. Hold to select user-programmable function 1.

⑭ RESET/INFO switch: Tap to reset a fault condition. Hold to display information about the last fault on the LCD.

⑮ AUX switch: Used to force a firmware load (see page 26).

Power On

⚠ IMPORTANT

When the KPA1500 is turned off using the front-panel switch ⑩, part of the control circuitry remains on as long as mains power is applied to the Power Supply. Keeping the control circuitry energized allows the KPA1500 to be turned on and off remotely as well as from the front-panel switch.. If you do not need to control the KPA1500 remotely and would prefer to save the small amount of power required to power the control circuitry, either switch the Power Supply completely off or provide an external mains power switch capable of handling 20A.

1. Ensure a suitable 50 ohm load is attached to the ANT 1 or ANT 2 connector on the rear panel. Tap the front panel ANTENNA switch to select the antenna connector used. The associated LED will be illuminated. A dummy load is recommended for initial tests.

2. Enable the power supply by placing the rocker switch on the power supply module in the On (**I**) position. The power supply unit fan will turn on and run whenever the power supply is on.

3. Tap the **ON** switch ⑩. The LCD ④, ANT 1 or ANT 2 and the OPER or STBY LEDs should light. By default the KPA1500 starts in standby mode at power on. You can change the behavior to have the KPA1500 start in operate mode using the Menu (see *Menu* on page 21).

If the FAULT LED ⑦ lights at any time, refer to *Fault Conditions*, page 20.

Band Switching

Band switching may be done automatically or manually as follows:

> **Automatic Band Switching via Frequency Counter:** The KPA1500 measures the frequency of the RF drive and automatically selects the proper band. The KEY IN input must be connected to the driving transmitter to enable the KPA1500.
>
> ⚠ **The automatic band selection via frequency counter function is active whenever the KEY IN is low (transmit mode) and the transmitter is delivering RF drive to the KPA1500. The automatic band selection function overrides band selection made by any other means to protect the KPA1500 from damage by wrong-band operation.**
>
> **Manual Band Switching:** Tap any of the front-panel BAND switches to manually switch the KPA1500 to that band.
>
> **Coordinated K3s or K3 and KPA1500 Band Switching:** When the optional AUX cable (page 7) is connected between the KPA1500 and the K3s or K3:
>
> - The KPA1500 will follow the band selected on a K3s or K3 transceiver without the need to transmit.

- Tapping a BAND switch on the KPA1500 will cause the K3S or K3 to change bands accordingly.

Band switching control in which the KPA1500 follows the transceiver band selection without transmitting is available with other popular transceivers such as Icom and Yaesu with the appropriate interconnection cable. See *AUX and XCVR Serial Connector Interface* on page 32. However, the control is one-way. The KPA1500 cannot command the transceiver to change bands as it does when connected to a K3S or K3 with the optional AUX cable.

Antenna Selection

Tap **ANTENNA** ⑫ to select the desired rear panel antenna indicated by a lighted ANT 1 or ANT 2 LED above the switch.

You can choose which antenna output is used for each band. By default, the KPA1500 will return to that choice when returning to that band. Also you can disable one of the antenna outputs for selected bands. See ANTENNA ENABLE and ANTENNA PREFER entries under *Menu* on pg 21.

Transmitting

The POWER (W) and standing wave ratio (SWR) bargraphs are functional when the amplifier is in standby (STBY). Fifty watts from the driving transceiver will illuminate the first POWER LED. You may run up to 200 watts through the KPA1500 in STANDBY.

1. Be sure you have an antenna or dummy load connected to the active antenna output (see *Antenna Selection* on pg 15) and your driving transceiver is on a frequency inside an Amateur band.

   ⚠ **If you attempt to drive the KPA1500 on a frequency that is more than 100 kHz outside of an Amateur band or in the range of 26 to 28 MHz, the KPA1500 automatically switches to standby, the red FAULT LED lights and a tone is sounded in the speaker.**

2. If you have a 50 ohm dummy load connected or an antenna that you know presents a low SWR to the KPA1500, use the **ATU MODE** switch to put the ATU in bypass (BYP LED lights). If you are not sure of the SWR of the load attached to the active antenna output, use the **ATU MODE** switch to put the ATU in operate (IN LED lights).

3. Tap the MODE switch ⑬ as needed so that the OPER LED lights.

4. Apply a few watts of RF drive and note that the POWER (W) ⑦ bargraph illuminates to indicate the RF output power. Normal drive levels to produce the full 1500 W output will be about 50 W, but start with a much lower level to observe how the KPA1500 behaves. The KEY IN must be pulled low and the KPA1500 must be in OPER mode for it to amplify. Note that the TX LED ⑨ lights when the KEY IN signal is present.

   ⚠ **NOTE: If you apply RF drive at a frequency between 26 MHz and 28 MHz the KPA1500 automatically switches to standby (STBY) and will not amplify.**

5. Slowly increase the drive power and confirm that the SWR bargraph ⑧ indicates less than 1.5 while the output indicated by the POWER (W) LEDs increases. For ease in reading the critical SWR levels, the SWR LEDs are green from 1 to 1.5. The 1.5 to 2.1 SWR LEDs are yellow and the LEDs for SWRs above 2.1 are red. If your load shows a higher SWR, be sure the ATU is enabled (press the **ATU MODE** switch to light the IN LED), and then tap ATU TUNE to initiate a tuning cycle. About 50 watts of drive may is required to produce the full 1500 watts output from the KPA1500.

⚠ **During heavy use, you may hear audible clicking sounds, particularly as amplifier components cool after transmitting. This is normal. It does not indicate that the amplifier is being overly stressed. The rear panel fans will turn on and increase speed as needed automatically. If desired, you can keep the fans running at all time using the FAN SPEED MIN menu setting (see pg 21)**

6. When driving the KPA1500 with an Elecraft K3 or K3s, use the K3 or K3s per-band power control to set the amplifier output just below the desired peak output on each band. Do not rely on ALC to control the power output (see *Using ALC*, page 16). At the K3 or K3s, set *CONFIG:POWER SET* to Per Band and adjust the power level for each band. If your K3s or K3 has firmware version 4.82 installed, see *Per-Band Power Control* in your K3 or K3s Owner's manual for further details.

⚠ **If you use the AUX cable interface between the K3 or K3s and KPA1500 (pages 11 or 12), the KPA1500 will send the operate/standby status to the K3 or K3s. You can then set two per-band power levels at the K3 or K3s: one to drive the KPA1500 when it is in operate mode and another for pass-through transmitting when the KPA1500 is in standby. The K3 or K3s will automatically furnish your preset power levels as you switch the KPA1500 between operate and standby.**

Using ALC

Automatic Level Control (ALC) is a useful safety mechanism, but never use ALC as the principle power control. Doing so causes many of the unwanted transmit dynamics you often hear on the air including excessive intermodulation distortion (IMD) and clicks. Instead, set your transmitter power output correctly as described under *Transmitting* and adjust the ALC so it does not affect output power in normal operation. To do this, drive the KPA1500 to the desired output. Adjust *ALC THRESH* in the menu (page 21) until power just starts to drop and then set *ALC THR* above this setting so it does not affect the output power in normal operation.

Elecraft recommends using the K3s or K3 *PWR SET-PER BAND* function to set proper drive levels, not ALC. The Elecraft K3s and K3 ALC intentionally have a slow attack and much slower decay to avoid adding more distortion or dynamics problems than necessary. However, not all of the negative effects of ALC action can be avoided. It is still best to set the ALC threshold and then adjust the drive to avoid ALC action in normal operation.

Automatic Antenna Tuner (ATU)

The internal ATU may be used with the KPA1500 in either operate mode or standby. When the KPA1500 is in standby mode, power from the driving transceiver is passed directly to the ATU. Press `ATU MODE` to select whether the ATU is active (IN) or bypassed. The corresponding LED above the switch will light.

At lower power levels, such as using your driving transceiver 'barefoot' at 100 watts, the ATU will match loads up to an SWR of 10:1 on 80 through 10 meters and 5:1 on 160 and 6 meters. At 1500 W the tuner will match an SWR of at least 3:1. The ATU recalls the tune solutions based on the frequency reported by the KPA1500 frequency counter when the KEY IN line is held low. This works in both standby and operating mode.

Tap ATU TUNE to initiate an ATU tune cycle.

Manual Tune Operation

Relays in the ATU operate to search for values of inductance (L) and capacitance (C) that match the impedance of the antenna to a value close to 50 ohms non-reactive for the KPA1500 amplifier circuits or for the driving transceiver when the KPA1500 is in standby.

The SWR lights indicate how close the antenna impedance is matched to the transceiver. The L and C values switched in will provide a good match for most situations, but if you feel the resultant SWR is high you can tap TUNE again within 3 seconds to initiate a second, fine tuning process in which smaller changes in L and C values are tried. That may result in a lower SWR.

If the SWR is 1.2 or less when a tune operation begins, the KPA1500 bypasses the matching network without searching for a tuning solution. You can change the SWR at which the KPA1500 bypasses the matching network without searching for a solution with the *SWR BYP THRESH* parameter in the Menu.

Automatic Tune Operation

You can configure the ATU to recall previous tuning solutions automatically when it detects load SWR greater than a preset value. In the Menu, set *ATU HiSWR AUTO RETUNE* to *ENABLED*: (see page 21). Normally an automatic tuning cycle begins when the load SWR exceeds 1.8:1. You can change this with the *SWR AUTO THRESH* parameter in the Menu. You can set a different threshold for each band.

Memories

After successfully tuning, the KPA1500 stores the L and C settings or the bypass setting and the antenna output used in memory. They will be recalled almost instantly when transmitting on that frequency later. The entire spectrum from 1.8 through 60 MHz is divided into frequency segments and tuning information is stored for each segment in which you have successfully completed a tune operation.

Since re-tuning to maintain a low SWR is normally required over a narrower frequency range on the lower frequencies, the lower frequencies have narrower segments assigned as follows:

- Below 3 MHz the segments are 10 kHz wide.

- From 3 MHz through 26 MHz the segments are 20 kHz wide.

- From 26 MHz to 38 MHz the segments are 100 kHz wide.

- From 38 MHz to 60 MHz the segments are 200 kHz wide.

When starting a tune operation for a frequency segment that has no previously stored L and C values, the KPA1500 first tries the settings in the nearest frequency segment that has tuning data.

Training the ATU

If you want to ensure that you are never faced with doing a tune operation while moving from one frequency to another, you can do a tune operation at points across each band so that the KPA1500 will memorize the L and C settings and antenna selected in advance. The KPA1500 ATU will not need to do a full search tune operation again unless you change your antenna. Normally you won't need to do a tune operation in every segment shown under *Memories* above depending upon how "flat" your antenna SWR remains across each band. If you transmit in a segment where there is no tuning solution stored, the ATU logic automatically checks the solutions for adjacent segments to see if they produce an acceptable SWR.

 When used with a K3 or K3s, the KPA1500 may be configured track frequency changes without transmitting, providing virtually instantaneous amplifier and ATU setting updates as you tune across the band. See *Frequency Tracking with an Elecraft K3 or K3s Transceiver* below.

Frequency Tracking with an Elecraft K3 or K3S Transceiver

When the KPA1500 is used with an Elecraft K3 or K3s transceiver, the K3 or K3s can be configured to cause the KPA1500 and ATU to follow changes in the K3 or K3s VFO frequency during receive. (KPAK3AUX cable is required.) The KPA1500 ATU will switch bands and change to the tuning solution for each frequency segment as the K3 or K3s VFO frequency is tuned across the band. To use frequency tracking:

- Connect the KPA1500 and K3 or K3s using the AUX interface cable as shown in Figure 4 (page 11) or Figure 5 (page 12).

- Ensure that your K3 or K3s is equipped with firmware revision 4.82 or later. See Firmware Upgrades in your K3 or K3s Owner's Manual for instructions about how to upgrade your firmware, if needed.

- Enable the frequency tracking function at the K3 or K3s: select *CONFIG:KAT3* and then tap the 1 switch to toggle between *KAT500N* (no KPA1500) and *KAT500Y* (KPA1500 connected and frequency tracking enabled).

Monitoring

KPA1500 operation is monitored by the LEDs ⑦, ⑧ and ⑨ and reported in text on the LCD.

LEDs

The SWR of the load and the output power are displayed on LED bar graphs. The intensity of the power bar graph LEDs also increases as output power increases within a LED's power range. The bar graphs are color-coded: green for normal operating range, yellow for marginal levels and red for excessive levels. Excessive levels may trigger a fault and shut the KPA1500 off (see *Fault Conditions* below). The FAULT LED lights if a fault condition occurs. Also two LEDs indicate whether the amplifier is in standby (STBY) or operating (OPER) mode.

LCD

Normally the LCD displays the band currently selected. The four switches around the LCD select other information to be displayed on the screen and the behavior of the LEDs. Note that these switches have both tap and hold functions (page 4). Repeat the tap or hold action to return the LCD to the band display.

STATUS

Tap UP or DOWN arrows to the right of the LCD (05,06) to move between the four STATUS pages. When TECH MODE is enabled, additional status pages are available. Example displays are shown below. The actual values will vary according to your operating conditions:

Band, PA current, temperature, forward power, SWR:

```
3.5MHz 50A 42C
PWR 1234W 1.7:1
```

Forward and reflected power:

```
FWD PWR: 1234W
```

```
REFL PWR: 23W
```

Banner:

```
ELECRAFT KPA1500
```

Banner text appears briefly on the LCD when the amplifier is switched on. You may customize this text with the *KPA1500 Utility* Edit Configuration dialog to do, for example, display your call sign.

Forward power, efficiency, PA voltage, current, and temperature:

```
F: 983W 56%
```

```
52V 34A 23C
```

In this example, the DC power input to the amplifier was 52 volts times 34 amperes, or 1768 Watts. RF power out was 983 Watts. Efficiency is Output power / DC power, 983 / 1768 or 56%.

LCD Transient Operator Notification Messages

Fault messages are displayed briefly on the LCD. When the band is changed, the LCD shows the new band for about half a second, like "BAND 7 MHz". When the ATU TUNE switch is pressed, "NEED TUNE PWR, Key Exciter" is shown to tell the owner to provide RF for ATU tuning. You may tap ATU TUNE again to cancel the full search tune request. "TUNE CANCELLED" appears briefly on the LCD. When ATU tuning finishes normally, the LCD shows "TUNE COMPLETE" briefly.

Some menu items appear only when TECH MODE is enabled.

Remote Operation

The KPA1500 can be controlled remotely using a personal computer connected to the RJ45 Ethernet port or to the USB port. A basic remote operating capability is built into the KPA1500 Utility program (see page 26). For those who may wish to develop their own software, a Command Reference Manual is available on the Elecraft web site. (www.elecraft.com).

Additionally, the rear panel REM jack allows turning on and off the KPA1500 semi-automatically. When +12V is supplied, the amplifier will power ON. It will turn off when the 12V is removed. Less than 1mA of current is required.

Fault Conditions

The FAULT indicator lights and the speaker sounds to indicate a fault condition has occurred. To avoid unnecessarily interrupting amplification because of moderately abnormal conditions, there are two levels of faults that may occur, attenuator faults and hard faults.

Attenuator Faults

Relatively minor faults such as excessive reflected power cause an internal 3dB attenuator to be switched into the RF path that reduces the output to protect the KPA1500. When an attenuator fault occurs, the OVR LED blinks and the cause is displayed on the LCD for about 1 second. The KPA1500 tests the condition at intervals and will return to normal operation automatically after the cause of the fault is removed. The interval between tests is set with the *ATTEN REL* menu (page 21). If the fault persists over time or if it is severe enough, a hard fault will occur.

Unauthorized Frequency (INVALID) Fault

If you try to transmit on an unauthorized frequency the KPA1500 will automatically switch to standby and *INVALID* will be displayed on the LCD until RF drive is removed.

Hard Faults

Hard faults are those that require switching the KPA1500 to standby to protect it, such as conditions of extremely high reflected power or high drive power, or because a critical component such as a power supply has failed. When a Hard Fault occurs, the cause of the fault is displayed on the LCD. When the condition has been corrected, tap the OPER/STBY switch to return the KPA1500 to normal operation, or tap the **INFO** switch to return the KPA1500 to standby mode.

LCD Display	Fault	Fault Type
NO KEY IN 30 WATTS	Protects the TR Switch if drive power is applied in operate mode but the key line is not pulled down to enable the KPA1500.	Temporary switch to standby
LPF VMON	Incorrect bias voltages at the TR switch.	Hard
NO MATCH 4.3	ATU unable to match to the load at the selected ANT connector.	Hard
PA CURRENT 68 AMPERES	Excessive PA current drawn	Attenuator-Hard
PWR DISS 2050 WATTS	Power amplifier is dissipating excessive power. [1]	Hard
PWR FOR SWR BYPASS 4.3	Tuned Antenna SWR exceeds safe limits at selected power.	Attenuator-Hard
FWD PWR 2005 WATTS	Excessive forward power measured.	Attenuator-Hard
GAIN HIGH RATIO 33	Ratio of Input Power to Forward Power too high.	TBD
FREQUENCY INVALID 26123KHZ	RF from the driving transceiver not within 100 kHz of an Amateur band or somewhere between 26 and 28 MHz	Hard
INPUT PWR 65 WATTS	Excessive power from the driving transceiver.	Hard

LCD Display	Fault	Fault Type
REFL POWR *180 WATTS*	Excessive reflected power detected.	Attenuator-hard
HIGH SWR *19.3*	SWR too high.	Hard
HI TEMP *112 DEGREES C*	Heat Sink Temperature Too High	Hard
50 V0LTS *42.123 VOLTS*	50V Supply out of range	Hard

NOTES:

1. Commonly caused by excessive power output or excessive reflected power.

Menu

Tap MENU ② to toggle between *STATUS* and *MENU* to select *MENU*. The Menu function allows the following parameters to be set. With the menu function enabled, the MENU, EDIT and switches next to the △ and ▽ symbols all respond to a simple tap. Use them to scroll through the menu items. The menu items are in alphabetical order and when you reach the last or first item, the list automatically starts over with the next tap. To change a parameter, hold EDIT and the parameter on the LCD will blink, then tap the △ and ▽ switches to change the parameter. Tap MENU again to save the parameter. Tap MENU another time to exit the menu. Tapping STATUS ③ also exits the menu.

Note that:

- Some menu items are "per band"; these menu items will show the frequency band along with the parameter on the LCD. Changing a per band parameter will change it only for the band being displayed. If you wish to change a parameter for more than one band, tap the BAND switch while editing the menu item to view and change the configuration for each band. Optionally, you may use the *KPA1500 Utility* (page 26) may be used to modify several settings on all bands at once.

- Some menu items, such as serial number and firmware revision, may not be edited.

- Some menu items appear only when Tech Mode is enabled.

To reset all the parameters to the default value, press and hold the EDIT switch while tapping the ON switch to turn the KPA1500 on.

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Menu Entry	Default	Description
ALARM TONE	*ON*	An internal speaker normally sounds a tone on faults. ALARM TONE turns this on or off. When the ALARM TONE menu item is changed from OFF to ON, a sample fault alarm tone is sounded
ALC THRESH *(Per Band)*	127	KPA1500 provides an ALC voltage between 0 and -12V, a function of output power and this per-band ALC THRESH value. If ALC is used at all, set the ALC threshold high, transmit at full power, then lower the ALC until the exciter's power just starts to drop, then increase the ALC threshold one count. ALC is for severe overdrive, not normal amp power control. Misuse may cause distortion. See page 16 for more information.
ANTENNA ENABLE *(Per Band)*	*BOTH*	Antenna connectors ANT1 or ANT2 may be disabled, per band. UP and DOWN move between ANT1, ANT2 and BOTH. A disabled antenna connector cannot be selected by the ANT switch or text commands; the ANT switch will become ineffective, as only one antenna may be chosen. You cannot disable both ANT1 and ANT2.

Menu Entry	Default	Description
ANTENNA PREFER (Per Band)	LAST USED	When switching to a new band with both ANT 1 and ANT 2 enabled the stored preference is chosen: ANT 1, ANT 2 or LAST USED.
ATEN RELEASE (Appears in Tech Mode Only)	3000	When the attenuator switches in due to excessive drive power, there is a delay after the excessive power condition is corrected before the attenuator switches out. This delay can be adjusted in steps of 100 ms between 1400 ms and 5000 ms (1.4 sec and 5 sec.)
ATU BYPASS (Per Band)	1.2:1	When a tune operation is started, the first ATU setting tested is ATU bypassed. If the ATU bypassed setting is at or lower than this value, the search is ended, and the stored ATU tuning solution is "bypassed". (see page 17).
ATU CAP (Appears in Tech Mode Only)	--	Allows manually choosing the capacitance used by the ATU. Capacitance in pF and the corresponding SWR is also displayed on the LCD. Normally, the ATU selects the correct value automatically.
ATU HiSWR RETUNE (Per Band)	ATU HiSWR RETUNE OFF	When SWR exceeds this value, the ATU examines previously stored ATU settings for the current frequency and chooses the first one that meets the SWR STOP threshold. This does not start a full search tune. The amplifier pulls down (grounds) the TUNE connector's KEY line (the tip), and can also send a message to a K3 to provide TUNE POWER for ATU tuning. If a suitable ATU setting is not found, the SWR may still be too high for efficient use (see the ATU NO MATCH SWR menu item below). If this occurs, press the amplifier's ATU TUNE switch to start a full-search tune.
ATU IND	—	Allows manually choosing the inductance used by the ATU. Inductance in nF and the corresponding SWR is also displayed on the LCD. Normally, the ATU selects the correct value automatically.
ATU MEM ERASE	—	Clears all ATU settings for the currently selected band and antenna. ATU MEM ERASE clears the current ATU setting to ATU BYPASSED. You may change ANT and BAND while within this menu.
ATU MODE SWITCH	—	The ATU "mode" is either "IN" (in line) or "BYP" (bypassed). This menu item chooses between one setting for all bands and antennas, or individual ATU mode by band and antenna. ATU MODE SWITCH All Bands ATU MODE SWITCH Per-Band Per-Ant If you chose "All bands", the ATU Mode won't change as you change bands and antennas. If you choose "Per-Band Per-Ant", the ATU Mode will be as you last left them when you visited that band and antenna. This is intended for owners of an externally-tuned antenna that are matched separately from the KPA1500's ATU.
ATU NO MATCH (Appears in Tech Mode Only)	3.0:1	When an ATU search completes, the best setting the ATU can find may be too high for practical use (e.g., ATU attempting to match an open antenna connector). If the ATU search cannot find an SWR below the ATU NO MATCH SWR threshold, a NO MATCH fault is generated. You may be able to reset the fault, reduce power to keep the reflected power down, and continue to transmit if necessary.
ATU SIDE (Appears in Tech Mode Only)	—	The ATU uses a series inductance with a shunt capacitance on either the source or antenna side. This entry manually switches the shunt capacitance in the ATU matching network to put the capacitance on the source (TX) or antenna (ANT) side of the L-network inductance. Normally, the ATU selects the correct side automatically.

Menu Entry	Default	Description
ATU STOP TUNE SWR (Per Band)	1.2:1	When an **ATU HiSWR RETUNE** is started, up to 16 stored ATU settings for the current antenna connector and the current or near frequencies are examined. **ATU STOP TUNE SWR** tells the ATU when an acceptable match has been found. If an ATU setting is found that results in "good enough" SWR, the search is ended. If this is not low enough, a NO MATCH fault may occur (see **ATU NO MATCH SWR** menu item), and you should tap the KPA1500 front panel ATU TUNE switch to start a "full search" tune. Some stations have several antennas, all sharing the same KPA1500 antenna connector, switched externally. The KPA1500 ATU memory store allows up to 31 ATU settings for the same antenna connector and frequency. For example, you might have a dipole, a Yagi, and a vertical on 20 meters, all on KPA1500 ANT1, using an external antenna switch. The KPA1500 can store tuning solutions for all three antennas. Later, when you change antennas, key the radio briefly, and the **ATU HiSWR RETUNE** search looks first at the already-saved tuning solutions for this frequency. Another application is different ATU settings for "wet" and "dry" conditions. This technique allows both settings to be stored concurrently. In all Search tunes, the result of the search is stored as the "first to try" setting for this frequency / antenna. It is the setting found on a subsequent Recall tune
ATU XCVR KEY (Appears in Tech Mode Only)	ON	Used with a K3 (MCU version 5.93 and later) connected with an AUX cable. When ON, the KPA1500 sends an AUXBUS message to the K3 when needed for TUNE POWER. The K3 provides carrier for the ATU to complete tuning. The KPA1500 sends another message to stop tuning. When ATU XCVR KEY is ON, the KPA1500 asks the K3 for TUNE POWER when it performs an ATU HiSWR RETUNE tune or a full search tune (press of the KPA1500's ATU TUNE switch). Radios other than K3 & K3S may use a keying cable from the tip of the KPA1500 TUNE connector to the transceiver straight key input line. That key line is not affected by ATU XCVR KEY.
BAND CHANGE STBY	NO	Chooses whether to switch from operate (OPER) to standby (STBY) when changing bands. *YES* will switch to standby when changing bands.
DEMO MODE (Appears in Tech Mode Only)	OFF	Used only for non-transmitting demonstrations where proper mains power is not available. When keyed shows nominal SWR and full power output even though no RF is being generated.
FAN SPEED MIN	0	The speed of the three rear panel fans varies according to the KPA1500 internal temperature. This setting allows setting a minimum speed of greater than zero all the way to all fans running at full speed at all times. This setting does not affect the fan in the power supply enclosure.
FIRMWARE VERSION	—	Displays the installed version of the KPA1500 firmware.
LCD BACKLIGHT	7	Adjusts the brightness of the LCD backlight over a range of 0 to 50.
LCD CONTRAST	23	Adjusts the contrast of LCD characters from 0 to 50.
LED BRIGHTNESS	22	Adjusts the brightness of the front-panel LEDs from full on (50) to full off (0).
NET GATEWAY (Appears in Tech Mode Only)	—	Shows the IP address of the router. This address is provided by a DHCP server when the KPA1500 connects to a TCP/IP network. Leading zeros are removed from each octet.
NET IP ADDRESS (Appears in Tech Mode Only)	—	The network IP Address assigned to the KPA1500 by a DHCP.
NET MAC (Appears in Tech Mode Only)	MAC -	Displays the unique media access control (MAC) address assigned by the microcontroller manufacturer. The MAC address is six pairs of hex digits displayed on two lines with colon delimiters.

Menu Entry	Default	Description
NET MASK (Appears in Tech Mode Only)	255.255.255.0.-	DCHP –assigned Subnet Mask in dotted octet format.
POWER ON MODE	STBY	Selects whether the amplifier starts in operate (OPER) or standby (STBY) mode when turned on.
RADIO POLL	ON	ON: Enables KPA1500 polling of the transceiver for frequency band via RS232X port (e.g. for Kenwood/Elecraft compatible interface). For RADIO TYPE "serial" using compatible transceivers such as a K2, KX2, KX3, Kenwood, or Yaesu transceiver, a command string like "IF;FA;FB;FT;" is sent to via the XCVR SERIAL connector. Responses are used to select bands and ATU settings based on the TX VFO frequency.
RADIO TYPE	K3 OR K3S	Provides frequency information and communication between a transceiver and KPA1500. **K3 / K3S**: Select when a K3 or K3S is connected through a 15-pin AUX cable to your KPA1500, which appears to a K3 as a combination of KPA500 and KAT500. The ACC cable provides band and frequency information (in steps of 8 kHz) via AUXBUS (one of the wires in the 15-pin AUX cable), with K3 KAT3 menu item "KAT500=Y". The KPA1500 provides band information and OPER/STBY messages to the K3 to select exciter power. Choose the K3/K3S menu item PWR SET. The drive requirement may vary band-to-band. BAND0 through BAND3 are also used for a K3 to indicate band to KPA1500. The amplifier's ATU TUNE switch or an ATU HiSWR retune can cause the K3 to provide TUNE POWER for the duration of the ATU tuning operation if **ATU XCVR KEY** is enabled. **BCD**: The 4 BAND lines on the ACC connector carry band information in a BCD format. Some Yaesu radios provide this information. The BAND0 thru BAND3 BCD values for the K3 are used. **ICOM**: The XCVR SERIAL connector is configured for CI-V protocol, and the KPA1500 accepts frequency messages from the Icom exciter in its CI-V "transceive" mode to switch bands and select ATU settings on in-band QSY. The transceiver's CI-V speed must match the SERIAL SPEED XCVR menu item. 4800 bits/second works fine. The KPA1500 does not send to an Icom radio via CI-V. ACC connector BAND VOLTAGE and BAND REF VOLTAGE are examined for frequency information (there no band voltage distinction between 60/40, 15/17 and 12/10 meters). The KPA1500 rear panel TUNE jack accepts a 3.5mm TRS plug to a 4-pin Molex connector for AH-4 protocol tuning. With this connection, pressing the Icom transceiver's AUTO TUNE switch causes the KPA1500 to start an ATU "search" tune, the KPA1500 provides a "AH4 KEY" logic level to cause the Icom transceiver to generate steady RF carrier for ATU tuning. When the ATU tune completes, the KPA1500 removes the "AH4 KEY" level to un-key the Icom transceiver. **Serial**: A Kenwood, Yaesu, Elecraft K2, K3, K3S, KX2, or KX3, or FlexRadio® transceiver that responds to IF; FA; FB; FT; polls with frequency and VFO information. The XCVR SERIAL connector is configured as TTL-level RS-232. Choose "Serial" and turn off RADIO POLL if you are using an unsupported radio.
SERIAL NUMBER	—	Displays the KPA1500 serial number. Not editable.
SERIAL SPEED HOST	230400 bps	The speed of the Host PC (USB) connection. The KPA1500 incorporates a USB-to-Serial adapter that appears as a COM port to computer software. The speed range is 4800 to 230,400 bits/second. Use the highest reliable speed you can. KPA1500 Utility finds the KPA1500 at any of its speeds.

Menu Entry	Default	Description
SERIAL SPEED XCVR	*38400 bps*	The speed of the 3.5mm TRS connector labeled XCVR SERIAL. This is a dual-purpose connector, either a TTL-level RS-232 connector for connection to Kenwood, K2, K3, KX3, KX2, or a CI-V connector to Icom transceivers.
TECH MODE	*DISABLED*	Status and menu items indicated shown only when Tech Mode enabled.
TR ADDED TIME (Appears in Tech Mode Only)	*0 msec*	Delay added to the receive recovery if the transceiver has an RF envelope that continues after its KEY OUT signal. For most transceivers, 0 ms is correct.
TX INHIBIT (Appears in Tech Mode Only)	*DISABLED*	Chooses whether to enable or disable the ACC connector INHIBIT line, pin 11. When enabled and the INHIBIT line is pulled down, the PA stage is bypassed. The MODE LED will remain in OPER.
WMTR ADJUST (Per Band: Appears in Tech Mode Only)	*100*	User-adjustable Wattmeter calibration. Note that the KPA1500 Wattmeter is factory-calibrated on all bands. WMTR ADJUST affects the displayed power (LCD & LED, KPA1500 Utility operate page), but not fault thresholds.

KPA1500 Utility Program

The KPA1500 Utility program is available for downloading free from Elecraft at www.elecraft.com. It is essential for updating your KPA1500 firmware and may be used to more quickly edit various parameter settings.

- Download the KPA1500 Utility program and install it on your computer.

- Connect the USB A to B interface cable supplied with your KPA1500 between the USB port on the KPA1500 rear panel and your personal computer.

  ⚠ **Your PC must be connected directly to the USB port. You cannot 'daisy chain' the KPA1500 with the K3S or K3 through the AUX port**

KPA1500 Firmware Updates

From time to time updated and improved firmware may become available for the KPA1500 and can be downloaded from www.elecraft.com and installed using the KPA1500 Utility Program.

To download the firmware:

- Connect your personal computer to the KPA1500 and launch the KPA1500 Utility Program.

- Click on Firmware tab and then the Click on Copy Firmware Files from Elecraft to download the latest production released firmware or,

- Download the new file from the Elecraft web site manually and place it in a local folder, then in the KPA1500 Utility program click on Browse… to locate the folder on your computer. This is the way to access the latest Beta firmware available from Elecraft.

To install new firmware in your KPA1500:

- Click on the KPA1500 Utility Program Send Firmware to the KPA1500 switch to start the transfer. Follow any on-screen instructions.

- During download the LCD will display *FIRMWARE LOAD.* The KPA1500 will return to its normal power on state when the transfer is completed.

Be sure to check the notes supplied with the new firmware. They may include changes that affect the instructions in this manual.

Checking your Firmware Revision

Use the Menu entry *FIRMWARE VERSION* to determine versions of the currently-installed firmware (see page 21).

Forcing a Firmware Load

If the KPA1500 becomes unresponsive, you may force a re-load of its operating firmware. Connect a computer running KPA1500 as described above. Press and hold the front-panel AUX key for more than 5 seconds and the hardware bootloader will run. Click on the Utility *Send Firmware to the KPA1500* switch to start the transfer.

Wattmeter Calibration Procedure

The KPA1500 wattmeter is factory-calibrated. However, if you have a wattmeter that you feel is more accurate, you can adjust the KPA1500 wattmeter to match its readings as follows. The calibration is done per-band so you can make adjustments for individual bands without affecting the others.

In addition to your wattmeter, you will need a good 50Ω dummy load capable of handling 1500 watts.

- Connect your wattmeter to one of the KPA1500 ANT connectors using short, direct 50 ohm coaxial cable.

- Connect your dummy load to the wattmeter.

- Select the band that you wish to calibrate.

- Tap **ANTENNA** on the KPA1500 to select the ANT output where you connected the wattmeter and dummy load. (Depending upon your menu preferences, the antenna output may change when you change bands.)

- Bypass (disable) the ATU by holding **ATU MODE** if needed so the BYP LED lights.

- Transmit briefly at 1500 watts output into the external wattmeter and dummy load and compare the reading on the external wattmeter with the KPA1500 wattmeter.

- If you wish the adjust the power displayed on the KPA1500 LCD and LEDs, hold **MENU** and tap switches next to the △ and ▽symbols until PWR ADJ is displayed on the LCD.

- Hold **EDIT**. A number between 80 and 120 will be displayed on the LCD. Write this number here under Factory Cal. for the band you are calibrating in case you wish to return to the factory calibration later:

BAND	FACTORY CAL.	USER CAL.		BAND	FACTORY CAL.	USER CAL.
1.8				18		
3.5				21		
5				24		
7				28		
10				50		
14						

- If the power displayed on the KPA1500 wattmeter needs to be higher, tap the △ switch. If the power displayed on the KPA1500 needs to be lower, tap the ▽ switch. The number displayed indicates the percentage change in the power reading. For example, changing 100 to 110 will result in a 10% increase in the power indicated.

- Tap **MENU** twice to exit the menu. The current band will be displayed on the LCD.

- Transmit again and compare the readings on the KPA1500 and your external wattmeter. Repeat the procedure as needed until you are satisfied with the readings, and then write the new calibration number under User Cal. on the table above for future reference.

Specifications

⚠ **The following performance specifications are guaranteed only within the Amateur bands.**

Frequency Range	All Amateur Bands from 1.8 to 29.7 MHz and 50 to 54 MHz
Supply Voltage and Current	195 to 250 VAC, 50/60 Hz up to 20A.
RF Deck Weight	22 lbs (10 kg)
RF Deck Size	Enclosure only, 4.5 x 13.5 x 11.5 in., HWD (11.5 x 34 x 29 cm).
Power Supply Weight	17 lbs (7.5 kg)
Power Supply Size	Same as RF Deck: Enclosure only, 4.5 x 13.5 x 11.5 in., HWD (11.5 x 34 x 29 cm) excluding feet and protrusions..
Power Output	1500 watts PEP CW/SSB/Data
Duty Cycle at 1500 Watts	100% ICAS for 100 % duty cycle modulation modes (FM, RTTY, FT8. JT65. etc.) 1.8-30 MHz: Maximum 5 minutes key down / Minimum 5 minutes receive (after 5 minuteTX) 50 MHz: Maximum 50 seconds key down / Minimum 50 seconds receive
Drive Power	50-60 watts, typical, for 1500 watts output
Input VSWR	Less than 1.5:1
ALC Out	Negative-going, adjustable
Metering	Power Output, SWR (bargraph and on the LCD display), supply voltage and current, temperature, frequency band
Heat Sink Temperature	110°C, maximum
Key In	+5V maximum, open circuit on receive, closed to ground on transmit (5 mA max.)
Efficiency	Approximately 50%

Customer Service and Support

Technical Assistance

You can send e-mail to **support@elecraft.com** and we will respond quickly – typically the same day Monday through Friday. If you need replacement parts, send an e-mail to **parts@elecraft.com**. Telephone assistance is available from 9 A.M. to 5 P.M. Pacific time (weekdays only) at 831-763-4211. 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 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 turnaround 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. We will give you the address to ship your kit to at the time of repair authorization. *Packages shipped without authorization will incur an additional shipping charge for reshipment to our repair depot.*

Elecraft 1-Year Limited Warranty

This warranty is effective as of the date of first consumer purchase (or if shipped from the factory, the date the product is shipped to the customer). 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.

Who is covered: This warranty covers the original owner of the Elecraft product as disclosed to Elecraft at the time of order. Elecraft products transferred by the purchaser to a third party, either by sale, gift, or other method, who is not disclosed to Elecraft at the time of original order, are not covered by this warranty. If the Elecraft product is being bought indirectly for a third party, the third party's name and address must be provided at time of order to ensure warranty coverage.

What is covered: During the first year after date of purchase, 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. For Alaska, Hawaii, and other destinations outside the U.S. and Canada, actual return shipping cost is paid by the 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 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.
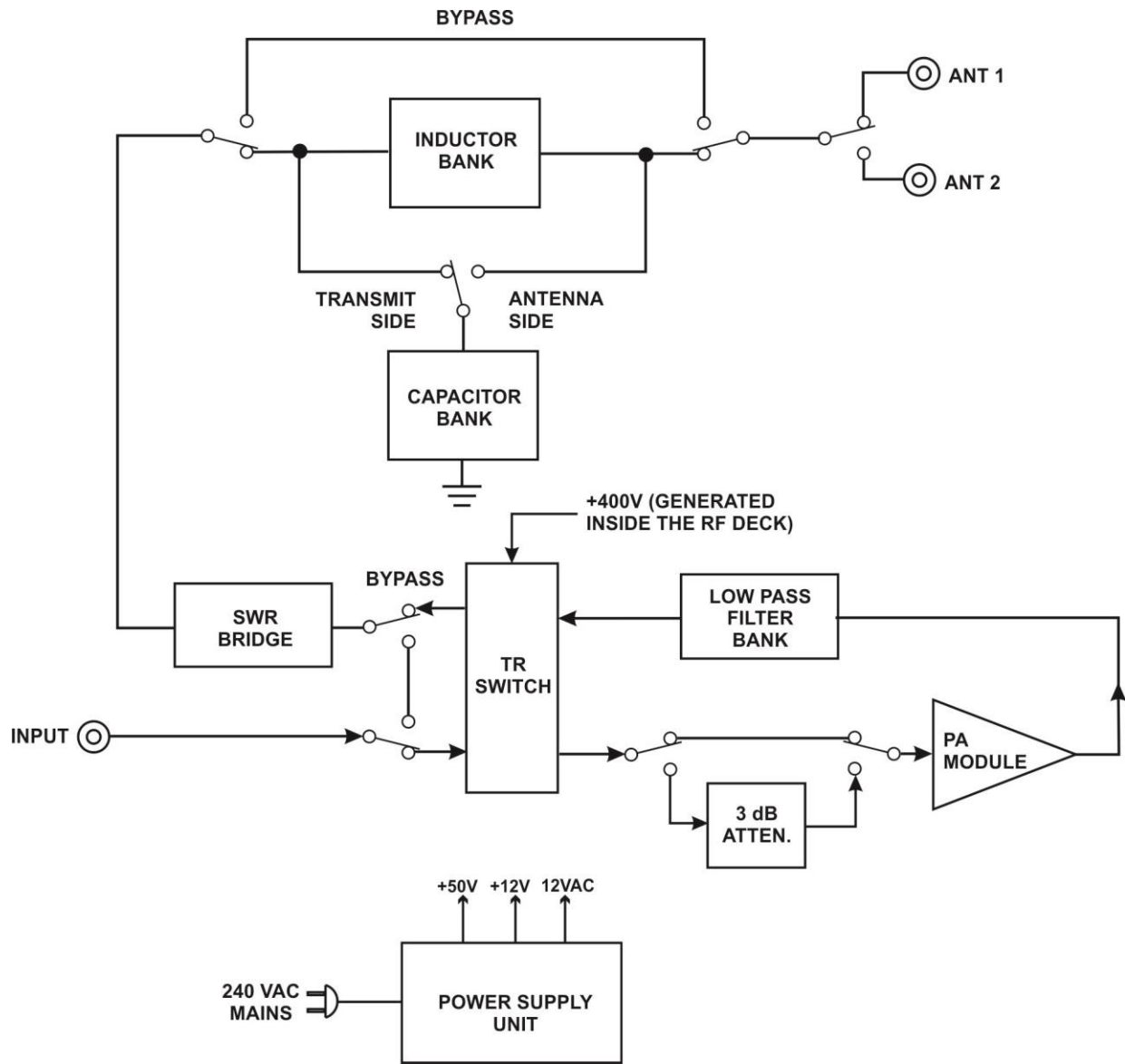

Theory of Operation

Figure 7. KPA1500 Block Diagram.

When the KPA1500 is in operate mode, the transmit-receive (TR) switch routs RF from the driving transceiver to the power amplifier (PA) module where it is amplified by a pair of LDMOS transistors. The Low Pass Filter Bank contains low pass filters to suppress harmonic energy. The TR switch then routs the high-level RF power to the SWR Bridge.

In receive mode the TR switch connects the input directly to the SWR bridge, bypassing the amplifier circuits entirely. When the power is off the Bypass relay performs this function.

RF from the SWR Bridge is sent to the ATU which converts the impedance seen at the antenna connector to a 50 ohm non-reactive load as measured by the standing wave ratio (SWR) bridge.

The ATU uses an "L" matching network with series inductance and shunt capacitance. Combinations of eight capacitors in the Capacitor Bank and seven inductors in the Inductor Bank are switched in by relays to provide up to 2624 pF of capacitance and up to 8370 nH of inductance. An algorithm operates relays to select the

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inductors and capacitors required and chooses whether the capacitors are placed on the transmit side or antenna side of the inductors to arrive at a tuning solution for the current operating frequency.

When the ATU relays are changing capacitors or inductors, the amplifier circuit is kept in receive mode (RF routed through the TR switch but not the PA module), using only the RF power from the driving transceiver to monitor the SWR.

Control logic uses a firmware programmed MCU to control and monitor the KPA1500 operation including making critical measurements of a number of operating conditions including two levels of fault conditions that automatically alter the operation of the KPA1500 (see page 20):

- When a key line low is sensed, the amplifier is switched into transmit mode provided no fault conditions are present, the input signal is not in the 26 to 28 MHz range and an ATU tune operation is not underway.

- When RF is present at the input, the frequency of the signal is measured and the correct low pass filter is switched into the signal path.

- When the amplifier is connected to an Elecraft K3 or K3s by a KPAK3AUX cable as shown in Figure 4 (page 11) or Figure 5 (page 12), the logic receives band data from the K3 or K3s and switches in the correct low pass filter. This provides a speed advantage in rapid band changes since it is not necessary to detect the frequency of the RF drive before switching in the proper filter. However, the RF frequency sensing takes priority if it does not agree with the band data to avoid transmitting with the incorrect filter selected.

- The 3 dB attenuator is automatically switched in if excessive the RF drive power is applied or if other marginal conditions occur such as excessive RF output, reflected power (high SWR) or current is drawn by the finals.

- When a fault condition is detected the TR switch is inhibited so no RF power reaches the PA module unless the applied RF drive is so high it may damage the TR switch. In that case the amplifier is switched into bypass so no RF flows through the TR switch.

- The same control logic that controls the amplifier controls the ATU functions.

To facilitate very rapid frequency changes, tuning solutions are stored in memory and recalled when returning to that frequency. They will be recalled almost instantly when returning to that frequency later.

The entire spectrum from 1.8 through 60 MHz is divided into frequency segments and tuning information is stored for each segment in which you have successfully completed a tune operation.

When starting a tune operation for a frequency segment that has no previously stored tuning solution, the ATU logic first tries the settings in the nearest frequency segments that have tuning data for the antenna connector in use. The antenna connector used is associated with the band and may be the same as was used on that band previously (last used) or an antenna connector identified as preferred (the KPA1500 will switch to that antenna when returning to the band regardless of the antenna connector previously used on that band.) See antenna enable and antenna prefer menu entries on page 21

Since retuning is normally required over a narrower frequency range on the lower frequencies to maintain a low SWR, the lower frequencies have narrower segments assigned as follows:

- Below 3 MHz the segments are 10 kHz wide.
- From 3 MHz through 26 MHz the segments are 20 kHz wide.
- From 26 MHz to 38 MHz the segments are 100 kHz wide.
- From 38 MHz to 60 MHz the segments are 200 kHz wide.

The external power supply provides 50 Vdc 12 Vdc and 12 Vac to the amplifier.

AUX and XCVR Serial Connector Interfaces

⚠ **Do not attach a common VGA cable to the AUX connector.**

The AUX connector provides an optional interface that more closely integrates the KPA1500 with a K3 or K3s transceiver. The XCVR Serial connector provides RS232 level data for other transceivers such as the Elecraft K2 and some Kenwood Yaesu and Icom transceivers. Below are the signals available at the AUX connector. Specific cable connections for Elecraft, Icom and Yaesu equipment follow.

Refer to the *RADIO* entry in the menu (page 21) to enable communications via the AUX connector.

KPA1500 AUX Connector Pinout (DE-15 Male)

Signal Name	Pin	Direction	Notes
Band VRef (Icom)	1	In	Reference for Icom input
AuxBus I/O	2	Out	K3/K3**S**
Band1 In	3	In	BCD Band Input – Bit 1*
NC	4		
GND	5		
Band V (Icom)	6	In	Uses Icom standard band voltages
Alarm Out	7	Out	Drives low for fault input Not used by K3/K3**S**. Must not be connected to K3/K3**S**.
Power On/Off	8	In	Pulse low to turn KPA on or off – do not hold low!
Band2 In	9	In	BCD Band Input – Bit 2*
Key	10	In	Low enables amplification. Internally pulled up to +5V. Sources 1 mA when pulled to ground. Diode isolated from the KEY IN RCA jack.
Inhibit#	11	In	Low inhibits amplifier operation
GND	12		
Band0 In	13	In	BCD Band Input – Bit 0*
Band3 In	14	In	BCD Band Input – Bit 3*
ALC	15	Out	ALC output to transceiver

* See page 34 for the BCD band codes used.

Details of Aux Connector wiring cables for popular transceivers are shown on the following pages.

Elecraft KPAK3AUX Interface Cable

This is available direct from Elecraft (page 29): order KPAK3AUX for the complete set:

- KPAK3AUX Cable, 59.5" (1.5 m) long. May be ordered separately. Order E850463.
- 15 pin Y cable that allows access to the K3 or K3s Aux port for other devices. May be ordered separately. Order E980190.
- 15 pin male-female Key Line Interrupter.

KPAK3AUX cable wiring. Pins not shown have no connection.

KPA1500 AUX CONN. PIN	K3 AUX CONN. PIN	SIGNAL
2	2	AUXBUS
3	3	BAND 1
5	5	GND
9	9	BAND 2
10	10	PTT (See Note)
11	11	Inhibit
12	12	GND
13	13	BAND0
14	14	BAND3
15	15	ALC (Optional, see page 16)

Notes:

1. If you have devices that need access to the PTT line (e.g. some ATUs, SteppIR controllers, etc.), use the key line interrupter supplied with your KPAK3AUX cable set. The interrupter breaks the pin 10 line so you can use the separate KEY IN cable (see Figure 5 on page 12).

2. Pin 4 is not used but the wire is included in the KPAK3AUX cable.

Icom Cable

Various models of Icom radios use either a 13-pin DIN or a 8-pin DIN connector. Be sure to use the connector that is correct for your radio. Pins not shown have no connection.

KPA1500 AUX CONN. PIN	ICOM DIN13 CONN. PIN	ICOM DIN7 CONN. PIN	SIGNAL
1	1	1	8V REFERENCE
5	2	2	GND
6	5	4	BAND VOLTAGE (NOT CI-V)
10	3	3	HSEND
15	6	5	ALC (OPTONAL, SEE PAGE 16)

Icom Band Voltages

Some Icom radios provide an 8V fixed band reference voltage and a variable band voltage, scaled to the band reference voltage. If the band reference voltage is far from 8V, band voltage is ignored.

This band voltage scheme does not provide unique voltages for each band. KPA1500 chooses 7, 21, and 28 MHz when there is ambiguity. For this reason (and ATU recall by frequency segment within a band), a CI-V connection is preferable for Icom frequency information. Note that the internal frequency counter will override these voltages to select the proper band should there be a conflict.

The band voltages accepted are:

VOLTAGE	BAND
0-1 V	10 MHz
1-2 V	50 MHz
2-3 V	24 or 28 MHz
3-4 V	18 or 21 MHz
4-5 V	14 MHz
5-6 V	5 or 7 MHz
6-7 V	3.5 MHz
7-8 V	1.8 MHz

XCVR Serial Cable

The XCVR Serial jack is a 3-terminal 3.5mm serial port. When the KPA1500 is configured in "ICOM" mode, it operates as a 2-terminal CI-V compatible port compatible with Icom and some TenTec® transceivers. Tip = data, ring = no connection, and shank = ground. When configured in SERIAL mode, it is a standard serial port with the tip = TX DATA, ring = RX DATA, and shank = ground and is compatible with KX2, KX3, and many Kenwood transceivers.

For a KX2 or KX3, use a cable with 3.5mm plugs on each end. Cross over tip to ring.

For transceivers using DE-9 connectors, use a female DE-9 connector and a 2 wire + shield cable to a 3.5mm plug for KPA1500 XCVR SERIAL connector.

DE-9 PIN	FUNCTION	KPA1500 3.5MM PLUG
2 (RXD)	RADIO SENDS TO KPA1500	TIP
3 (TXD)	KPA1500 SENDS TO RADIO	RING
5 (GND)	GROUND	SHIELD
7 (RTS)	REQUEST TO SEND	JUMPER TO PIN 8 (CTS)
8 (CTS)	CLEAR TO SEND	JUMPER TO PIN 7 (RTS)

TUNE Cable

The TUNE port is a 3-terminal 3.5mm jack that supports automatic antenna tune requests from Icom radios. Tip = RF request output, Ring = Start tune input, shank = Ground. This connector may be used with non-Icom radios by connecting the tip to the CW Key input of your radio. Grounding the ring terminal will initiate a tune.

Several Icom transceivers have an AUTO TUNE switch intended to control an Icom AH-4 Antenna Tuner. The same AUTO TUNE switch can be used to start a KPA1500 ATU TUNE operation. A 4-pin Molex to 3.5mm TRS plug is required. The Molex plug connects to the transceiver's rear-panel "Tuner Control" socket and the other end plugs into the TUNE jack on the KPA1500 rear panel.

MOLEX TO ICOM XCVR	SIGNAL	3.5mm TRS to KPA1500 TUNE	2.1 mm COAXIAL POWER CONNECTOR
Pin 1 (angled)	KEY is an open collector transistor output, normally pulled up by the transceiver. Low means "key down".	Tip	No Connection
Pin 2	START, pulled up to +5V by the KPA1500, low means "start".	Ring	No Connection
Pin 3	+12V DC	N/C	Center
Pin 4	Ground	Shield	Outer shell

Yaesu Cable

Although various models of Yaesu radios use either DIN8/262 or a MiniDIN8 connector, the pin connections are the same. Pins not shown have no connection.

KPA1500 AUX CONN. PIN	YAESU CONN. PIN	SIGNAL
3	5	Bit 1
5	3 & 8	GND Note: Yaesu pin 8 must be grounded or TX is inhibited.
9	6	Bit 2
10	2	Key
13	4	Bit 0
14	7	Bit 3

BCD Interface

The following are the band codes used by the KPA1500:

Band (Meters)	BCD Code
60	0x0
160	0x1
80	0x2
40	0x3
30	0x4
20	0x5
17	0x6
15	0x7
12	0x8
10	0x9
6	0xA