

Pro Audio Eng PAE-Kx33 AC Power Supply

for the Elecraft™ KX3 Transceiver (and others w/ adapter)



Owner's Manual

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Thank you for purchasing the PAE-Kx33 AC Power Supply.

We originally designed this power supply for use with the Elecraft™ KX3 Transceiver, but it is perfect for use with any device requiring 12-14VDC at up to 4A.

This supply was specifically designed to power high-performance communications equipment, and features an innovative design which inherently minimizes RFI. In addition this supply features multiple filters to further reduce emissions. The result is a power supply offering the small size and light weight advantages of a switching supply without the common disadvantages of RF noise, poor regulation and others. For full information on its specifications, design and performance capabilities, please visit: www.proaudioeng.com

We welcome any and all comments regarding the design, operation or performance sent to: info@proaudioeng.com

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IMPORTANT NOTES:

This power supply must be operated from a 50-60Hz AC power source between 100 and 250VAC ONLY. Operate in an environment away from direct sunlight or moisture. This supply should not be used to directly charge a battery, damage, injury or fire may result. Failure to observe these constraints will result in voiding of the warranty.

Operation:

We suggest you plug the PAE-Kx33 power supply into an AC source before turning on the attached equipment. If you are using the Kx33 to power more than one piece of equipment at the same time, turn on the one with the largest power requirement first. For optimum noise elimination it is useful to place the supply at the full DC power cord length away from the rig being powered.

The Kx33 is rated at 4A output, but will produce considerably more for a period of a few seconds. This allows it to drive large capacitances and transient loads without current fold-back.

The Kx33 offers comprehensive protection circuitry including input over and under-voltage, output over-current, over-temperature and short-circuit protection. These have been incorporated into the Kx33 to protect your equipment, but they should not be relied on as a replacement for proper wiring or fusing.

At loads less than 25mA the Kx33 enters a skip-cycle mode in order to maintain voltage regulation. When in this mode there can be additional noise on the output. For lowest noise it is recommended that a load of greater than 25mA be maintained. This is standard behavior for most switchmode supplies.

Some antenna systems will encourage common-mode coupling through the power supply. This can result in an apparent increase in noise, but is easily remedied. Please read the following section on RFI and AC power supplies for more information.

AC Power Supplies and RFI:

When powering a 12VDC receiver from an AC line power source you may occasionally find the receive noise floor becomes contaminated with noise of various sorts which are not present when powered by a battery and isolated from the AC power system. It is tempting to believe that all of the additional noise originates from within the power supply, but this is often not the case. It is a common misconception that all linear power supplies powered from the AC mains are as quiet as batteries, and that all switching power supplies are noisy. The truth is more complicated due to the multiple routes by which RF Interference (RFI) can be induced into a receiver.

The main routes for RFI are:

1: *Transverse or Differential-mode conduction* of RF ripple superimposed on the DC power supply output can introduce RFI into the equipment being powered. It is critical for the designer of a supply to resolve this source of noise inside the supply as it can cause radiated RFI if allowed to propagate on the DC power cord. We specifically designed the Kx33 to have extremely low RF ripple on the DC output.

2: *Common-mode coupling* of the antenna system to the AC power line through a power supply can introduce several types of RFI to sensitive receive systems. Since the potential exists between the AC input and DC output, not between either of the AC input or DC output conductors it is common-mode. The magnitude of this type of RFI depends on two main factors:

a. *The impedance of the AC input to DC output of the power supply at the frequency of interest.* All AC line powered supplies have a combination of inductive and capacitive coupling between the AC line and the DC output. This represents a path for RF energy to take if a difference in potential exists between the two. When using

a linear supply the instantaneous input to output impedance will be modulated at the AC line frequency, leading to the hum commonly heard in older single-conversion receivers. In the case of a switching supply the coupling can be modulated by the dynamic impedance of the switching action and can cause RFI. Measurements taken by PAE show linear and switching supplies to offer mainly capacitive coupling, with ~1000pF being average. At <100pF the Kx33 minimizes this coupling and the magnitude of this common-mode RFI.

b. The magnitude of antenna system voltage on the chassis of the rig. Well-implemented antenna systems with little imbalance and small common-mode feedline currents are much less likely to cause this form of RFI. When operating with a high-impedance antenna like many end-fed long-wires, or while operating with an indoor antenna, the use of any line-operated supply can potentially induce antenna counterpoise currents to be coupled to the AC power system through the power supply. Inserting a common-mode choke in the antenna feedline will reduce or eliminate the feedline current flow. An excellent reference on this subject can be found on K9YC's site: <http://audiosystemsgroup.com/RFI-Ham.pdf>

In order to minimize common-mode coupling through the Kx33 we offer the #33-410 Fair-Rite Ferrite Clamp-On core at our cost to Kx33 customers at: <https://proaudioeng.com/accessories/> Winding the DC power cable 6 to 8 turns through this core will effectively increase the common-mode impedance of the DC power cable by >3000 ohms@10MHz, effectively minimizing this source of RFI. While the Kx33 does feature both input and output common-mode chokes, we have had a couple of customers inquire as to why we did not integrate a ferrite choke like this into the design of the Kx33 itself, and the answer is size, weight, and cost. The ferrite is over 1/2 the weight and size of the KX33, and would have increased the cost. For 99% of all users, the RFI performance of the Kx33 itself will be sufficient, and those users will enjoy a much smaller, lighter power supply at lower cost.

3. Radiated RFI can come from many sources and can be picked up by the antenna system or many other cables with poorly designed shield terminations and appear as a signal in the receiver. In a well-designed supply like the PAE-Kx33, the external fields from the high-current PCB loop between the switching devices and transformer, as well as the fields of the transformer itself are extremely small. In order to minimize the pickup of any radiated RFI we recommend placing the supply the full length of the DC supply cord away from the rig. Another excellent paper on Jim Brown K9YC's site shows how improper termination of cable shields and improper chassis grounding of connector shells can allow radiated RFI to conduct into our systems: <http://audiosystemsgroup.com/PAARA-RFI-2011.pdf>

Less than 1% of Kx33 customers have experienced any additional RFI caused by proper use of the Kx33. Of those that have, addition of the ferrite core to the DC power cable has remediated the noise. We are sure you will be happy with the Kx33 or we will refund both your purchase and shipping costs, so there is no risk other than a small amount of your time evaluating it.

Accessories:

33-100 - KX3 & PX3 DC Power Splitter Allows you to power the Elecraft KX3 and PX3 from one PAE-Kx33 AC Power Supply.



33-120 - 4.0mm x 1.7mm DC Power Adapter
Adapts the output of the PAE-Kx33 for use with the Yaesu FT-817 and others.



33-140 - 5.5mm x 2.5mm DC Power Adapter
Adapts the output of the PAE-Kx33 for use with the Flex1500 and others.



33-160 - PowerPole DC Power Adapter
Adapts the output of the PAE-Kx33 for use with any 12-14VDC device requiring a PowerPole connector such as the Elecraft K3 and others.



33-180 - 28-piece DC Power Adapter Kit Adapts the output of the PAE-Kx33 for use with almost any device requiring 12-14 VDC power at up to 4A.



33-410 - Fair-Rite Ferrite Snap-It Core (1.5"OD x 0.75"ID x 1.87"L) Useful for choking common-mode RFI from cables such as the Kx33 DC power cable.



See <https://proaudioeng.com> for more information and accessories.

Specifications:

Input Voltage: 100VAC to 240VAC.

Input Current: 1.6A peak at turn-on,
0.7A max at 100VAC full-load,
0.3A max at 240VAC full-load.

Input Frequency: 50-60Hz

Output Voltage @ plug (+/- 0.1V): 14.4VDC at no load,
14.2VDC at 0.2A load,
14.0VDC at 3.5A load.

Output Voltage as shown in KX3 (+/- 0.1V):
14.2VDC in receive at 0.2A load,
13.6VDC in transmit at 2.4A load.

Output Current: 4A maximum.

Maximum Ripple: 10mV.

Efficiency: 82% minimum @ => 200ma load.

Protection: over-voltage, over-current, over-temp., short-circuit.

MBTF: >50,000 hours.

Approvals: UL, FCC GS, TUV, CE, PSE, KC, SAA, CCC

Dimensions (excluding cables): 2" x 1.25" x 4.5"
(50mm x 32mm x 114mm)

Cable Length: AC line cord - 58" (1.4M),
DC power cable - 78" (2M)

Weight: supply: 9.3oz (264G), AC cord: 3oz (85G),
total: 12.3oz (349G)

Warranty: 1 year from date of purchase.