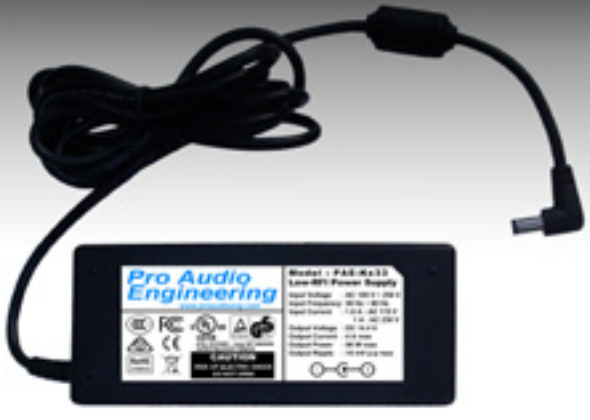
Pro Audio Engineering

PAE-Kx33 Low-RFI AC Power Supply



Owner's Manual

Rev 1.9
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Thank you for purchasing the PAE-Kx33 Low-RFI AC Power Supply.

The Kx33 was specifically designed for the needs of high-performance HF transceivers and communications equipment requiring a low-noise source of DC. It is perfect for use with any device designed to operate from DC 12-14 V at up to 4 A.

This supply features an innovative design which inherently minimizes RFI. In addition the Kx33 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 Hz ~ 60 Hz power source between AC 100 V and 250 V 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 4 A 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 relied on as a replacement for proper wiring or fusing.

At loads less than 25 mA 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 25 mA be maintained. This is standard behavior for most switch-mode supplies.

Some antenna systems, especially end-fed antennas will encourage common-mode coupling through the power supply. This can result in an apparent increase in noise, but thanks to the Kx33's very low input to output coupling, it is easily remedied by the use of a common-mode choke. This can be made easily by running the DC power cable 3-4 turns through the Snap-It core provided with the Kx33. If additional cores are needed Pro Audio Engineering offers a range of Fair-Rite products at very low cost: https://proaudioeng.com/fair-rite-ferrites/

Please read the following section on RFI and AC power supplies for more information.

AC Power Supplies and RFI:

When powering a DC 12 V 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 when using the Kx33 this is seldom the case. It is a common misconception that all linear power supplies powered from the AC mains are as quiet as batteries and 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 and to date have not had any of this type of RFI reported.

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. This potential exists between the AC input and DC output. Whether this coupling introduces noise depends on two main factors:

a. The AC input to DC output impedance of the power supply. All AC line powered supplies have capacitive coupling between the AC line and the DC output. This can be 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. When using a switching supply the coupling can be modulated by the dynamic impedance of the switching action and can cause RFI. Measurements taken of many power supplies by PAE show linear and switching supplies offer ~1000 pF of capacitive coupling on average. At ~70 pF the Kx33 greatly minimizes this coupling and the magnitude of this common-mode RFI current. This makes choking common-mode currents much easier with the Kx33 than other power supplies.

b. Balance and common-mode potential of the antenna system. If the antenna system has a current imbalance between the main radiator and counterpoise or two halves of a dipole as many temporary antenna systems do, it will force the imbalance current back down the outside of the coax feedline shield making it an active part of the antenna system. This will affect the antenna pattern in receive and transmit as well as allow the feedline to receive ambient noise. The rig chassis, the power supply and AC mains are then all in a series path for these common-mode currents making them an active part of the antenna system as well. Inserting a common-mode choke in the antenna feedline at the antenna feedpoint is the best way to reduce or eliminate this common-mode current flow. An excellent reference on this subject can be found on K9YC's site: http://audiosystemsgroup.com/RFI-Ham.pdf

For cases where an antenna system may present common mode potential we include a Fair-Rite mix 31 Snap-It core which can be used to make a choke by winding the DC output cable of the Kx33 through the core 3-4 turns. This will effectively increase the common-mode impedance through the Kx33 by 800 to 1000 ohms @ 10 MHz, effectively minimizing this current path through the supply. If additional ferrite products are desired we offer a range of Fair-Rite Ferrite Clamp-On and toroid cores at low cost to our customers at: https://proaudioeng.com/fair-rite-ferrites/ We made the decision not to integrate a large ferrite choke like the included Snap-It core inside the Kx33 in order to minimize size and weight. For 99% of all users, the RFI performance of the Kx33 itself will be sufficient, and if additional common-mode choking is required the additional core can be employed.

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 Kx33, the external fields

from the high-current PCB loop between the switching devices and transformer, and 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 cable termination or chassis grounding of connectors can allow radiated RFI to conduct into our systems: http://audiosystemsgroup.com/PAARA-RFI-2011.pdf

We are sure you will be happy with the Kx33 or we will refund both your purchase and shipping costs. There is no risk other than a small amount of your time evaluating it.

Maintenance:

Clean with a dry cloth, use no solvents, cleaners or water. There are no adjustments inside. If the supply is not performing as expected, please contact us at: info@proaudioeng.com

Accessories:

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

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

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

33-160 - PowerPole to Female DC Adapter
Adapts the output of the Kx33 for use with any DC 12 ~ 14 V device requiring a PowerPole connector such as the Elecraft K3/10 and others.

33-165 - PowerPole to Male DC Adapter
Adapts any PowerPole DC 12 ~ 14 V source to power an Elecraft KX1/KX2/KX3 or other device needing a 2.1 mm x 5.5 mm DC power plug.

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

Fair-Rite Ferrite Mix 31 Cores
Useful for choking common-mode RFI from RF and power cables.

33-400 - Snap-It (0.933″OD x 0.4″ID x 1.55″L)
33-405 - Snap-It (1.22″OD x 0.514″ID x 1.55″L)
33-410 - Snap-It (1.52″OD x 0.722″ID x 1.87″L)
33-420 - Snap-It (2.22″OD x 1.01″ID x 1.69″L)
33-430 - Toroid Core (2.4″OD x 1.4″ID x 0.5″L)
33-440 - Toroid Core (4.0″OD x 3.0″ID x 1.0″L)

33-510 - Right Angle AC Adapter
Replaces the Kx33's AC cord, allowing the Kx33 to be mounted flush to the wall supported by the AC plug, eliminating the clutter of an AC cord.

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

Specifications:

Input Voltage: AC 100 V ~ 250 V, autoswitching

Input Current: 0.7 A : AC 115 V full-load,
0.3 A : AC 230 V full-load.

Input Frequency: 50 Hz ~ 60 Hz

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

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

Output Current: 4 A maximum continuous, 5 A for 30 seconds.

Maximum Ripple: 10 mV (30 MHz BW).

Protection: over-voltage, over-current, over-temperature,
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″
(50 mm x 32 mm x 114 mm)

Cable Length: AC line cord - 58” (1400 mm),
DC power cable - 78” (2000 mm)

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

Warranty: 1 year from date of purchase.