

ExAmp-20KB Extracellular Amplifier

User Guide

General description

The ExAmp-20KB is an AC-coupled amplifier designed for low-noise extracellular recording. Its unique headstage probe design puts the first stage of amplification at the microelectrode interface, resulting in less external interference noise pickup. The built-in filters are optimized for solid-conductor microelectrodes such as carbon fiber, tungsten or stainless steel. The included 60 Hz (50 Hz optional) reject filter and our special electrode holder adapters virtually eliminate the need for Faraday cages. Possible applications are single-unit or single-axon recording, field potential, cord dorsum potential recording, bipolar electrocardiography, EMG and EEG. The ExAmp-20KB can be used for research and teaching purposes only that do not involve human subjects.

Front panel view



Color of parts may vary

Front panel controls

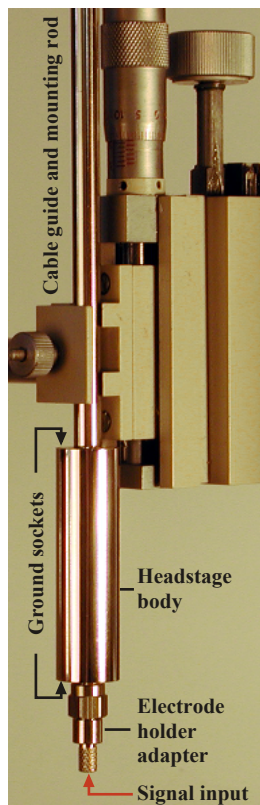
- Power: Turns the unit on or off.
Probe In: Connects the plug of the headstage probe.
Do not overtighten the probe's plug!
Gain: Selects the magnitude of amplification.
Signal Out: Output for the amplified signal.
Battery test: When the combined voltage of the batteries drops below 5.2 V the 'Battery Test' pushbutton switch will no longer produce an audible tone. Replace batteries then.

Main unit specifications

- Input impedance: 10 T Ω , input leakage current: 0.8 pA
Gain: Probe: 10x, System: 200x to 20,000x
Filters built-in: Two 6-pole, tuned circuit bandpass, 60 Hz reject filter (50 Hz optional)
Bandpass frequencies: 300 Hz to 8000 Hz
Output voltage swing: ± 13.5 V, maximum
Power: 4 standard "D" size batteries
Battery test: Audible tone
Lifetime of batteries: 500 hours, estimated
Dimensions: 6 1/8" x 2 1/4" x 6 7/8" (155x54x175 mm)
Weight: 2.5 lbs (1130 grams) with batteries

Headstage probe specifications

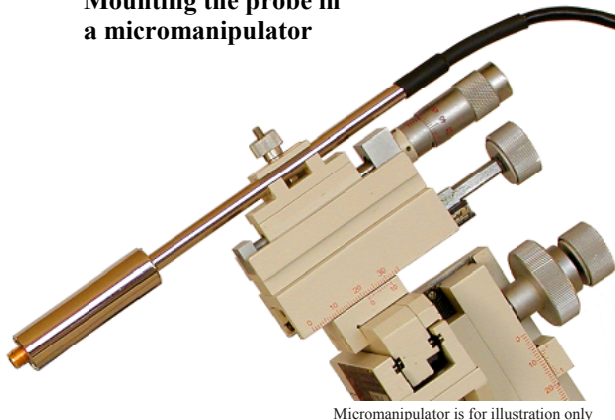
- Mounting rod: 1/4" (6.4 mm) x 4" (105 mm), diam. x length
Body: 5/32" (14.4 mm) x 2" (50 mm), diam. x length
Material: Nickel-plated brass
Cable length: 52" (132 cm)
Input sockets mate with: 0.0315"-0.0370" (0.80-0.94 mm) diam. pins



Headstage probe

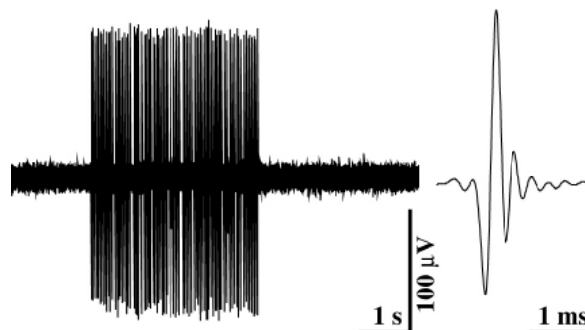
This unique probe design is an electrode holder in one. Either Kation made glass insulated carbon fiber electrodes or standard metal electrodes can directly be plugged into the probe. See next page for details.

Mounting the probe in a micromanipulator



Micromanipulator is for illustration only

Sample recording



Recording was taken from a medullary neuron in the rat using Kation Scientific's Carbostar-3 carbon fiber microelectrode.

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Performing an experiment

In order to minimize external noise pickup and interference, experimental set-ups have to be correctly shielded and grounded. Overall shielding is often provided by a Faraday cage. Faraday cages do not necessarily remove interference from magnetic fields which usually cause the most problems. Here we provide a few tips to improve quality of recordings.

Tip 1. Place the the preparation to be recorded as close to a large iron steel (not stainless steel!) baseplate as possible (which should be connected to the ground pin of the headstage probe). The greater the mass of the plate, the more helpful it will be at deflecting a magnetic field. A steel slab 1/2" (12 mm) thick and at least 20" (500 mm) on each side greatly improves the quality of extracellular recordings.

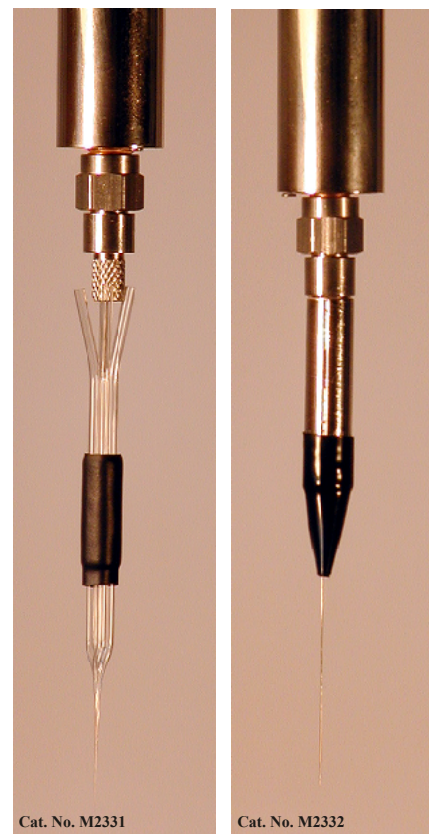
Tip 2. Always keep the lead wire from the electrode to the headstage probe (or to the animal's foot when used as an electrocardiograph) as short as possible, less than 2" (5 cm). This is accomplished by our unique headstage probe design so that microelectrodes can actually be plugged straight into the probe. See figures →

Tip 3. Keep line-powered equipments as far away from the site of recording as it is possible. Everything near the preparation should be grounded to a single point, that is the ground pin on the headstage probe and to nothing else. Use of a "star" formation grounding will minimize ground loops.

After following these basic rules, the removal of interference noise is normally a process of trial and error, involving experiments with slightly different patterns of grounding and shielding. Remember that our ExAmp-20KB amplifier permits a very smooth, low-noise recording. Thus, if your extracellular recording shows a frustrating level of noise keep trying to find and eliminate the source.

Electrode holder adapters

Two types of electrode holders are offered for our headstage probes. The first is used for attaching Kation-made single or multibarreled carbon fiber electrodes to the headstage. In order to configure this type of electrode holder, screw the adapter onto the headstage and simply plug the electrode's connector pin in as shown in the leftmost diagram. The other type of adapter is used for accomodating long, small-diameter metal electrodes. To configure this type of electrode holder, first insert the electrode pin—first into the front of the adapter and pull it through so that it protrudes somewhat from the back end of the adapter. Use a small tweezers to grasp the pin of the electrode and insert it into the input socket of the probe. Screw the adapter onto the probe gently by hand. Finally, take an inch-long strip of electrical tape and roll it cylindrically so that one-third of the tape's width is around the front end of the adapter and two-thirds of it is around the shank of the electrode itself, then flatten the front end of the tape using the thumb and forefinger. The end result of this procedure is illustrated in the rightmost diagram.

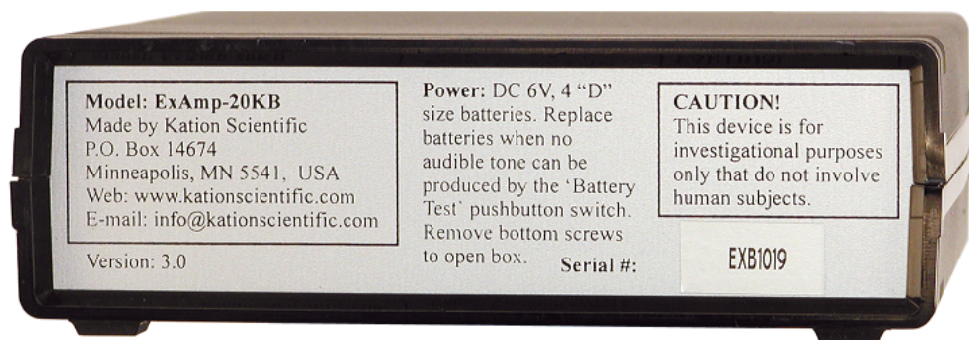


Cat. No. M2331
Adapter for Kation-made single and multi-barreled electrodes

Cat. No. M2332
Metal electrode adapter

Batteries

The ExAmp-20KB extracellular amplifier is powered by four standard D size batteries. According to factory calculations and tests, a set of good quality fresh batteries provide sufficient power for at least 500 hours of operation. To save batteries, turn off the unit when it is unused for an extended period of time. When the combined voltage of the batteries drops below 5.2 Volts the 'Battery test' pushbutton switch will no longer produce an audible tone. This signals the time to change batteries even though the unit will work fine for a while.



Back panel view

Certification:

Kation Scientific certifies that this instrument has been tested and inspected thoroughly and was found to meet all published specifications before shipment from the factory.

Warranty:

This product is warranted against defects in materials and workmanship for one full year from the date of shipment as long as it has been exposed to normal and proper use. Products which prove to be defective during the warranty period will be repaired or replaced without charge provided they are returned to the factory. Kation Scientific will provide for servicing and calibration after the warranty period for a reasonable service charge. The instrument should be shipped to the factory postage prepaid.