

ExAmp-20KS Extracellular Spike Amplifier

User guide

General description

The ExAmp-20K is an AC-coupled spike amplifier designed for low-noise extracellular recording from single- or multiple units. 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 (or 50 Hz, selectable) reject filter and our special electrode holder adapters virtually eliminate the need for Faraday cages. Front and rear panel controls are intentionally simplified for ease of use without compromising the quality of recordings.

The positive input of the front amplifier (center pin of the headstage's SMA receptacle) is referenced to the ground (ground socket) providing high-quality, single-ended (monopolar) recordings. The ExAmp-20K can be used for research and teaching purposes only that do not involve human subjects.

Front panel view



Color of parts may vary

Rear panel view



Front panel controls

- Power:** Turns the unit on or off. Red LED signals on status
- Probe:** Inputs the plug of headstage probe
- Gain:** Selects the magnitude of amplification from 200x to 20,000x in 7-positions
- Offset:** Offsets the output signal by +/- 1V, max.
- Polarity:** Changes the polarity of output
- Output:** BNC jack out-putting amplified signal

Back panel objects

- Power In:** Two identical DC power jacks for 12 VDC input and output, 2.1 mm x 5 mm type
- Gnd:** Circuit ground, galvanically isolated from 'Power In' ground (Case), 2.64 mm banana jack
- Case:** Ground (0V) of 12 VDC power input 2.64 mm banana jack

Main unit specifications

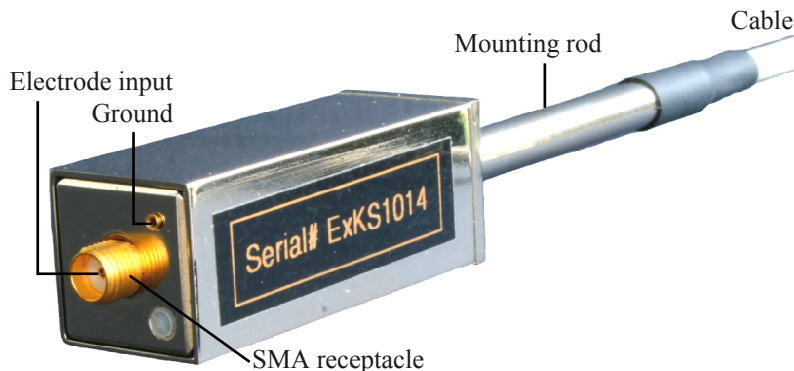
- Input impedance: $10^{13} \Omega$
- Input bias current: 2 pA
- System gain: 200x to 20,000x in 7 calibrated steps
- System noise: $> 2.5 \mu\text{V}$ peak to peak with probe input grounded
- Bandpass filter: 300 Hz to 8000 Hz, built-in Butterworth 4-pole
- Notch filter: 50/60 Hz, selectable inside the box
- Output voltage swing: $\pm 10 \text{ V}$, maximum
- Power source: External, 12 VDC power supply
- Power consumption: 200 mA, maximum
- Amplifier (Gnd) ground: Isolated from DC input ground (Case)
- Dimensions: 155 x 54 x 175 mm aluminum box
- Weight: 1.35 lb (614 grams)

Headstage probe

- Signal amplification: 10x, single-ended, AC-coupled
- Mounting rod diameter x length: 1/4" (6.35 mm) x 4" (105 mm)
- Body diameter x length: 0.75" (19 mm) square x 2.05" (52 mm)
- Material: Nickel-plated brass
- Cable length: 52" (132 cm)
- Input receptacle: SMA, spark plug type, gold-plated
- Input & ground sockets mate with: 0.0315"-0.0370" (0.80-0.95 mm) diameter male pins

This exceptional headstage probe is an electrode holder in one. Using appropriate holder adapters, all Kation-made microelectrodes or third-party standard metal electrodes can directly be plugged into the probe. There is no need for additional electrode holders. See next page for details.

Also, the coaxial arrangement of the mounting rod and the SMA-type electrode input receptacle allows an easy yet precise positioning of the recording electrode. The robust, nickel-plated body of the probe provides and unsurpassed protection from electromagnetic interference.



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.

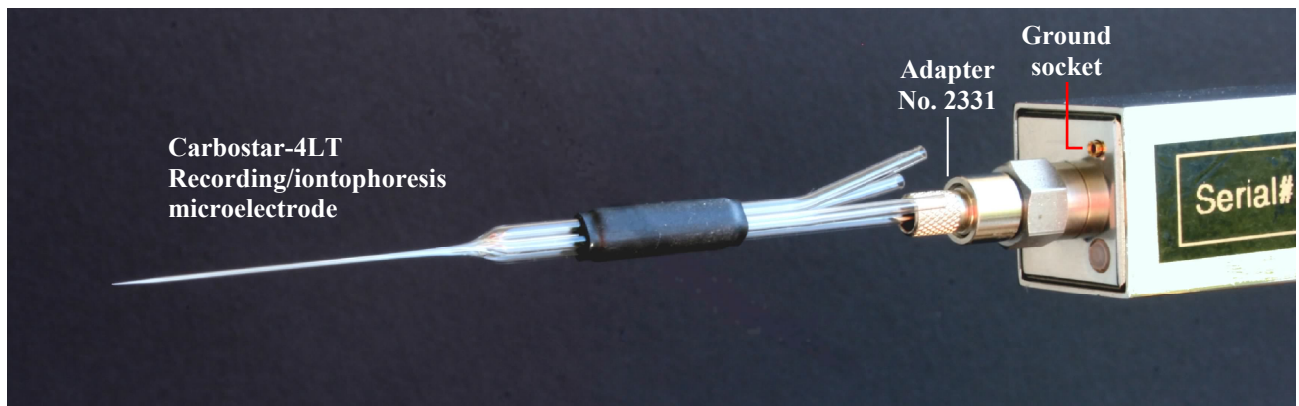
Tip 1. Place the preparation to be recorded as close to a large carbon steel (not stainless steel!) baseplate as possible (which should be connected to the ground pin of the headstage probe). The greater the mass of the plate, the more helpful it will be at deflecting a magnetic field. A steel slab 1/2" (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 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.

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.

Tip 4. Isolation of extracellular amplifiers from power line ground prevents ground loop formation.

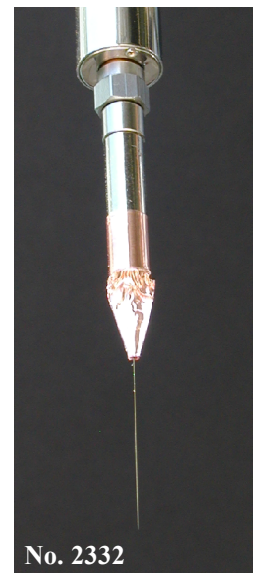
After following these basic rules, the removal of interference noise is normally a process of trial and error, involving experiments with slightly different patterns of grounding. Remember that our ExAmp-20K amplifier permits a very smooth, low-noise recording. Thus, if your extracellular recording shows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



Electrode holder adapters

Adapter No. 2331 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 above. Adapter No. 2332 is used to accommodate long, small-diameter metal (tungsten or stainless steel) 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, use an inch-long strip of metal or electrical tape to fix the electrode as shown in the right figure.

For other type of electrode holder adapters check our website.



Grounding

Circuits of the headstage probe and main amplifier are galvanically isolated from the input DC power (floating configuration). In many cases, however, **a better recording quality may be achieved by connecting the amplifier's ground (Gnd) to the input DC ground (Case).** This solution may be counterproductive in other instances.

The headstage probe has two miniature sockets for grounding: one on the front end (shown above) and one on the rear end. Use one of them to ground the amplifier to your preparation. All other instruments should also be connected to this point to achieve a "star formation" grounding.

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.

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