

BAB-600 Iontophoresis Pump

High Voltage Constant Current Source for microAmpere Microiontophoresis

General description

The BAB-600 iontophoresis pump is specifically designed for extracellular iontophoretic deposition of neural dyes or transport tracer substances such as pontamine sky blue, horseradish peroxidase (HRP), *Phaseolus vulgaris* leucoagglutinin or any other electrically charged particles. The maximum output current is 20 μA with a maximum compliance voltage of 600 V. The intensity of current is set by the ten-turn 'Current' dial. A built-in 10 M Ω resistor can be selected for termination to preview the required current. Toggling the 'Load' switch to 'Electrode' position initiates the selected current flowing through the 'Electrode' output with polarity referenced to the 'Ground' output. Polarity can be chosen by the 'Polarity' switch.

In 'External' (Ext.) mode, the output current is on whenever the gating input (the "External" BNC jack located on the back panel) is logic high and it is off on logic low. In pulse mode ('7s Pulses'), an internal timer turns on the output current for 7 s in every 14 s generating 7s on/ 7s off cycles. The current sensing resistor is in series with the current source providing a true measurement of the output current. The unit's high voltage circuitry is galvanically isolated from the input DC power providing a floating current output which is not referenced to the line ground.

Do not use too high ejection currents! In most applications, 2-3 μA ejected for 3 to 10 min will do the job.

Front panel controls

Power: This LED-tipped switch turns unit on or off.

Mode: In "Continuous" mode, iontophoresis current is continuously generated. In "External" mode, the unit can be gated through its "External" BNC jack by any logic pulse generator or computer. In "Pulse" mode, an internal timer turns on the output current for 7s every 14s generating 7s on/7s off cycles.

Polarity: Polarity of the "Electrode" output in reference to the "Ground" output can be selected by this switch.

Liquid Crystal Display (LCD): Displays current that actually flows through the iontophoresis pipette or the internal 10 M Ω dummy load. Sampling (refresh) rate of the display is 5 Hz.

Load: Select either "Electrode" to deliver iontophoresis currents or "Internal 10 M Ω " dummy load to preview the required current.

Current: Output current can be adjusted by this ten-turn knob up to 20 μA .

Ground: The ground or returning path electrode should be connected this output.

Electrode: This output delivers the iontophoresis current with the selected polarity in reference to the "Ground" output.

Front panel view



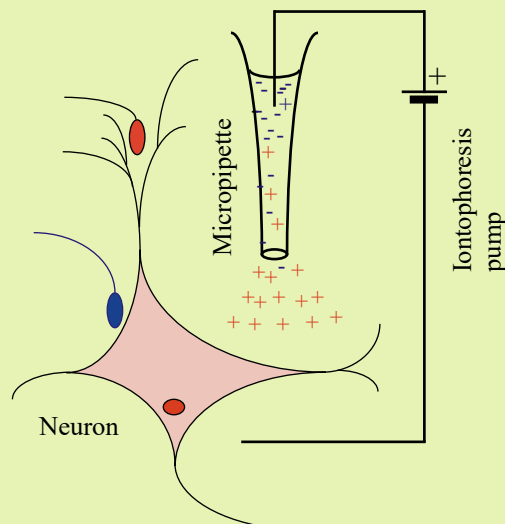
Color of parts may vary.

Specifications

Output current:	$\pm 20 \mu\text{A}$, maximum
Compliance voltage:	$\pm 600 \text{ V}$
Polarity:	+/-, switch selected
Termination:	Electrode/10 M Ω internal dummy load
Load configuration:	Floating
Mode of operation:	Continuous/External/Pulsed
Pulse duration:	7 seconds, factory set
External control:	Through 'External' BNC jack using TTL or CMOS gating signals
Power supply:	External 12V DC, 500mA max.
Duty cycle in pulse mode:	50% (7s on/7s off)
Case material:	Aluminum
Dimensions (WxHxD):	6.67" x 2.19" x 6.45" (169.5 x 55.6 x 164.0 mm)
Weight:	1.7 lbs (770 grams)

Basic principle of microiontophoresis

If a voltage is applied to a solution, ions and charged molecules will migrate toward and away from the source of the imposed electrical field depending upon the sign of their net charge.



The direction of current flow to eject cations.

Performing an experiment

Turn the unit on in continuous mode using the 10 M Ω internal dummy load for termination. Allow a few minutes for thermal equilibration. Connect the factory provided banana plugs to mini grabbers cable to the 'Ground' and 'Electrode' outputs with Ground to GND polarity. The red grabber will deliver the iontophoresis current into the micropipette through a piece of platinum or silver wire. The polarity of the current flowing through the red grabber is selected by the 'Polarity' switch and is referenced to the 'Ground' output *i.e.* to the black grabber. To provide a path for the returning current, ground the black grabber to the experimental system (*e.g.* by grabbing the skin of the experimental animal).

Using the current adjusting knob, select the required current level while keeping the 'Load' switch in 'Internal 10 M Ω ' position. Use the 'Mode' switch if other than continuous mode of operation is needed. The 'Polarity' switch will define the direction of the current flowing through the micropipette. The unit is now ready to deliver the pre-selected current: turn 'Load' switch into 'Electrode' position and iontophoresis will immediately take place at the tip of the micropipette in continuous mode. The iontophoresis current can be gated externally via the 'External' BNC connector or it can be pulsed by an internal timer when selected by the 'Mode' selector switch. In the latter case, current will be delivered in 7s on, 7s off cycles.

Useful tips: Keep in mind that microiontophoresis involves two-way traffic of electrically charged particles. Imposing an electrical field on your micropipette will cause the compound of interest to be ejected, but at the same time, oppositely charged particles, including tissue debris, will enter the pipette and may cause blockage. When the pipette gets clogged with tissue particles during iontophoresis the current may decline correspondingly. It is often helpful to reverse the polarity for 10 to 20 s in such cases. If this does not help then increase the diameter of the pipette's tip. Tissue debris particles are usually negatively charged so ejecting micropipettes always tend to get clogged faster when cations are ejected with positive currents. For this reason, opt for working with anions if you have the freedom to do so. **Do not use too high ejection currents!** In many cases, less current produces better results. Too high currents speed up pipette clogging and/or may cause hydrolysis (bubbles) at the tip of the micropipette which, in turn, may destroy the iontophoresis process.

Rear panel view



- Power In:** DC power jack, type: 2.1 mm x 5 mm.
- Case:** The aluminum case of the unit can be connected through this miniature banana jack to the line ground if necessary.
- External:** Input for the external gating signal to turn the unit on/off when the 'External' mode of operation is selected. Use TTL or CMOS (+5V) signals. Switching time: 0.5 msec; switching current: 3 mA.

Power supply

The international power supply that Kation Scientific offers (Cat#: M1116) is double isolated for safety. Current output of the BAB-600 is isolated from the line power ground. Nevertheless, any good quality 12 VDC power supply can be used.

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.