

Union-40 Iontophoresis Pump

Precision Constant Current Source for Nanoampere Microiontophoresis

General description

This precision constant current source may be operated in two switch-selectable current ranges. The 0-20 nA range is for intracellular dye or tracer deposition. The 0-200 nA range permits extracellular delivery of various substances to test their effects on neuronal firing. The retention and ejection currents can be set by the respective front panel knobs with an accuracy of 0.1 nA. Switching between the retention and ejection currents can be done manually using the 'Mode' selector switch or can be automated through the back panel 'Remote' BNC jack using a computer or timer. The ejection current is activated whenever the remote input is logic high, retention current is on when it is logic low. The polarity of the ejection current is switch selected, while the polarity of the retention current is automatically set. The current sensing resistor is in series with the current source providing a true measurement of the output current. The output current can be monitored by computer or chart recorder using the back panel 'I monitor' BNC jack.

Front panel controls

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

Range: Toggles between the 0-20 nA range, which is for intracellular dye or tracer deposition, and the 0-200 nA range, which permits extracellular delivery of various substances.

Ejection polarity: Selects the polarity of the ejection current. The retention current is automatically set to the opposite polarity.

Compliance: This bicolor LED turns red when the compliance voltage reaches its maximum.

Back-lit Liquid crystal display: Displays the current that is actually flowing through the iontophoresis pipette. The sampling (refreshing) rate of the display is 2.5 Hz.

Mode: In 'Retain/Remote' mode, the output delivers the retaining current unless overridden by a signal from an external timer or computer connected to the unit via the 'Remote' BNC jack. In 'Eject' mode, the selected ejection current is delivered through the center pin of the 'Output' BNC jack.

Retention: Sets retention currents between 0 and 20 nA of either polarity depending on the ejection polarity switch.

Ejection: Sets ejection currents between 0 and 200 nA of either polarity depending on the ejection polarity switch.

Output: Delivers the selected iontophoresis current through the center pin of the BNC jack with polarity referenced to the grounding shell. Maximum compliance voltage is $\pm 40V$.

Back panel controls

I Monitor: Telegraphs the magnitude of iontophoresis current to a recording device such as a chart recorder or computer. Conversion factor: 10 mV/nA.

Ground (Gnd): System ground of the iontophoresis current generator circuitry.

Case: The aluminum box of the unit can be connected through this banana jack.

Remote: When the 'Mode' switch is in 'Retain/Remote' position, the iontophoresis current can be gated through this BNC jack using an external timer or computer. It accepts TTL or CMOS signals.

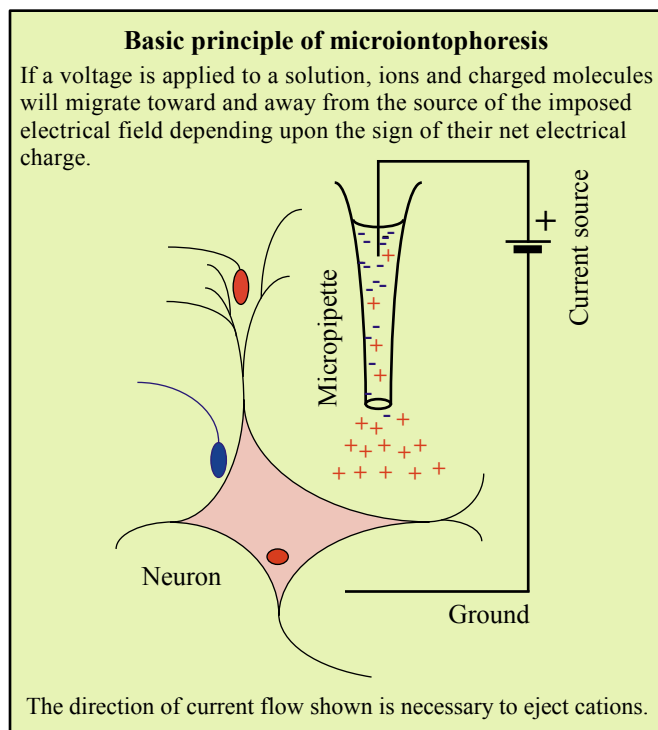
Power In/Out: One of the two identical DC power jack is for input from external power supply, the other is for transmitting power to the next unit in a daisy-chain configuration.

Front panel view



Color of parts may vary.

Back panel view



Kation Scientific, P.O. Box 14674, Minneapolis, MN 55414 Phone/Fax: (651) 698-5167.

E-mail: info@kationscientific.com Web site: www.kationscientific.com

Performing an experiment

Turn the unit on and allow a few minutes for thermal equilibration to take place. Connect the BNC plug end of a coaxial cable (preferably an RG 174/U type, external diameter 2.56 mm) to the unit's BNC jack output. Solder a one to two inch (2.5-5 cm) long platinum or silver wire to the free end of the center lead through which the unit will deliver the iontophoresis current into the micropipette. The polarity of the current flowing through the micropipette can be selected by the "Ejection Polarity" switch and it is referenced to the braid shield of the cable. To provide a path for the returning current, connect the shield to the experimental ground (*e.g.* to the skin of the experimental animal). The back panel 'Ground' miniature banana jack input can also be used for this purpose. There may be situations when the aluminum case should also be connected to the recording system for noise reduction. Use the 'Case' banana jack for this purpose. Select the necessary retention and ejection currents using the respective front panel knobs. Ejection currents can be initiated either manually by the 'Mode' selector switch or via the back panel 'Remote' input using a timer or computer. In the latter case, keep the mode selector switch in the 'Retain/Remote' position.

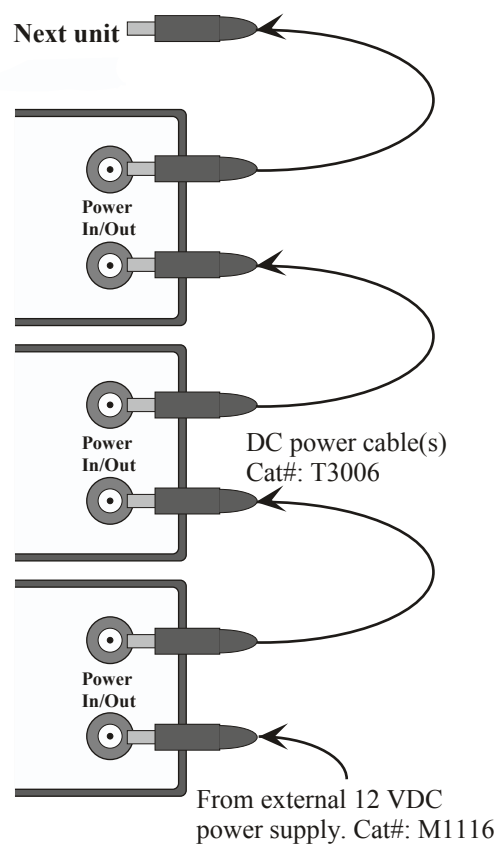
Useful tips: In extracellular studies, a retention current of 3 to 5 nA is usually sufficient. Always start from a low ejection current and gradually increase it until the desired biological effect shows. Keep in mind that microiontophoresis involves a two-way traffic of electrically charged particles. Imposing electrical field on your micropipette will cause the drug of interest to be ejected, but at the same time, oppositely charged particles (including tissue debris) will enter the pipette and may cause blockage. The compliance LED turns red when compliance voltage reaches its maximum meaning that the unit is unable to provide the required ejection current due to overly high pipette resistance.

Power supply

The international power supply that Kation Scientific offers (Cat#: M1116) can provide power for multiple units. Use a daisy chain formation when more than one unit is to be supplied from one source, as shown on the right. The power supply and the power conditioning circuitry employed in the Union-40 allows for galvanic isolation from the line power system.

Specifications

Ejection current range:	0- ±200 nA or 0- ±20 nA, switch selectable.
Retention current range:	0- ±20 nA or 0- ±2 nA.
Compliance voltage:	±40 V, maximum.
Max. pipette impedance:	400 MΩ at 100 nA output, 200 MΩ at 200 nA output.
Load configuration:	Floating.
Mode of operation:	Manual 'Retain' or 'Eject' by toggle switch, 'Remote' by external timer or computer.
Remote control:	Through back panel 'Remote' BNC jack by TTL or CMOS signals. Optical isolation is up to 5000 V.
Current monitor:	Through back panel 'I Monitor' BNC jack; 10 mV/nA.
Case material:	Aluminum
Dimensions:	6.67" x 2.19" x 6.45" (169.5 x 55.6 x 164.0 mm) (WxHxD).
Weight:	1.7 lbs (770 grams).
Power source:	12 V DC external power supply
Power consumption:	350 mA, maximum



Daisy-chaining multiple units

For related products and a list of iontophoretically applied neural dyes and tract-tracing materials, please visit our Web-site. See URL below.

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.

Kation Scientific, P.O. Box 14674, Minneapolis, MN 55414 Phone/Fax: (651) 698-5167

E-mail: info@kationscientific.com Web site: www.kationscientific.com