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Electronic Instruments
for the Life Sciences

made to measure

MVCS Series

Iontophoresis Amplifiers

Ref.: Liu et al. (1999). Neuron, 22:395–409
Murnick et al. (2002). J Neurosci.Meth. 116: 65-75
Kovalschuk et al. (2015). Nat Commun. 6:6349
Müller et al.,(2013). J. Vis. Exp. 77: e50701,
Heine et al. (2008). Science 320:201-205
Castilho et al. (2015). J Neurosci. 35: 5422–5433
Jacob et al. (2013). J. Neurosci.33: 13724 –13734

Iontophoresis involves the ejection of drugs or other ionic compounds through micropipettes by the application of current. Depending on the net charge of the substance to be ejected positive or negative current is applied to the micropipette to cause the ions to flow. npi electronic has designed very accurate current pumps to perform iontophoresis ejection of ionic substances. npi MVCS systems are high-voltage, high-speed current sources for iontophoresis or other applications, where constant currents in the nA or µA range are needed. Some models allow very fast drug applications down to the sub-millisecond range. Therefore, these systems can be used to simulate synaptic events. The unique operating and display elements of the instruments facilitate the application of drugs in physiological, pharmacological, and biochemical studies. The standard version is designed for relatively slow drug applications in the range above 100 milliseconds. With these models the microelectrode is connected via a special cable directly to the front panel of the instrument. The fast version with high-speed capacity compensation is suitable for drug application in the sub-millisecond range. This version includes a special small headstage for each channel as well as an electrode resistance test circuit.

Features:

- One or two channel versions (one channel versions can be upgraded)
- Time resolution: down to **100 µs**, spatial resolution: down to **1 µm**
- Simulation of synaptic events, suitable for receptor density mapping
- Automated balancing of iontophoretic current (option)
- Currents from tens of pA up to µA
- High-voltage, high-speed current source
- Automated electrode resistance test
- Also available as module for the EPMS-07 system

Headstage of MVCS

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Technical Data

Electrode Output:
floating current source
output impedance $>10^{12}$ Ω

Maximum Current:
±450 nA [±1.5 µA] into 100 MΩ load

Display:
current: XXXX nA, balance: XX.XX µA,
voltage: XXX.X V, R_{EL}: XXXX M, displayed value is set by a three position toggle switch, separate displays for each channel

Eject:
ten-turn control, range: ±100 nA resp. ±1 µA, selected by switch

Minimum pulse duration:
100 µs

Retain:
ten-turn control, maximum ±100 nA

Capacity compensation:
ten-turn control, range 0-30 pF

Output current polarity:
selected by INVERTED/NORMAL toggle switch

TTL input (AUTO mode):
LO = RETAIN, HI = EJECT, R_{in} >5 kΩ

Modes of operation:
set by two toggle switches
EJECT/RETAIN/AUTO switch enables manual or TTL controlled operation
SET/OPERATE switch connects automatically electrode outputs to ground (SET position)

Analog input:
sensitivity 100 nA / V, R_{in} >100 kΩ, range ±10 V

Current monitor:
sensitivity 100 nA / V, R_{out} = 50 Ω

Voltage monitor:
V_{EL} / 10, R_{out} = 50 Ω

Balance output:
inverted sum of all injection currents, sensitivity 1 µA / V

Power requirements:
230 V / 115 V, 50 Hz / 60 Hz AC, 50 W, fuse 0.4 A / 0.8 A, slow

Dimensions:
19" rackmount cabinet, 19" (483 mm), 10" (250 mm), 3.5" (88 mm)
Headstage: 65x25x25 mm

The various configurations of MVCS systems are reflected in the part number

MVCX-C-0YA-V

where
X: S = Iontophoresis System C = Balance channel (Module only)
C: Fast System with Headstage(s)
Y: Number of Channels (1 or 2)
A: C = Iontophoresis System with Balance U = Upgrade M = Module
V: max. Voltage (45 V or 150 V)

Examples

MVCS-01C-45	19" instruments, one application channel, one balance channel, slow (>100 ms), 45 V
MVCS-C-02M-150	Module for EPMS-07 system, two application channels, fast (<1 ms), 150 V

MVCS Series

19" Stand Alone Systems

	Standard (Slow, >100 ms without headstage)		*Fast (<1 ms, with cap.comp. and headstage)*	
One channel (without balance)	**MVCS-01-45** 45 V	**MVCS-01-150** 150 V	**MVCS-C-01-45** 45 V	**MVCS-C-01-150** 150 V
One channel (with balance)	**MVCS-01C-45** 45 V	**MVCS-01C-150** 150 V	**MVCS-C-01C-45** 45 V	**MVCS-C-01C-150** 150 V
Upgrade to second channel	**MVCS-01U-45** 45 V	**MVCS-01U-150** 150 V	**MVCS-C-01U-45** 45 V	**MVCS-C-01U-150** 150 V
Upgrade to balance	**MVCC-U-45** 45 V	**MVCC-U-150** 150 V	**MVCC-C-U-45** 45 V	**MVCC-C-U-150** 150 V
Two channels (without balance)	**MVCS-02-45** 45 V	**MVCS-02-150** 150 V	**MVCS-C-02-45** 45 V	**MVCS-C-02-150** 150 V
Two channels (with balance)	**MVCS-02C-45** 45 V	**MVCS-02C-150** 150 V	**MVCS-C-02C-45** 45 V	**MVCS-C-02C-150** 150 V

Modules for EPMS-07 System

	Standard (Slow, >100 ms without headstage)		*Fast (<1 ms, with cap.comp. and headstage)*	
One channel	**MVCS-01M-45** 45 V	**MVCS-01M-150** 150 V	**MVCS-C-01M-45** 45 V	**MVCS-C-01M-150** 150 V
Two channels	**MVCS-02M-45** 45 V	**MVCS-02M-150** 150 V	**MVCS-C-02M-45** 45 V	**MVCS-C-02M-150** 150 V
Balance module	**MVCC-M-45** 45 V	**MVCC-M-150** 150 V	**MVCC-C-M-45** 45 V	**MVCC-C-M-150** 150 V

Standard systems come with a set of cables to connect the electrode directly to the 8-pole connector at the front panel

Fast systems come with a headstage with BNC connector, capacity compensation and an automated electrode resistance test

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Examples

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Examples

MVCS Series

MVCS-C-02C, two channels, fast, with balance channel
(headstages not shown)

MVCS-02C, two channels, slow, with balance channel

MVCS-C-02M, iontophoresis module,
fast, two channels for EPMS
(headstages not shown)

MVCS-01M, iontophoresis module,
slow, one channel for EPMS

MVCC-M, balance modules for EPMS

fast

slow

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