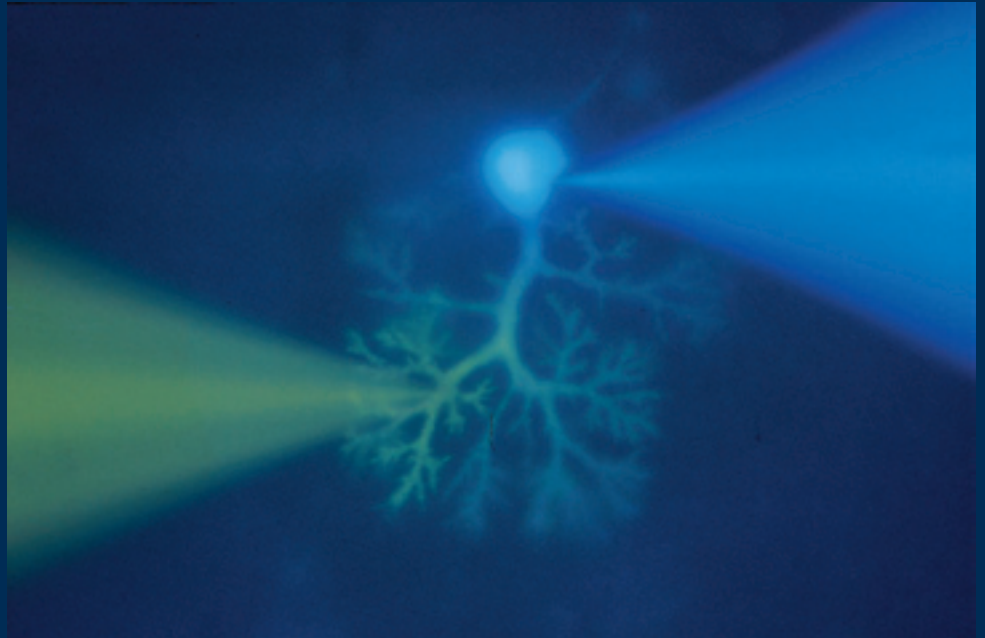




EPC 10 Double EPC 10 Triple Patch Clamp Amplifiers

The EPC 10 Double and Triple are the ideal instruments for simultaneous stimulation and data acquisition from multiple amplifiers.



If you believe your job is to make new discoveries...

...discover the **EPC 10 Double and Triple Patch Clamp Amplifiers:**

The highly integrated patch clamp amplifier system

EPC 10 Double: 2 completely independent amplifiers with 2 headstages in one housing

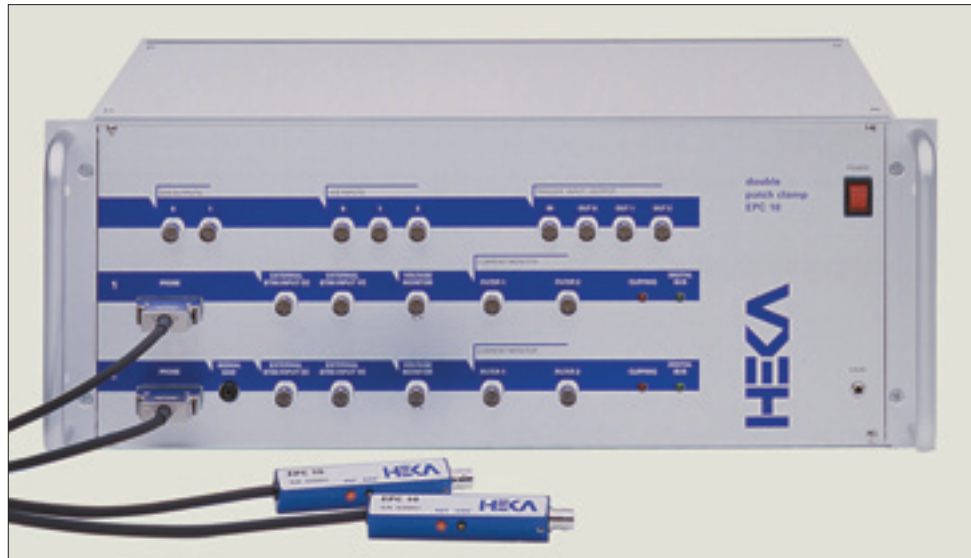
EPC 10 Triple: 3 completely independent amplifiers with 3 headstages in one housing

HEKA

HEKA provides the finest instruments today to achieve the needed progress of tomorrow...

The successor of the revolutionary EPC 9 Double and EPC 9 Triple

With new, state-of-the-art amplifier features, the EPC 10 Double and EPC 10 Triple will meet the exceeded needs of electrophysiological researchers.



Continuing the tradition of providing the world's best electrophysiology amplifiers, the EPC 10 Double and Triple have all of the features of their predecessors, the EPC 9 Double and Triple; but they go much further in offering many improvements that have been implemented according to the wishes, suggestions and proposals of our customers.

The EPC 10 Double and EPC 10 Triple patch clamp amplifiers are the optimal instruments for performing double or triple patch clamp experiments. Although either two (EPC 10 Double) or three (EPC 10 Triple) amplifiers are combined in a single housing; each amplifier is completely independent with clearly defined operation and handling. HEKA's software stimulates the desired amplifier and selected channels are programmed without tedious connection of cables by the user.

The amplifiers and headstages are clearly identified, thus, the user can immediately assign the amplifiers to particular patched cells. Although independent, the amplifiers can be stimulated simultaneously with resulting simultaneous data acquisition. Current or voltage signals from multiple amplifiers can be recorded, displayed and even analyzed online. This versatility makes these amplifiers ideal instruments for experiments such as studying gap junctions, pre- and post-synaptic events, and even usage in amperometric measurements.

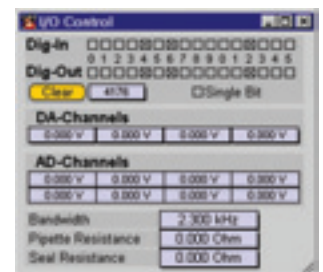
The versatility of the EPC 10 Double and EPC 10 Triple stem from their adjustment and control at the software level. Leak currents, capacitances, and series resistances can instantly be neutralized automatically while you still retain the possibility of full manual control of the amplifier. Voltage- and Current-Clamp experimental protocols are easily automated; not only ensuring simplicity, great speed and accuracy but also providing enormous flexibility for the integration of extensions such as photometric and fluorescence measurements.

For applications which require even more patch clamp amplifiers, HEKA has developed the EPC 10 Quadro featuring four independent patch clamp amplifiers in one housing. For details please refer to the data sheet "EPC 10 Quadro".

The EPC 10 Double and EPC 10 Triple also provide economical solutions in comparison with the combination of several individual instruments. They also have the advantages of optimized noise performance and grounding over that of multiple external amplifiers.



Compare the EPC 10 Double and EPC 10 Triple with any other amplifier systems on the market and prepare yourself for an amazing experience!



• **The EPC 10 Double and EPC 10 Triple are fully integrated with the new ITC-1600 AD/DA interface.**

The advanced integration of the EPC 10 Double and EPC 10 Triple with the AD/DA interface and software minimizes total recording noise, eliminates compatibility problems, saves on additional equipment expenses and set-up and training times. The built-in interface is connected to the PCI-1600 computer interface card via fiber optic data cables. This connection provides superb optical isolation, virtually eliminating ground loops and increasing the distance between the computer and the amplifier by up to 5 meters. The ITC-1600 has eight analog inputs, four analog outputs, 16 digital inputs and 16 digital output channels all sampling synchronously.

• **New Low Frequency Voltage Clamp (LFVC).**

In current clamp (C Clamp) mode, the membrane potential (V_m) is measured and used to compute a current waveform which is fed back into the cell. As a result, slow voltage drift and other artificial voltage-dependent conductances are controlled and adjusted to a fixed value. This negates any readjustment of the holding current while conducting C Clamp experiments.

• **True C Clamp in fast mode.**

In C Clamp mode, the headstage acts as a voltage follower circuit. The cell voltage is measured on a very high input resistance and C-fast compensation is no longer necessary.

• **Bridge Balance Mode.**

Series resistance compensation in current clamp mode allows offset-free voltage recordings during current injections.

• **Voltage gain 100x.**

The output of the V-mon channel can now be scaled x10 or x100. The latter one can be used for recording small potential changes such as field potentials.

• **A new slim-line headstage design with plug-in connector.**

Using novel components and a new arrangement of the parts on a multi layer board, we drastically reduced the dimensions of the headstage. The slim shape of the completely new designed headstage allows optimal access to your cells. The connection to the pipette holder is achieved via a stable BNC connector.

• **Digital Trigger In-/Outputs.**

The EPC 10 is equipped with 3 TTL trigger outputs and 1 trigger input on the front panel. There are 16 additional digital outputs and 16 digital inputs available at the rear panel of the EPC 10. The digital outputs can be used to control external devices like perfusion systems or video imaging systems.

• **Clustering of two EPC 10s.**

Two patch clamp amplifiers of the EPC 10 series (Single, Double, Triple, Quadro) can be connected to one PCI-1600 interface board to build an extended multi-amplifier. Systems with up to 8 patch clamp amplifiers are possible (2 x EPC 10 Quadro).

• **Expandable with LIH 1600.**

EPC 10 Double and EPC 10 Triple patch clamp amplifiers in a scientific research setup can be extended by an LIH 1600 acquisition interface to provide 4 additional DA channels and 8 additional AD channels.

The virtual front panel and a complete data acquisition system

HEKA software will automatically recognize the type of amplifier you are using (EPC 10, EPC 10 Double, EPC 10 Triple or EPC 10 Quadro). Each amplifier can be stimulated separately and automatically.

Documentation:

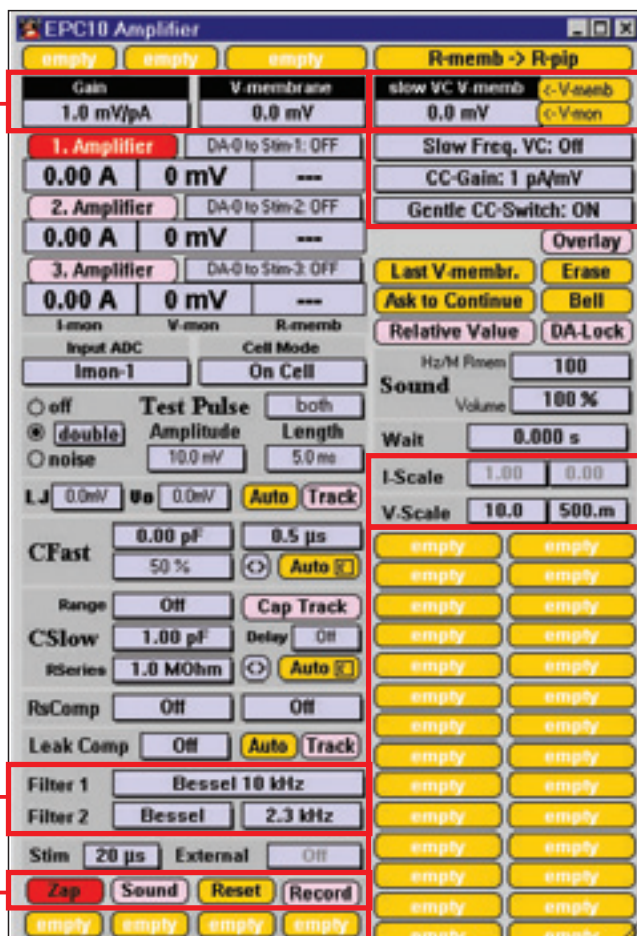
All EPC 10 settings will be stored with the raw data for easy reconstruction, analysis and documentation of your experimental procedures

Filters

Two built-in high quality hardware filters (Butterworth/Bessel) perform excellent signal conditioning and remove the expense of purchasing additional filter instruments.

Zap Pulse

A high voltage pulse is applied to the pipette in order to rupture the patch membrane. The parameters (duration and amplitude) can be specified



Low Frequency Voltage Clamp:

Vmembrane or Vmonitor can be measured and set as the Vhold for LFVC

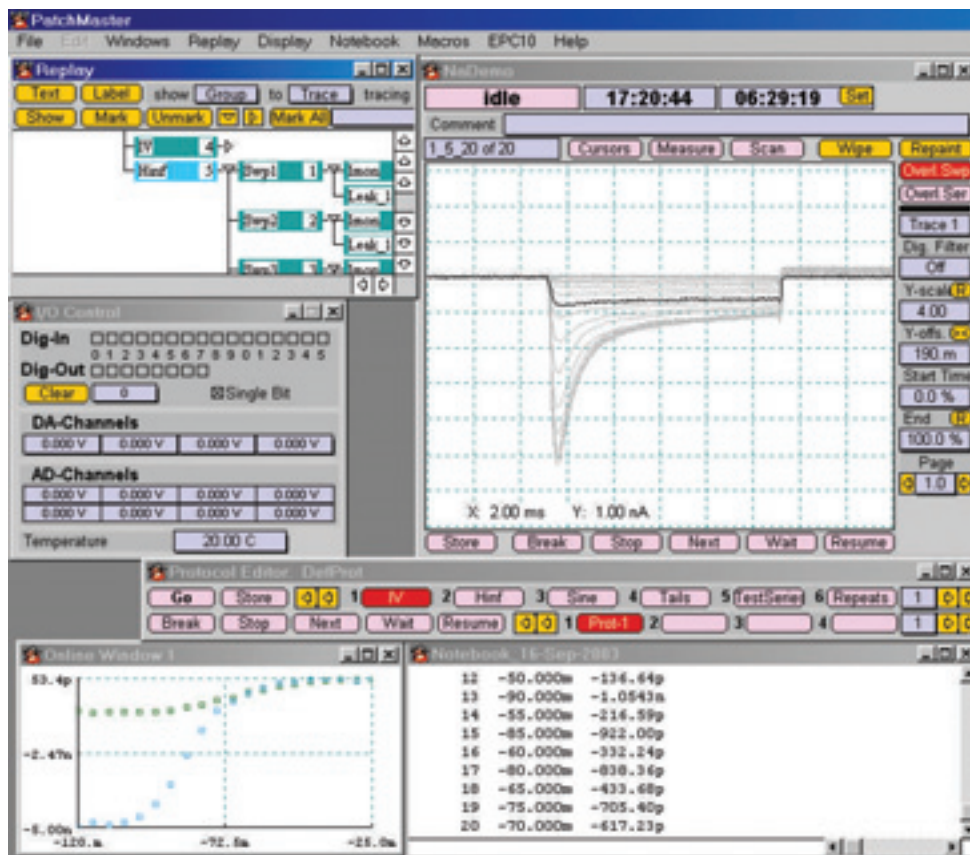
CC injection current range:

Three different Current Clamp ranges max. current 1 nA to 100 nA

I-Scale, V-Scale

Macros

Macro features allow the recording of routine functions and then accessing these Macros by a simple click of a button



The EPC 10 Double and EPC 10 Triple are complete data acquisition systems, which can be used with our PATCHMASTER software.

The EPC 10 Double and EPC 10 Triple patch clamp amplifiers combined with a computer are equivalent to a fully equipped set-up which includes either two or three patch clamp amplifiers, a digital storage oscilloscope, a variable analog filter, a sophisticated pulse generator, and a full featured data acquisition and analysis system.

Technical specifications

EPC 10 Main Unit

EPC 10 Double

Dimensions:
(31.1 x 48.3 x 18.0) cm,
(12.2 x 19.0 x 7.1) inch

Weight: 12.2 kg

EPC 10 Triple

Dimensions:
(31.1 x 48.3 x 26.9) cm,
(12.2 x 19.0 x 10.6) inch

Weight: 15.3 kg

Both mount in a 19" rack.

Both operate on standard
115 V / 230 V.

EPC 10 Headstage

Dimensions:

(90 x 17 x 14.5) mm,
(3.54 x 0.67 x 0.57) inch

The new developed hybrid
contains the input circuitry with
improved current clamp
performance.

Current measuring resistors:

50 G Ω (high range)

500 M Ω (medium range)

5 M Ω (low range)

Injection/compensation capacitors:

1 pF (all ranges)

10 pF (medium and low range)

Noise measured with open input:
(8-pole Bessel filter, high range)

up to 1 kHz: <30 fA RMS

up to 3 kHz: <85 fA RMS

up to 10 kHz: <350 fA RMS

Maximum bandwidth:

100 kHz (medium and low ranges)

60 kHz (high range)

Filters

Filters: The EPC 10 contains two
built-in filters per individual patch
clamp amplifier for the current
monitor signal. Filter 1 is a 3-pole,
10 to 100 kHz Bessel prefilter.
Filter 2 is a 4-pole, 100 Hz to 15
kHz filter with selectable Bessel
or Butterworth characteristics.

Capacitance Compensation

Fast and Slow capacitance com-
pensation is either automatic or
manual. There is also capacitance
tracking for measuring cell surface
area.

C-fast: 0 to 15 pF, 0 to 8 μ s tau

C-slow: 0.2 to 1000 pF, limited
only by the size of the voltage
step.

R-series: 1 M Ω to 1 G Ω

Series Resistance
Compensation

Trimming can either be performed
automatically or manually. The
maximum compensation is 95%;
with the optimal setting being
dependent on cell capacitance.

Equivalent time constants:

2 μ s / 10 μ s / 100 μ s

Ranges:

1 to 1000 M Ω (medium range)

0.1 to 10 M Ω (low range)

Leak Subtraction

Linear leak can either be
subtracted automatically or
manually.

Range:

0 to 2 nS (high range)

0 to 200 nS (medium range)

0 to 20 μ S (low range)

Pipette Offset

Automatic or manual adjustment
within a \pm 200 mV range.

Holding Commands

Voltage Clamp

Software controlled holding
potential with a \pm 1000 mV range.

Current Clamp CC Command:

1 pA/mV input; up to \pm 1 nA

10 pA/mV input; up to \pm 10 nA

100 pA/mV input; up to \pm 100 nA

Low input capacity allows rapid
changes in membrane potential
to be followed.

Bridge Balance Mode:

Series resistance compensation
in CClamp mode allows offset
free voltage recordings during
current injection.

Low frequency voltage clamp:

Automatic CClamp tracking re-
adjusts the holding current to fix
any slow voltage drift while in
CClamp mode.

Stimulation

Four 16-bit digital-to-analog (D/A)
converters are provided by the
built-in data acquisition interface.
With the EPC 10 Double, two of
these outputs are used for the
stimulation of the two amplifiers.
The remaining two outputs are
available for custom use. In case
of an EPC 10 Triple one free D/A
output is available.

D/A-Resolution: 16 bits

Settling time: <1 μ s to 0.001 %

Maximum update rate: 200 kHz

Stimulation range: -

10.24 V to 10.23 V

Acquisition

Two 16-bit Analog-to-Digital (A/D)
converters are provided by the
built-in data acquisition interface
per differential, optical isolated
input channel.

A/D-Resolution: 16 bit digitization,
16 bit data format

Maximum Acquisition Rate:
200 kHz per A/D converter; 100
kHz when simultaneously
recording 4 channels.

Telegraphing Inputs: Two 12 bit
asynchronous inputs

Digital In- and Outputs

The EPC 10 is equipped with 3
digital outputs and 1 trigger input
at the front panel. 16 digital inputs
and outputs are available on the
rear panel

ZAP

A ZAP pulse is provided by the
stimulation software.

The amplitude (up to \pm 1 V) and
duration are programmable.

Additional Requirements

Software: PATCHMASTER

Computer: See data sheet
"Recommended Configuration".

Related Products

PatchMaster

Multichannel stimulation/ acqui-
sition patch clamp software for
Windows and Mac OS.

FITMASTER

Software for data review, analysis
and fitting. Runs on Windows
and Mac OS.

EPC 10 Quadro

Fully computer controlled
quadruple patch clamp amplifier
with built-in interface board.

LIH 1600

16 bit multi-channel data
acquisition system.

PROBE SELECTOR

Headstage multiplexer that turns
each channel of the EPC 10 into
an eight channel serial patch
clamp device.

Service & Support

As the first manufacturer of
patch clamp amplifiers in the
world HEKA knows the needs
of scientists. We provide
exceptional pre and post sales
customer support from our
trained international sales re-
presentatives and our own
technical support advisors. With
thousands of high performance
hardware and software prod-
ucts in daily use worldwide we
understand all aspects of data
acquisition systems not just the
software.



HEKA Elektronik
Dr. Schulze GmbH
Wiesenstraße 71
D-67466 Lambrecht/Pfalz
Germany

Phone +49 (0) 63 25 / 95 53-0
Fax +49 (0) 63 25 / 95 53-50
Web Site <http://www.heka.com>
Email sales@heka.com
support@heka.com

HEKA Electronics Incorporated
47 Keddy Bridge Road
R.R. #2
Mahone Bay, NS B0J 2E0
Canada

Phone +1 902 624 0606
Fax +1 902 624 0310
Web Site <http://www.heka.com>
Email nasales@heka.com
support@heka.com

HEKA Instruments Inc.
33 Valley Road
Southboro, MA 01772
USA

Phone +1 866 742 0606 (Toll Free)
Fax +1 508 481 8945
Web Site <http://www.heka.com>
Email nasales@heka.com
support@heka.com

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