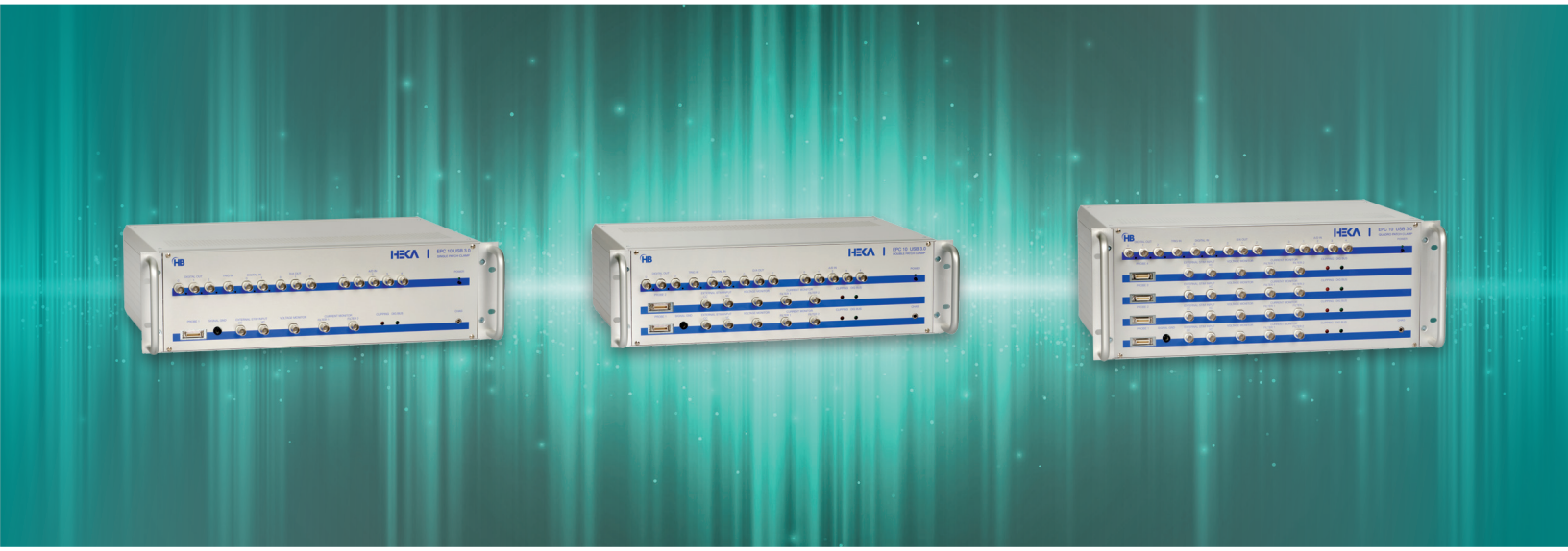
HEKA EPC 10 USB 3.0 Patch Clamp Amplifiers

Record from single-channel to whole-cell with confidence.



- Software-controlled amplifier with integrated data acquisition interface.
- Compact, low-noise headstage that's suitable for most electrophysiological measurements.
- A family of versatile amplifiers that allow multiple simultaneous Patch Clamp recordings.

HEKA

An Affiliate of Harvard Bioscience, Inc.

We've pioneered Patch Clamp applications for biomedical research for nearly 40 years.

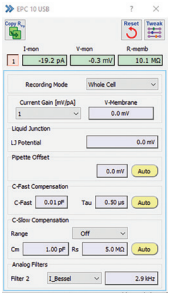
HEKA integrates instrumentation (from amplifiers to all necessary accessories), software, and support services to provide single-sourced, complete Patch Clamp solutions that enable users to generate high-quality data for their publications.

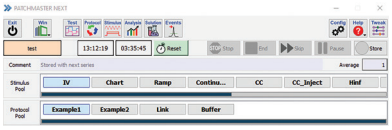
In developing the EPC 10 USB 3.0 amplifier, we harnessed HEKA's decades of expertise to uphold innovative ideas culminated in a refined and sophisticated amplifier that offers enhanced workflow capabilities.

The HEKA difference

- **Built-in data acquisition interface –** Integrating the EPC 10 USB 3.0 amplifier with the low-noise data digitizer technology (LIH3.x) in one housing enhances the communication between the amplifier, interface, and software, refining the system's functionalities. It also provides optimal grounding, and removes external connections, resulting in excellent noise mitigation.

- **Full software control –** The PATCHMASTER NEXT software allows complete command of the amplifier settings and experimental protocols with a high degree of automation and reproducibility. A 3-in-1 software application to control the amplifier, acquire, and analyze data. All amplifier settings are stored with the data.





- **Multifunctional headstage –** Noise-optimized for single-channel and whole-cell recordings, with high signal clarity and automated feedback resistor adjustments. Streamlined design to facilitate its utilization in experimental setups constrained by limited space.

- **Simultaneous multi-channel recordings –** Acquire concurrent signals from up to four headstages, providing adaptability for gap junction, pre- and post-synaptic, and amperometry studies, among others.

Features

- **NEW! Improved data acquisition –** The increased sampling rate of 2 MHz allows for better recording of rapid events, such as ion channel activation kinetics, high-frequency single-channel flickering, or nanopore currents. The software-controlled anti-aliasing filter removes high-frequency noise, and the faster data transfer from the USB 3.0 connection delivers minimal latency for online data visualization and analysis.
- **NEW! Hardware connectivity –** All amplifier models count on 5 free AD channels and 3 free DA channels to enable the integration of parallel experiments, such as amperometry, photometry, or fluorescence data. Incorporate external stimuli via a BNC input connector.
- **Operational flexibility –** Automated compensation of pipette offset potential, series resistance, and capacitance. Programmable ZAP pulse and p/n leak subtraction protocols for high versatility. In the PATCHMASTER NEXT software, you control which routines to automate or to perform manually.
- **Thorough current clamp capabilities –** To ease the assessment of changes in membrane potential, the EPC 10 USB 3.0 is equipped with a Bridge Mode to compensate voltage drops across the pipette resistance, a low-frequency voltage clamp mode to automatically preserve the membrane potential at a desired level during current clamp measurements, as well as a Gentle Switch option for voltage clamp to current clamp transitions.
- **Effective capacitance neutralization –** Minimize the impact of capacitive transients with automated C-fast and C-slow compensation, perform low-noise whole-cell measurements with C-slow compensation in the high-gain range, and voltage recordings at high bandwidth with C-fast compensation in current clamp mode. The EPC 10 USB 3.0 amplifier family provides synchronous C-slow compensation to simplify the recording of multiple electrically connected cells.

Applications

- **Collect data in different configurations and experimental settings:** Whole-cell voltage clamp and current clamp, single-channel, perforated and loose patch, field potential and intracellular voltage recordings, lipid bilayers and nanopores.
- **Record currents from all types of pore-forming proteins:** Voltage-, ligand-, and light-gated channels, mechano-sensitive, store-operated, and chloride channels, gap-junctions, aquaporins, nanopores, and electrogenic transporters.
- **Study the electrophysiological mechanisms of cellular processes and diseases:** Examples may include neuronal excitability, plasticity, synaptic transmission, exocytosis and endocytosis, epilepsy, neurotoxicity, neurodegenerative diseases, nociception, cardiac electrophysiology and arrhythmias, cardiac contractility, cardiac safety, insulin secretion, and skeletal muscle contraction, among others.

Technical Specifications

General Specifications

Amplifier Models

- Single: One amplifier/headstage
- Double: Two amplifiers/headstages
- Quadro: Four amplifiers/headstages

Amplifier Control

The built-in acquisition interface enables full software control, featuring direct command of all amplifier settings, experimental procedures, automatic calibration, self-testing, and advanced diagnostics.

Noise Cancellation

Power Supply: Low-noise optimized built-in 125 W power supply covering a wide voltage input range (100 V-240 V) at line frequencies of 50 or 60 Hz.

Ground Lines: A Signal ground and a Chassis ground are accessible via banana plugs on the front panel of the main unit and are connected via a 10 MΩ resistor.

True noise measurements (from 100 Hz to 15 kHz) allow the amplifier's noise to be monitored and the setup's noise to be minimized.

Dimension and Weight
Main Unit

	Single	Double	Quadro
Depth x Width	31.1 x 48.3		
Height	14.5 cm	14.5 cm	18.0 cm
Width	8.7 kg	9.2 kg	12.8 kg
Mounting	Mounts in a 19" rack		

Headstages

Red Star: D x W x H: 102 x 17 x 17 mm; Weight: 42 g
S-Probe: D x W x H: 58 x 17 x 17 mm; Weight: 25 g

Stand alone LIH 816 USB 3.0

Acquisition Interface LIH 3.x

Host Interface: USB 3.0 **NEW!**

Analog Inputs

- Number of AD converters: one per amplifier **NEW!**
- Free AD channels: 5 (for all amplifier models) **NEW!**
- Fully synchronous AD channels **NEW!**
- Fastest sampling rate: 2 MHz **NEW!**
- Analog input bandwidth: 500 kHz **NEW!**
- AD resolution: 18 bits **NEW!**
- AD input voltage range: ± 10 V (± 0.1V)
- AD input linearity: >99%

Analog Outputs

- Number of DA-converters: two per amplifier **NEW!**
- Free DA channels: 3 (for all amplifier models) **NEW!**
- Fully synchronous DA channels **NEW!**
- DA rise time (20%-80%): 250 ns **NEW!**
- Settling Time: 250 ns **NEW!**
- DA resolution: 16 bits
- DA output voltage range: ± 10 V (± 0.1V)
- DA linearity: >99%
- DA output accuracy: >99%

Digital Inputs

- Number of channels: 16, via 25 sub-D connector on rear panel. Two of the channels can be accessed on the front panel via BNC connectors.

Digital Outputs

- Number of channels: 16, via 25 sub-D connector on rear panel. Three of the channels can be accessed on the front panel via BNC connectors.
- TTL compatible.

Additional Connectors

- Digital I/O: 16 digital-in and 16 digital-out channels on a 40-pin male connector in the rear panel.
- Sound Output: One 3.5 mm jack the rear panel for resistance monitoring. Frequency range of 1 Hz to 100 kHz. Volume and Resistance/Frequency ratio can be adjusted by the PATCHMASTER NEXT software.
- Two LEMO connectors in the rear panel for synchronization of a second amplifier/interface.

Voltage Clamp Mode

Current Measuring Resistors
The headstage provides three feedback resistors. The gain ranges can be switched during the experiment.

Low-gain range:
(5 MΩ): ± 2 µA current range

Medium-gain range:
(500 MΩ): ± 20 nA current range

High-gain range:
(50 GΩ): ± 200 pA current range

Current Gain Settings

Low gain range:
0.005, 0.01, 0.02, 0.05, 0.1, 0.2 mV/pA

Medium gain range:
0.5, 1, 2, 5, 10, 20 mV/pA

High gain range:
50, 100, 200, 500, 1000, 2000 mV/pA

Input Capacitance: < 1 pF

Noise Performance: Measured with open input via external 8-pole Bessel filter.

Medium gain range: Up to 1 kHz: ~ 180 fA rms (theoretical limit) up to 3 kHz: ~ 320 fA rms (theoretical limit) up to 10 kHz: ~ 580 fA rms

High gain range: Up to 1 kHz: ~ 31 fA rms up to 3 kHz: ~ 72 fA rms up to 10 kHz: ~ 350 fA rms

Bandwidth: 100 kHz (low and medium gain range), > 60 kHz (high gain range).

Current Filter: Filter 1 is a 6-pole Bessel pre-filter with 10 kHz, 30 kHz, 100 kHz, and HQ 30 kHz. The EPC 10 USB 3.0 Single, Double, and Quzadro allow to directly sample the current signal of Filter 1.

Filter 2 is a 4-pole filter with 100 Hz to 15 kHz bandwidth with selectable Bessel or Butterworth characteristics. Filter 2 is usable in series with Filter 1 or as separate filter for external signals.

Holding Potential: Software controlled holding within a ± 2000 mV range.

Pipette Offset Potential Compensation
Automated or manual adjustment of the offset potential in the range ± 200 mV.

Injection Capacitors
The C-Fast compensation signal is injected via a 1 pF capacitor. The C-Slow compensation signals are injected via a 10-pF capacitor in medium and low gain and via a 1 pF capacitor in high gain range.

C-Fast Compensation
Automated or manual compensation in all gain ranges: 0 to 15 pF, 0 to 8 µs tau (calibrated); 0 to ~ 80 pF (Extended C-Fast).

C-Slow Compensation
Automated or manual compensation in all gain ranges: 0.2 to 1000 pF (low and medium range); 0.2 to 100 pF (high range). Rs range 1 MΩ to 1 GΩ.

Series Resistance Compensation
Maximal compensation is 95% with the optimal setting being dependent on the cell capacitance. Equivalent time constants: 2 µs, 5 µs, 10 µs, 100 µs.

Zap Pulse
Programmable amplitude (up to ± 1 V) and duration via PATCHMASTER NEXT software.

Current Clamp Mode

Current Injection

Four current injection gains are selectable:

0.1 pA/mV range:	± 1 nA
1 pA/mV range:	± 10 nA
10 pA/mV range:	± 100 nA
100 pA/mV range:	± 1 µA

In the “Extended Stimulus Range” the current injection capability in current clamp mode is increased by factor of 5.

Voltage Filter

Filter 2 settings do also allow the filtering of the voltage signal in a current clamp measurement.

Voltage Measuring Range

The voltage measuring range is ± 1 V (± 5 V when using the “Extended Stimulus Range”) in current clamp mode.

Model Cell Circuits

Model circuits are available to ease the EPC 10 USB 3.0 testing and calibration. Circuits mimic one cell, or two cells coupled by a gap-junction, and voltage clamp, current clamp, and gap-junction conductance can be modeled.

Ready to get started?

Reach out to speak with a sales representative and start building your patch clamp rig today.

Contact HEKA online

Scan to request more information or get a quote.

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