The MultiClamp™ 700B Microelectrode Amplifier from Molecular Devices is a computer-controlled microelectrode current- and voltage-clamp amplifier for electrophysiology and electrochemistry. This versatile amplifier is capable of single-channel and whole-cell voltage patch-clamp, high-speed current-clamp (sharp electrode or field potentials), ion-selective electrode recording, amperometry/voltammetry and bilayer recordings. The MultiClamp 700B amplifier is designed to support up to two primary CV-7B headstages and two optional auxiliary (HS-2 or VG-2 type) headstages. Each CV-7B headstage contains a current-to-voltage converter for voltage-clamp and a voltage follower for true current-clamp. This allows the user to conveniently switch between low-noise patch-clamp recording and high-speed current-clamp recording. An optional CV-7B/BL headstage is available for bilayer recording.

**KEY FEATURES**

- Computer-controlled amplifier capable of single-channel and whole-cell voltage patch-clamp, high-speed current clamp (sharp electrode or field potential), and more
- Support up to two primary headstages and two optional auxiliary headstages

**Powerful features**

The MultiClamp 700B Amplifier uses either an external trigger command or user-programmable voltage threshold for rapid, automatic mode-switching between current and voltage-clamp. For example, by pre-setting a voltage threshold in current-clamp mode, the amplifier will automatically switch to voltage-clamp mode when the membrane potential reaches the threshold voltage. A user-specified delay can be programmed allowing further customization of recording procedures.

Sudden changes in membrane or pipette parameters may result in undesirable oscillations during whole-cell recordings. To overcome this, the MultiClamp 700B amplifier detects current or voltage oscillations and automatically disables or intelligently reduces compensation settings to protect the cell from damage.
The small profile of the CV-7B headstage makes it easy to incorporate into an electrophysiology setup. The dovetail design integrates with a base plate for easy attachment to micromanipulators.

Slight voltage drift, often due to changing electrode properties, may contaminate an otherwise decent current-clamp recording. In order to maintain the membrane potential at a consistent level, the MultiClamp 700B amplifier automatically injects a compensatory current over a user-defined time course.

The MultiClamp 700B amplifier enables researchers to perform experiments that were previously not possible using a single amplifier.

**True current-clamp and voltage-clamp headstage**

Traditionally, amplifiers are designed for optimal performance in voltage-clamp or current-clamp mode, but cannot perform both during the same experiment. The CV-7B headstages supplied with the MultiClamp 700B amplifier overcome this limitation by integrating both current-to-voltage and voltage-following circuitry. This design allows users to rapidly switch between patch-clamp recording and high-speed current-clamp recording. The CV-7B headstage has four different feedback resistors in voltage-clamp mode, allowing for a wide range of cellular recording. In current-clamp mode, the CV-7B headstage provides three different setting resistors to clamp current from a few pA up to 200 nA.

With two headstages, the MultiClamp 700B amplifier can perform the function of two patch-clamp, two current-clamp, or a combination of patch- and current-clamp amplifiers. In addition, two optional voltage-follower headstages (HS-2 type) can be connected to auxiliary inputs to allow third- and fourth-point voltage recording. Dual headstages allow more complex synaptic experiments to be performed, as well as increasing throughput for drug discovery experiments, all at a significantly lower cost per channel.

Specialized headstages are available for bilayer and electrochemistry recordings. The optional CV-7B/BL headstage was designed to handle the large membrane capacitances found in bilayer recording. The CV-7B/EC headstage was designed to handle the large (±2V) command voltages required during electrochemistry recording.

**Computer control**

**MultiClamp 700B Commander Software**

The MultiClamp 700B amplifier is fully controlled by the MultiClamp Commander software. Computer control allows for tremendous flexibility, including broad ranges of current passing and recording levels, extensive filtering options and multiple signal outputs. Computer control simplifies the patching process by providing automation of pipette offset, fast/slow electrode capacitance compensation, whole-cell capacitance compensation, series resistance correction, pipette capacitance neutralization and bridge balance—all without moving parts.

**Third-party programming**

A Software Development Kit (SDK) is included to allow full integration of the MultiClamp Commander Software into third-party applications.
Voltage- and Current-Clamp Functions

Software user interface features

Two meters display output voltage (or resistance) and current (or \(I_{\text{rms}}\)) for each channel. An Options menu allows easy set up of filters, headstage feedback resistors, audio signals, mode switching and advanced capacitance compensation parameters. Computer control allows the amplifier configuration to be saved and easily re-opened. The last state of the amplifier is independently maintained during a power-off condition. The MultiClamp Commander Software interface is not dependent upon any particular data acquisition software, and therefore can be used with most data acquisition systems in stand-alone mode.

Smart telegraphs

As the amplifier interface, the MultiClamp Commander Software provides vital information to the data acquisition program about the state of the amplifier. In addition to the values that are typically telegraphed by hardware connections on conventional amplifiers (cell capacitance, filter cutoff frequency, and output gain), the MultiClamp Commander Software provides five additional signal settings: command sensitivity, operating mode (voltage/current-clamp), scaled output signal, scale factors and scaling units of the output signal. These additional settings allow the data acquisition software, such as pCLAMP® 11 Software, to automatically configure stimulus and recording signals based on the commander software settings.

Comprehensive microelectrode amplifier solution

The MultiClamp 700B Microelectrode Amplifier offers high-quality voltage- and current-clamp capability with fast mode switching and oscillation suppression, all under convenient computer control. Together with its extensive set of signal conditioning features, the MultiClamp 700B amplifier is the choice for a large variety of experimental needs. Whether you perform whole-cell, excised or cell-attached patch-clamp recordings, sharp-electrode, field potential or ion-selective measurements, bilayer recordings with voltammetry or amperometry, the MultiClamp 700B Amplifier is a comprehensive solution for your microelectrode amplifier applications.

General specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (in.)</td>
<td>3.5 (H) x 19 (W) x 12 (D)</td>
</tr>
<tr>
<td>Dimensions (cm)</td>
<td>8.9 (H) x 48.3 (W) x 30.5 (D)</td>
</tr>
<tr>
<td>Weight (lbs.)</td>
<td>10 (4.54 kg)</td>
</tr>
<tr>
<td>Headstage (in.)</td>
<td>0.875 (H) x 1.625 (W) x 2.3125 (D)</td>
</tr>
<tr>
<td>Headstage (cm)</td>
<td>2.0 (H) x 4.0 (W) x 8.4 (D)</td>
</tr>
<tr>
<td>Channels</td>
<td>2 (sharing a common ground)</td>
</tr>
<tr>
<td>Communications</td>
<td>USB 1 Type B female ports</td>
</tr>
<tr>
<td>Rack use</td>
<td>Standard 19” rack-mount (2U) with handles</td>
</tr>
<tr>
<td>Benchtop use</td>
<td>Bayonet feet</td>
</tr>
<tr>
<td>Power</td>
<td>85–260 Vac 50–60 Hz, 30 watts (max.)</td>
</tr>
<tr>
<td>Safety</td>
<td>CE marking (Conformité Européen)</td>
</tr>
<tr>
<td>Computer</td>
<td>1 GHz or better processor, Windows XP Pro / 2000 / 98 SE or Mac OS X 10.4.6 (Tiger), CD-ROM drive 512 MB RAM, 500 MB HD space, 2 USB 1 ports</td>
</tr>
<tr>
<td>Software</td>
<td>MultiClamp® Commander Software (included)</td>
</tr>
</tbody>
</table>
**Test signals**

**Voltage-clamp**
- **Seal test amplitudes**: 0 to ±1 V at electrode
- **Pulse amplitudes**: 0 to ±1 V at electrode
- **Seal test frequency**: Selectable from 2–1000 Hz
- **Pulse duration**: Selectable from 0.1–500 ms
- **Zap**: Fixed at ±1 V with selectable 0.025–50 ms duration

**Current-clamp**
- **Tuning amplitude**: A at electrode (see DC range)
- **Tuning frequency**: Selectable from 2–1000 Hz
- **Pulse amplitude**: 0 to ±10 V/R at electrode (see DC range)
- **Pulse duration**: Selectable from 0.1–500 ms
- **Buzz amplitude**: Fixed at 15 V signal to the headstage capacitor, with selectable 0.05–500 ms duration
- **Clear (±) amplitude**: Fixed at ±15 V signal to the headstage capacitor

**DC holding commands**

**Voltage-clamp**
- **Holding**: ±1000 mV
- **Pipette offset**: ±100 mV

**Current-clamp**
- **Range**: ±200 nA (50 MΩ Rf)
- **Pipette offset**: ±200 pA

**Output gain and filters**

**Scaled output filters**
- **Lowpass**: Four-pole Bessel or Butterworth
- **Bessel cutoff (-3 dB)**: 2–30 kHz, Bypass
- **Butterworth cutoff**: 3–45 kHz, Bypass

**Scope filter**
- **Lowpass**: Two-pole Bessel
- **Lowpass cutoff**: 1 kHz, 3 kHz, 10 kHz, Bypass (-3 dB)

**Audio monitor**
- **Current or voltage (x 1 or x 100)** from either Channel 1 or Channel 2 is available for direct monitoring or via a voltage-to-frequency converter (VCO)
- **VCO range**: 4 kHz at +100 mV to 0.3 kHz at -100 mV
- **Audio output**: Jacks drive a 50 Ω headphone directly, or a powered external speaker
- **Audio input**: Jacks allow mixing of amplifier output with other signals, such as a PC sound card output

**Ordering information**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>MultiClamp 700B Microelectrode Amplifier</td>
<td>MultiClamp 700B Amplifier with power cord; (2) CV-7B headstages (with mounting plates); (2) Patch-1U model cells; (1) MultiClamp commander software CD; (1) USB cable; Theory and operation user guide (printed)</td>
<td>MULTICLAMP 700B</td>
</tr>
</tbody>
</table>

**Optional accessories**

- **SoftPanel™ Controller**
- **Headstages**: For bilayers
- **Auxiliary headstages**: For voltage recording
- **Blayer model cell**: For virtual ground or bath clamp

**CV-7B technical specifications**

**Voltage-clamp**
- **Gain**: Feedback resistor (Rf) = 50 GΩ, 5 GΩ, 500 MΩ, 50 MΩ
- **Noise (for given load, in pA_in)**: 10 kHz (8-pole Bessel filter)
  - 50 GΩ: 0.28
  - 5 GΩ: 0.9
  - 500 MΩ: 1.4
  - 50 MΩ: 4.0
- **Fast capacitance compensation magnitude**: Up to 12 pF for 50 GΩ range; Up to 36 pF on all other ranges
- **Fast capacitance compensation tau**: 0.5 µs to 18 µs
- **Slow capacitance compensation magnitude**: 0–1 pF for 50 GΩ range; 0–3 pF on all other ranges
- **Slow capacitance compensation, tau ranges**: 10–200 µs and 200–4000 µs
- **Whole cell capacitance compensation**: 500 MΩ range: Cm from 1–278.4 pF; Rs from 0.4–744.7 MΩ; 50 MΩ range: Cm from 11.06–3080 pF; Rs from 0.036–67.31 MΩ
- **Series Resistance compensation**: Bandwidth is adjustable from 0.32 to 16 kHz
- **Series resistances correction (0–100%)**: 0.4 to 744.7 MΩ on 500 MΩ range; 0.036 to 67.31 MΩ on 50 MΩ range

**Current-clamp**
- **Gain**: Rf = 5 GΩ, 500 MΩ, 50 MΩ
- **Compliance**: ±3 V
- **Rise time**:<10 µs for load of 10 MΩ on 50 MΩ range (filter bypassed); <30 µs for load of 100 MΩ on 500 MΩ range; <150 µs for load of 1 GΩ on 5 GΩ range
- **Pipette capacitance neutralization**: -8–16 pF

**Contact Us**
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- Check our website for a current listing of worldwide distributors.

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