

Amplifiers

Patch Clamp & Intracellular

ELC-01X

Loose clamp amplifier with basic voltage clamp



- Perform juxtacellular recordings and cell staining
- Have the precise current clamp of a bridge amplifier
- Basic voltage clamp capabilities for approaching cells

ELC-03XS

Full featured voltage clamp and current clamp amplifier



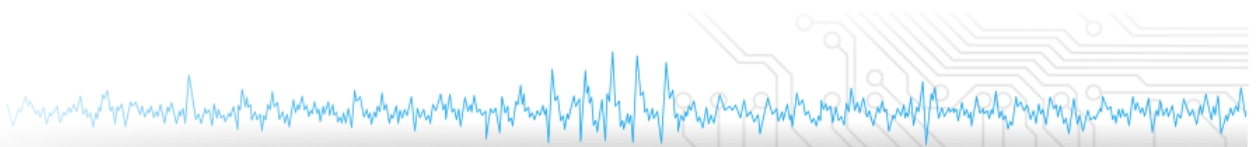
- One amplifier for multiple purposes
- Recording, staining, electroporation
- no need to change pipette or headstage
- Record in the low pA range and have headroom for up to 1.2 μ A
- Full voltage clamp with series resistance compensation

Features:

In contrast to other conventional patch clamp amplifiers the ELC-03XS has some unique ways for guaranteeing accurate recordings:

- The real series resistance is measured accurately with the bridge circuit and then compensated close to the theoretical maximum of $\sim 82\%$.
- The bridge circuit allows true current clamp recording with maximum precision
- High gain and filters allow recordings of various extracellular signals

Options: see last page





BA-01X

Intracellular Bridge Mode Amplifier



- Easy to use cell penetration mode
- Can be used with patch pipettes or sharp microelectrodes
- Oscillation shut-off and audio monitor

BA-03X

Full featured intracellular bridge mode and extracellular amplifier



- Includes all features as BA-01X, **PLUS:**
- High gain to record sub-millivolt signals
- Elaborate filters to record a large variety of signals

Features:

Bridge amplifiers are the **most accurate** instruments for **current clamp** recordings. Any artefacts by the electrode's impedance or the cell's series resistance are compensated by the bridge circuit during recording. The pipette's stray capacitance can be fully compensated.

Options: see last page

ELC, BA and SEC are also available as modules for the EPMS-07 system





SEC-05X

Single Electrode Clamp Amplifier



- Discontinuous voltage clamp and current clamp
- Bridge amplifier built-in

SEC-10LX

Full featured intracellular Single Electrode amplifier



- More advanced cell penetration modes
- Gated stimulus application with digital potentiometers

Benefits:

- npi's Single electrode clamp amplifiers are the most accurate in the market.
- Perform voltage clamp with sharp microelectrodes
- Complete compensation of the recording electrode allows high-current single-electrode recordings with patch pipettes or sharp electrodes.
- No series resistance error due to discontinuous recording

Optional recording modes:

Voltage **C**lamp controlled **C**urrent **C**lamp (VCcCC):

Allows Current Clamp experiments at controlled resting potentials

Dynamic **H**ybrid **C**lamp (DHC):

Allows precise measurement of conductances after action potentials

Linear (unswitched) mode (optional with series resistance compensation):

x1: low-noise recordings of small currents; approaching cell and seal formation in VC

x10: 10 times more current or voltage for non-invasive (juxtacellular) filling of cells

Which model to choose?

| | BA-01X | BA-03X | ELC-01X | ELC-03XS | SEC-05X | SEC-10X |
|-----------------------------------|----------------|----------------|----------------|----------|---------|---------|
| Extracellular recordings | | ✓ | | ✓ | | |
| Juxtacellular recordings | ✓ (CC only) | ✓ (CC only) | ✓ (CC only) | ✓ | ~ | ~ |
| Patch Clamp (VC) | | | | ✓ | ~ | ~ |
| Intracellular recording (CC) | | ✓ | | ✓ | ✓ | ✓ |
| Electroporation | ✓ | ✓ | ✓ | ✓ | ~ | ~ |
| Perforated Patch Clamp | | | | ✓ | ✓ | ✓ |
| Discontinuous Clamp (VC or CC) | | | | | ✓ | ✓ |

✓ = good choice, ~ = use **LIN** mode in SEC for lower noise or higher output current

Which options to choose?

Switchable headstage (ELC-SWI, BA-SWI)

Standard feedback resistor in the ELC or BA headstages is 100 MΩ. Adding a second switchable feedback resistor can enhance the output current (for electroporation) or enhance sensitivity (for more delicate recordings).

Differential headstage (ELC-DIFF, BA-DIFF)

In extracellular recordings pick-up of noise is a common problem. Differential recording helps minimizing this external noise by subtracting a reference signal from the actual recording signal.

Linear mode (LIN)

See SEC amplifiers' page.

Common features of all npi amplifiers

- Compatible with all data acquisition systems (BNC connectors for control and read-out)
- Miniature headstages available for in-vivo recordings

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