

# 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  $1.2 \mu\text{A}$
- Full voltage clamp with series resistance compensation

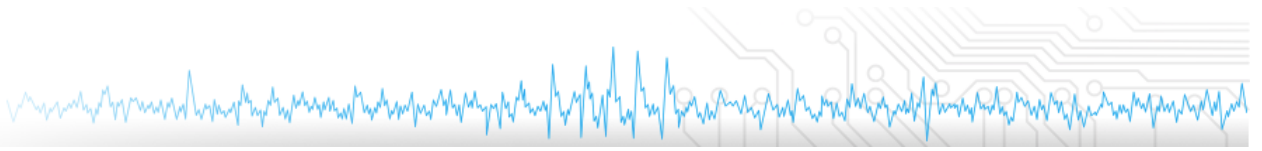
#### Features:

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

##### **L**inear (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 (see also <b>EXT</b> amplifiers)		✓		✓		
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 M $\Omega$ . 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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