SWAM 2c
Patch-clamp amplifier

celica biomedical

Tehnološki park 24, SI-1000 Ljubljana, Slovenia
SWAM 2c
Patch-clamp amplifier with an in-built dual-phase lock-in amplifier

TECHNICAL SPECIFICATIONS
Version 2000-01-4
- Head stage: 20 x 20 x 90 mm (duraluminium)
- Cable: 1.3 m (flexible)
- Controller (main console):
  19" rack mounting; 134 x 487 x 236 mm,
  weight cca. 2.5kg
- Power requirements:
  115 - 230 AC, 50 - 60 Hz, 20 W,
  fuse T 0.6A or T0.3A.

Conventional patch-clamp measuring modes:

1 Voltage-Clamp modes:

- Noise
  (8 pole low pass Bessel, RMS, -3dB, 100 GΩ resistor)

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Current (fA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>330</td>
<td>25</td>
</tr>
<tr>
<td>1000</td>
<td>40</td>
</tr>
<tr>
<td>3300</td>
<td>100</td>
</tr>
<tr>
<td>10000</td>
<td>240</td>
</tr>
</tbody>
</table>

- Current monitor output:
  filtered, Bessel, 8 pole LP, -3dB (0.33; 1.00; 3.33; 10.00 kHz)

- Gain:
  1 GΩ and 100 GΩ measuring resistors, automatically switched from main console by gain switch.

- Range:
  1 GΩ resistor 20 pA/V to 1 nA/V;
  100 GΩ resistor 10 pA/V to 1 pA/V

- Risetime
  1 GΩ resistor 5 μs and with 100 GΩ resistor
  10 μs (5 frequency compensation stages).

- Audio alarm monitor
  for head stage and main console electronic circuit saturation.

- Amperometry mode:
  voltage clamping carbon fibres at ± 1200 mV

2 Tracking mode:
Enables membrane sealing observation, sets the average current monitor output to zero value (low speed current-clamp mode).

- Reset:
  Speeds current zero setting.

- Pipette offset potential adjustment:
  ± 100 mV; polarity selection switch.

3 Pipette holding potential:

- Range:
  ± 200 mV, polarity selection switch

- Pipette potential display
  3 1/2 digit LCD DVM

- Pipette potential output:
  x 10.

- Stimulus input scaling:
  0.000, 0.001, 0.010, 0.050, 0.100, -0.100

- Stimulus input time constant selection:
  1 and 10 μs.
4 Transient signal cancellation:
(2 cancellation stages)

• Fast capacitance range
(cancellation of the pipette holder stray capacitance): 0 to 10 pF; 0.5 to 10.0 μs.

• Slow capacitance range
(cancellation of membrane capacitance):
  0.01 - 1 pF; 0.1 - 10 pF; 1 - 100 pF

• Series conductance cancellation:
  0 - 1 μS for 0.1 – 10 pF and 1 – 100 pF range; 0 - 100 nS for the 0.01 - 1 pF range.

• Optional increment
  1% of whole slow capacitance range
  (used in compensated capacitance measurements; see below).

5 Series conductance cancellation:

• Range:
  0 - 1 µS (automatically determined from transient cancellation controls).

• Compensation level:
  0 to 90 % for slow (8 kHz) and fast response (30 kHz).

6 Current-clamp mode:
Current-clamp and current-clamp and command modes (bandwidth 10 kHz; 1 GΩ resistor in use only).

• Holding current range:
  ± 1 nA (polarity selection switch).

• Command input scaling:
  1 nA/V.

Capacitance measurement modes:

• Noise:
  (1600 Hz, 111.3 mVrms, 100 GΩ feedback resistor)
  30 Hz (4 pole LP Bessel, -3dB) 12 aFrms

• Digitally generated sine wave signal and dual-phase lock-in amplifier: (ω = 10000 or 5000; 1600 Hz, 800 Hz) amplitude from 1.11 - 111.3 mVrms.

• Real and imaginary part of admittance monitors:
  (G, C), filtered, LP, Bessel, 2 pole; full, 30, 10, 3, 1 Hz.

• Digital phase setting:
  0.1 degree accuracy.

• Phase angle display:
  3 1/2 digit LCD DVM (99.9 degrees).

Adjust mode:
enables phase setting using an automatic calibrated signal simulating cell membrane capacitance changes (1 % of slow capacitance change; optional 1 MΩ resistance change).

Measure mode:
locks the 1% capacitance steps.

Gate mode:
TTL controlled intermittent capacitance measurement (TTL controls the sine wave generator), can be used as a stand-by mode.

(Specifications subject to change without notice.)