Subject: Purchase of equipment Axopatch 200B with Digidata 1440A and pCLAMP 10 for the department of Neurosurgery at AIIMS, New Delhi-29 on proprietary basis—Inviting comments thereon.

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The request received from Dr. P. Sarat Chandra, Deptt. of Neurosurgery, AIIMS by M/s. Molecular Devices, USA on proprietary basis. The proposal is submitted by Molecular Devices, USA and PAC certifications are attached.

The above documents are being uploaded for open information and to submit objections, comments, if any, from any manufacturer regarding proprietary nature of the equipment/item within issue of 15 days giving reference No.08/Stores/Neurosurgery/PSC/Proprietary/2012-13/RS. The comments should be received by office of Stores Officer (RS), Research Section at AIIMS on or before 18.02.2013 upto 12.30 p.m., failing which it will be presumed that any other vendor is having no comment to offer and case will be decided on merits.

Yours faithfully,

STORES OFFICER (RS)

Encl: Related documents enclosed.

PAC Certificate enclosed.

Specification of equipment.
SPECIFICATIONS:

**Axopatch 200B with Digidata 1440A and pCLAMP 10. (Molecular Devices, USA) from Spinco Biotech.**

**Specification of Microelectrode Amplifier:** Includes: amplifier, CV-203BU headstage, US Power cord, European power cord, CEE7/7, Accessory kit containing: ACC fuse, Baseplate for attaching headstages to manipulator Electrode Holder, Series Resistance Dither Box, Patch-1U Model Cell

**Specification:**

Unless otherwise noted: TA=20 °C, 1 hr warm up time.

**CV 203BU HEADSTAGE**

Construction: All critical components are in a sealed hybrid and cooled with a solid state cooling element.

Configuration: High-speed, low-noise current-to-voltage converter

Cooling: Input circuitry -15 °C typical. Headstage cooling should be kept on at all times to ensure proper calibration of offset voltages.

Headstage Gain: 1 mV/pA (= 1) Patch or Whole-Cell modes. 0.1 mV/pA (= 0.1) Whole-Cell mode.

Feedback Element: Patch 1pF

Whole Cell $\beta = 1$, 500 Min parallel with 1 pF.

Whole Cell $\beta = 0.1$, 50 Min parallel with 1 pF

Feedback Element Selection: FET switches in hybrid enable remote selection of either a capacitor (Patch mode) or a parallel combination of a capacitor and resistor (Whole-Cell mode)

Tuning: (Whole Cell mode only): Tuning circuit to idealize response of the feedback resistor is contained in the main instrument. Tuning is automatically bypassed when the capacitive feedback is selected.

Pipette-Capacitance-Compensation Injection Capacitor: 1 pF

Whole-Cell-Capacitance-Compensation Injection Capacitor:

Patch mode: none

Whole Cell mode: CV 203BU: 5 pF, $\beta = 1$ 50 pF, $\beta = 0.1$

Case: Case connected to ground. Case jack mates to 1 mm plugs

Bandwidth: Test signal applied via Speed Test input; Patch or Whole Cell mode:
Internal: 140 kHz capacitor feedback, 70 kHz resistor feedback

Max. External: 100 kHz (limited to output filter)

Capacitative Load Stability: 1000 pF, 0 in series

Maximum Instrument Measured with minimal external noise

Noise: sources (i.e., radiated line-frequency noise, mechanical vibration) 8-pole Bessel Filter.

<table>
<thead>
<tr>
<th>PATCH</th>
<th>WHOLECELL</th>
<th>WHOLECELL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without Holder: Line frequency &amp; harmonics</td>
<td>0.005 pAp-p</td>
<td>0.005 pAp-p</td>
</tr>
<tr>
<td>0.1-100 Hz</td>
<td>0.020 pAp-p</td>
<td>0.50 pAp-p</td>
</tr>
<tr>
<td>0.1 – 1 kHz</td>
<td>0.015 pArms</td>
<td>0.25 pArms</td>
</tr>
<tr>
<td>0.1 - 5 kHz</td>
<td>0.060 pArms</td>
<td>0.55 pArms</td>
</tr>
<tr>
<td>0.1 – 10 kHz</td>
<td>0.130 pArms</td>
<td>1.10 pArms</td>
</tr>
<tr>
<td>With holder</td>
<td>0.1 – 10 kHz</td>
<td>0.145 pArms</td>
</tr>
</tbody>
</table>

RESET CHARACTERISTICS (Patch Mode only)

Total reset time: 50 µs ± 10%

This includes: integrator reset 10µs differentiator reset 30µs other overhead 10µs

Time between resets (TBR):

For DC currents: TBR = 10/ (IDC – IBIAS) where IDC and IBIAS are in pA and TBR is in seconds.

IBIAS is typically 10–30 fA.

For Transient currents: A reset will occur if the headstage must deliver more than 10 pC of charge to the membrane. For example, a 60 mV step imposed on a 200 pF bilayer membrane will cause a reset (12 pC of charge needed) whereas a 40 mV step will not (8 pC of charge needed).

Reset transients in current waveform at Scaled Output (typical)

| 100 Hz bandwidth | ± 0.25 pA |
| 1 kHz | ± 0.5 pA |
Current Clamp

The current clamp mode has two speed settings: I-Clamp Normal and I-Clamp Fast. I-Clamp Normal is for use with electrode resistances greater than 1 MΩ. I-Clamp Fast is for use with electrode resistances greater than 10 MΩ.

The speed in I=0 mode is the same as in I-Clamp Normal. In addition, Track mode is a slow clamp to zero current. Note that series resistance compensation remains active in current clamp mode, allowing measurement of pipette resistance and (when Rs is compensated) accurate monitoring of cell membrane potential, but the speed setting is still determined by the actual electrode resistance and not only the remaining uncompensated resistance.

The speed of the current clamp depends on the Mode setting (Normal or fast), the time constant of the cell and the pipette resistance.

<table>
<thead>
<tr>
<th>Rp</th>
<th>Rm</th>
<th>Cm</th>
<th>I-Clamp Normal</th>
<th>I-Clamp Fast</th>
</tr>
</thead>
<tbody>
<tr>
<td>1M</td>
<td>0M</td>
<td>0pF</td>
<td>15µs (10%)</td>
<td>N/A</td>
</tr>
<tr>
<td>1M</td>
<td>500M</td>
<td>33p</td>
<td>350µs (0%)</td>
<td>N/A</td>
</tr>
<tr>
<td>10M</td>
<td>0M</td>
<td>0pF</td>
<td>200µs (20%)</td>
<td>20µs (&lt; 1%)</td>
</tr>
<tr>
<td>10M</td>
<td>500M</td>
<td>33pF</td>
<td>250µs (10%)</td>
<td>10 µs (&lt; 1%)</td>
</tr>
<tr>
<td>50M</td>
<td>500M</td>
<td>33pF</td>
<td>500µs (30%)</td>
<td>150 µs (&lt; 1%)</td>
</tr>
</tbody>
</table>

CAPACITANCE COMPENSATION

Pipette Capacitance

Fast : 0.2-2µs  Slow : 0.05-10 ms

Fast Magnitude: 0-10 pF  Slow Magnitude: 0-1 pF

These controls are used to charge pipette capacitance. In I-Clamp modes they act as a negative capacitance.

\[ \beta = 1 \quad \beta = 0.1 \]

Whole-Cell Capacitance  0.3 – 100 pF  3-1000 pF

Series Resistance  0-100 M  0-100 M
These controls are used to charge membrane capacitance in whole-cell V-Clamp. For Patch mode, whole-cell capacitance is not operative. In I-Clamp modes only. The Series Resistance control is operative. The whole-cell capacitance control places an analog voltage proportional to setting on Cell Capacitance Telegraph output.

SERIES RESISTANCE COMPENSATION

% Prediction: OFF, 0-100%. Acts with Whole-Cell Parameters to speed up charging of the membrane. Maximum achievable % Prediction is limited by the magnitude of the voltage step.

% Correction: OFF, 0-100 %. Acts with Series Resistance setting to reduce series resistance errors and to speed up response to ionic currents.

Lag : 1-100 s. Cuts high-frequency response of series- resistance correction circuit to enable a higher Correction setting

CAPACITANCE DITHERING

Enabled during a TTL High level signal to Whole Cell Capacitance Dither input. Effectively increases the observed cell capacitance by 100 fF (β = 1) or 1 pF (β = 0.1). Useful for cell membrane capacitance measurements. May be used in conjunction with the DR-1 Resistance Dither unit.

DR-1 Resistance Dither unit (supplied with the Axopatch 200B) normally provides a short-circuit link between preparation and ground. Inserts a 500 k resistor in series with bath ground during TTL High signal. Suitable for finding the phase tracking angle in capacitance measurement experiments.

MODE

V-Clamp : Pipette voltage is clamped

I-Clamp Normal or fast:

Pipette current is clamped to command current from Holding Command knob or external input. Normal mode is stable for electrode resistances greater than 1 M. Fast mode is stable for electrode resistances greater than 10 M. Series Resistance control is active.

Track: Slow I-Clamp to zero current.

(I=0) : I-Clamp to zero current used to correct pipette offset. Selected mode sets analog voltage on Mode Telegraph Output.

COMMAND POTENTIALS

Seal Test: 5mV (V-Clamp mode). 50 pA (I-Clamp, β = 1) or 500 pA (I-Clamp, β =0.1) command at line frequency.

External
Command: Two separate BNC Input, one front-switched, one rear-switched.

Sensitivity: Front-Switched: 20 mV/V in V-Clamp, 2 + \( \beta \) nA/V in I-Clamp, disabled in TRACK and \( 1 = 0 \).

Read-Switched: 100 mV/V in V-Clamp, 2 + \( \beta \) nA/V in I-Clamp, disable in Track and \( I = 0 \).

Input impedance: 10k. Inputs may be connected in parallel to increase sensitivity.

Holding

Command: Ten-turn potentiometer with dial. Polarity switch. Value can be previewed on meter.

V-Clamp mode: \( \pm 200\text{mV} \) (toggle X1); \( \pm 1 \text{V} \) (toggle X5)

I-Clamp modes: \( \pm 2 \text{nA} \) for \( \beta = 1 \), \( \pm 20 \text{nA} \) for \( \beta = 0.1 \) (toggle X1) \( \pm 10\text{nA} \) for \( \beta = 1 \), \( \pm 100 \text{nA} \) for \( \beta = 0.1 \) (toggle X5) Disabled in Track and \( 1 = 0 \) modes

Pipette Offset

Manual: \( \pm 250\text{mV} \). Ten-turn control with uncalibrated dial.

Track, \( 1 = 0 \): \( \pm 1\text{V} \). Nulling potential automatically adjusts to maintain zero pipette current.

ZAP

Amplitude: \( \pm 1.3 \text{VDC} \) at pipette for chosen duration

Duration: 0.5 – 50 ms or Manual. Triggered by front-panel pushbutton. In Manual position Zap amplitude is maintained as long as pushbutton is depressed.

RMS NOISE

3.5 digit meter displays rms current noise in pA. Measurement bandwidth is 30 Hz to 5kHz. Upper -3 dB frequency is set by 4-pole Butterworth filter.

INPUTS

Forced Reset: Positive edge triggered. Initiates a reset of the integrator; has no control over the duration of reset.

Blank Activate: Clauses Scaled Output and I Output to hold their initial value for the duration of the blanking pulse. Does not affect 10Vm output.

Speed Test: Injects current into headstage input through a 1 pF capacitor. Injected current waveform is the derivative of the voltage waveform applied at Speed Test input. For example, a 100 Hz 10 Vp-p triangle wave will inject a 1 nAm-p square wave into the headstage input.

SIGNAL OUTPUTS
Scaled Output: Scaled and filtered by output control settings. Sample and hold pedestal compensation. Output is \( I \, (\alpha \beta \text{ mV} / \text{pA}) \) when in V-Clamp or Track modes. Output is \( V_m \, (\alpha \text{ mV} / \text{mV}) \) when in I-Clamp mode. BNCs on front and rear panels are identical.

**I:** Pipette current Rear –panel switched gain of either \( \beta \text{ mV/pA} \) or \( 100 \beta \text{ mV/pA} \); fixed filter; 10 kHz 3-pole Bessel. Output does not benefit from samples and hold pedestal compensation.

**10V_m:** Membrane potential at x10 gain. Junction potentials removed.

**OUTPUT CONTROLS**

Output Gain (\( \alpha \)) : 10 values from 0.5 – 500. Affects Scaled Output only. Selected value sets analog voltage on Gain Telegraph Output for reading by computer.

Lowpass Bessel Filter: 4-pole lowpass Bessel filter with five settings; 1, 2, 5, 10 and 100 kHz. Selected value sets an analog voltage on Frequency Telegraph Output.

Leak Subtraction: Causes a signal proportional to the command to be subtracted from current record. Range:

\[
100 \beta \text{ M}^{\alpha} \text{ to } 1000 \beta \text{ M}^{\alpha}
\]

**TELEGRAPH OUTPUTS**

Gain Takes \( \alpha \) and \( \beta \) gain factors into account.

Performance Specifications of Data Acquisition System

Analog outputs: 4 channels, 4 DACs, ±10 V range, 16-bit resolution, 1 Hz–250 kHz sampling rates.

Analog inputs: 16 channels, 16 ADCs, ±10 V range, 16-bit resolution, 1 Hz–250 kHz sampling rates.

Digital outputs: 8 bits, BNC and DB-25F connections

Digital triggers: Start input, Tag input, Scope output

Telegraphs: 4 channels or via internal Windows messaging for supported software

Analog output impedance: < 0.1Ω

Analog input resistance: 1 MΩ

Digital output current: ±4 mA source, ±32 mA sink

Analog crosstalk: < 1 mV Avgp-p
Digitization noise: < 1 mV Avgp-p
Rack use: Standard 19'' rack-mount (2U) with handles
Benchtop use: Bayonet feet
Safety: CE marking (Conformité Européan)
13 November, 2012

To whom so ever it may concern,

This is to inform that the below mentioned items are proprietary of Molecular Devices LLC, USA

a) Axopatch 200B Microelectrode Amplifier,
b) pClamp 10 Software,
c) Digidata 1440a Data acquisition system along with headstage & holders

Best Regards,

Jeffrey Tang, PhD
Product Marketing Manager
Conventional Electrophysiology of Molecular Devices