MCE100C MICRO-ELECTRODE AMPLIFIER

The MCE100C is an extremely high input impedance, low noise, differential amplifier that accurately amplifies signals derived from mini and micro-electrodes. Mini and micro electrodes are characterized by small surface contact areas that result in high electrode to tissue contact impedance. A number of selectable options make the amplifier module useful for general-purpose recording of cortical, muscle and nerve action/resting potentials.

The MCE100C is useful for measuring biopotentials (voltage signals) from the following types of electrodes:

- Catheter-based
- Fluid-filled glass
- Ion selective
- Needle (all types)
- Nerve chamber (NERVE1)

When performing voltage measurements using Ion Selective Microelectrodes, the adjacent shield output, associated with either the Vin+ or Vin- input, is the buffered output of the input signal (1x gain) at the Vin+ or Vin- port. These shield outputs can be used to measure reference electrode voltages (against a remote non-polarizable Ag/AgCl-indifferent electrode) and the output of the MCE100C can be used to measure the differential voltages between a pair of ISM electrodes, one of them being the reference.

Generally considered, best performance is obtained when the mini or micro-electrode recording is performed in a shielded environment. The smaller the contact area of electrode, the higher the requirement for shielding. The MCE100C provides options for driven (voltage following) or grounded shields. Voltage following shields are useful for minimizing electrode lead input capacitance, to extend frequency response, when shielded cables are used. Grounded shields are useful for minimizing feedback noise and employed when distant shielding is utilized (Faraday cage or spiral shielding).

For special recording cases, as included options, the MCE100C provides manual controls for input capacity compensation (0-100pF) and clamp (I-bias) current zeroing (±100nA). In addition, the MCE100C incorporates an external voltage control to vary the clamp current proportionally to the control voltage (100 mV/nA), if required.

For very accurate (less than ±10 mV error) reference or differential voltage measurements, it's important to first calibrate out amplifier offset voltages by shorting the various inputs together to obtain a true 0 volt input for each measurement type.

An MP160/150A D/A output channel can drive this external voltage control to change clamp currents automatically during recording. The MCE100C also includes a clamp current monitor output so the clamp current can easily be recorded by another MP160/150 input channel.

For general-purpose recording, without input capacity compensation or a current clamp, use standard shielded or unshielded electrode leads terminating in 1.5 mm female Touchproof sockets.

Add simple input capacity compensation and current clamp control by connecting the respective signal ports to the [Vin+] input of the MCE100C using the JUMP100C jumper connectors.

For the best performance and shielding, use the MCEKITC to interface a micro-electrode lead cable to the MCE100C.
Current Clamping can be enabled/disabled, by connecting/disconnecting the "I CLMP" port to either differential input of the MCE100C. Negative Capacity Compensation can be enabled/disabled, by connecting/disconnecting the "NEG C" port to either differential input of the MCE100C.

- See Application Note 190 for details: [http://www.biopac.com/Manuals/app_pdf/app190.pdf](http://www.biopac.com/Manuals/app_pdf/app190.pdf)

**FREQUENCY RESPONSE PLOTS**

The $0.5 \text{ Hz}$ high pass lower frequency response setting is a single pole roll-off filter.

Modules can be set for $50 \text{ Hz}$ or $60 \text{ Hz}$ notch options to match the wall-power line frequency of the destination country. The proper setting reduces noise from interfering signals when the notch filter is engaged. Generally, wall-power line frequency is $60 \text{ Hz}$ in the United States and $50 \text{ Hz}$ in most of Europe; if necessary, contact BIOPAC to determine the correct line frequency, adjust the bank of switches on the left panel of the amplifier module.

- The $50/60 \text{ Hz}$ notch on the MCE100C is only engaged when the $100 \text{ Hz}$ HPN high pass notch filter switch is set to ON — see Amplifier Filtering for details.

### Line Frequency switch bank is on the left panel of biopotential and transducer amplifiers

<table>
<thead>
<tr>
<th>50 Hz</th>
<th>60 Hz</th>
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<tbody>
<tr>
<td>Both switches DOWN</td>
<td>Both switches UP</td>
</tr>
<tr>
<td>100 Hz HPN (with 50 Hz notch)</td>
<td>100 Hz HPN (with 60 Hz notch)</td>
</tr>
<tr>
<td>3 kHz LP</td>
<td>3 kHz LP</td>
</tr>
<tr>
<td>30 kHz LP</td>
<td>30 kHz LP</td>
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**MCE100C CALIBRATION**

No calibration required. Use the CBLCALC to verify accuracy.
### MCE100C SPECIFICATIONS

<table>
<thead>
<tr>
<th>Gain &amp; Input Voltage</th>
<th>Gain</th>
<th>Vin (mV)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>±1000</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>±200</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>±50</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>±10</td>
</tr>
</tbody>
</table>

Output Range: ±10 V (analog)

Offset Voltage (DI): Differential Input: ±5 mV maximum (Vin+ to Vin-)

Offset Voltage (SE): Driven Shield to Input: ±15 mV typical (Vin+ or Vin- to Adjacent Shield)

Low Pass Filter: 3 kHz, 30 kHz

High Pass Filter: DC, 0.5 Hz, 100 Hz

CMRR: 92 dB typical; see Shield Drive Operation

CMIV referenced to:
- Isolated ground: ±10 V
- Mains ground: ±1500 VDC

Notch Filter: 50 dB rejection (50/60 Hz)

Noise Voltage: 2.1 µV rms (DC-3000 Hz)

Noise Current: 0.1 fA/√Hz

Input Bias Current: ±3 fA (typical), ±100 fA (maximum)

**Note: Current Clamping and Negative Capacity Compensation Disabled**

Z (input):
- Differential: 10 E15 Ω
- Common mode: 10 E15 Ω

Capacit. Comp (Neg): Input capacitance compensation (0-100 pF) — manual control

I Clamp (I CLMP port): Adjustable (±100 nA) - voltage control

I Clamp Control: Input 3.5 mm phone jack (100 mV/nA)

I Clamp Monitor: Output 3.5 mm phone jack (100 mV/nA)

Signal Source: Micro-electrodes

Weight: 350 grams

Dimensions: 4 cm (wide) x 11 cm (deep) x 19 cm (high)

Input Connectors (front panel): Seven 1.5 mm Touchproof sockets (Vin+, Gnd, Vin-, 2 of shield, I-clmp, neg C)