Testing of a light-weight portable muscle stimulator for long-term space flight

BME 460 Senior Design II

Professors: Marom Bikson PhD
Luis Cardoso PhD

Teaching assistant: Thomas Radman

Sponsor: National Aeronautics and Space Administration (NASA)

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Acquisition system (National Instruments DAQ BOARD AND DAQ CARD)
Channel 1 (V input)
Channel 2 (I input)

2 outputs: current and voltage

Testing Output

Ag-Cl wires

2 outputs: current and voltage

NaCl solution

Our device

NaCl solution
• Minimum current we can measure using this set-up: $20mA/2^{16} = 0.000305176 mA$

• We need to measure at least $0.1 \ mA$

• To be tested when switched electrical polarity, power on and off

• Preliminary data

<table>
<thead>
<tr>
<th>Voltage (Vrms)</th>
<th>Current (Arms)</th>
<th>Impedance (Ohm)</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.56</td>
<td>0.0044</td>
<td>354.5454545</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>0.0044</td>
<td>295.4545455</td>
<td>increased</td>
</tr>
<tr>
<td>1.53</td>
<td>0.0044</td>
<td>347.7272727</td>
<td></td>
</tr>
<tr>
<td>5.3</td>
<td>0.004</td>
<td>1325</td>
<td></td>
</tr>
</tbody>
</table>

Constant current!
Moist Sponge attached to the device to see the effects of moisture while the device is in functional mode for duration of application.
Temperature and Battery life

• Place device in a beaker and submerge beaker into a temperature controlled water bath; see the effects of increasing temperature while device remains functional

• Evaluating the battery life of the device will be achieved by measuring the time the device remains functioning under normal operation; the time when the device stops functioning will be recorded
Durability and Cable Strength

• The strength of the device will be evaluated by several drop tests; after each drop test, the device will be observed for any physical damage to the casing as well as tested for normal function.

• The strength of the electrode leads will be tested under tension; maximum strength values will be recorded based on the load applied to cause the electrodes or the leads to tear or to cease functioning correctly.
Device Performance

• The transient response when the device is switched on will be measured. The user may not use the device for the duration of this response.

• The device design will be revised if any safety threshold values of current are exceeded.