www.I-CubeX.com

BioEmo User Guide

Warning

The BioEmo sensor is to be used only with extreme caution according to the following instructions. It is intended for research purposes only and not intended for any medical purposes whatsoever.

1. The BioEmo sensor must only be plugged into a battery powered, wireless I-CubeX digitizer (eg. the Wi-microDig or Wi-miniDig) manufactured by Infusion Systems and not any other digitizer.
2. The BioEmo sensor must only be connected as shown in the diagram on the wireless digitizer.
3. The wireless digitizer used with the BioEmo sensor must only be powered by a common 9V battery as used in consumer goods or an I-CubeX BatteryPack.
4. Only I-CubeX sensors may be connected to the wireless digitizer that is used for interfacing the BioEmo.
5. When using the BioEmo sensor, I-CubeX products may not be connected in any way to the electrical power grid or any other high voltage source.

Any violation of these instructions nullifies any warranty (express or implied) and nullifies any liability or culpability (express or implied) of Infusion Systems Ltd.. Any violation of these instructions can result in electrocution, severe injury, or even death.

Using the sensor with the Wi-microSystem not only ensures electrically safe operation but also enables you to use the sensor without being tethered to your computer or MIDI device.

Introduction

The BioEmo wristband is a sophisticated bioelectric signal acquisition device that is designed to capture the **GSR** - galvanic skin response.
BioEmo converts the GSR into a form usable by a computer for interactive applications.

The **GSR** is a measure of skin impedance that varies with moisture produced by sweat glands. When measured from the fingers or palm of the hand, the GSR gives an indication of a person's stress response to a stimulus. For this reason the GSR is used as one of the channels for a lie detector test. It is a rough indicator of a person's emotional state – thus the name Bio"Emo". The GSR is very sensitive to slight changes in the sweat response, so if a person tells a lie when asked a question, they will have a slight increase in physiological stress which is turn produces a GSR change.

Stress as reflected in a sweat gland response produces a decrease in skin impedance (because of the moisture). The BioEmo outputs a voltage that corresponds to the change in skin impedance. The example plot shown below shows the GSR change over a period of seconds. Increased stress is plotted as a rise in voltage. Very simple stimuli can elicit changes in the GSR. For example, if you take a sudden deep breath (indicated by the white mark above the plot), the GSR plot will rise abruptly about one second later. Then if you sit quietly, the GSR will slowly decrease back to baseline. So the GSR is useful for indicating stress and arousal, and it is also useful for showing levels of relaxation.
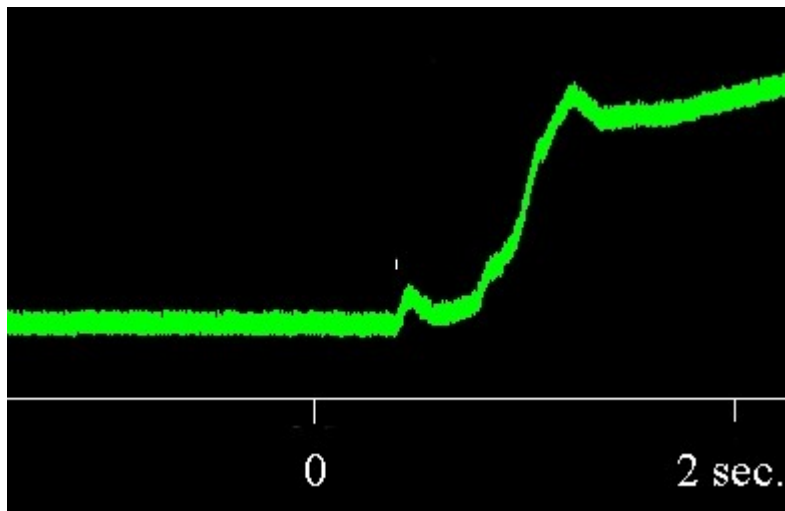
BioEmo set-up

The BioEmo wristband can be rotated to wear in any position on the wrist, so the input sensor wires can travel over the top of the hand to the finger tips or across the palm. The finger sensors have Velcro bands that allow you to place the copper contact on your finger tip and then tighten to hold the electrode snuggly against the finger tip.

Sensor contact adjustment

The gold-plated sensor contacts work for most people with simple skin contact. Your skin should be clean and free of oily substances such as suntan lotion. Some users have very dry skin and this can make it difficult for the sensor contacts to capture a good signal. Users with very dry skin will get better BioEmo operation by putting a little tap water on the fingertips. Dry off the water and then apply the contact bands.

The wristband includes a 1 meter cable with a connector that plugs into the Wi-microDig unit. This allows the Wi-microDig unit to be worn at a distance from the band (e.g. on the belt) and allows freedom of motion.

BioEmo use

The wristband has Velcro strips on both ends that allow for adjusting the fit. The band can be worn quite loosely on the wrist if desired. The finger contacts should be snug on two adjacent fingers – usually the index and second finger – but not too tight to be uncomfortable.

BioEmo Max patch

To start using your BioEmo - position the band and finger contacts as shown in this photo. Check to be sure that the two sensor contacts are making good contact with the skin. Each finger has slightly different contours and you may have to reposition the finger bands to get good contact.

Assuming that you have already verified that your Wi-microDig is functioning with an input device using the I-CubeX Editor, now:
- Launch the BioEmo Max patch
- Plug your BioEmo into the microDig
- Connect the Wi-microDig battery
- Check that the red power LED on the Wi-microDig light is lit

With the BioEmo screen in view, first select your input COM port in the top center box. Allow a few seconds for the Bluetooth connection to be established, and the blue LED should light up on the Wi-microDig, indicating a connection.

Next, verify that the "min" and "max" sliders on the left of the screen are set to 0 and 511 respectively.

To activate the patch, click on "Reset" and then in the "On/Off" toggle box at the upper left.

BioEmo patch

To run this patch you must install the iCube object in your externals folder. Download the iCube object from www.icubex.com

1) Look in the max window to see which virtual serial port the wi-microDig is assigned

[COM 1   ⬍]   2) Choose the port that corresponds to the wi-microdig
                              (choose any other port to disconnect)

Reset
  ○   3) Click reset once connected

On/Off
  ⊠   4) Turn the patch on, and start audio if desired

Scale Signal

Use current max
as baseline ○

[▶ 331] [▶ 202] [▶ 332]
Signal   Min   Max

Audio (sine wave)

Set volume

Start
audio

🔊

GSR data   [▶ 0.1]   Set smoothing value [0 ..1]

Once the program is running, you will see the data trace scrolling across the "GSR data" window. If your BioEmo finger sensors are making good contact with the skin, the trace will look like the figure above with high baseline activity. Note that the patch inverts the input, so the low baseline shown in the picture at the beginning of this document corresponds to high baseline in the patch. If one of the sensors is not touching the skin, you will see low and noisy baseline activity scrolling across the window. If this happens you need to adjust one or both of the finger contacts to make sure they have good skin conductivity. Note that you can click on the radio button next to the "min" and "max" sliders to set the max as the current baseline. You'll need to adjust these sliders to "zoom in" on the signal by moving the max and min values closer to the signal, as seen in the screenshot above.

BioEmo GSR

Now that you are running with a good low noise baseline with your BioEmo, try relaxing for a couple of minutes in order to establish a low baseline GSR. Now, test your GSR by taking a sudden deep breath. You should see the plot drop rapidly after about a second. You can see this response in the screenshot below. Next, sit quietly for a couple of minutes and watch the GSR response slowly decrease back to the level you had at the beginning.

You can now experiment with different types of stimuli to observe the numerous ways that the GSR "stress" can be evoked. You can even use the BioEmo as a lie detector. With a friend as a subject, start by asking some neutral questions to establish a baseline. Then try asking a more emotionally charged true or false question and see if what type of GSR response you get.

Also, this is a good time to experiment with the MIDI audio. The MIDI algorithm included in this patch maps signal amplitude to note number. Click on the "Start audio" button and you can listen to the varying pitch of your GSR. This is a great feature, since you can work on relaxation by closing your eyes and listening to the pitch decrease as you become more and more relaxed.

BioEmo patch

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1) Look in the max window to see which virtual serial port the wi-microDig is assigned

COM 1   2) Choose the port that corresponds to the wi-microdig
(choose any other port to disconnect)

Reset   3) Click reset once connected

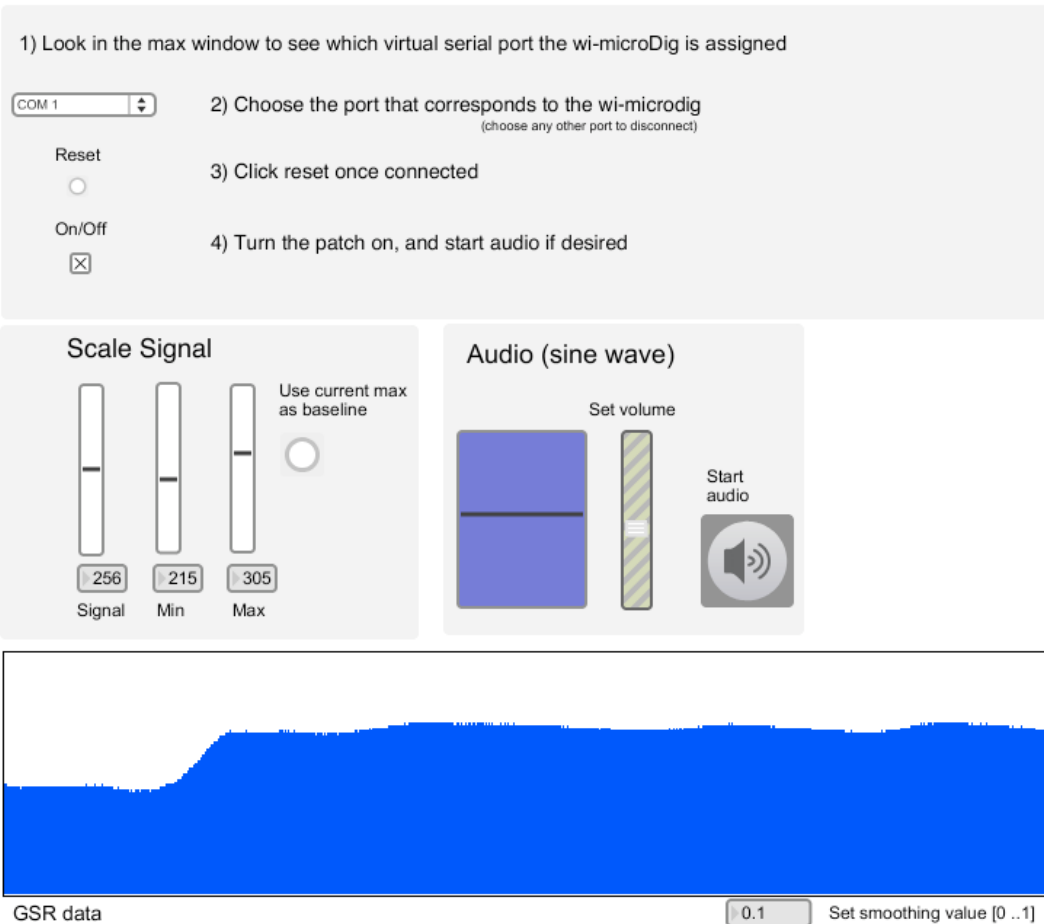On/Off   4) Turn the patch on, and start audio if desired

Scale Signal

Use current max as baseline

| 256 | 215 | 305 |
| Signal | Min | Max |

Audio (sine wave)

Set volume

Start audio

GSR data   0.1   Set smoothing value [0 ..1]