

## BioBeat User Guide

### Warning

The BioBeat 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.

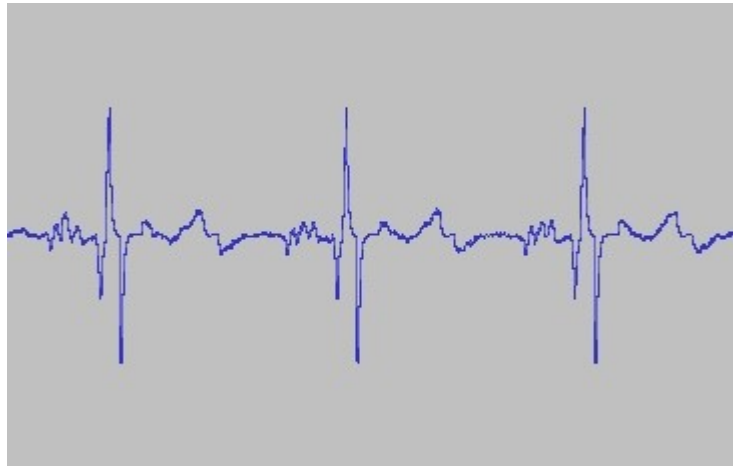
1. The BioBeat sensor must only be plugged into a battery powered, wireless I-CubeX digitizer (eg. the Wi-microDig or Wi-miniDig) manufactured by Infusion Systems and not any other digitizer.
2. The BioBeat sensor must only be connected as shown in the diagram on the wireless digitizer.
3. The wireless digitizer used with the BioBeat 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 BioBeat.
5. When using the BioBeat 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.

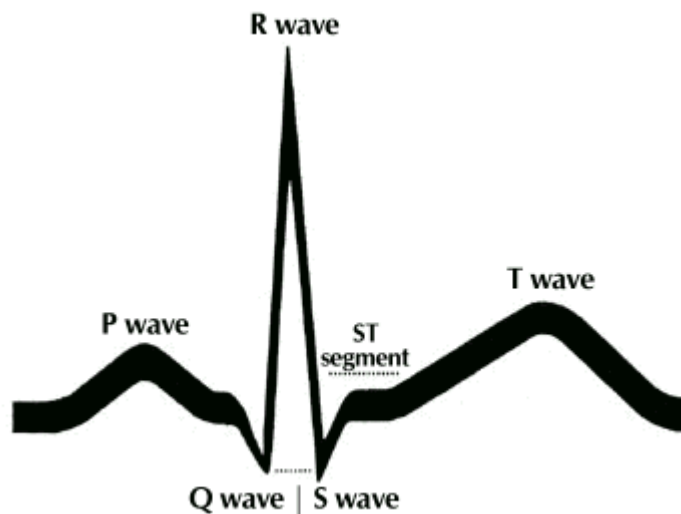
Using the sensor with the [Wi-microSystem](#) not only ensures electrically safe operation but also enables you to use the sensor without being tethered to your computer or MIDI device.

## Introduction

The BioBeat is a sophisticated bioelectric signal acquisition device that is designed to capture the heart ECG (electrocardiogram) signal and convert this signal into a form usable by a computer for interactive applications. The ECG is an AC (alternating current) wave complex that is generated as a result of the heart muscle contractions. The figure below shows the actual ECG raw data generated when you put the BioBeat module on your chest.



Almost everyone knows what a basic ECG tracing looks like. But what does it mean? The heart contracts on average 70 – 80 times per minute. Each contraction represents one heartbeat. The atria contract a fraction of a second before the ventricles so their blood empties into the ventricles before the ventricles contract.



The first little upward notch of the ECG tracing is called the "P wave." The P wave indicates that the atria (the two upper chambers of the heart) are contracting to pump out blood. The next part is called the "QRS complex." This part indicates that the ventricles (the two lower chambers of the heart) are contracting to pump out blood. The next short upward segment is called the "ST segment." The ST segment indicates the amount of time from the end of the contraction of the ventricles to the beginning of the rest period before the ventricles begin to contract for the next beat. The next upward curve is called the "T wave." The T wave indicates the resting period of the ventricles. Variations in size and length of the different parts of the tracing may be significant.

## BioBeat set-up

The BioBeat band is configured with a 1 meter elastic band designed to hold the sensor module in place on the torso. The sensor module has 3 gold sensor contacts that are designed to contact the skin and capture the electrical signals from the heart.

### Sensor contact adjustment

The gold 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 BioBeat operation by putting a little tap water on the skin where you will wear the unit, dry off the excess water and then apply the sensor band.



The band 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.

## BioBeat use

The band has a cambuckle that allows for adjusting the fit of the band around the chest. The easiest way to put on the band is to hold the BioBeat module on the chest to the left of the sternum and then slip the tongue of the elastic into the open cambuckle. Then tighten the elastic when the band is in the desired position, and latch the cambuckle closed.

By the way, you can wear the BioBeat module anywhere on your upper body. For instance, you can wear it on your back and it will still capture a good ECG signal. You can experiment with wearing the module in different places and observe how location affects the relative size of the P-QRS-T wave components.

### BioBeat Max patch

To start enjoying your BioBeat – you can *hold* the module on your chest just left of your sternum with the elastic band folded up out of the way - as shown in the photo. Be sure that all 3 sensor contacts are touching the skin.

Assuming that you have already verified that your Wi-microDig is functioning with an input device using the I-CubeX Editor, now:

- launch the Biobeat Max patch
- plug your BioBeat into the Wi-microDig
- connect the Wi-microDig battery
- note that the red pilot light is lit

With the Biobeat Max patch 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 light should appear on your Wi-microDig.

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 the “On/off” box at the upper left. Sometimes it is necessary to toggle between Reset and On/off in order to start the program.

Once the program is running, you will see the data trace scrolling across the “ECG data” window. If your BioBeat is making good contact with the skin the trace will look like the figure below with low baseline activity.

Reset  On/Off

COM 5

Select the COM port that's used for the WI-microDig

BioBeat test patch v1.1

To run this patch you must install the iCube and f0.smooth objects in your externals folder. Download the iCube object from [www.icubex.com](http://www.icubex.com) and the f0 objects from [www.frednikolofsson.com](http://www.frednikolofsson.com).

0.1 Set smoothing value [0 ..1]

Signal   Min Max set Min and Max to zoom in on range of signal

Set volume

Start audio

ECG data

If your BioBeat is not fitted properly and one of the sensor contacts is not touching the skin, you will see high baseline activity scrolling across the window as shown below. If this happens, you need to reposition the unit to make sure that all sensor contacts touch the skin.

Reset  On/Off

COM5  
Select the COM port that's used for the Wi-microDig

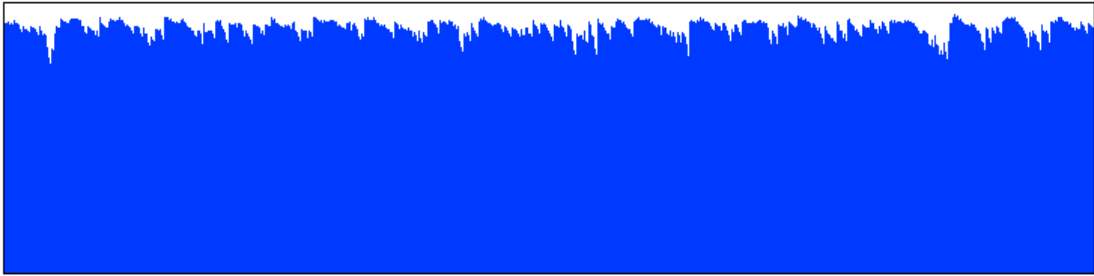
BioBeat test patch v1.1

To run this patch you must install the iCube and f0.smooth objects in your externals folder. Download the iCube object from [www.icubex.com](http://www.icubex.com) and the f0 objects from [www.fredrikolofsson.com](http://www.fredrikolofsson.com).

0.1 Set smoothing value [0 ..1]

Signal    
Min Max set Min and Max to zoom in on range of signal

Set volume  Start audio



ECG data

The image shows a software interface for a BioBeat test patch. At the top, there are controls for 'Reset' (checked) and 'On/Off' (unchecked). A dropdown menu is set to 'COM5' with the instruction 'Select the COM port that's used for the Wi-microDig'. To the right, the title is 'BioBeat test patch v1.1' and there is a paragraph of instructions about installing objects. Below these are several sliders: 'Set smoothing value [0 ..1]' is set to 0.1; 'Signal' has 'Min' at 0 and 'Max' at 511, with a note 'set Min and Max to zoom in on range of signal'; 'Set volume' is at 0; and a 'Start audio' button with a speaker icon. The main part of the interface is a large blue plot labeled 'ECG data' at the bottom. The plot shows a dense, noisy blue area that fills most of the vertical space, indicating high baseline activity as described in the text above.

Now that you are running with a good low noise baseline with the BioBeat on your chest, you'll notice the ECG signals start scrolling across the screen. Since the display is an envelope or signal summation display you do not see the P-QRS-T complex shown at the beginning of this document. Rather, the envelope display shows the total energy of the ECG wave complex. To optimize the envelope display in the data window, you can adjust the min and max sliders.

Note that your heart rate changes with your breathing rate. Try activating the MIDI audio by clicking on the "Start audio" button. Since the MIDI algorithm is mapping note number to signal amplitude, each (big) ventricular contraction will hit a high note. So now you have your own version of a hospital heart monitor that beeps with every heart beat.

Enjoy.

Reset  On/Off

COM5

Select the COM port that's used for the Wi-microDig

BioBeat test patch v1.1

To run this patch you must install the iCube and f0.smooth objects in your externals folder. Download the iCube object from [www.icubex.com](http://www.icubex.com) and the f0 objects from [www.fredrikolofsson.com](http://www.fredrikolofsson.com).

0.1 Set smoothing value [0 ..1]

Signal

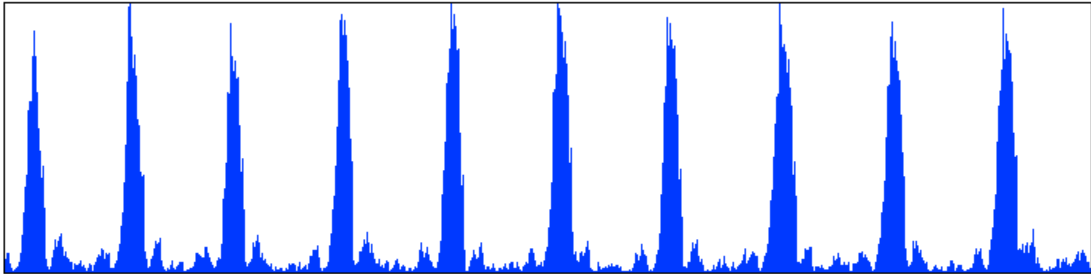
20 400

Min Max

set Min and Max to zoom in on range of signal

Set volume

Start audio



ECG data