



# AIM Physiological Monitor

This manual contains general operating instructions, precautionary measures, maintenance instructions, and information for use of the CGX AIM Physiological Monitor. Please read this manual carefully and familiarize yourself with the controls and accessories before using the product.

## **Note**

- This is an investigational device designed for research and development efforts.
- It is not an FDA-approved medical device.
- There are no known side effects from the use of this product.

## **Description**

The AIM Physiological Monitor provides pulse oximetry (PPG), heart-rate variability (HRV), oxygen saturation (SpO2), respiration, temperature, galvanic skin response (GSR), and four EXG channels in a portable, self-contained, wireless system.

Wireless technology allows the subject to move about while real-time data is collected and displayed.

The device uses a modular design; any

combination of sensors can be used at any time, from a single sensor to every sensor simultaneously.

Sensor channels are sampled at a time resolution of 500Hz and converted to digital data at 24 bits of resolution.

The AIM Physiological Monitor provides research-grade signal quality and is ideally suited for laboratory and field environments.

**The AIM is intended to be used to acquire biometric signals and transmit them wirelessly to a computer.**

**This Device Is Intended For Research Only.**

**It Is Not Intended For The Following Uses:**

- monitoring of patients in a clinical environment
- use in medical diagnosis
- on subjects undergoing surgery
- use in sterile environments
- use with sleeping subjects

**Do Not Use This Product In These Situations:**

- near high-frequency surgical equipment
- if exposed to ionizing radiation
- in oxygen-rich environments (concentration > 25% at 1 atm)
- in wet environments
- in the presence of flammable anesthetics or gases

**Precautions For The Practitioner**

- Do not drop, sit on, or step on the product.
- Check if your subject has a sensitive dermatological condition causing sensor intolerance.
- To avoid cross-subject contamination, do not use with subjects having open wounds or infections.
- The AIM is not a diagnostic tool. Any medical diagnosis related to the measurements should be derived by a certified physician.

**Subject Considerations**

- This device is intended for human use only.
- Subject should have healthy skin.
- Do not use with infants or neonates.

**Follow These Advisories To Keep Your AIM In Good Working Order**

- Do not immerse any part of the system in liquid.
- Do not expose the system to direct sunlight or heat source, moisture, vibration, mechanical shock, excessive dust, or humidity.
- Do not open, modify or disassemble any part of the system — this will void the warranty.
- Do not use if any part of the system is damaged.
- Do not use when wet — if moisture penetrates the system, let it thoroughly dry prior to use.
- Do not use caustic or abrasive cleaners on the system or sensors.
- Avoid sharply bending the lead wires.

**Disposable Sensors May Be A Biohazard**

Dispose of EXG sensors after each use.

**Always Use Supplied Accessories**

Using accessories other than those supplied with your system may result in damage or diminished efficacy of the system.

**Avoid Cross-Subject Contamination**

Clean the device and clean or replace sensors after use following the cleaning instructions on Page 10 to avoid cross-subject contamination.

# Package Contents

## The Package Contains The Following Items

AIM Wireless Amplifier  
Bluetooth Dongle  
11 Passive Lead Wires

PPG/HRV/SpO2 Sensor  
Temperature Sensor  
Respiration Sensor Set  
30 Skintact ECG Electrodes  
USB Charging Cable  
Wall Charger

Carrying Case  
Manual

## AIM Physiological Monitor



## Device Overview

## AIM



Wireless amplifier  
collects signals and  
transmits to Bluetooth  
Dongle.

## Bluetooth Dongle



High-speed receiver  
dongle plugs into your  
computer's USB port.

## Passive Lead Wires



Passive lead wire for  
ExG, GSR and GND

## PPG/HRV/SpO2



Combined pulse oximeter (PPG)/heart-rate variability (HRV)/oxygen saturation (SpO<sub>2</sub>) sensor provided in a clip form-factor for application on the earlobe or fingertip.

## Respiration



Respiration paddles applied just below the collarbones provide respiration data and ECG.

## Temperature



Place the temperature sensor anywhere on the body to record surface temperature.

## SkinTact Electrodes



Sticky electrodes for use with ExG sensors, GSR sensors, and Respiration paddles

### Sensor Setup Guide

You can use any combination of sensors concurrently.

#### PPG/SpO2/HR Sensor

To acquire PPG/SpO2/HR, connect the PPG/SpO2/HR module to the 9-pin port on the top left side of the amplifier.

You do not need to attach a ground terminal (GND).

- Clip PPG/SpO2/HR sensor onto the fingertip or earlobe.
- Go to the Display tab in the software and change the channels from **All** to **1**
- Set the Show Page drop-down menu to **EEG 7 to 7**.
- View SpO2 and heart rate data on the Status tab in the software.
- Heart rate is listed in beats per minute.
- SpO2 is listed as a percentage of blood oxygen saturation.

#### PPG/SpO2/HR Sensor



#### Respiration Paddles



#### Respiration Sensor Paddles & ECG Measurements

To acquire respiration and ECG signals:

1. Attach the two respiration paddles to the positive and negative respiration inputs on the AIM device.
2. Attach a lead to the ground terminal (GND).
3. Snap Skintact electrodes into the respiration and ground sensors.
4. Attach ground.
5. Apply respiration paddles to the subject so arrows on the paddles face each other and point toward the midline. Paddles should sit just below the collarbone.
6. To view both the ECG and respiration signals in the software, go to the Display tab in the software and change the channels from **All** to **2**
7. Set the Show Page drop-down menu to **EEG 5 to 6**

#### Temperature Sensor



#### Temperature Sensor

To acquire temperature:

1. Connect the temperature module to the AIM. You do not need to attach a lead to the ground terminal (GND).
2. Hold the temperature sensor in the hand or tape under the arm for increased accuracy.
3. View temperature data (Celsius) on the Status tab in the software.

### GSR Sensor

To acquire a GSR signal:

1. Connect passive lead wires into the positive and negative GSR ports.
2. Attach a lead to the ground terminal (GND).
3. Snap Skintact electrodes into the GSR and ground sensors.
4. Attach ground and GSR sensors to the body.
5. To display the GSR channel, go to the Display tab in the software and change the channels from **All** to **1**.
6. Set the Show Page drop-down menu to **EEG 10 to 10**

### EXG Sensors

1. Attach passive lead wires to the positive and the negative ExG channel inputs for however many ExG channels you want to acquire.
2. Attach a lead to the ground terminal (GND).
3. Snap Skintact electrodes into each sensor.
4. Place the leads and ground onto the subject on the desired locations.
5. To selectively display ExG channels, go to the Display tab in the software and change the channels from **All** to **1**.
6. Navigate between the ExG channels by using the **Show Page** drop-down menu.

### GSR Sensor

Use passive lead wire and Skintact electrode.

### EXG Sensors

Use passive lead wire and Skintact electrode.



### Emotional Arousal/Stress Test

Measure emotional arousal in response to presented stimulus, capturing changes in respiration, heart rate, and galvanic skin response.

- Respiration paddles.
- GSR sensors placed close together on the palm of the hand.

### Cardiac Output Test

Measure common cardiac functions for monitoring heart health including blood oxygen saturation, heart rate variability, and respiratory sinus arrhythmia.

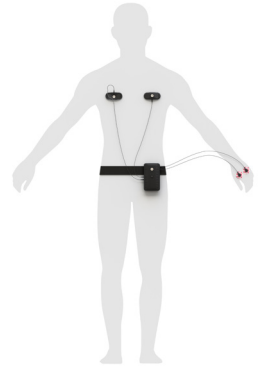
- SpO2 on ear.
- Respiration paddles.

### ECG + EMG + Respiration Test

Measure physiological response in a light ambulatory setting, capturing muscle EMG from the leg.

- Respiration paddles.
- ECG electrodes across the heart on the left upper chest with the medial sensor placed above the heart and the lateral sensor below.
- EMG electrodes to the upper quadricеп with one sensor placed above the other.

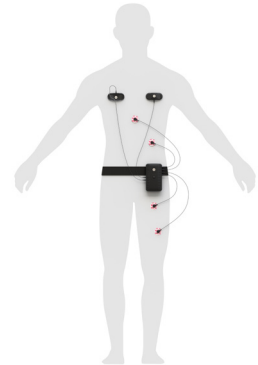
### Emotional Arousal/Stress



### Cardiac Output



### ECG + EMG + Respiration



## Product Features

### Power Button

Push button to turn the device on and off.

### Micro USB Port

Use the Micro USB port to charge the AIM Physiological Monitor.

### Trigger LED

The Trigger Status Light is for use with the optional CGX Wireless StimTrigger, and indicates when the headset is receiving trigger signals from the StimTrigger unit.

**Off** Wireless StimTrigger Out Of Range

**Blue** Wireless StimTrigger In Range

### Battery LED

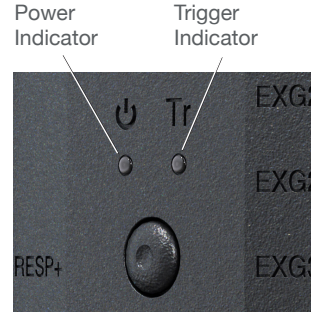
The bottom light is the battery indicator.

- Red indicates charge is not complete.
- Yellow indicates low battery.
- Green indicates full charge.

*Note: Fully charge the battery before use.*

### Belt Clip

The back face holds the optional belt clip for ambulatory signal capture.



#### Power LED

**Green** On

**Yellow** Low Battery

**Red** Battery Critically Low

#### Trigger LED

**Off** Out Of Range

**Blue** In Range





## Preparation

### USB Dongle

Plug the dongle into your computer and Windows should automatically install the correct drivers. Verify driver installation by checking the Device Manager for problems, marked by a yellow exclamation mark.

- The dongle is specific to each headset.
- For best performance, ensure a clear line of sight between the dongle and the front of the headset

*If Windows did not successfully install the driver for the dongle, refer to the FTDI driver installation manual on our website.*

Each AIM is permanently paired to a receiver dongle. The pair automatically discover and initiate a connection when both are powered on and within a 10m range.

The light on the dongle indicates its current state:

|                      |                      |
|----------------------|----------------------|
| <b>Green</b>         | Power On, Not Paired |
| <b>Purple</b>        | Searching For Device |
| <b>Blue</b>          | Device Found         |
| <b>Flashing Blue</b> | Data Transmitting    |

### AIM Dongle



**Green** Not paired

**Purple** Searching for device

**Blue** Device found

**Flashing Blue** Data transmission

## Acquisition Software

### Start the Acquisition Software

Have the CGX Data Acquisition software installed and ready.

Insert the AIM Physiological Monitor's Bluetooth dongle into your computer's USB port. If you are using a desktop computer, insert the dongle into a port facing the subject not obscured by the computer's chassis.

Double click on the CGX Data Acquisition Software icon. You should see **CGX AIM Phys. Mon.** under **Discovered Devices**. If you do not, remove and re-insert the dongle, then restart the software.

Click the device name in this window to select the AIM and click **Connect**.

You should see a small pop-up window asking if you wish to auto-configure. Click **Yes**. If you do not see the pop-up, check beneath the main window of the software.

You should now see the device configuration window momentarily. If you do not, double check to make sure the AIM is powered on and in standalone mode.

Keep settings in their default values. Click **Write to Device and Start**

You will now see data streaming into the display.

Download the latest copy here:  
<http://cognionics.com/wiki/pmwiki.php/Main/DataAcquisitionSoftware>

## Recording A Session

### Recording A Session

After you have an acceptable connection on all applicable sensor channels, go to:

- **Device > Record** to begin recording.
- To end recording, click **Stop Recording** under the same tab.

### Ending A Session

- Close out the current file in the software if one is active and exit the program.
- Press the power button once to turn off the device.
- Disconnect all leads from the system before storing.

### Position Of The Subject During Recording

Use the AIM Physiological Monitor for subjects in an upright position or for low-impact ambulatory recordings. Do not let the subject lie or sleep on the sensors.

## Care And Handling

To avoid cross-subject contamination, follow the cleaning instructions to clean sensors and system after each use.

This device is not intended to be sterilized in an autoclave.

### Cleaning Sensors

Use hand sanitizer or 70% alcohol wipes to clean components that contact the skin.

### Disposal Instructions

To protect the environment, always follow local law, rules, and policies regarding electronic and battery disposal. You may also return the system to CGX for proper disposal.

Use the supplied carrying case when transporting the system to avoid damage to the amplifier or any of the components.

### Resetting the Amplifier

Resetting the amplifier will set the device back to its original settings and can resolve a wide range of issues.

If the AIM Physiological Monitor has been misconfigured or is otherwise unable to contact the software, reset the amplifier by turning the device on and off.

Since the AIM's settings are stored in the device, this reset process can cause issues if you have changed the auto-configuration screen to fit your experiment. Please contact CGX support if you have changed your settings and need to reset your device.

### Power Issues

If the AIM Physiological Monitor does not power on OR powers on but quickly shuts off, check to make sure the battery is fully charged.

### Other Issues

If you find still have issues or questions, please contact us at 858-864-9400, or at [sales@CGXSystems.com](mailto:sales@CGXSystems.com)

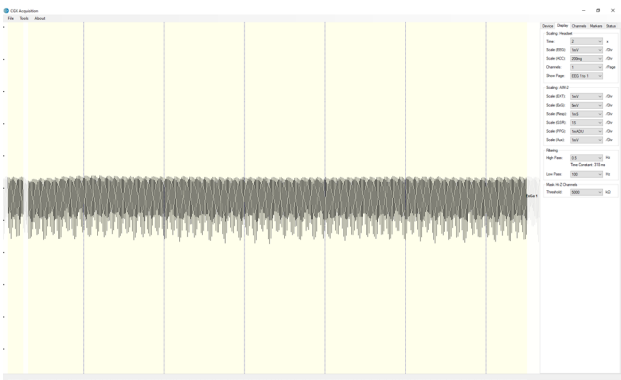
# Troubleshooting Readings

The most important aspect of AIM recording is that output data is only as good as the recording input. While algorithms exist to remove artifacts, poorly recorded data cannot be fixed in post processing.

Recording good data requires preparation of the participant for optimal sensor contact:

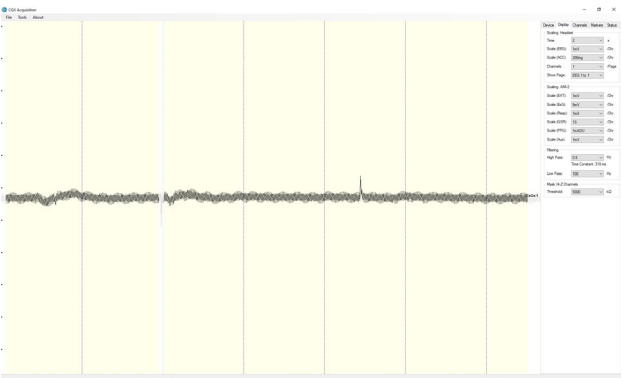
- 1. Clean each sensor location on the subject with a cotton swab soaked with 70% alcohol.
- 2. It is important for subjects to reduce tension in the head, neck, and shoulders during readings.

## Missing Ground

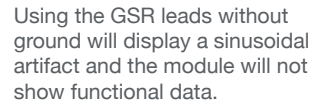


Using the EXG leads without ground will cause the channel to be obscured by electrical (50/60Hz) noise.

## EXG Missing A Lead



Using a single EXG lead will cause the signal to be obscured by electrical noise.

[illegible]

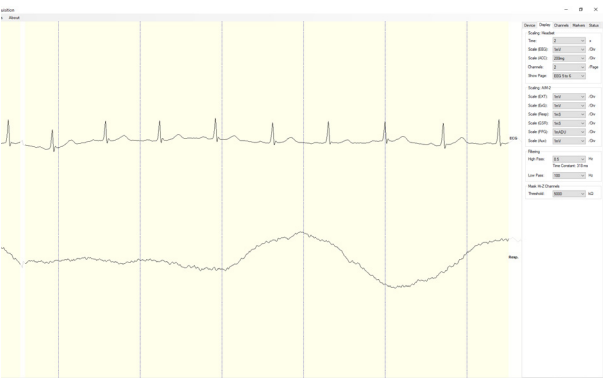
Using the GSR with only a single lead will cause a flat line.

Respiration Paddles Placed Properly



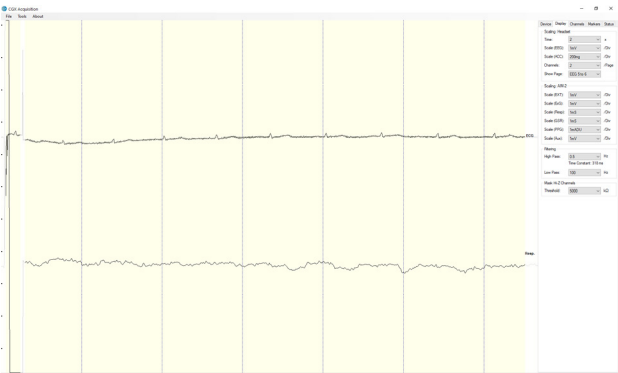
When the respiration paddles are placed properly the ECG channel will display a distinct and clean signal and the respiration paddle will be responsive to actual respiration.

Respiration Paddles Too Close Together



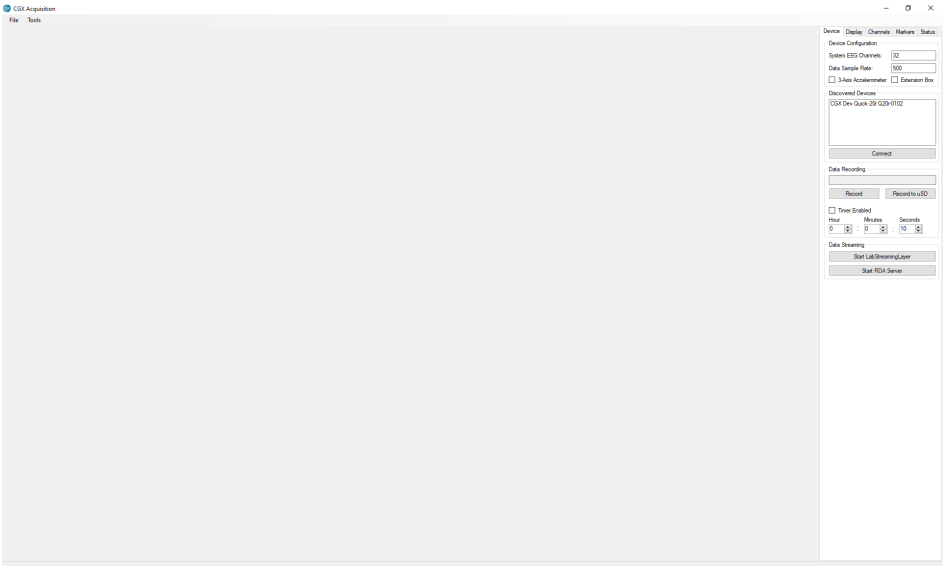
Respiration paddles placed too close to each other display poor signal quality. Amplitude of respiration and ECG channels will be lower than expected.

Only 1 Respiration Paddle Connected



Without using both respiration paddles, the respiration signal presents as noise and the ECG will be unreliable and noisy.

## Device Tab



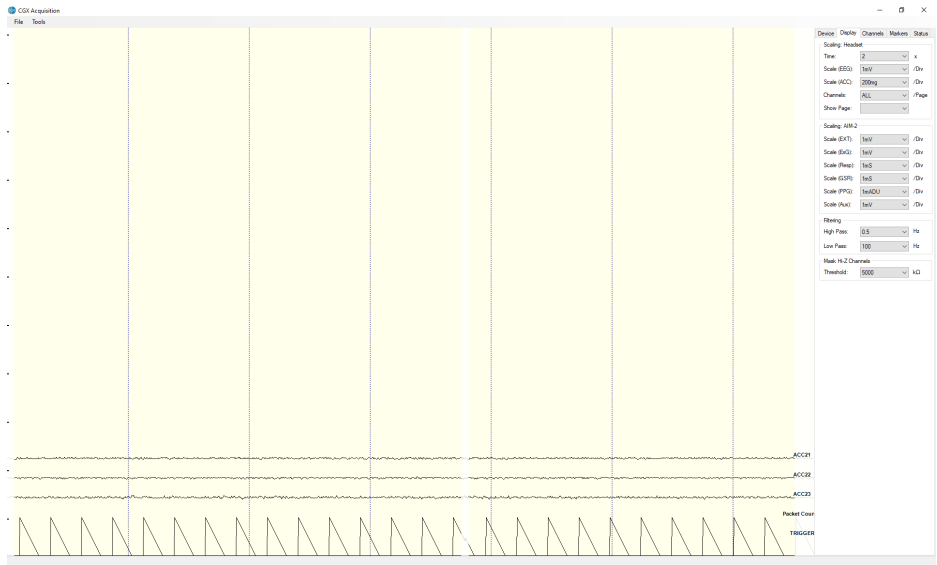
### Device Configuration

- **Discovered Devices** Connected dongles will be listed here. Select the device name of your system and hit **Connect**.
- The software automatically connects to your device to retrieve stored settings.
- The **Device Configuration** window is only for your information; changing the settings will not change the configuration of the device. If you need to change device configuration, contact support at CGX.

### Data Recording

- **Record** Click to open a file dialog. Select the desired location, file name, and file type. (CSV files have a time stamp built in). Recording begins when you press **OK**.
- **To Stop Recording** hit the button again. Elapsed time is shown in the box above the button.
- **Start LabStreamingLayer** Hit the **Start LabStreamingLayer** button.
- **Start RDA Server** To use the BCI2000 software with the Data Acquisition Software, click on this button. Then, connect to the application in BCI2000.
- **Timer** The timer allows you to limit file recording to a specific length.

## Display Tab



### Scaling: Headset

- **Time** sets the x axis time window. By default, it is set to 2 seconds.
- **Scale (EEG)** sets the y axis vertical gain for the EEG channels on the head.
- **Scale (ACC)** sets the y axis vertical gain for the accelerometer channels.
- **Channels** sets the maximum number of channels displayed per screen. To flip through the pages of channels, use the option below.
- **Show Page** switches between different pages of channels.

The display tab controls scaling and other viewing parameters for the signals.

### Scaling: AIM Physiological Monitor

#### Filtering

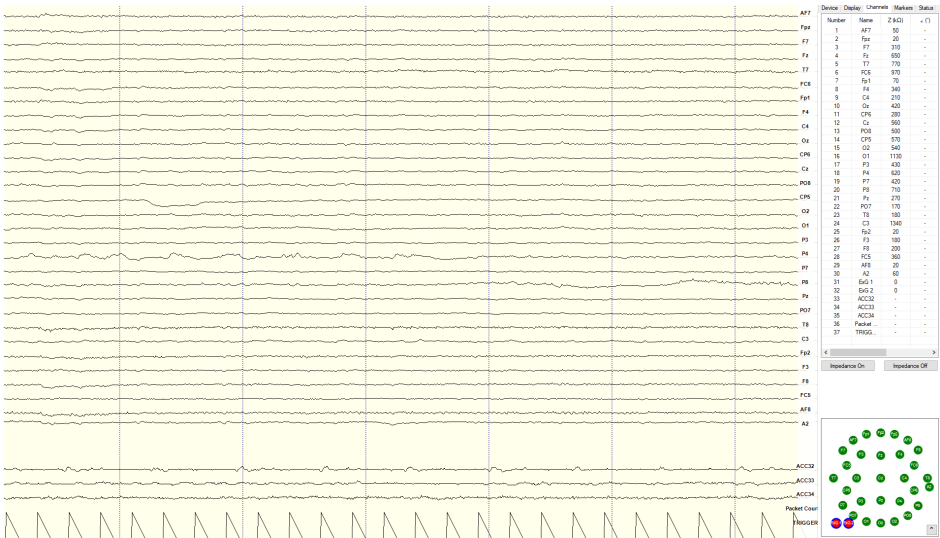
- **High Pass** sets the floor (removes offsets and slow signals) corner frequency for the display.
- **Low pass** sets a ceiling (removes high frequency signals and noise) corner frequency for the display.
- Note: filtering is for display only. Data files are saved raw and unfiltered to preserve the maximum amount of information.

### Mask Hi-Z Channels

**Threshold** hides channels with sensor impedances above the specified threshold from the display.



Channels Tab



The bottom half is a graphical map of sensor contact quality. Red circles indicate poor contact, whereas light green circles indicate acceptable contact. Dark green circles indicate ideal contact.

The threshold for this contact quality is, by default:

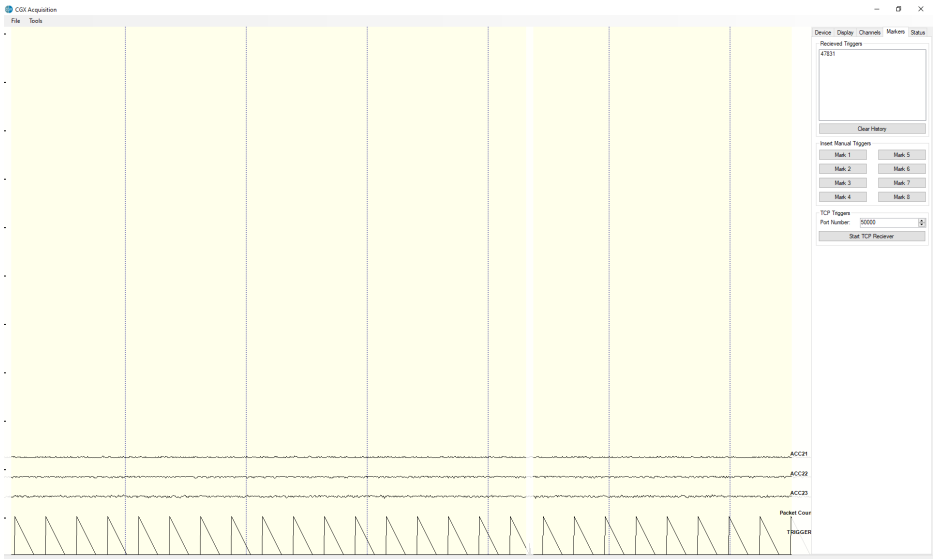
- Red** Above 5000 kΩ
- Light Green** Between 2500-5000 kΩ
- Dark Green** Below 2500 kΩ

This threshold can be changed with the Mask Hi-Z menu on the display tab.

- Red** 100% or greater of Hi-Z threshold
- Light Green** Between 50%-100% of Hi-Z threshold
- Dark Green** Below 50% of Hi-Z threshold

The top half of the Channels tab contains a table displaying information about each channel in the system including its number, name, contact impedance ( $Z$  (kΩ)) and sensor offset (Off (mV)). The offset is calculated relative to the reference channel A1.

## Markers Tab



### Received Triggers

- The box shows all of the received triggers chronologically.
- If no trigger is in range, value received will be 47831 (in hex: 0xBAD7).
- **Clear History** This button will clear all of the triggers in the box. It will not delete triggers from the recording itself.

### Insert Manual Triggers

- You have the option to select any one of eight trigger codes to insert into the recording. These will be inserted in the same way as a normal trigger sent from our Wireless StimTracker. However, we recommend only using the trigger for precision event marking, and to use these software triggers for general annotation.

### TCP Triggers

- **Port Number** Allows you to choose which port to receive triggers.
- **Start TCP Receiver** Starts the receiving service.
- Do not use for precision event marking.
- For general annotation only.

## Specifications

| Wireless Amplifier |  |
|--------------------|--|
| A/D Resolution     | 24-Bit simultaneous sampling analog-to-digital converters  |
| Sampling Rate      | 500 samples per second   |
| Bandwidth          | 0-131 Hz with true DC coupling   |
| Accelerometer      | 3-axis, measures head motion   |
| Wireless Range     | 10 meters  |
| Noise              | <1.0 $\mu$ V RMS from 1-30 Hz, shorted inputs  |
| Sensors            |  |
| Included Sensors   | PPG/SpO2/HR<br>Bioimpedance-based Respiration<br>12-bit solid state Temperature<br>GSR (EDA)<br>4 Channels ExG |
| Data Stream        |  |
| Streaming          | Stream data using the simple API in C, C++, C#, Java, MATLAB or Python.  |

| Export Data To                  | EEG or CSV (text)   |
|---------------------------------|---|
| API                             | Open API to build custom applications.  |
| Power                           |   |
| Power                           | Rechargeable Lithium-Ion battery  |
| Supply Voltage                  | 3.7 V DC  |
| Power Consumption               | 0.4 VA, 5 hour battery life   |
| General                         |   |
| Minimum Computer Hardware Specs | 8th Generation Intel Core processor<br>8 GB DDR3 RAM<br>256 GB solid state drive<br>Integrated graphics processor<br>Microsoft Windows 10 |
| Weight                          | 190g  |
| Dimensions (LWH)                | 14 x 8 x 3 cm   |



## Warranty and Service

### Device

3 year warranty on manufacturing defects. 90 day warranty on disposable parts. All units returned to CGX for repair and assessment must have an RA number, issued by CGX. CGX will pay outbound shipping costs only.

### Returns

Ship all returns with an RA number to:

### CGX

Attn: Service  
8445 Camino Santa Fe, #213  
San Diego, CA 92121



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