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

<table>
<thead>
<tr>
<th>The Package Contains The Following Items</th>
<th>PPG/HRV/SpO2 Sensor</th>
<th>Carrying Case</th>
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</thead>
<tbody>
<tr>
<td>AIM Wireless Amplifier</td>
<td>Temperature Sensor</td>
<td>Manual</td>
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<tr>
<td>Bluetooth Dongle</td>
<td>Respiration Sensor Set</td>
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<tr>
<td>11 Passive Lead Wires</td>
<td>30 Skintact ECG Electrodes</td>
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<td>USB Charging Cable</td>
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<td></td>
<td>Wall Charger</td>
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<tr>
<td></td>
<td>Carrying Case</td>
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<tr>
<td></td>
<td>Manual</td>
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</tr>
</tbody>
</table>

### AIM Physiological Monitor

- **SpO2**
- **Power LED**
- **Respiration**
- **Temperature**
- **GSR**
- **Battery LED**
- **Micro USB Charging Port**
- **4 EXG Ports**
- **Trigger LED**
- **Power Button**
- **GND**
| Device Overview |
|-----------------|-----------------|-----------------|
| **AIM**         | **Blutooth Dongle** | **Passive Lead Wires** |
| Wireless amplifier collects signals and transmits to Bluetooth Dongle. | High-speed receiver dongle plugs into your computer’s USB port. | Passive lead wire for ExG, GSR and GND |

<table>
<thead>
<tr>
<th><strong>PPG/HRV/SpO2</strong></th>
<th><strong>Respiration</strong></th>
<th><strong>Temperature</strong></th>
<th><strong>SkinTact Electrodes</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined pulse oximeter (PPG)/heart-rate variability (HRV)/oxygen saturation (SpO2) sensor provided in a clip form-factor for application on the earlobe or fingertip.</td>
<td>Respiration paddles applied just below the collarbones provide respiration data and ECG.</td>
<td>Place the temperature sensor anywhere on the body to record surface temperature.</td>
<td>Sticky electrodes for use with ExG sensors, GSR sensors, and Respiration paddles</td>
</tr>
</tbody>
</table>
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.

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
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.
**Sensor Overview**

**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.
Common Configurations

**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 quadricep with one sensor placed above the other.
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.
- 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.
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:

- **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

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.

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.

Battery Storage

Remove the batteries when system is not in use.

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.

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.
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
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.

**Troubleshooting 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.
GSR Missing Ground

Using the GSR leads without ground will display a sinusoidal artifact and the module will not show functional data.

GSR Missing A Lead

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

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.

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.
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.

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
Running The Acquisition Software

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

<table>
<thead>
<tr>
<th>Wireless Amplifier</th>
<th>Data Stream</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A/D Resolution</strong></td>
<td><strong>Streaming</strong></td>
</tr>
<tr>
<td>24-Bit simultaneous sampling</td>
<td>Stream data using the simple API in C, C++, C#, Java, MATLAB or Python.</td>
</tr>
<tr>
<td>analog-to-digital converters</td>
<td></td>
</tr>
<tr>
<td><strong>Sampling Rate</strong></td>
<td><strong>Export Data To</strong></td>
</tr>
<tr>
<td>500 samples per second</td>
<td>EEG or CSV (text)</td>
</tr>
<tr>
<td><strong>Bandwidth</strong></td>
<td><strong>API</strong></td>
</tr>
<tr>
<td>0-131 Hz with true DC coupling</td>
<td>Open API to build custom applications.</td>
</tr>
<tr>
<td><strong>Accelerometer</strong></td>
<td></td>
</tr>
<tr>
<td>3-axis, measures head motion</td>
<td></td>
</tr>
<tr>
<td><strong>Wireless Range</strong></td>
<td><strong>Power</strong></td>
</tr>
<tr>
<td>10 meters</td>
<td>Rechargeable Lithium-Ion battery</td>
</tr>
<tr>
<td><strong>Noise</strong></td>
<td><strong>Supply Voltage</strong></td>
</tr>
<tr>
<td>&lt;1.0 μV RMS from 1-30 Hz,</td>
<td>3.7 V DC</td>
</tr>
<tr>
<td>shorted inputs</td>
<td></td>
</tr>
<tr>
<td><strong>Sensors</strong></td>
<td><strong>Power Consumption</strong></td>
</tr>
<tr>
<td><strong>Included Sensors</strong></td>
<td>0.4 VA , 5 hour battery life</td>
</tr>
<tr>
<td>PPG/SpO2/HR</td>
<td></td>
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<tr>
<td>Biopedance-based Respiration</td>
<td></td>
</tr>
<tr>
<td>12-bit solid state Temperature</td>
<td></td>
</tr>
<tr>
<td>GSR (EDA)</td>
<td></td>
</tr>
<tr>
<td>4 Channels ExG</td>
<td></td>
</tr>
<tr>
<td><strong>General</strong></td>
<td><strong>General</strong></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>190g</td>
</tr>
<tr>
<td><strong>Dimensions (LWH)</strong></td>
<td>14 x 8 x 3 cm</td>
</tr>
</tbody>
</table>
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, #104
San Diego, CA  92121