biosignal acquisition tool-kit for advanced research applications

Blood Volume Pulse (BVP) Ear-Clip Sensor User Manual

PROTOTYPE

ATTENTION

Please read this datasheet before
using your biosignalsplux sensor.

The current sensor provided is a prototype and
does not represent the final form-factor. The
sensor and this document may be changed in
the future without further notice.

The information contained in this document has been carefully checked and were made every effort to ensure its quality. PLUX reserves the right to make changes and improvements to this manual and products referenced at any time without notice.

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Please check your systems and sensors after receiving and before using it the first time to confirm if it contains all the ordered sensors, accessories and other components. Contact our support via e-mail at support@plux.info if there are any variations from your original order.

For regulatory information, please see the Regulatory Disclaimer at the end of this document.

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1. General Information

1.1. General Description

The biosignalsplux Blood Volume Pulse (BVP) Ear Clip sensor is an optical, non-invasive sensor measures changes in the arterial translucency using the light emitter and detector adjusted to an ear clip form-factor.

When the heart pumps blood, the arteries become opaquer, allowing more light to be reflected from the emitter back to the receiver. This variation in light reflection can be used to determine important characteristics of cardiac monitoring (e.g. heart rate) which can afterwards be used for further analysis (e.g. heart rate variation).

1.2. Typical Unfiltered Sensor Output

Figure 1 shows a typical unfiltered BVP sensor output acquired using the ear-clip form factor at the ear lobe.

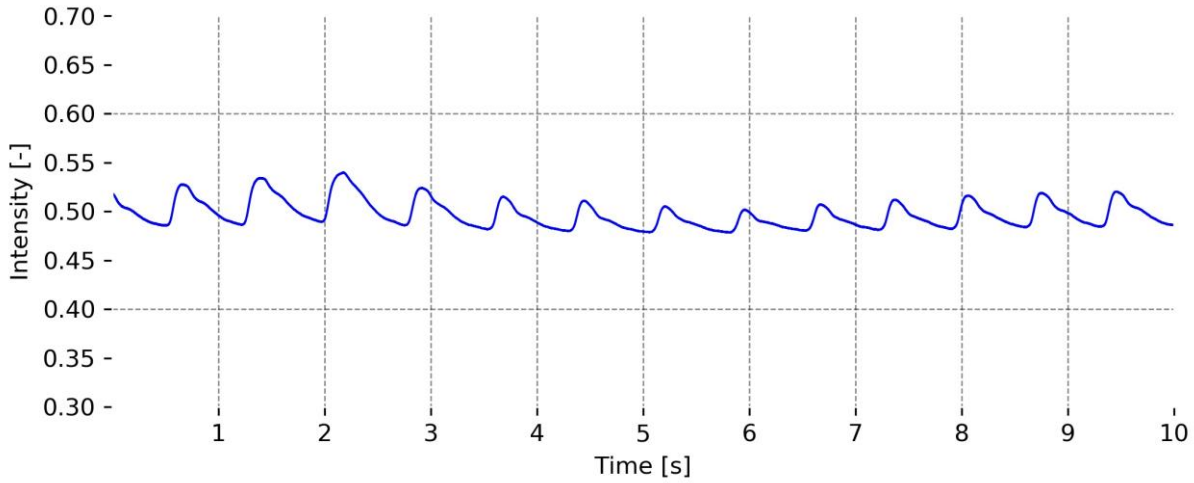

Figure 1: BVP ear clip sample signal.

1.3. Sensor Specifications

> Type:	Optical sensor	**> Bandwidth:**	0.02-2.1Hz
> Wavelength of Peak Emission:	530nm (green)	**> Centroid Wavelength:**	535±10nm

1.4. Features

> High signal-to-noise ratio
> Medical-grade raw data output
> Ready-to-use form factor
> Unobtrusive & lightweight sensor
> Pre-conditioned analog output

2. Application Notes

The Blood Volume Pulse (BVP) Ear-Clip sensor is intended for acquisition at the ear lobe as shown in . It is recommended to place the sensor (LED & detector) at the centre of the ear lobe Figure 2.

Figure 2: Application of the ear-clip form-factor.

In addition, the sensor comes with a flexible silicon cable holder which provides additional support to hold the sensor in place. This accessory aims to reduce the risk of signal artefacts due to sensor displacements caused by the weight of the sensor itself and its cable. The use of this accessory is not mandatory but strongly recommended.

3. Using the Blood Volume Pulse BVP Sensor with biosignalsplux & OpenSignals

3.1. Connecting the sensor to biosignalsplux Systems

3.1.1. biosignalsplux 4-Channel Hubs

The biosignalsplux BVP sensor is compatible with all 8 analog input channels of the 4-channel biosignalsplux hub, but incompatible with the reference/ground port. Connect the sensor to an analog input to use it with this device.

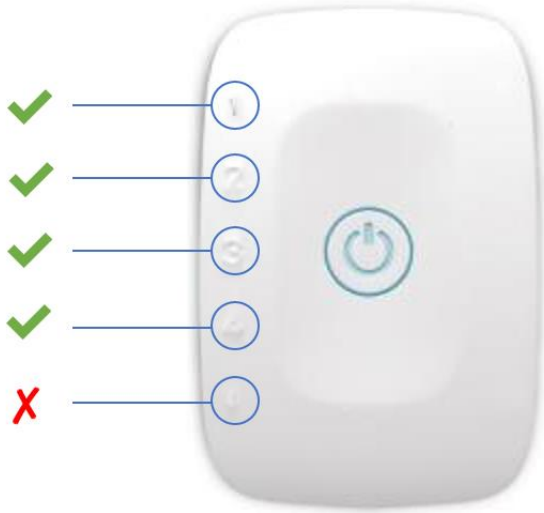

Figure 3: Compatible biosignalsplux channels (green checkmarks).

3.1.2. biosignalsplux 8-Channel Hubs

The biosignalsplux BVP sensor is compatible with all 8 analog input channels of the 8-channel biosignalsplux hub, but incompatible with the reference/ground and digital I/O ports. Connect the sensor to an analog input to use it with this device.

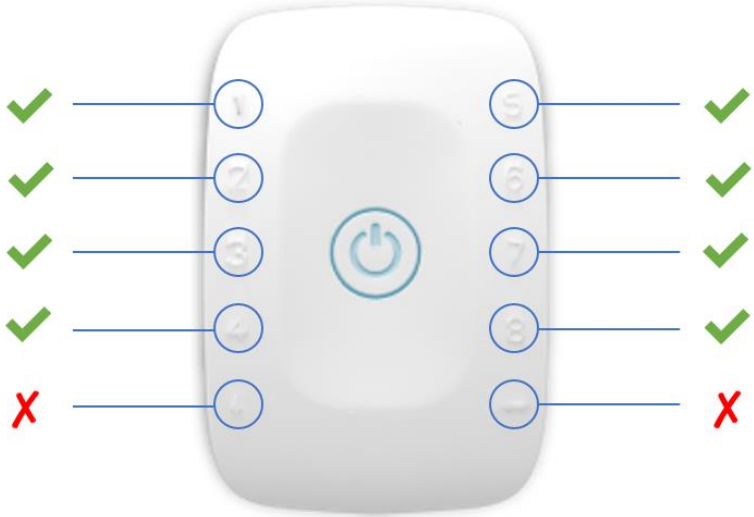

Figure 4: BVP compatible biosignalsplux channels (green checkmarks).

3.1.3. biosignalsplux Solo & Single-Channel openBAN Devices

The biosignalsplux BVP sensor is compatible with the analog input channel of the biosignalsplux Solo (openBAN) device. Connect the sensor to the analog input channel to use it with this device.

Figure 5: Connect the BVP to the analog input channel of the biosignalsplux Solo (openBAN).

3.2. Configuring the Sensor in OpenSignals

3.2.1. OpenSignals (r)evolution (Windows, macOS, Linux)

Open the OpenSignals (r)evolution device manager to access and configure your biosignalsplux device.

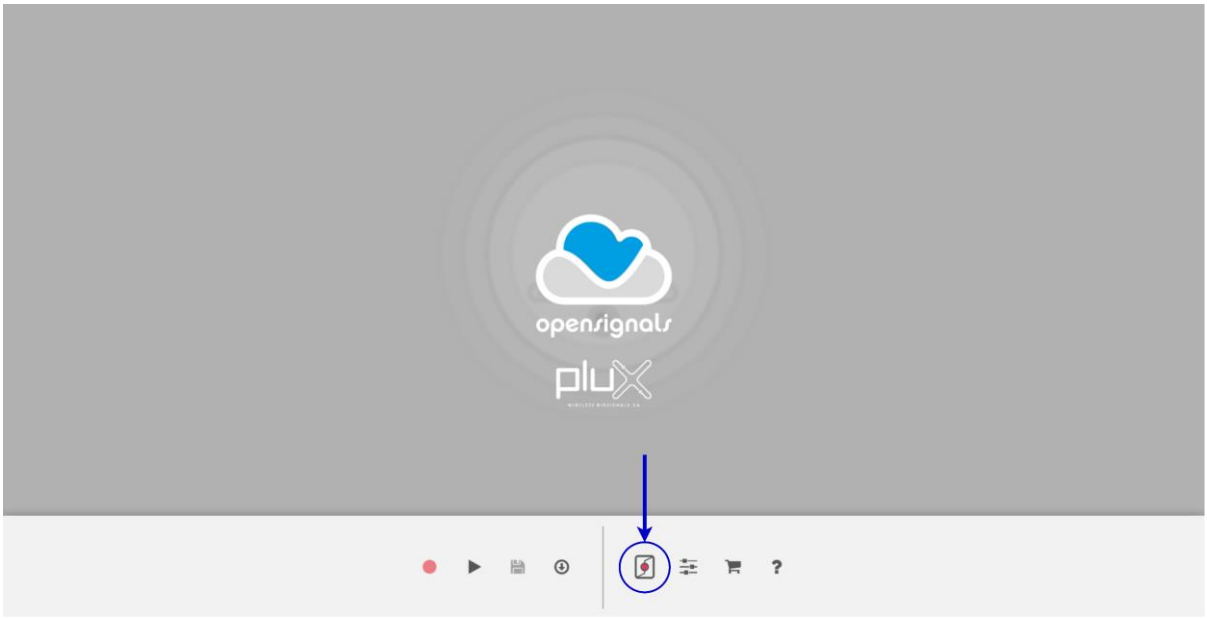

Figure 6: Access the OpenSignals (r)evolution device manager.

Select the device you intend to use for acquisition by clicking on *ENABLE button on* the device panel in the OpenSignals device manager. The device is activated for acquisition if the *ENABLE* button is blue.

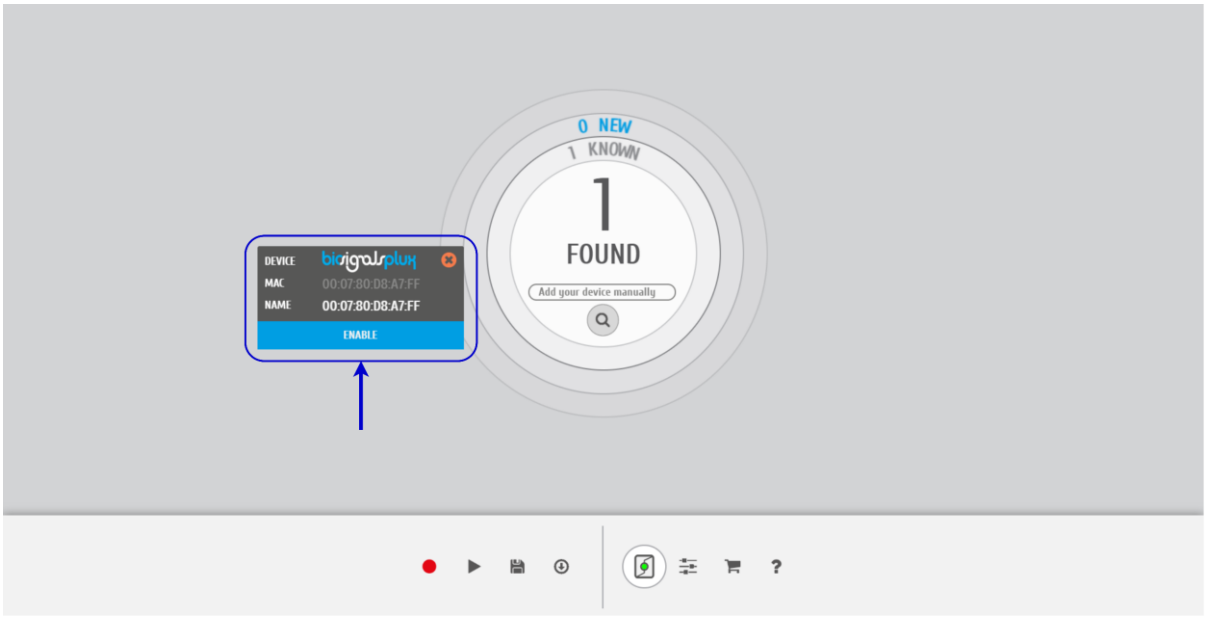

Figure 7: Enabling the device for acquisition.

Click on the biosignalsplux logo to access the available settings. Select the channel your sensor is connected to and select the *BVP* from the dropdown menu highlighted in the next screenshot.

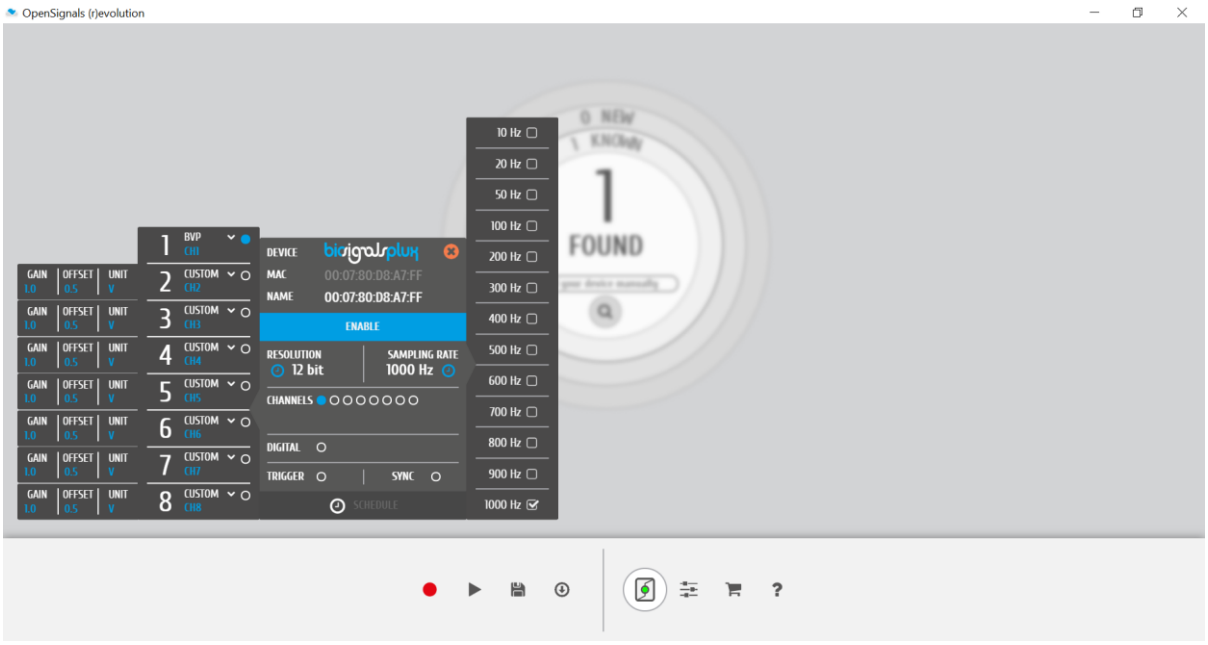

Figure 8: Set the channel type of the channel you have your BVP sensor connected to, to *BVP*.

Activate the channel for acquisition by clicking on the circle next to the channel type (must be blue). Click on the record button in the OpenSignals main interface whenever you're ready for your acquisition.

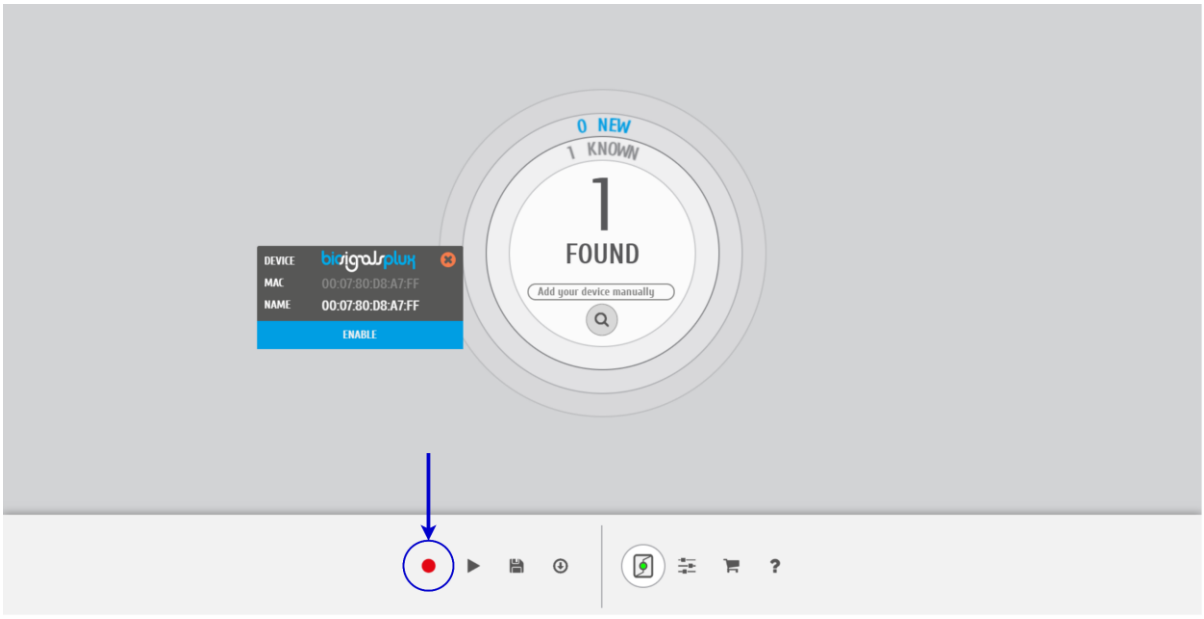

Figure 9: Start the acquisition whenever you're ready.

4. Safety & Maintenance

4.1. Safety Instructions

Please read the following safety instructions **before** using your *biosignalsplux* system with the BVP sensor to prevent any damages or problems with the user, test persons and/or *biosignalsplux* devices. Violations of these instructions can lead to inferior signal quality and/or damages to the *biosignalsplux* system and user.

- ! The user should always keep the device and its accessories dry.
- ! The user must turn off the *biosignalsplux* device and contact Technical Support if the system or accessories reach uncomfortable temperatures.
- ! The user should not use the *biosignalsplux* device in noisy environments (environments with microwaves and other similar equipment). Doing so will lead to noise increase in the acquired signals and Bluetooth connectivity issues.
- ! The user must not use the device near the fire or in potentially explosive atmospheres, such as atmospheres with flammable gas.
- ! The user should only use the detection surfaces or other approved accessories purchased from PLUX or by a PLUX agent.
- ! The user should inspect the sensors on a regular basis to ensure that they remain in good working order.
- ! The user should stop using the *biosignalsplux* device if experience any kind of discomfort or skin irritation.
- ! Do not use the system on persons with allergies to silver.
- ! The user should dispose detection surfaces after using the *biosignalsplux* device. Detection surfaces are single-user and disposable. Reusable electrodes should be reused by the same user. Do not use reusable electrodes on several users.
- ! The user must not place the device in the microwave.
- ! The user must not insert objects into the holes of the device.
- ! The user should not open the *biosignalsplux* device or its accessories. The repair of the same should be only done by properly authorized PLUX personnel.
- ! The user should make sure the cables do not obstruct the passage of people.
- ! The user should use the sensor cables with extreme caution to avoid risk of strangulation.
- ! The user should keep a safe distance between the *biosignalsplux* device and other devices to ensure their proper functioning.
- ! The user should only send the device to repair to qualified PLUX personnel.

- ! The user should not immerse the sensors or the *biosignalsplux* device, nor clean with liquid or abrasives.

- ! The user should handle the *biosignalsplux* device with caution and not expose the device or accessories to high accelerations and vibrations.

- ! *biosignalsplux* devices should not be used in patients with implanted electronic devices of any kind, including pace-makers, electronic infusion pumps, stimulators, defibrillators or similar.

- ! Do not apply electrodes over damaged or irritated skin.

- ! Do not use your device while charging its internal battery.

4.2. Transportation and Storage

Please follow these recommendations to ensure safe transportation and storage of your *biosignalsplux* equipment and sensors to prevent any damaging of your system.

The *biosignalsplux* equipment and sensors should be stored in the original box in a dry place when those are not being used.

- Relative humidity: up to 95% with no condensation
- Ambient temperature: 10°C to 30°C
- Atmospheric pressure between 500hPa and 1060hPa

Whenever the equipment needs to be transported, it should be placed in the original box, since this was designed and tested to ensure the equipment and accessories are securely stored.

Take care while handling the transportation of the system and avoid dropping it, since the device is not shock-proof and should not be placed under stress or sudden acceleration.

4.3. Cleaning

Please follow these cleaning instructions to prevent any damage of the system or the user because of conducting cleaning methods that may cause any damage.

- The *biosignalsplux* and sensors should be visually checked before each use and cleaning process to ensure that no mechanical damage occurred.

- The *biosignalsplux* equipment and sensors (including the cables) should be cleaned with a slightly damp cloth or suitable absorbent paper, ensuring no liquid enters the equipment of sensors. Do not use detergent or any type of cleaning liquid as these may damage your equipment and/or sensor.

- Do not clean or re-use detection surfaces (electrodes). They are only suitable for single use, and should be disposed of after usage except indicated otherwise.

5. Ordering Guides, Regulatory & Legal Information

5.1. Contact & Support

Contact us if you are experiencing any problems that cannot be solved with the information given in the biosignalsplux documentation.

Please send us an e-mail with precise information about the error occurrence, device configuration, and, if possible, screenshots of the problem to support@plux.info.

5.2. Regulatory Disclaimer

biosignalsplux products are intended for use in life science education and research applications; they are not medical devices nor are they intended for medical diagnosis, cure, mitigation, treatment or prevention of disease. we expressly disclaim any liability whatsoever for any direct, indirect, consequential, incidental or special damages, including, without limitation, lost revenues, lost profits, losses resulting from business interruption or loss of data, regardless of the form of action or legal theory under which the liability may be asserted, even if advised of the possibility of such damages.

The currently provided version of this sensor is a prototype and may not represent the final solution. The regulatory disclaimer above applies to this sensor.

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