

# Reference Cable

for Biosignals PRO

User Manual & Datasheet





PLUX wireless biosignals S.A.  
Av. 5 de Outubro 70-2  
1050-059 Lisbon, Portugal

+351 21 195 6542

[www.pluxbiosignals.com](http://www.pluxbiosignals.com)

For support visit [www.support.pluxbiosignals.com](http://www.support.pluxbiosignals.com)

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**Reference Cable**  
for Biosignals PRO devices  
Designed & Made in Portugal

## Table of Contents

General Information .....	5
Datasheet.....	6
Overview .....	6
Specifications .....	7
Compatible Sensors.....	7
Using the Reference Cable.....	8
Compatible Systems .....	8
Connecting the Sensor to Your Biosignals PRO.....	9
Connecting the Electrode to the Reference Cable .....	10
Application Notes .....	10
General Guidelines for Selecting a Reference Location .....	10
Skin and Electrode Preparation.....	11
Sensor-Specific Recommendations.....	11
Electrocardiography (ECG).....	12
Electromyography (EMG) .....	12
Electrooculography (EOG).....	13
Electroencephalography (EEG) .....	14

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Electrogastrography (EGG) .....	15
Safety & Maintenance .....	16
General Safety .....	16
Transportation and Storage.....	17
Cleaning.....	17
Regulatory & Legal.....	19
Intended Use & Disclaimer .....	19
Guarantee of Quality & Warranty .....	19
CE Marking .....	20
Document Version & Revision History .....	21
Contact & Support.....	22

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**Reference Cable**  
for Biosignals PRO

## General Information

The **Reference Cable** provides a stable electrical reference point required for accurate biosignal acquisition.

It establishes a **common ground** between the participant's body and the **Biosignals PRO** acquisition device, reducing electrical noise and enabling reliable signal comparison between active sensors.

This cable is **essential** when using electrode-based sensors that measure biopotentials, such as:

- Electrocardiography (ECG)
- Electromyography (EMG)
- Electrooculography (EOG)
- Electroencephalography (EEG)
- Electrogastrography (EGG)
- And other biopotential measuring sensors

It is not required for EDA/GSR and non-electrode sensors (e.g., IMU, PZT, or temperature sensors).

Compact, durable, and easy to connect, the Reference Cable is designed for **research and educational use** in life sciences, neuroscience, physiology, and biomedical engineering.

# Datasheet

## Overview

Table 1: General Information

Attribute	Information
<b>Product Name</b>	Reference Cable for Biosignals PRO
<b>Product Type</b>	Smart Sensor Accessory
<b>SKU</b>	840201401
<b>Product Line</b>	Biosignals PRO
<b>Description</b>	Provides a reference (ground) connection between the subject and the acquisition device. Essential for stable and noise-free biosignal acquisition.
<b>Features</b>	<ul style="list-style-type: none"> <li>- High-quality, low-noise reference connection</li> <li>- Compatible with pre-gelled electrodes or reusable snap connectors</li> <li>- Flexible and lightweight cable design</li> </ul>
<b>Use Case Applications</b>	<p>Provides the reference connection required for biopotential recordings such as:</p> <ul style="list-style-type: none"> <li>- <b>ECG (Electrocardiography):</b> stabilizes the electrical baseline for accurate heart signal detection.</li> <li>- <b>EMG (Electromyography):</b> ensures low-noise muscle activity recordings by defining a common ground.</li> <li>- <b>EEG (Electroencephalography):</b> enables reliable brainwave measurement with reduced interference.</li> <li>- <b>EOG (Electrooculography):</b> improves small eye movement potential detection.</li> <li>- <b>EGG (Electrogastrography):</b> maintains stable low-frequency baseline for gastric signal acquisition.</li> </ul>
<b>Excluded Applications</b>	This product is not a medical device and must not be used for clinical diagnosis or treatment.
<b>Compatible Systems</b>	Biosignals PRO
<b>Incompatible Systems</b>	BITalino and biosignalsplux systems

## Specifications

Table 2: Sensor Specifications

Attributes	Information
Cable Type	Shielded single-channel reference cable
Electrode Connector Type	2 mm snap connector (PLUX standard)
Color	Black
Operating Temperature	-20 to +60 °C
Short-Term Storage	-20 to 45 °C
Long-Term Storage	5 to 30 °C
Cable Length	1 m
Material	Flexible PVC-insulated cable
Weight	11.5 g

## Compatible Sensors

The reference cable can be used with both **Smart Sensors** and **Legacy Sensors** (biosignalsplux sensors):

- Electrocardiography (ECG)
- Electromyography (EMG)
- Electrooculography (EOG)
- Electroencephalography (EEG)
- Electrogastrography (EGG)
- And other biopotential measuring sensors

The reference is not needed for non-biopotential measurement sensors, such as conductivity (galvanic skin response / electrodermal activity sensors), mechanical (force, angular sensors), or optical (PPG, fNIRS, SpO2) sensors. Using it along these types of sensors will have no effect.

## Using the Reference Cable

### Compatible Systems

The Reference Cable is **exclusively** compatible with **Biosignals PRO**.



This sensor is not compatible with any **biosignalsplux** or **BITalino** sensors.



Figure 1: Incompatible PLUX systems with this sensor.

## Connecting the Sensor to Your Biosignals PRO

Connect the sensor to any of the available **Biosignals PRO** ports.



Figure 2: Compatible Biosignals PRO ports and example of Port 1.

Once connected, the system will recognize the Reference Cable, configure everything automatically, and activate it.

You can also see the Reference Cable in the **Biosignals Studio**, where it's listed as **REF** sensor in your device settings.

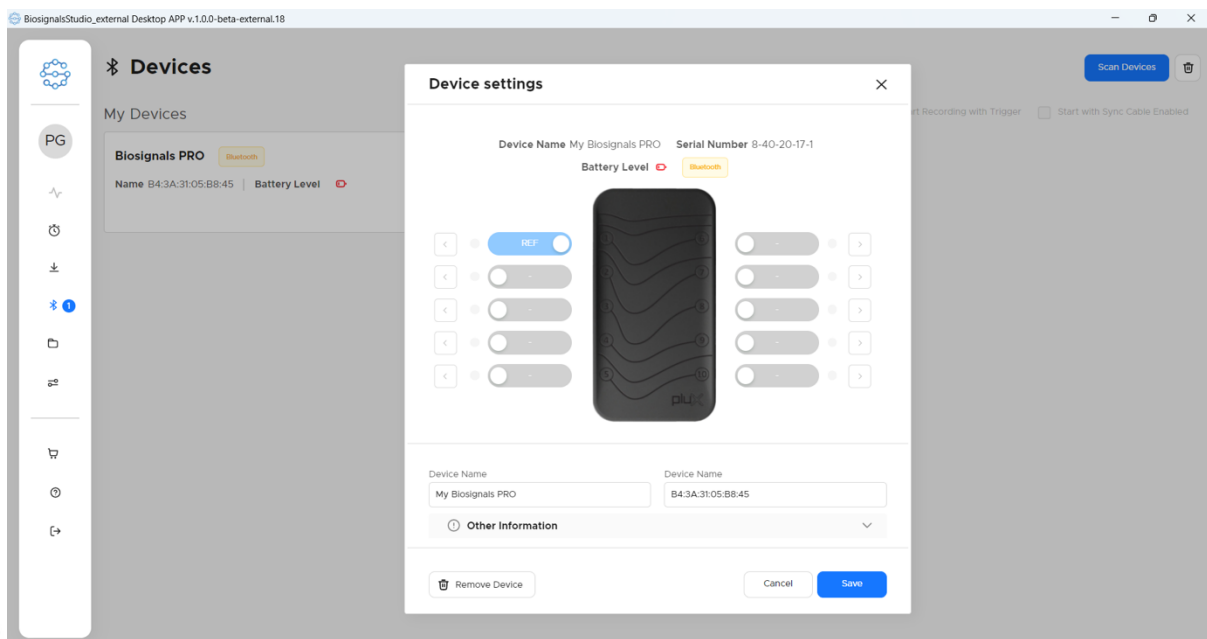


Figure 3: Reference Cable in the Biosignals PRO settings in Biosignals Studio

## Connecting the Electrode to the Reference Cable



Figure 4: Disposable electrode

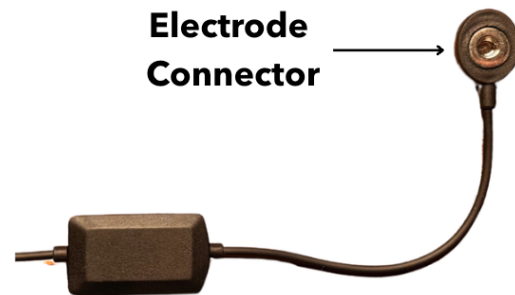


Figure 5: Electrode connector

We recommend using disposable electrodes for optimal recording conditions. Connect a disposable electrode to your reference cable and place this as the reference electrode that will record the signal on a location of your choice (see **Application Notes** for further information on recommended locations).



Disposable electrodes are single use only. Dispose them after use and use fresh electrodes for new recordings.

Reusing disposable electrodes impacts your signal quality.

## Application Notes

### General Guidelines for Selecting a Reference Location

For accurate biopotential recordings, the Reference Electrode should be placed on a **stable, electrically neutral area** of the body, ideally where:

- There is little or no muscle activity underneath.
- The area is bony and not affected by movement during recording.
- The skin is dry and clean for reliable contact.

Typical placement examples include:

- Wrist bone (styloid process): suitable for EMG or ECG
- Forearm (dorsal side): convenient when upper-body sensors are used

- Clavicle or collarbone area: stable location for ECG or EEG
- Mastoid bone (behind the ear): recommended for EEG or EOG
- Ankle or tibial bone: alternative for lower-limb EMG setups
- Elbow: often used for EMG recordings
- Top of the hip: commonly used in ECG setups in Einthoven configuration

While most of these locations are suitable, it's important to adjust the selection to your recording setup and conditions. Research your ideal sensor placement and see the sensor-specific recommendations on the next page(s).

For instance, a hip placement for ECG recording while running may result in noisy data as the running movement, creates a unstable electrode location both due to motion itself and the underlying muscles that are impacting the hip movement and hip stability.



The reference electrode should remain **electrically quiet** relative to the active measurement sites to ensure accurate signal differentials and reduce common-mode noise.

## Skin and Electrode Preparation

To achieve optimal signal quality and minimize impedance:

- Clean the skin using an alcohol wipe to remove oils and debris
- Lightly abrade the skin (if required) using a skin preparation pad to reduce impedance
- Attach a pre-gelled Ag/AgCl electrode or apply conductive gel before connecting the reference cable snap

For detailed guidance on skin preparation procedures, visit the official PLUX guide:

<https://support.pluxbiosignals.com/knowledge-base/electrode-skin-preparation-tutorial/>

## Sensor-Specific Recommendations

The recommendations below provide only an overview of the positioning options for specific sensors. For more detailed information, review the sensor documentation of the sensor you're using.

### Electrocardiography (ECG)

The reference cable is essential to stabilize the signal baseline and minimize interference from body movement or ambient electrical fields. It ensures clear detection of heart signal waveforms and accurate differentiation between cardiac phases.

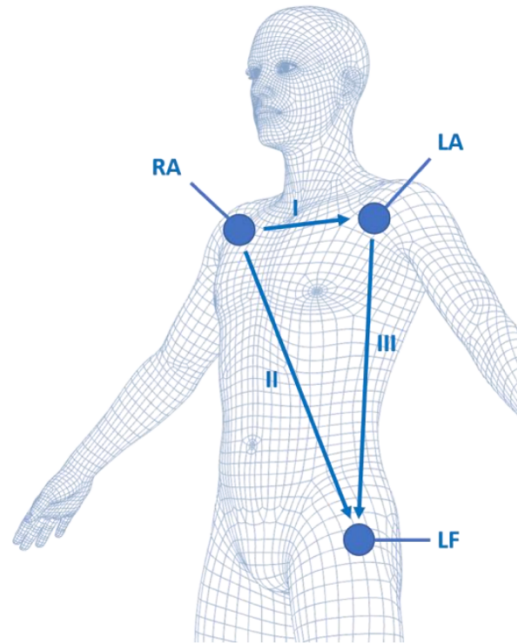


Figure 6: Example ECG reference electrode placements, depending on Einthoven leads.

**Recommended placement:** Wrist, forearm, or clavicle areas where skin movement is minimal. For high movement setups, a non-traditional (yet electrically valid) placement on the Mastoid Bone (behind the ear).

For single-lead Einthoven derivations (ECG Lead I, II, and III), follow the following reference electrode placements:

- Lead I: Left Foot (LF) placement (examples: left ankle, hip or ribcage [lowest rib])
- Lead II: Left Arm (LA) placement (examples: left, wrist, shoulder or clavicle)
- Lead III: Right Arm (RA) placement (examples: right, wrist, shoulder or clavicle)

### Electromyography (EMG)

In muscle recordings, the reference cable reduces baseline drift and common-mode noise, providing cleaner readings even in dynamic contractions. It also minimizes the baseline width due to this noise removal.

It is particularly important for long-duration or low-amplitude EMG measurements and for comparison of multi-EMG sensor setups by providing a common reference signal for all EMG sensors.

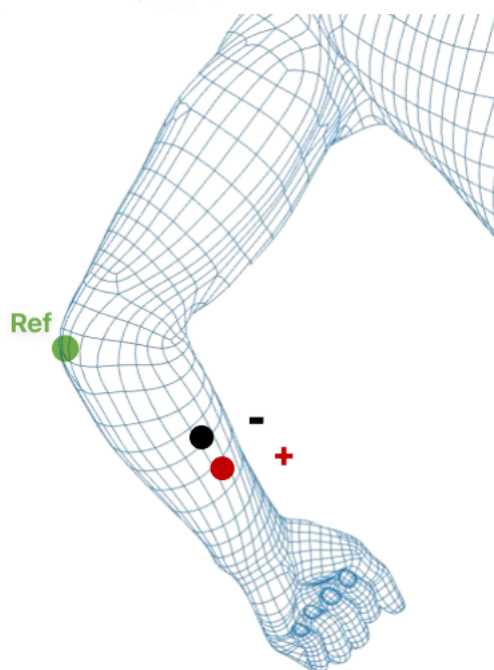


Figure 7: Example EMG reference electrode placement on the elbow

**Recommended placement:** Wrist or bony area close to the recorded muscle (e.g., forearm for upper-limb EMG). Avoid placing over muscle tissue.



For standardized recommendations on general and muscle-specific electrode placements, consult the **SENIAM (Surface Electromyography for the Non-Invasive Assessment of Muscles) project guidelines**, an established reference in EMG research and clinical practice:

<http://seniam.org/fixation.htm>

### Electrooculography (EOG)

The reference cable improves baseline stability, enabling precise detection of small voltage changes caused by eye movements. It helps maintain consistent signal polarity and reduces slow drift caused by skin impedance changes.

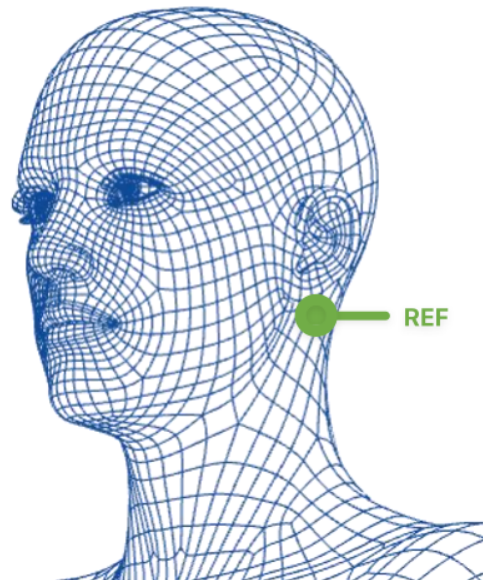


Figure 8: Example EOG electrode placement on the mastoid bone.

**Recommended placement:** Mastoid bone or temple area, ensuring minimal facial muscle interference.

### Electroencephalography (EEG)

For EEG recordings, reference stability is critical since brain signals are in the microvolt range. The reference cable ensures minimal noise contamination and consistent potential balance across all electrodes.

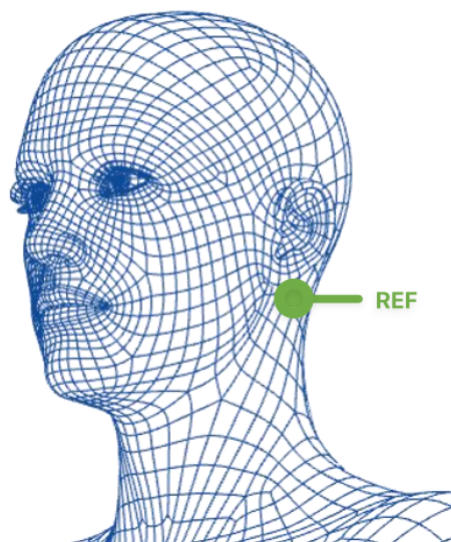


Figure 9: Example EEG electrode placement on the mastoid bone.

**Recommended placement:** Mastoid bone (behind the ear) or central bony areas away from the recording electrodes.

**Electrogastrography (EGG)**

In EGG recordings, the reference cable helps maintain low-frequency stability and reduce baseline drift caused by respiratory motion or skin impedance variations.

**Recommended placement:** Clavicle, wrist, or other bony areas distant from the abdominal region to prevent motion-induced artifacts.

## Safety & Maintenance

Please read the following safety instructions before using your **Biosignals PRO** system. Failure to follow these guidelines may result in degraded signal quality, or damage to the device and accessories, or, in the worst case, user.

### General Safety

- ! Keep the device and all accessories dry.
- ! Keep the device and all accessories dry.
- ! Do not immerse the device or sensors in water or clean with liquids or abrasives.
- ! Do not expose the device to fire, heat sources, or explosive environments (e.g., flammable gases).
- ! Do not place the device in a microwave oven or similar appliance.
- ! Do not use the device near or inside MRI systems or other strong magnetic fields.
- ! Do not insert objects into any openings of the device.
- ! Do not attempt to open, modify, or repair the device. Repairs must only be performed by authorized PLUX personnel.
- ! Handle the device carefully and avoid drops, shocks, or excessive vibration.
- ! Keep cables organized to avoid tripping hazards and risk of strangulation.
- ! Maintain a safe distance between Biosignals PRO and other wireless or electronic devices to minimize interference.
- ! Do not use the device in environments with strong electromagnetic noise (e.g., near microwaves).
- ! Do not connect third-party sensors or accessories to Biosignals PRO.
- ! Use only the charger provided with the system or an official PLUX charger.
- ! Stop using the device immediately if you or a subject experience discomfort, irritation, or a skin reaction.
- ! Do not use on individuals with implanted electronic devices (e.g., pacemakers, defibrillators, stimulators, infusion pumps).
- ! Do not apply electrodes to damaged or irritated skin.
- ! For long-term recordings, use suitable long-term or disposable electrodes designed for extended wear.
- ! Use only approved accessories and sensors from PLUX or authorized distributors.

- ! Dispose of single-use electrodes after each session. Reusable electrodes should only be reused by the same user.
- ! Do not use the device while charging.
- ! If the device or accessories become unusually warm, turn it off immediately and contact PLUX Technical Support (helpdesk@pluxbiosignals.com).

## Transportation and Storage

Follow these recommendations to ensure long-term performance and safety of your **Biosignals PRO** and sensors:

- Store the device and sensors in their original packaging, in a **dry environment**.
- Relative humidity: up to **95%** (non-condensing)
- Temperature: **5°C to 30°C**
- Atmospheric pressure: **500–1060 hPa**

Use the original packaging or PLUX provided alternatives (example: carrying case) when transporting the system to protect against shocks and vibrations. Avoid dropping or subjecting the device to sudden acceleration or impact.

## Cleaning

This device should be cleaned/sanitized between uses of different users to ensure a hygienic and safe use of your setup. The instructions below provide information on how to clean your PLUX products without damaging them.

- Do not apply the alcohol solution directly on your product;
- Proceed with a visible inspection of your product(s) to identify mechanical damages (e.g., broken cable, damaged casing). Should you determine any damage, please contact our support before proceeding with the cleaning process);
- Use an alcohol-water solution with an alcohol content of up to 70%;
- Apply a bit of your alcohol solution on a cotton pad and clean your product with the cotton pad;
- Let your product fully dry after the cleaning process, before turning it on and using it again.
- Use only alcohol-water solutions and refrain from using other alcohol products (e.g., nail polish remover) as they may contain other components that can damage your product.

Do not:

- Cleaning your products with water, detergent, or any other cleaning liquid not listed in the instructions above;

- Cleaning products with visible mechanical damage as the cleaning process may further damage your product risking its safe use and reliability;
- Do not clean or re-use disposable electrodes, as they are only suitable for single use and should be disposed of after use;
- Cleaning your products without following the instructions and limits listed on this page may void your products' warranty.

For more up-to-date information, visit

<https://support.pluxbiosignals.com/knowledge-base/how-do-i-clean-my-plux-products/>

## Regulatory & Legal

### Intended Use & Disclaimer

PLUX 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.

### Guarantee of Quality & Warranty

Biosignals PRO is covered by PLUX's standard warranty terms of 2 years, which define coverage periods, exclusions, and replacement procedures.

Full details are available at:

Standard Warranty Terms

<https://support.pluxbiosignals.com/knowledge-base/what-are-the-standard-warranty-terms/>

Additional resources:

What will void my warranty?

<https://support.pluxbiosignals.com/knowledge-base/what-will-void-my-warranty/>

How do I report a warranty, replacement or repair case?

<https://support.pluxbiosignals.com/knowledge-base/how-can-i-report-a-warranty-or-replacement-case/>

In accordance with Portuguese consumer law, all products sold in Portugal are covered by a 3-year legal guarantee.

## CE Marking

[To be added soon]

## Document Version & Revision History

Version #	Date	Description / Changes
1.0	27/10/2025	First version



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## Contact & Support

**PLUX wireless biosignals S.A.**  
Av. 5 de Outubro 70 – 2º  
1050-059 Lisbon, Portugal

Email: [hello@pluxbiosignals.com](mailto:hello@pluxbiosignals.com)  
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