

enobio<sup>NE®</sup>

Neuroelectrics User Manual  
Enobio



**Europe Office**

Avinguda Tibidabo, 47 bis  
08035 Barcelona, Spain  
Tel. +34 93 254 03 66  
Fax. +34 93 212 64 45

**US Office**

210 Broadway, Suite 201  
Cambridge, MA 02139, USA  
Tel. +1 617 682 0770

Email: [info@neuroelectrics.com](mailto:info@neuroelectrics.com)

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

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Manufacturer:

Neuroelectrics Barcelona SLU  
Avinguda Tibidabo 47, bis  
08035 Barcelona, Spain  
Telephone: + 34 93 254 03 70

Code: UM003E  
Version: 2.4  
Date: 2018.12.10

Brand:

Enobio

Models:

Enobio 8

Enobio 20

Enobio 32

The manufacturer should be contacted:

- for assistance, if needed, in setting up, using or maintaining the Enobio system;
- to report an unexpected operation of events that result from the usage of the device.



Input: 5W, 4.25 - 7 V

# About the Enobio User Manual

The Enobio User Manual belongs to Part I of the Neuroelectronics User Manual.

The Neuroelectronics User Manual includes three parts:

- ▶ Part I: Enobio User Manual
- ▶ Part II: Electrode User Manual
- ▶ Part III: NIC User Manual

Before your first use of the Enobio system, read the three parts of the Neuroelectronics User Manual. The Enobio User Manual does not discard the need of reading the Electrode and NIC parts.

The PDF version of all parts of the Neuroelectronics User Manual can be found under the Documentation section of Neuroelectronics webpage:

**[www.neuroelectronics.com/documentation/](http://www.neuroelectronics.com/documentation/)**

# Change of Record

Issue	Date	Changes made
1.0	2012.02.14	First version
2.0	2016.02.18	Neuroelectrics User Manual divided into three parts: (1) Enobio / Starstim, (2) Electrode and (3) NIC.
2.1	2017.03.10	SGS Update
2.2	2017.07.25	Product content update
2.3	2017.08.07	CE 0120 & symbols update
2.4	2018.16.07	Product content & safety symbols update
2.5	2019.20.03	EMC Compliance update

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# I. Use of Enobio

Enobio is a wireless and portable electrophysiology sensor system for the recording of the electrical activity of the human brain.

Enobio is a modern EEG device:

- ▶ Available with 8, 20 or 32 channels
- ▶ Wireless operating system
- ▶ Ideal for out-of-the-lab applications
- ▶ Offline data storage possible with microSD card
- ▶ Comfortable and precise head cap, with different head sizes available
- ▶ Flexible electrode placement with 39 possible positions based on the 10-10 system
- ▶ Capable of monitoring EOG, ECG and EMG
- ▶ Ease of use despite of the complexity of the technology



Enobio 8



Enobio 20



Enobio 32

## I.1

### Electroencephalography (EEG)

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Electroencephalography is a non-invasive neuroimaging technique that records the electrical activity of the brain. Voltage fluctuations, that result from the ionic current within the brain neurons, are detected by electrodes placed on the scalp. The 10-20 international system defines 21 scalp positions to place the EEG electrodes. Additionally, the 10-10 system is obtained by adding electrodes in the intermediate positions. Both locations and nomenclature of the electrodes are standardized by the International Federation of Clinical Neurophysiology. The EEG measurements can be either bipolar or unipolar. The former method measures the potential difference between pairs of electrodes, while the latter measures the electrode potential compared to a reference.

The reference might be either the signal from one electrode or the average of the measurement from two or more electrodes.

The EEG measurements are frequently analyzed with spectral methods to define frequency bands, also known as brain waves. The five most common bands are delta (0 - 4 Hz), theta (4 - 8 Hz), alpha (8 - 13 Hz), beta (13 - 30 Hz), and gamma (30 - 50 Hz). These waveforms provide crucial information regarding brain function which is widely used to diagnose Epilepsy, sleep disorders, Coma or cerebral death. The EEG differs from other neuroimaging techniques due to its high temporal resolution. However, it is often combined with magnetic resonance imaging (MRI) or computed tomography (CT) for the diagnosis of tumors, stroke and other brain disorders whose diagnosis also requires high-spatial resolution.

## I.2

### Intended Use

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ENOBIO WF is an EEG portable monitoring device of 8, 20, 32 channels intended for use in a clinical environment, hospital, research center or home healthcare environment. The applications considered are medical and non-medical such as: Brain to computer interface (BCI), Basic EEG research, Medical applications developments, neuromodulation, biometry and user affective state. ENOBIO use must be controlled by specialized medical personnel able to guarantee the correct recording.

It is intended to acquire, store, transmit and display electrophysiological signals in wireless mode as an aid in diagnostics. The system digitizes analogue EEG signals collected by a cap with electrodes, amplifies them, and uses Wi-Fi wireless connectivity to transmit the EEG data to a dedicated host computer with the software.

## I.2 Intended Use

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This device is intended to be used by trained health-care personnel. It is restricted to sale by or on order of a physician.

## I.3 Device Operation Environment

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During montage preparation phase

The patient must be situated in a comfortable position which facilitates the electrode and device placement of the required montage positions.

During Quality Check and Recording Phase

Although the specific position of the patient, an operator or other people do not influence the quality of the recording, both patient and operator must minimize sudden movements or touching elements of the headset to maximize signal quality.

## I.4 Applied Parts

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Electrodes are the components applied directly on the patient's scalp.

For detailed instructions regarding the use of the all electrodes applicable with Enobio, consult the Electrode User Manual. It can be also found at [www.neuroelectrics.com](http://www.neuroelectrics.com).

## I.5 Applications

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### Brain Computer Interface (BCI)

In order to build real world BCI applications, it is essential that the subject be comfortable and behaving naturally in his typical environment. Enobio was designed with these constraints in mind, thus it may be used as a platform for the development of BCI applications away from the lab. Possible BCI paradigms include Motor Imagery ERD, SSVEP and P300 among others. Currently, Enobio is being used by many researchers and it is compatible with BCI software systems such as BCI2000, OpenVibe, PureData and Processing.

### Medical application development

Enobio is the ideal platform for when large amounts of data need to be collected from several subjects in natural environments in order to develop medical applications.

It may be used anywhere, by anyone, and as often as necessary, to quickly and reliably, acquire medical data. Data integrity, versatility and ease of use are the keys to the development of medical applications. NIC software and the Nube Cloud Service provide the means to achieve them efficiently. Clinical applications include sleep monitoring and Epilepsy.

### Basic electrophysiological research

Enobio offers an advantage in any scenario in which electrophysiological data is difficult to obtain in a natural way. Spontaneous EEG or ERP's on the go are possible with Enobio due to the absence of long wires.

### Neuromodulation

EEG neuromodulation is the process of modifying brain state via feedback-based training. By visualizing the brain activity, the user can learn to modify it. Recent work provides evidence for

the use of neuromodulatory therapy in the treatment of a variety of disorders. This can be achieved by combining Enobio with the Neurosurfer - the Neuroelectrics neurofeedback software tool. Neurosurfer integrates EEG data, brain stimulation, and an immersive virtual reality game, all into one platform.

### User affective state

User emotional state can be derived from physiological signals like EEG and ECG. Enobio provides a platform for research and development in affective computing and smart systems.

## I.6

### Conditions of Use

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Enobio must be used with normal temperature, humidity and pressure conditions:

- ▶ Temperature Range: +5 to 40 °C
- ▶ Humidity: 15 - 93 %
- ▶ Atmospheric Pressure:  
700 - 1.000 hPa

The device must be stored inside the box between uses, in the following environmental conditions:

- ▶ Temperature Range: -25 to +65 °C
- ▶ Humidity: 15 - 93 %

This equipment needs to be installed and put into service in accordance to the information provided in this user manual.

# II. Quality and Regulatory Information

## II.1

### Quality Management System

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Neuroelectrics is an ISO 13485 and ISO 9901 certified company. Thus, our medical devices are designed and manufactured following the corresponding ISO quality management systems.

Neuroelectrics complies with Quality System Regulation 21 CFR 820.

## II.2

### Medical Device Regulations

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Neuroelectrics Enobio is a class IIa device according to the classification in the Council Directive 93/42/EEC for medical devices.

Enobio conforms to the following Standards and Directives:

#### USA

Clearance by the FDA, regulation 510(k) (K162681)

#### Europe

Directive 93/42/EEC for medical devices

#### Canada

Canadian Medical Device Regulations SOR/98-282

# III. Safety Information

Enobio conforms to the following standards:

- ▶ EN 60601-1:2006/A1:2013
- ▶ UNE-EN 60601-1-2:2008
- ▶ UNE-EN 60601-2-26:2004
- ▶ IEC 60601-1-11:2010
- ▶ EN 980:2008
- ▶ EN 1041:2008
- ▶ EN ISO 14971:2012
- ▶ IEC 60601-1-6:2010

The device cannot be turned on while it is connector to the mains power supply through the power adaptor. The isolation of the mains power supply is achieved by disconnecting the power adaptor.

### III.1

## Safety Warnings

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-  The result of the recordings must be analyzed by a doctor or a specialist. No self medication should be done based on the results.
-  The device must never be opened or damaged.
-  The battery can only be replaced by authorized personnel.
-  Before using, please check that the device is not damaged and the packaging has not been affected by transport or storage.
-  Before using the device, please inform the prescribing clinician or operator of the presence of any pacemakers, intracranial electrodes, implanted defibrillators, cranial pathologies (e.g. holes, plaques), implantable neurostimulators, deep brain stimulators, or any other prosthesis'. In these cases, the use of the device could become unsafe.
-  In the case of malfunction, immediately contact the manufacturer or the distributor.
-  The device is not protected against excessive moisture or immersion in liquid. In the case of the device becoming wet or damp, do not use it and immediately contact the manufacturer.
-  Do not touch the device while EEG monitoring is on.
-  Always unplug the USB power supply from the device prior to connecting electrodes to the subject. The device will not work when the battery is charging.
-  Never use the device or install the electrodes on the head of the patient while connected to the power network.
-  Do not switch the device on or off when it is assembled and placed on the subject's scalp.
-  The device must be used only with Ag/AgCl electrodes recommended by the manufacturer.
-  The device is not protected against other high frequency devices. To avoid risks place the CMS/DRL as far as possible from the electrodes of the high frequency device.
-  The device is wireless and can be affected by other RF devices.
-  The device needs special EMC precautions. It needs to be used according to the EMC information at the end of the user manual.
-  The EMC emissions and immunity have been tested using the 10-wire and 12-wire 34 cm cables provided with the system.
-  The device can only be used on healthy skin without wounds.
-  The device shall be connected to the charger in a way that makes it easy to disconnect.

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- ⚠ The use of cables or electrodes other than the ones delivered with the product might produce higher EMC emissions and less EMC immunity.
  - ⚠ The device cannot be used in the MRI room.
  - ⚠ The device is not provided sterile and should not be sterilized.
  - ⚠ The device does not need installation, maintenance or calibration.
  - ⚠ The device and the accessories should be regularly checked by the user.
  - ⚠ If the user wants to use the device in combination with another device connected to the patient, the user should contact Neuroelectrics to check the correct simultaneous use.
  - ⚠ The modification of the device is not allowed.
  - ⚠ If the device has not been used

during a long period of time, the user should check visually that there is no battery leakage.

- ⚠ The device cannot be used beside or put under other equipment. If such usage is needed, check the normal configuration.
- ⚠ The electrodes and wires or any conductive part cannot touch any other conductive part of any other device including the ground.
- ⚠ The cap is intended to be on the patient for less than 24 hours.
- ⚠ Enobio should not be used in an MRI room or close to CT, diathermy, RFID and electromagnetic security systems such as metal detectors. Some of these RF emitters (e.g. RFID) may not be visible and the device can potentially be exposed to fields from these RF emitters without the user's awareness. If any electromagnetic interference is encountered,

the user will be informed by the software with the "Packet Loss" alarm, and will indicate the user to stop the recording and move to a place without interference. In any case, the electromagnetic interference does not involve any risks to the patient, as Enobio is a non-invasive recording device that does not modify or interact with the person's brain.

- ⚠ Keep out of reach from children and anyone else who might swallow electrodes, or cause injury to themselves.
- ⚠ Keep out of reach from children and anyone else who might strangle themselves with the cables of the devices.
- ⚠ The result of the recordings is not displayed in legal units or other units within the meaning of Directive 80/181/ECC. Therefore the device is not considered to have a measuring function.

# IV. The Enobio System

This chapter describes the Enobio system. First, it lists the technical specifications of Enobio. Then, the components included in the Enobio package are listed and described. For each item, the product code, the product name, a picture and a short description of its function are listed. Lastly, the Neuroelectrics Control Box (Necbox) which is the core and the control unit of Enobio is described.

For further information regarding the use of the electrodes, please consult the Electrode User Manual. Additionally, to learn how to pair your device with the computer, read the NIC User Manual. The NIC User Manual explains the steps needed to correctly perform an EEG monitoring session.

## IV.1

# Technical Specifications

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### EEG functionality

- ▶ Number of channels: 8, 20 or 32
- ▶ Sampling rate: 500 SPS
- ▶ Bandwidth: 0 to 125 Hz (DC coupled)
- ▶ Resolution: 24 bits - 0.05  $\mu$ V
- ▶ Measurement noise: < 1  $\mu$ V RMS

### Other Technical Specifications

- ▶ Accelerometer: 3-axis
- ▶ Communication:  
Wi-Fi iIEEE 802.11 g or USB  
(Only available for use with USB Isolator accessory cable)
- ▶ Output: EDF+ (16 bits), ASCII data files or TCP/IP raw data streaming
- ▶ OS compatibility: Windows (Vista / 7 / 8 /10) and MAC OS X Snow Leopard

### Battery operating time:

		All Channels EEG
<b>Wi-Fi</b>	Enobio 32	5 h 15 min
	Enobio 20	5 h 20 min
	Enobio 8	6 h 23 min
<b>USB</b>	Enobio 32	19 h 0 min
	Enobio 20	19 h 0 min
	Enobio 8	23 h 35 min

\*SD card recording will increase these values slightly

### Minimum Computer Requirements

- ▶ Operating System: Windows Vista or MAC OS X Snow Leopard
- ▶ Processor: 1.6 GHz
- ▶ RAM: 2 GB
- ▶ Wi-Fi, or USB 2.0

### Wireless Information

Enobio is a wireless device. The Necbox connects through Wi-Fi to the Neuroelectrics Instrument Controller (NIC) software running on a computer. The EEG data is streamed through the Wi-Fi band, which has an operating distance range of 10 meters or less.

### Wireless Specifications

- ▶ Wi-Fi iIEEE 802.11 g
- ▶ Operating frequency band: 2412 ~ 2472 MHz
- ▶ Transmitting power  
Max. 16 ~+17.6 dBm
- ▶ Qualifications: CE, FCC, IC, Japan and South Korea
- ▶ Data rate: 921 kbps

## IV.2

# Contents of the Enobio Package

The Enobio package contains all the components required to perform an EEG monitoring session, and some additional items that may be useful during your experiments. In the following pages, you may find a description for each item. Please note that the necbox code, the number of electrodes, and the electrode

cables vary among the three models: Enobio 8 (EN8), Enobio 20 (EN20), and Enobio 32 (EN32).

Quantity	Code	Name
1	NE010WF NE011WF NE 009WF	Enobio 8/20/32 Necbox
1	NE055/NE055W	USB Power Adapter
1	NE013a NE013b NE013c	EU / US / UK Power Supply Plug
1	NE014	Curved Syringe
1	NE015	USB Stick with Manuals & NIC
1	NE016b	Electrode Gel 250g
1	NE017	10 Electrode Cable
0 / 1 / 1	NE018a	10 Electrode Cable EN 20/EN32
0 / 1 / 1	NE018b	12 Electrode Cable EN20/EN32
0 / 0 / 1	NE018c	12 Electrode Cable EN32

Quantity	Code	Name
1	NE019-M	Neoprene Head cap M (54cm)
8 / 25 / 40	NE022	Electrode: Geltrode
50 / 50 / 50	NE025	Electrode: Stickrode
1	NE027	Electrode: Earclip
1	NE172	USB Extension Cable
1	NE031b	USB Wi-Fi Dongle

Item	Name / Description	Code
	<p data-bbox="300 138 644 161"><b>Enobio Necbox (8ch/20ch/32ch)</b></p> <ul style="list-style-type: none"> <li data-bbox="300 174 1126 197">▶ The Enobio Neuroelectrics Control Box (Necbox) is the core of the Enobio system.</li> <li data-bbox="300 210 887 255">▶ The Necbox is battery operated and it is wirelessly paired with the computer using the NIC software.</li> <li data-bbox="300 268 1254 292">▶ The Necbox battery should never be charged during a stimulation session or an EEG recording.</li> </ul>	<p data-bbox="1310 138 1385 156">NE010WF</p> <p data-bbox="1310 174 1385 192">NE011WF</p> <p data-bbox="1310 210 1385 228">NE009WF</p>
	<p data-bbox="300 362 778 385"><b>USB Power Adapter &amp; Power Supply Plug</b></p> <ul style="list-style-type: none"> <li data-bbox="300 398 935 421">▶ The USB power adapter is used to charge the Necbox battery.</li> <li data-bbox="300 434 895 479">▶ The type of the power supply plug (EU/US/UK) included in the kit depends on the country of the customer.</li> <li data-bbox="300 492 679 515">▶ Minimum isolation 4000V, 2x MOPP</li> <li data-bbox="300 528 807 549">▶ Medical device EMC (IEC 60601-1, IEC 60601-2)</li> </ul>	<p data-bbox="1310 362 1385 380">NE055/ NE055W</p>
	<p data-bbox="300 586 480 609"><b>Curved Syringe</b></p> <ul style="list-style-type: none"> <li data-bbox="300 622 979 645">▶ The curved syringe is used to inject electrode gel in the electrodes.</li> <li data-bbox="300 658 655 676">▶ Wash and clean it after each use.</li> </ul>	<p data-bbox="1310 586 1362 604">NE014</p>
	<p data-bbox="300 810 695 833"><b>USB Stick with Manuals &amp; NIC SW</b></p> <ul style="list-style-type: none"> <li data-bbox="300 846 954 891">▶ The USB stick contains the PDF version of the three parts of the Neuroelectrics User Manual, and the NIC software.</li> <li data-bbox="300 904 887 930">▶ Both items can be also found at <a href="http://www.neuroelectrics.com">www.neuroelectrics.com</a>.</li> </ul>	<p data-bbox="1310 810 1362 828">NE015</p>

Item	Name / Description	Code
	<p><b>Electrode Gel 250 g</b></p> <ul style="list-style-type: none"> <li>▶ The electrode gel is a highly conductive and water soluble gel. It must be applied on the contact surface, between the electrode and the scalp, in order to decrease the impedance and improve the signal quality.</li> </ul>	NE016b
	<p><b>10 Electrode Cable</b></p> <ul style="list-style-type: none"> <li>▶ The 10 electrode cable contains 8 channels, numbered from 1 to 8, for EEG monitoring, and two reference channels labeled with CMS &amp; DRL. It is included with Enobio 8, Enobio 20 and Enobio 32. It allows the channels to be freely assigned to any position of the head cap.</li> </ul>	NE017
	<p><b>10 Electrode Cable EN20/EN32</b></p> <ul style="list-style-type: none"> <li>▶ This cable is included with Enobio 20 and Enobio 32, and is used together with NE018b.</li> <li>▶ Its 10 cable connections are labeled with the positions:</li> <li>▶ P7, P4, Cz, Pz, P3, P8, O1, O2, CMS &amp; DRL</li> </ul>	NE018a
	<p><b>12 Electrode Cable EN20/EN32</b></p> <ul style="list-style-type: none"> <li>▶ This cable is included with Enobio 20 and Enobio 32, and is used together with NE018a.</li> <li>▶ Its 12 cable connections are labeled with the positions:</li> <li>▶ F7, T7, Fp1, F3, C3, Fz, Fp2, F4, C4, F8, T8, and EXT (EN20) or Oz (EN32).</li> </ul>	NE018b

Item	Name / Description	Code
	<p><b>12 Electrode Cable EN32</b></p> <ul style="list-style-type: none"> <li>▶ This cable is included only with Enobio 32, and it is used together with NE018a and NE018b.</li> <li>▶ Its 12 cable connections are labeled with the positions:</li> <li>▶ PO3, AF3, FC5, FC1, CP5, CP1, CP2, CP6, AF4, FC2, FC6, PO4</li> </ul>	NE018c
	<p><b>Neoprene Head cap M (54cm)</b></p> <ul style="list-style-type: none"> <li>▶ The Neoprene Cap is a comfortable solution to precisely place the electrodes on the scalp based on the 10-10 system. It provides 39 possible electrode positions, but extra positions can be added using the neoprene punch tool (not included). The cap provided is medium sized, but other sizes are also available.</li> </ul>	NE019-M
	<p><b>Geltrode</b></p> <ul style="list-style-type: none"> <li>▶ The Geltrode is the traditional EEG electrode that can be used in areas with or without hair. It requires the application of electrode gel.</li> </ul> <p>Read the Electrode User Manual before using the Geltrode.</p>	NE022
	<p><b>Sticktrode</b></p> <ul style="list-style-type: none"> <li>▶ The sticktrode is a pre-gelled adhesive electrode used for the CMS &amp; DRL reference channels. It can be also used to monitor ECG or EOG. It does not require the application of electrode gel.</li> </ul> <p>Read the Electrode User Manual before using the sticktrode.</p>	NE025

Item	Name / Description	Code
	<p><b>Earclip</b></p> <ul style="list-style-type: none"> <li>▶ The Earclip is an easy-to-use alternative to the sticktrode. It is a dual reference electrode because it is used to connect the two reference channels, CMS and DRL, to the same earlobe. The application of electrode gel is highly recommended.</li> </ul> <p>Read the Electrode User Manual before using the earclip.</p>	NE027
	<p><b>USB Dongle or USB Wi-Fi Dongle</b></p> <ul style="list-style-type: none"> <li>▶ The USB Dongle is used to provide a Wi-Fi port for computers that do not have an incorporated port. The wireless communication between the Necbox and the computer is through Wi-Fi. The USB Dongle must not be used with Mac OS computers.</li> </ul>	NE031/ NE031b
	<p><b>USB Cable &amp; Isolator</b></p> <ul style="list-style-type: none"> <li>▶ The USB Cable &amp; Isolator can be used to transmit EEG and Stimulation data between the device and the computer. As we have already seen in the validation. This should always be used with the extender cable. Note that this cable does not charge the device.</li> </ul>	N1641/ NE172

In order to make your Enobio experience more complete, you can add accessories to your kit.

In our catalog and on our website, you can find:

- ▶ Different sizes of the neoprene head cap:  
XL, L, M, S, Kids (K) and Kids Small (KS)
- ▶ The neoprene punch tool:  
Customize your own neoprene cap!
- ▶ Mouse Head cap Cover:  
Provide kids a funny EEG experience
- ▶ Dry electrodes for EEG monitoring:  
For fast and gel-free EEG experiments
- ▶ Solid gel technology for EEG monitoring:  
For fast and gel-free EEG experiments

These items are available upon request.  
Please contact our sales team to learn more.

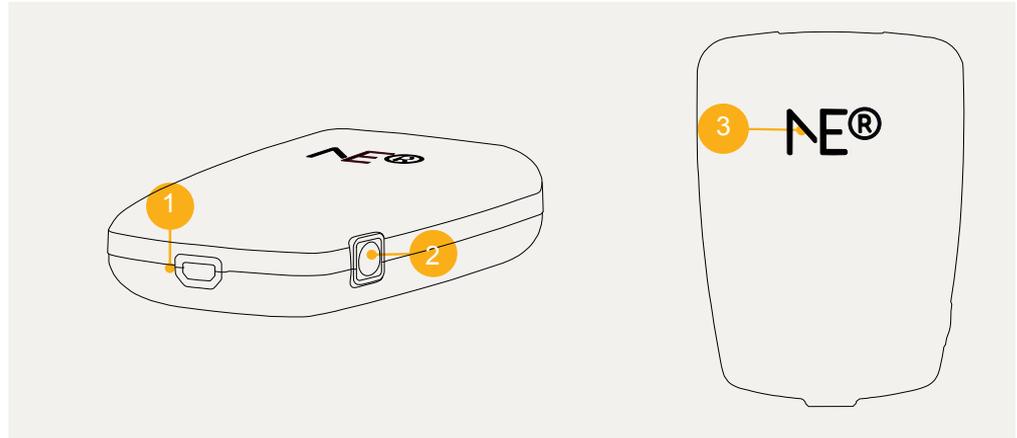


Mouse Head cap Cover

### IV.3

## Necbox: Neuroelectrics Control Box

The Necbox is the core and the control unit of Enobio. The Necbox is a battery operated device. It weighs 85 g and its dimensions are 89 mm x 61.1 mm x 23.8 mm. The following diagrams describe the details of the Necbox.



#### 1. Charging LED

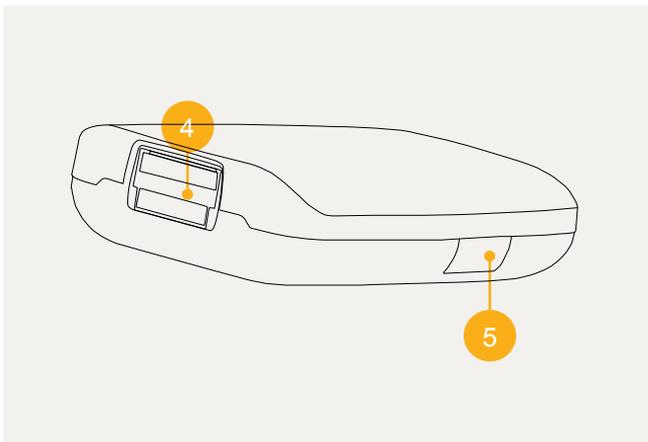
- Off: The charger is not connected.
- Yellow light: The charger is connected and the device is charging.
- Green light: The charger is connected and the device is charged.

#### 2 ON/OFF Push-Button

- On single push, switches on the device while off.
- On 2s hold, switches off the device while on.

#### 3 Operation LED

- Off: The device is off.
- Continuous light: The device is functioning correctly in standard operational mode.
- Blinking with 1s period: The device is functioning correctly in "holter" mode.
- Blinking with 250ms period: The device lost connection during protocol execution, ramped down, and became nonoperational. To continue, it needs to be switched off and on again.
- Blinking with 200ms period 16 times: The device cannot start in "holter" mode because of a problem with the SD card.

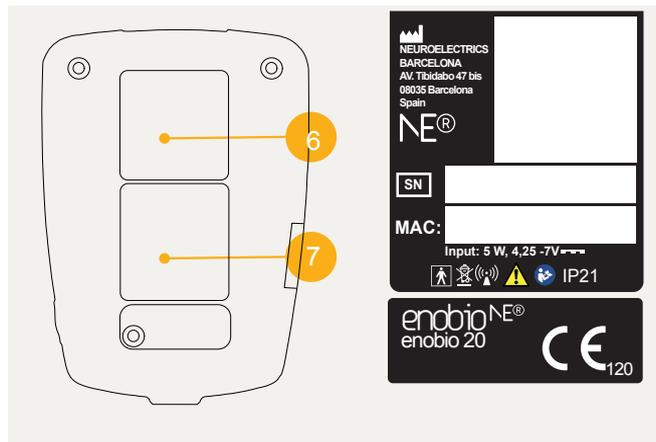


#### 4 Pin connector slots

The number of slots depends on the number of the channels of the Enobio (see next page).

#### 5 MicroSD card slot

Slot for microSD card (Card not included) for online data storage in the “holter” mode.



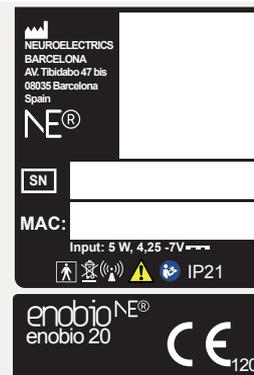
#### 6 Velcro

To attach the Necbox to the neoprene cap.

#### 7 Technical Specifications labels

Serial Number (SN), with the EYYYYMMDD format, where YYYY, MM and DD are the manufacturing year, month and day, respectively.

MAC address of the device.



## IV.4

### Assembling the Necbox and the electrode cables

First, the Necbox is attached to the neoprene cap using the velcro. Secondly, the Necbox should be connected to the electrode cable(s). The cables are inserted in the pin connector slots of the Necbox as described in the diagram below:

#### ▶ **Enobio 8**

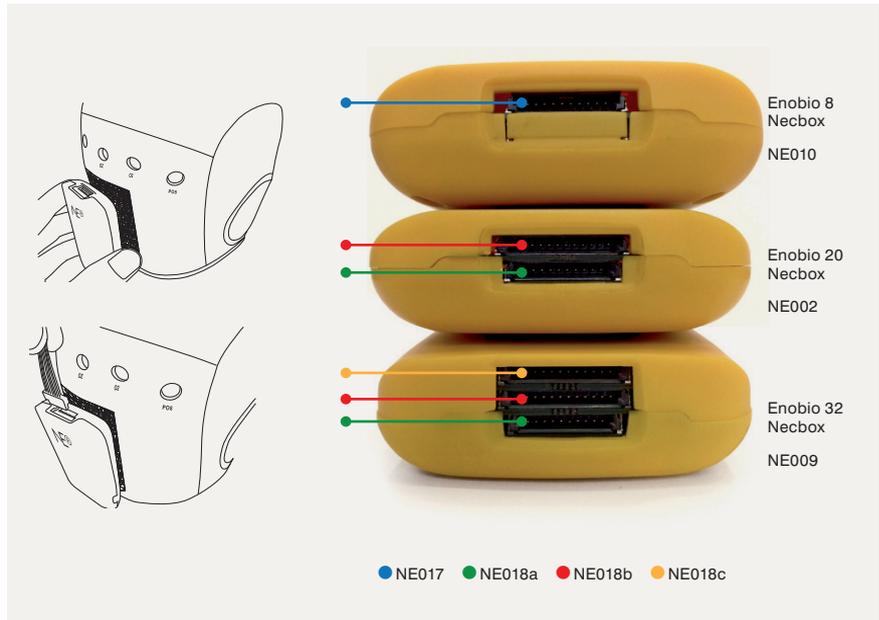
Only electrode cable ● NE017, should be connected to the Necbox using the only available slot (blue).

#### ▶ **Enobio 20**

The pair of cables ● NE018a and ● NE018b that must be connected to the green and red slots, respectively.

#### ▶ **Enobio 32**

Similarly to Enobio 20, but the cable ● NE018c is added and connected to the orange slot.



Enobio 20 and Enobio 32 may be alternatively used as an Enobio 8. In this case, the cable ● NE017 is the only cable that should be used, and it must be connected to the green slot while the remaining slots must be left empty.

## IV.5

### Necbox battery

The battery can only be charged when the device is at the OFF position. The battery charger connects to the Necbox. The battery charger connects to the Necbox through the microUSB connector located at the rear part of the Necbox. To charge the battery, the following specifications need to be met:

- ▶ Nominal output: 5V (4.25V - 7V)
- ▶ Current output: 1A
- ▶ Battery charger: must comply according to Standard IEC-EN 60601-1
- ▶ The battery state of charge is measured by NIC when the device is powered ON and paired with the computer.
- ▶ The battery should not be over discharged when the device is not used for a long time. It should be periodically charged instead.

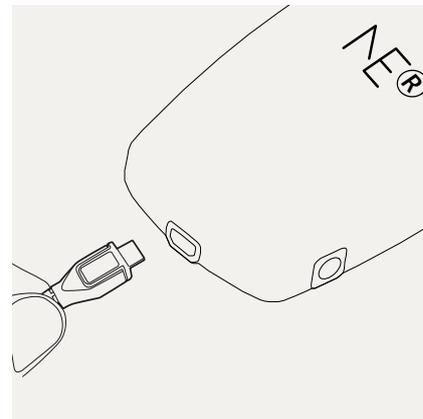
- ▶ Overdischarging may cause loss of cell performance and/or damage to battery function.
- ▶ Expected life cycle: > 500 cycles > 70% of initial capacity
- ▶ Charging with higher voltage than specified may damage the cell.
- ▶ The usual time to charge a battery from the cut-off voltage to the maximum capacity is around 2 hours, but it depends on each (battery life and memory is a function of time).
- ▶ The device can be connected to any Class 2 electrical installation.
- ▶ Device will not operate when charging.
- ▶ Only use the charger that came with the device to charge the battery.

#### Operating Temperature

- ▶ Charging: 0°C to 40°C
- ▶ Discharging: 0°C to 40°C

#### Electrical Specifications for charging:

- ▶ Voltage nominal input: 5 V DC
- ▶ Voltage input min/max: 4.25 V - 7 V
- ▶ Power input: 5 W



## IV.6

### Disassembly of the Device

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First, disconnect all the electrode cables from the electrodes.

Then, take off the head cap and disconnect the electrode cables from the Necbox device.

Once the cables are disconnected, switch off the Necbox device by holding the ON/OFF push button for 2 seconds.

## IV.7

### Cleaning Instructions of the Enobio Kit

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#### Necbox & Electrode Cable

The Enobio Necbox should be cleaned using a dry paper towel after each use.

#### Neoprene Head cap

The Neoprene Head cap should be cleaned and disinfected as it follows:

- ▶ Rinse off the gel with warm tap water and ivory soap
- ▶ Dry the cap carefully using a paper towel
- ▶ Spray the cap with disinfectant and let it sit for 10 minutes, or use disinfectant wet wipes
- ▶ Rinse the cap thoroughly
- ▶ Hang up the cap to dry

#### Electrodes

The cleaning instructions for the electrodes can be found in the Electrodes User Manual.

# V. Symbols Used

Symbol	Description
	Refer to the manual/booklet
	General warning sign
	IEC 60417-5010 Push ON/OFF button UNE-EN 60601-1=2008
	ISO 7000-2498 Serial Number according to UNE-EN 980
	Device manufacturer symbol according to UNE-EN 980
	ISO 7000-2606 do not use device if product or packaging have been damaged symbol according to UNE-EN 980
	Do not throw Enobio in generic waste symbol. WARNING! When you want throw away the device, NEVER throw it in the trash, but go to the RECYCLABLE POINT or the nearest waste collection..
	CE marked device certified by the Notified Body n. 0120 of the European Community.
	ISO 60417-5140 Non-Ionizing Electromagnetic radiation.
	ISO 7000-0632 Transport and storage temperature conditions

Symbol	Description
	ISO 7000-2620 Transport and storage humidity conditions
	ISO 7000-2621 Transport and storage atmospheric pressure conditions
	Transport package shall be kept away from rain and in dry condition.
	Transport package shall not be exposed to sunlight.
	IEC 60417-5333 BF Type applicable part according to UNE-EN 6061
IP 21	Medical device is protected from objects not greater than 12 mm in diameter and protected from dripping water
	Direct Current symbol

# VI. Error Messages

The following messages might appear during normal operation:

Error message	Cause	Actions
Connection lost	The computer cannot communicate with the device.	Check that the device is switched on, that the device has battery, that the computer is communicating properly, and the device is close to the computer.

# VII. Electromagnetic Compatibility (EMC) Information

# For Professional Use

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The Enobio is suitable for use in the specified electromagnetic environment. The customer and/or user of the Enobio should ensure that is used in an electromagnetic environment as described below:

Emissions Test	Compliance	Electromagnetic Environment Guidance
RF Emissions CISPR 11:2015 + A1:2016	Group 1	The Enobio uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF Emissions CISPR 11:2015 + A1:2016	Class B	The Enobio is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emissions UNE-EN 61000-3-2:2014	Class A	
Voltage fluctuations/flicker emissions UNE-EN 61000-3-2:2013	Complies	

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The Enobio image intensifier is suitable for use in the specified electromagnetic environment. The customer and/or the user of Enobio image intensifier should ensure that it is used in an electromagnetic environment as described below:

<b>Immunity Test</b>	<b>IEC 60601-1-2 Test Level</b>	<b>Compliance Level</b>
Electrostatic discharge (ESD) UNE-EN 61000-4-2:2010	+ - 8 kV contact	+ - 8 kV contact
	+ - 15 kV air	+ - 15 kV air
Electrical fast transient/burst UNE-EN 61000-4-4:2013	2 kV for power supply lines	2 kV for power supply lines
	1 kV for input/output lines	N/A
Surge UNE-EN 61000-4-5:2015	1 kV differential mode	1 kV differential mode
	2 kV common mode	N/A
Voltage dips, short interruptions and voltage variations on power supply input lines UNE-EN 61000-4-11:2005	0% U; 0.5 cycles at 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°	0% U; 0.5 cycles at 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°
	0% U; 1 cycle	0% U; 1 cycle
	70% U; 25 cycles single phase at 0°	70% U; 25 cycles single phase at 0°
	0% U; 250 cycles	0% U; 250 cycles
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8:2011	30 A/m	30 A/m

Note: U is the A/C's main voltage prior to application of the test level.

**The Enobio is suitable for use in the specified electromagnetic environment.** The customer and/or the user of Enobio should ensure that it is used in an electromagnetic environment as described below:

<b>Immunity Test</b>	<b>IEC 60601-1-2 Test Level</b>	<b>Compliance Level</b>	<b>Electromagnetic Environment Guidance</b>
Conducted RF <b>IEC 61000-4-6:2014</b>	3 Vrms 0.15 MHz - 80 MHz 6 Vrms in ISM bands between 0,15 MHz and 80 MHz 80% AM at 1 kHz	3 Vrms 0.15 MHz - 80 MHz 6 Vrms in ISM bands between 0,15 MHz and 80 MHz 80% AM at 1 kHz	Portable and mobile RF communications equipment should be used no closer to any part of the Enobio, including cables, than the recommended separation distance calculated from the equation appropriate for the frequency of the transmitter Recommended Separation Distance d=1,2 P d=1,2 P 80 MHz to 800 MHz d=2,3 P 800 MHz to 2,5 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey <b>(a)</b> , should be less than the compliance level in each frequency range <b>(b)</b> . Interference may occur in the vicinity of equipment marked with the following symbol:
Radiated RF <b>IEC-EN 61000-4-3:2007 + A1:2008 + A2:2011</b>	3V/m 80 MHz - 2.5 GHz	3V/m 80 MHz - 2.5 GHz	
Proximity Fields <b>IEC 61000-4-3:2007+ A1:2008 + A2:2011</b>	27V/m 380 MHz - 390 MHz, 1.8W 28V/m 430 MHz - 479 MHz, 2W 9V/m 705 MHz - 787 MHz, 0.2W 28V/m 800 MHz - 960 MHz, 2W 28V/m 1700 MHz - 1990 MHz, 2W 28V/m 2400 MHz - 2570 MHz, 2W 9V/m 5100 MHz - 5800 MHz, 0.2W	27V/m 380 MHz - 390 MHz, 1.8W 28V/m 430 MHz - 479 MHz, 2W 9V/m 705 MHz - 787 MHz, 0.2W 28V/m 800 MHz - 960 MHz, 2W 28V/m 1700 MHz - 1990 MHz, 2W 28V/m 2400 MHz - 2570 MHz, 2W 9V/m 5100 MHz - 5800 MHz, 0.2W	

**(a)** Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength outside the shielded location in which the Enobio is used exceeds the applicable RF compliance level above, the Enobio should be

observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the Enobio. **(b)** Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

**NOTE 1:** These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

**The Enobio is intended to be used in a controlled radiated RF environment.** The user of the Enobio can help to prevent electromagnetic interferences keeping a minimum distance between the portable RF device (transmitter) and the Enobio as recommended below, according to the maximum output power of the communications device.

Rated Maximum Output Power of Transmitter watts	Separation distance metres		
	150 kHz to 80 MHz $d=1,2 P$	150 kHz to 800 MHz $d=1,2P$	800 MHz to 2,5 GHz $d=2,3 P$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters rated at a maximum output power not listed above, the separation distance can be estimated using the equation in the corresponding column, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

**NOTE:** These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.