

EPOC Flex User Manual

EPOC FLEX User Manual



Image: Pre-configured EPOC Flex Gel

This document is intended to help you get started using the EPOC Flex. The EPOC Flex is a 32-channel, flexible EEG system. It was built on the award winning EPOC+ technology and is designed for researchers who would like to have a more flexible sensor placement and / or greater density of sensors. The reference sensors can be placed in any location on the head, or on the ears with included earclips. EmotivPRO v1.4+ is required for operation.

If you have any queries beyond the scope of this document, please contact us through our [online support](#)

EPOC Flex

Introduction



EPOC Flex Saline Kit Contents

This document is intended to help you get started using the EPOC Flex. The EPOC Flex is a 32-channel, flexible EEG system. It was built on the award winning EPOC+ technology and is designed for researchers who would like to have a more flexible sensor placement and / or greater density of sensors. The reference sensors can be placed in any location on the cap, and on the ears with included earclips (gel sensors only). EmotivPRO v1.4+ is required for operation.

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EMOTIV products are intended to be used for research applications and personal use only. Our products are not sold as Medical Devices as defined in EU directive 93/42/EEC. Our products are not designed or intended to be used for diagnosis or treatment of disease.

Technical Specifications

Device	EPOC Flex
No. of Channels	32 (plus CMS/DRL references)
Channel names	Configurable on standard 72 channel international 10-20 locations.
Sampling method	Sequential sampling. Single ADC
Sampling rate	128 SPS (1024 Hz internal)
EEG Resolution	14 bits 1 LSB = 0.51 μ V (16 bit ADC, 2 bits instrumental noise floor discarded)
Max Slew Rate	32.64 μ V/sample (Compression required for BLE data transmission)
Bandwidth	0.2 - 45Hz, high attenuation at 50Hz and 60Hz
Filtering	Built in digital 5th order Sinc filter
Dynamic range (input referred)	+/- 4.12 mV
Coupling mode	AC coupled
Connectivity	Proprietary 2.4GHz wireless, BLE(coming soon)
Battery Capacity.	LiPo battery 680mAh
Battery life (typical)	9 hours

Impedance Measurement	Real-time contact quality using patented system
IMU Part	ICM-20948 3-axis Accelerometer, 3-axis Gyroscope, 3-axis Magnetometer. Data Output 10 channels Quaternions, (Q0, Q1, Q2,Q3), Acceleration (X,Y,Z) and Magnetometer (X,Y,Z)
Motion Sampling	16 Hz
Motion Resolution	8-bit Output
Sensor Material	Sintered Ag/AgCl (EPOC Flex Gel model) can be used with any EEG gel Electroplated Ag/AgCl (EPOC Flex Saline models) with replaceable polyester felt pads can be sterilised and re-used (bulk pack available for separate purchase)

Safety Precautions

It is important to read the following safety precautions:

- EPOC Flex is a consumer product, it is not intended to be used for in-patient health care or in hazardous environments.
- EPOC Flex is designed to be used at room temperature; rapid changes in temperature will affect the performance of the amplifiers and increase the noise floor.
- EPOC Flex can be used with gel or saline based sensors.

Warnings

- EPOC Flex is powered by a Lithium-Polymer battery that is rated for operation in <45C environments. It is not user replaceable; please contact support if you suspect a fault or if you have any questions.
- Do not open the enclosure. Doing so will void the warranty and it can damage the headset.
- Do not charge EPOC Flex while wearing the device. In the unlikely event your PC has a faulty power supply, you and your headset could unintentionally become the ground path. If EPOC Flex detects a USB connection when turned on, it will stop communicating.

Regulatory Compliance

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FCC ID Number **2ADIH-FLEX01** and IC ID Number: **12769A-FLEX01**.

EMOTIV has undertaken testing and confirms:

This device complies with the radio equipment directive (2014/53/EU).

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or experienced person for help.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

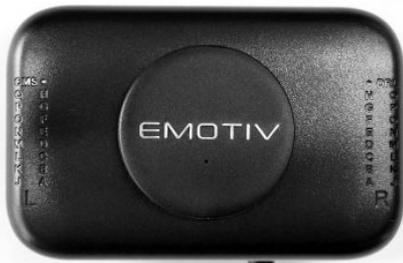
Please Note: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Section	Standards Tested
EMC and Telecom: Class B	ETSI EN 301 489-1 & 489-17
	ETSI EN 301 328 v2.1.1
	AS/NZS CISPR22 :2009
	AS/NZS 4268 :2012, BTLE 4.0
USA	FCC CFR 47 Part 15B & 15C
Canada	ISED RSS-247: Issue 2, IC RSS-102: Issue 5

Our USB dongle has FCC ID Number **XUE-USBD01**.

Package Contents

EPOC Flex is designed to allow users to buy the components required to meet their research need. When you open the box, you will find the following:



Controller



Universal USB Receiver (included with Controller)



EasyCap(tm) Emotiv Custom Cap

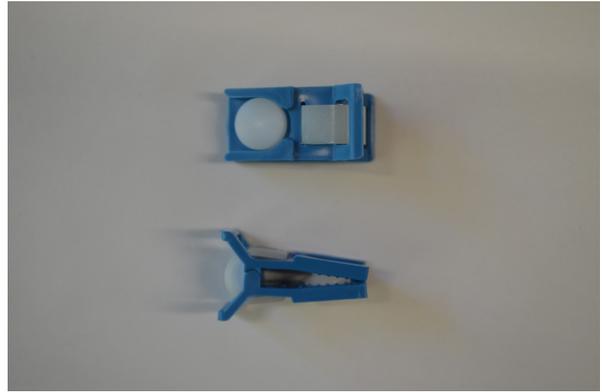


Electrode Sensors - EPOC Flex Gel model





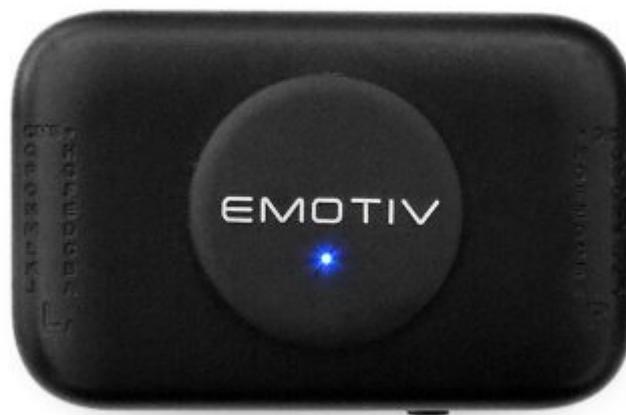
Micro-B to A USB charge cable



Earclips (included with Gel sensors only)

Assembly Quick Start

After unboxing your EPOC Flex for the first time because charge the controller unit for at least an hour and before fitting the controller to the cap please turn it on by moving the power switch to the right, a blue LED will show that it is on.



Please find the quick start guide for setting up your EPOC Flex cap in the setup section below.

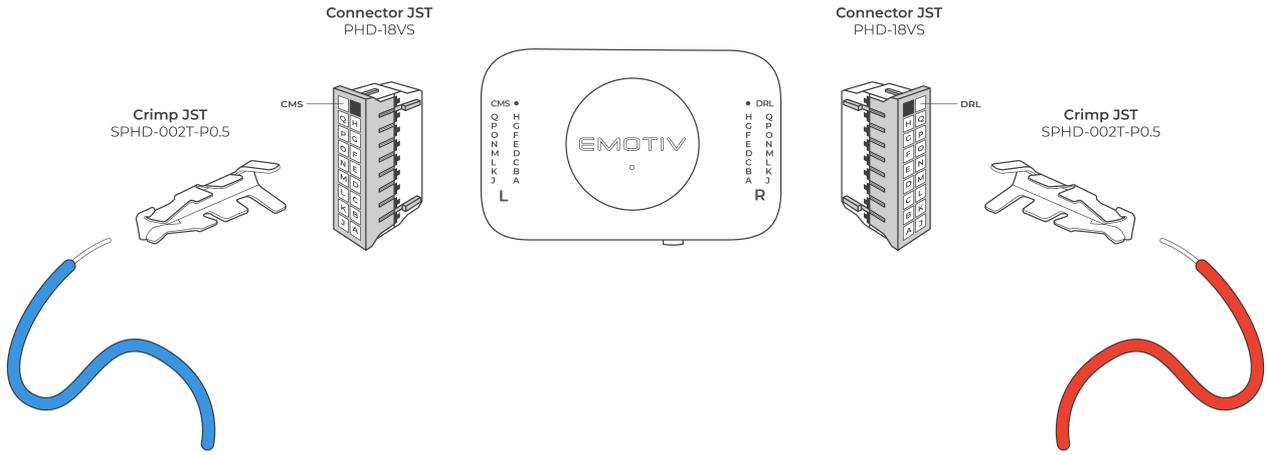
After the cap is setup it can then be fitted onto the test subject.

Please plug in the provided universal USB receiver into your computer, You should also see the lights on the receiver change to indicate it is receiving data from the controller.

Look at the contact quality map, you want to ensure all sensors are green this might require you to re-hydrate saline sensors or add additional gel until you have 100% CQ.

You are now all ready to start recording!

Controller



Charging and LED Indicators

The EPOC Flex has a single RGB LED to indicate power on and charging as shown in the table below.

Action	LED Colour
Power OFF / Battery Flat	OFF
Powered On	BLUE
USB connected / Charging	ORANGE
Charge complete	GREEN
Firmware failure	Fade On - Fade Off Blue
USB connected / powered On	WHITE

It is recommended that your headset is fully charged prior to taking recordings. The charge time depends on the remaining capacity in the Lithium Polymer cell and can take up to four hours. If the EPOC Flex LED does not turn blue on power on it requires charging. Please use the provided USB Micro-B cable to recharge using any usb port.

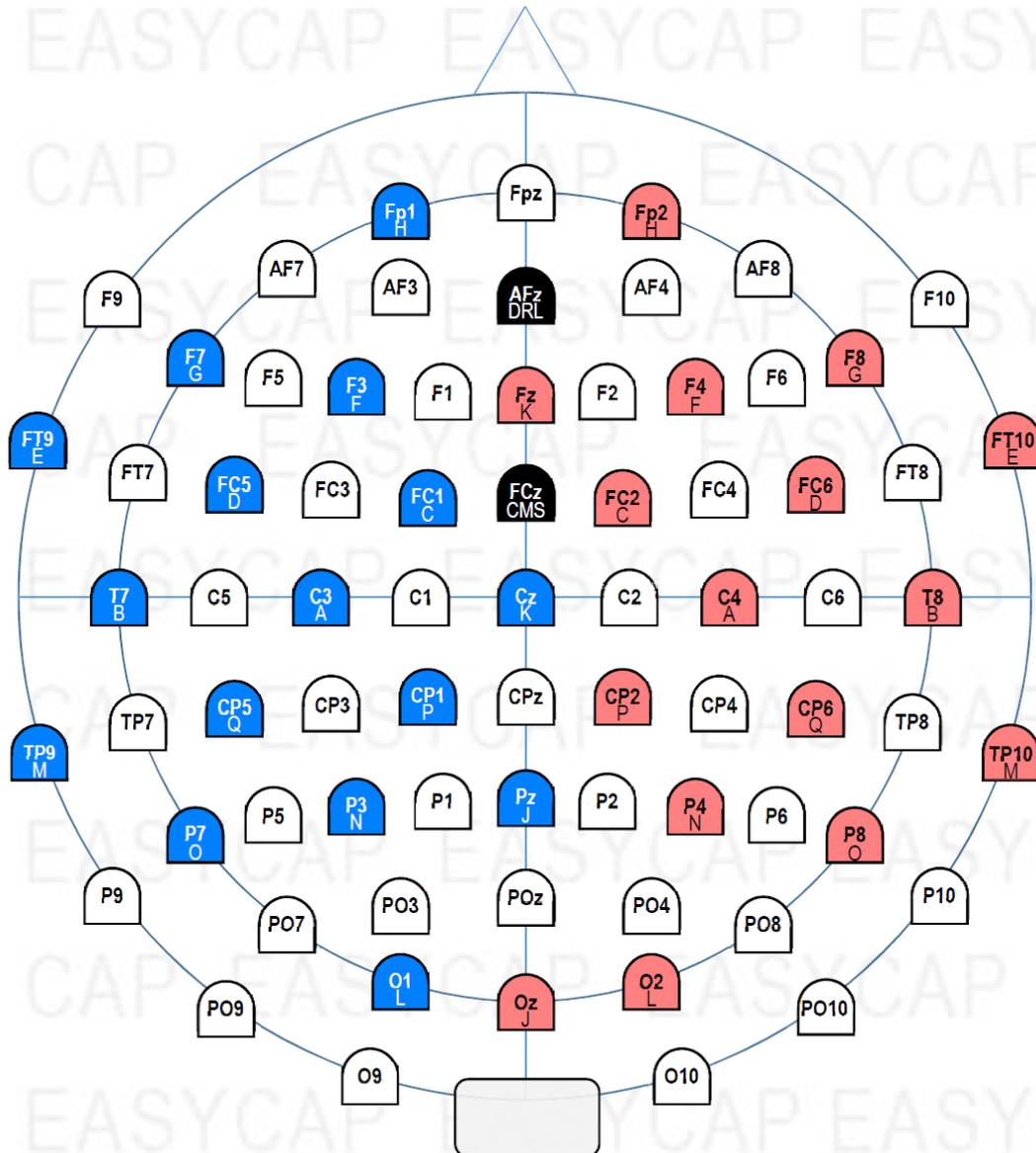
Note 1: The headset will charge faster if connected to a dedicated USB port.

Note 2: If the headset is heavily depleted or hasn't been used for a few months, leave it connected for 24hrs.

Electrodes

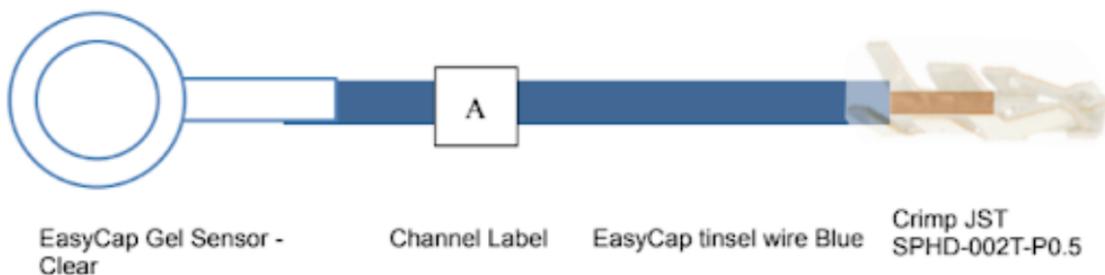
Example Sensor Placement

Below is an example electrode placement for 32 channels with central references or DRL and CMS can be moved to P9/P10 to be the same as EPOC+. The default configuration of EPOC Flex in EmotivPRO is as below. This placement gives good coverage of the entire head, with the pod fitted in the back pocket.



Gel Sensors

The EPOC Flex gel kit includes 34 EasyCap multi-rode gel sensors that are pre-configured and easy to setup. The sensors are made from sintered Silver/SilverChloride for minimising the electrode impedance. The sensors are attached to length of tinsel wire and terminated with JST gold plated crimps. This length is designed to be long enough to reach any position on the cap.



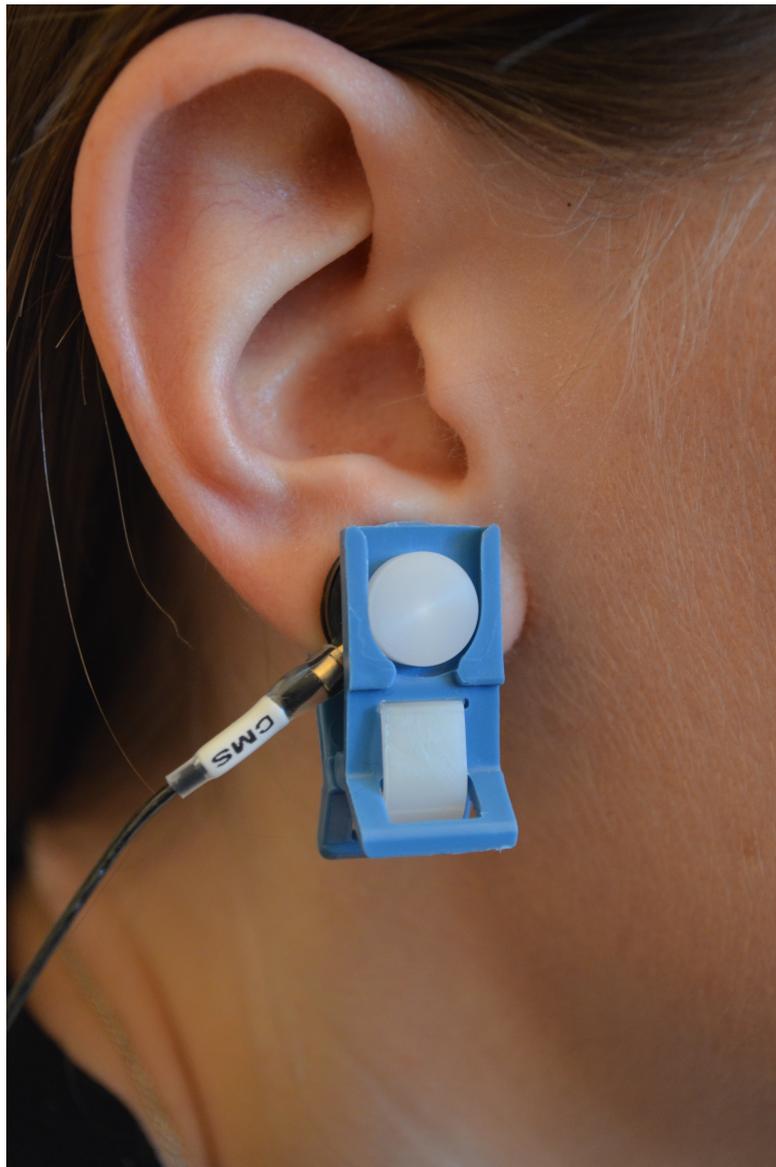
Sensor wires are colour coded, blue for left, red for right and black for references. In addition each sensor will be individually labelled with the channel name it is connected on the EPOC Flex. The aim of this colour coding is simple, when troubleshooting you can quickly identify the colour and channel name in the software and quickly find the electrode on the cap. For example if contact quality is low on channel LA this corresponds with the blue A wire.

The sensor wires are in two lengths to help to minimise the excess but also allow for any configuration, channels A-G are 300mm and channel J-Q are 150mm. Once you have fitted all the sensors in place we recommend that you use the included tagger pins and tagger tool to tidy up the wiring (See [link](#)). Or we recommend that you place a cap over the top to stop these wires catching. If your research involves minimising motion artefacts you should keep the excess wire secured.

We know that researchers can have different needs for references, so we have included ear clips and the gel sensors are compatible with adhesive pads.

Gel Ear Clip

The gel cap includes a set of blue earclips for fitting the sensors onto the ear as shown below. The clip will hold the sensor onto the ear however can be removed once the gel has hardened.



Saline Sensors

EMOTIV has developed our own saline sensors compatible with EPOC Flex available to purchase on their own or as a kit. These sensors use the same felt pads as EPOC+ but with are Silver / Silver Chloride plated electrode to grip the felt on the sides. Saline sensors start to dry out after 1-2hours and to enable easy topping up there is a refill hole to allow you re-wet the sensors without needing to take the cap off. To accommodate the existing felt size the saline sensors are bigger than the gel sensors but do still fit into the same caps holes.

Width 19 mm x Height 7.9 mm



Saline Sensor

This length is designed to be long enough to reach any position on the cap. Sensor wires are colour coded, blue for left, red for right and black for references. In addition each sensor will be individually labelled with the channel name it is connected on the EPOC Flex. The aim of this colour coding is simple, when troubleshooting you can quickly identify the colour and channel name in the software and quickly find the sensor on the cap. For example if contact quality is low on channel LA this corresponds with the blue A wire.

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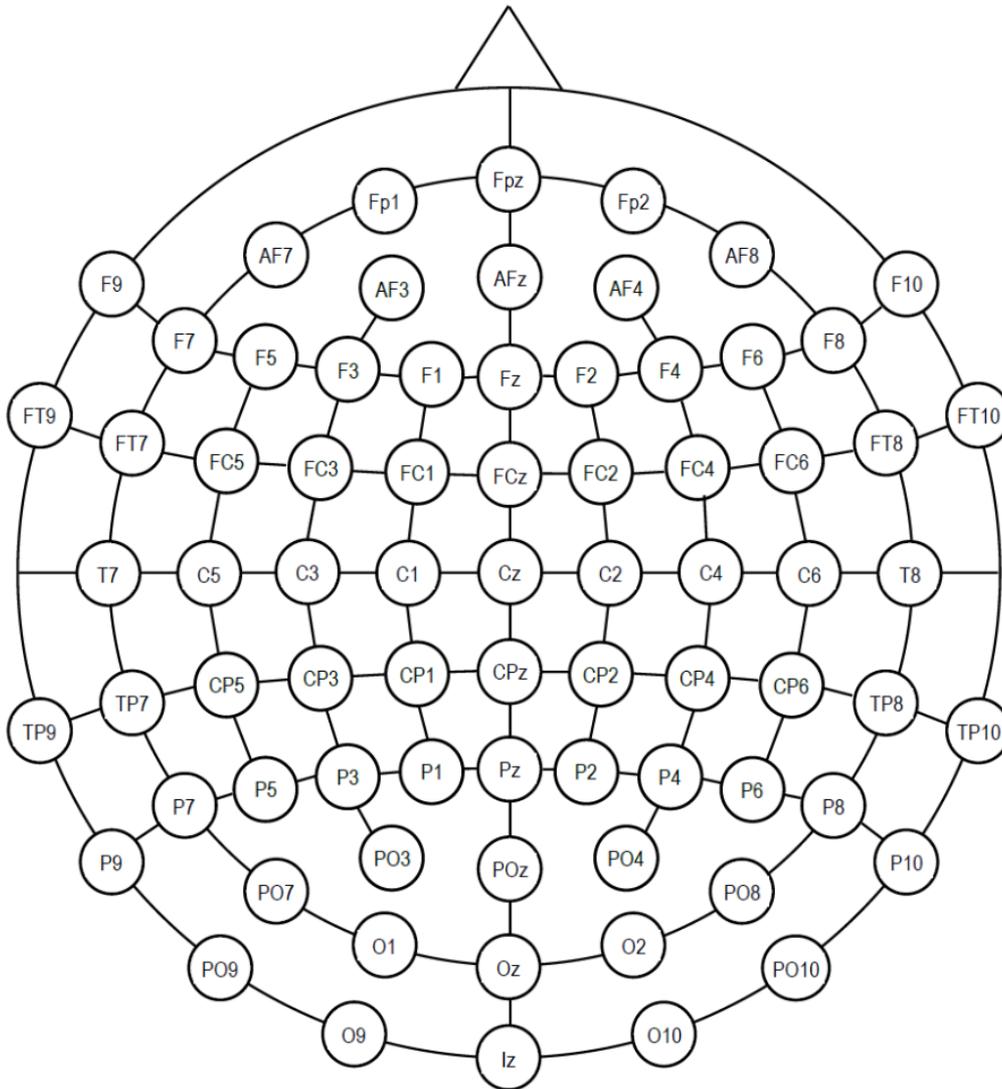
Cap

EPOC Flex Cap



EPOC Flex Cap

The standard EPOC Flex cap follows the official 10-20 system and has 72 openings as shown below. The cap has two pockets for securing the controller into the cap, one is fitted below Cz and the other Iz.

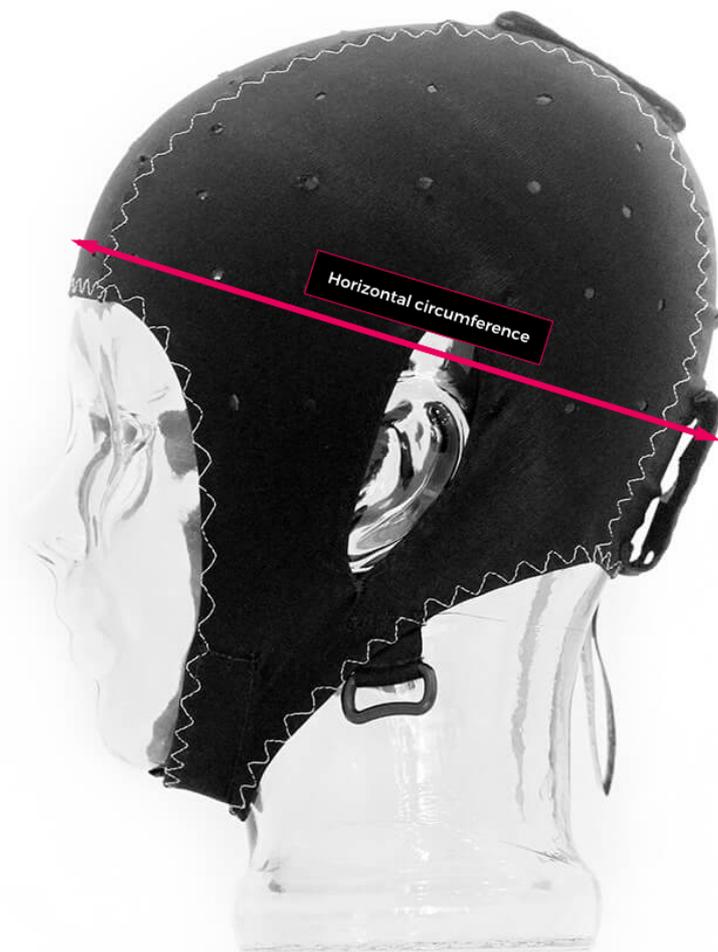


10-20 sensor map

The caps can be ordered in standard sizes are 54, 56 and 58 cm in a black high comfort material. Other sizes in 2cm increments, hole positions, materials and cuts are available please contact [online support](#) for further information.

Choosing the Cap Size

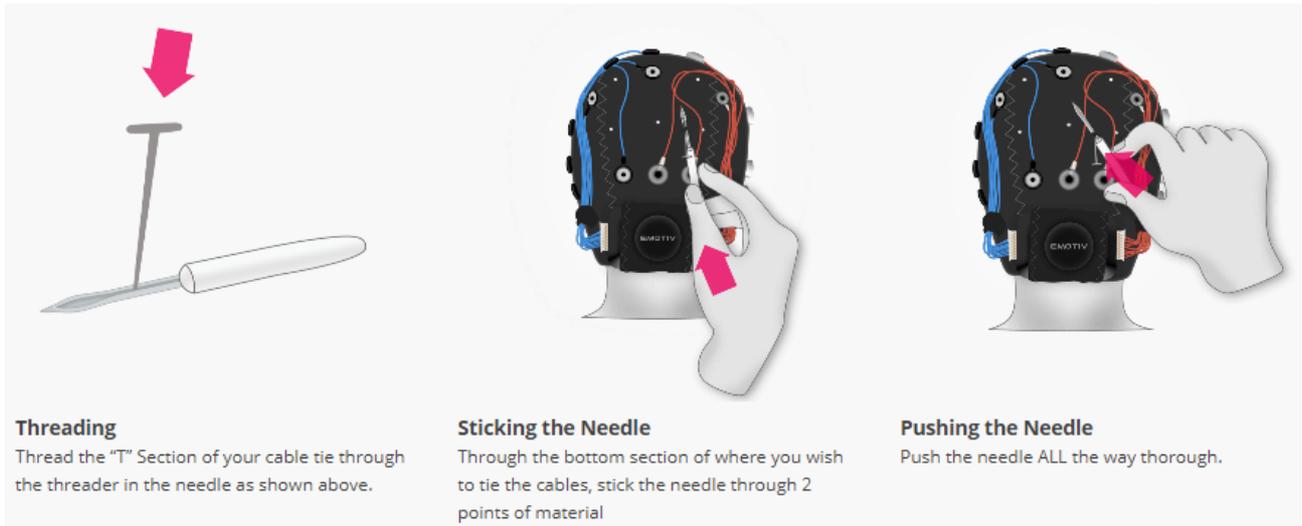
Specifying the right cap size is critical for ensuring the sensors are in the right place when taking measurements. Our supplier recommends measuring the head diameter in the horizontal circumference as shown in the image below.



Once you have the measurement for your test subjects, specify the closest size to the ones available, for example 54.5cm → 54cm, 59cm → 58cm, etc. If you need larger or smaller sizes, please contact support.

Working with Wires

If you need to tidy up your wires, use the black cable ties and the needle provided to lock your cables down and prevent any unwanted movement. This is something similar to sewing the cables into the material.



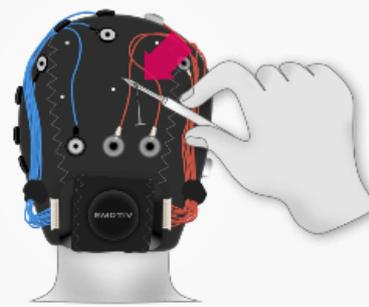
Tidying up the wires

On the other side of the cables if you want to tie down:



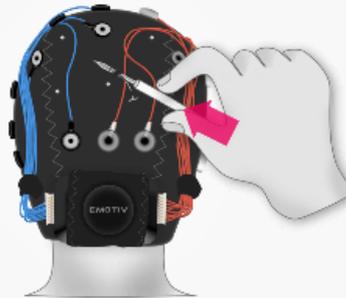
Rethreading

Re-thread other "T" in the black cable into the tip of the needle



Repeating the Process

Repeat the process as before, push the needle all the way through 2 layers of material:



Pulling the Needle

Slowly, pull the needle back and out, the black "T" should begin to slide out of the needle, keep pulling the needle out until the cable is attached on both sides of the wires.



Adjusting the Needle

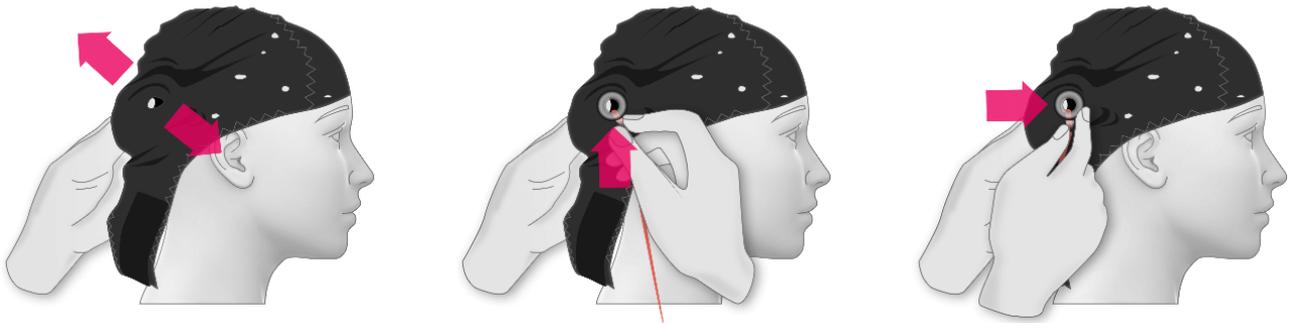
Adjust the needle to fit.

Tidying up the wires

Setup

Inserting the Sensors into the Cap

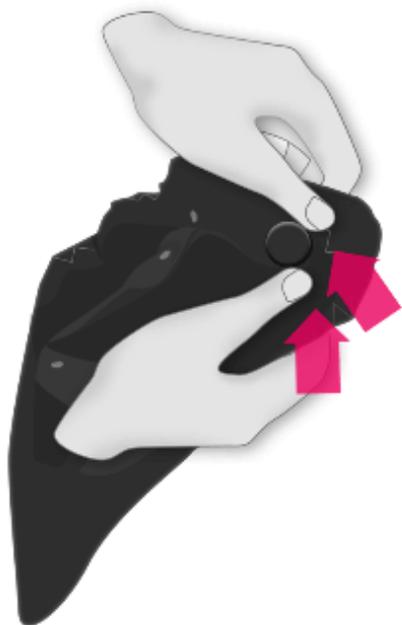
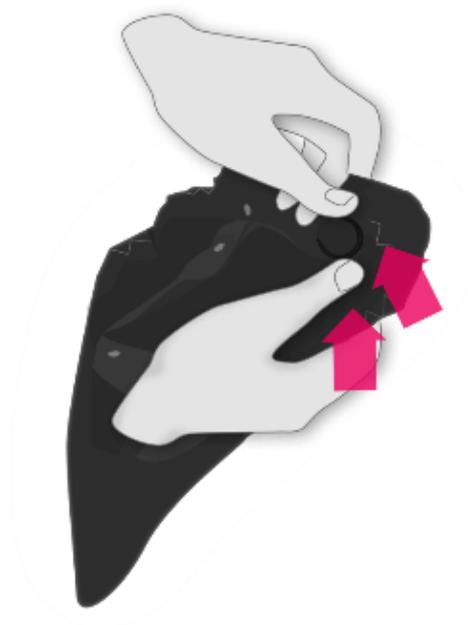
Hold the underside of the cap, stretch the material in all directions around the hole you intend to fit, then wedge the sensor into the hole. Push upwards first and then let the material move to fix the bottom half. Adjust the material until the sensor is fully fixed. Repeat this step for all the Sensors in your desired configuration.



Inserting the sensors

Since the Saline Sensors are a little larger than the Gel Sensors, it is easier to stretch the material of the cap around the Sensors than forcing the Sensor into the cap.

With the saline felt pad facing inwards, place it over the Sensor hole into which you wish to fit it. Flipping the Cap inside out, stretch the hole over the Sensor, let the material pop into place into the plastic groove. The majority of the Sensor should be on the outer side, while the felt should protrude towards the inside, where it will be resting against the scalp when the cap is in place. Repeat this step for all Sensors.

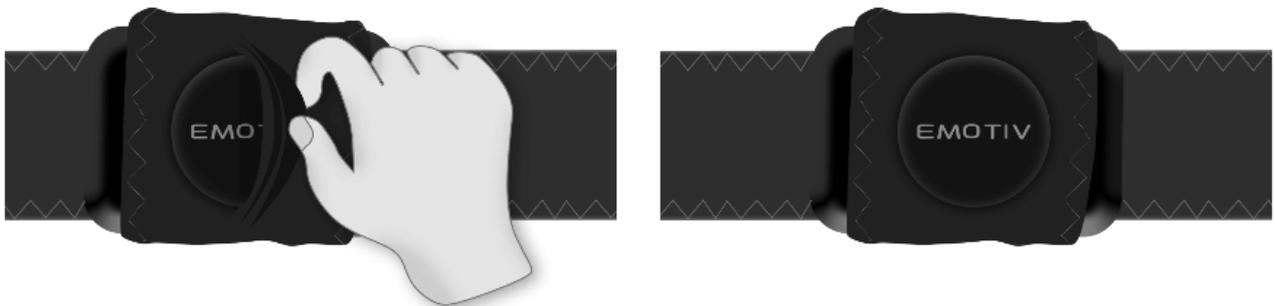


Placing the Control Box



EPOC Flex Controller Fitted into cap

Place the control box in either the rear head position or the top position. The top position is recommended for those who research on people where headrests are required in a chair (in wheelchairs, for example), or in studies where people are lying down (sleep studies).

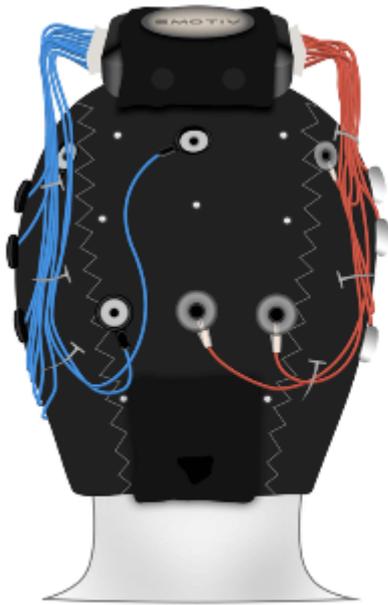


Positioning

With the EMOTIV logo facing outwards, stretch the fabric into the groove around the circular part of the control box securing the box in place.

Positioning the Control Box

The Control Box should be positioned as shown below:



Top Position of Control Box



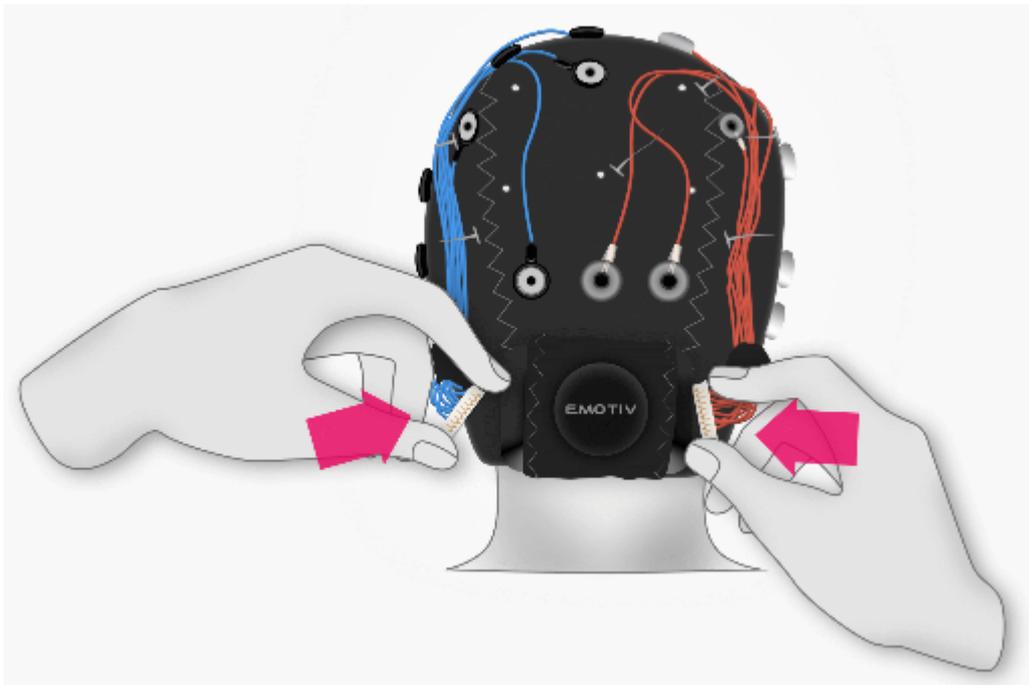
Back Position of Control Box

Positioning the Control Box

Plugging the Cables into the Control Box

Plug the white connector (attached to all your red cables) into the right hand side of the control box. The connector only fits in one way, so if it fits in, then you have successfully connected your control box! Repeat the process for the left side (blue cables).

Double check all your cables are in the right place – you are almost ready for recording!

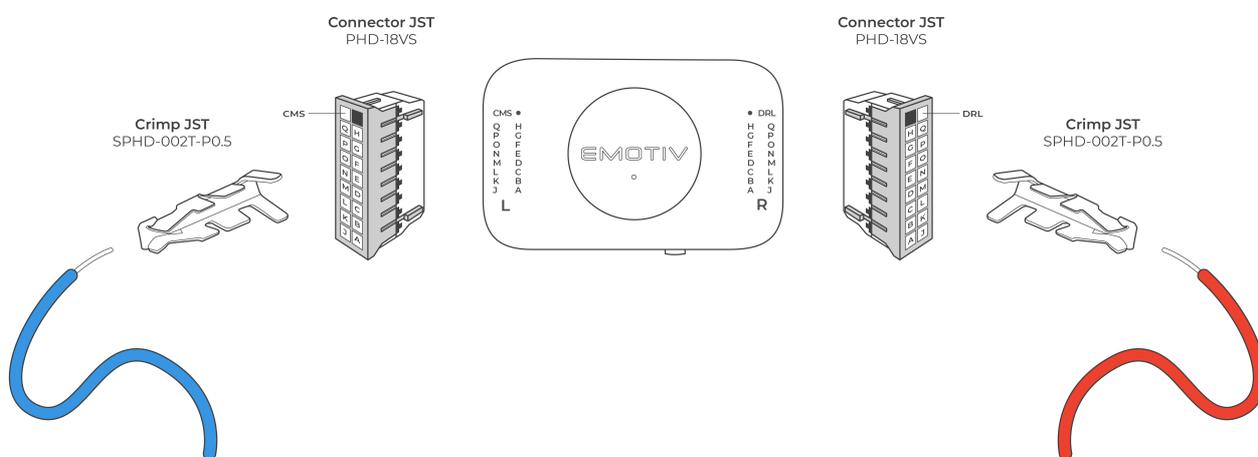


Plugging the cables



Adjusting Wire Positions

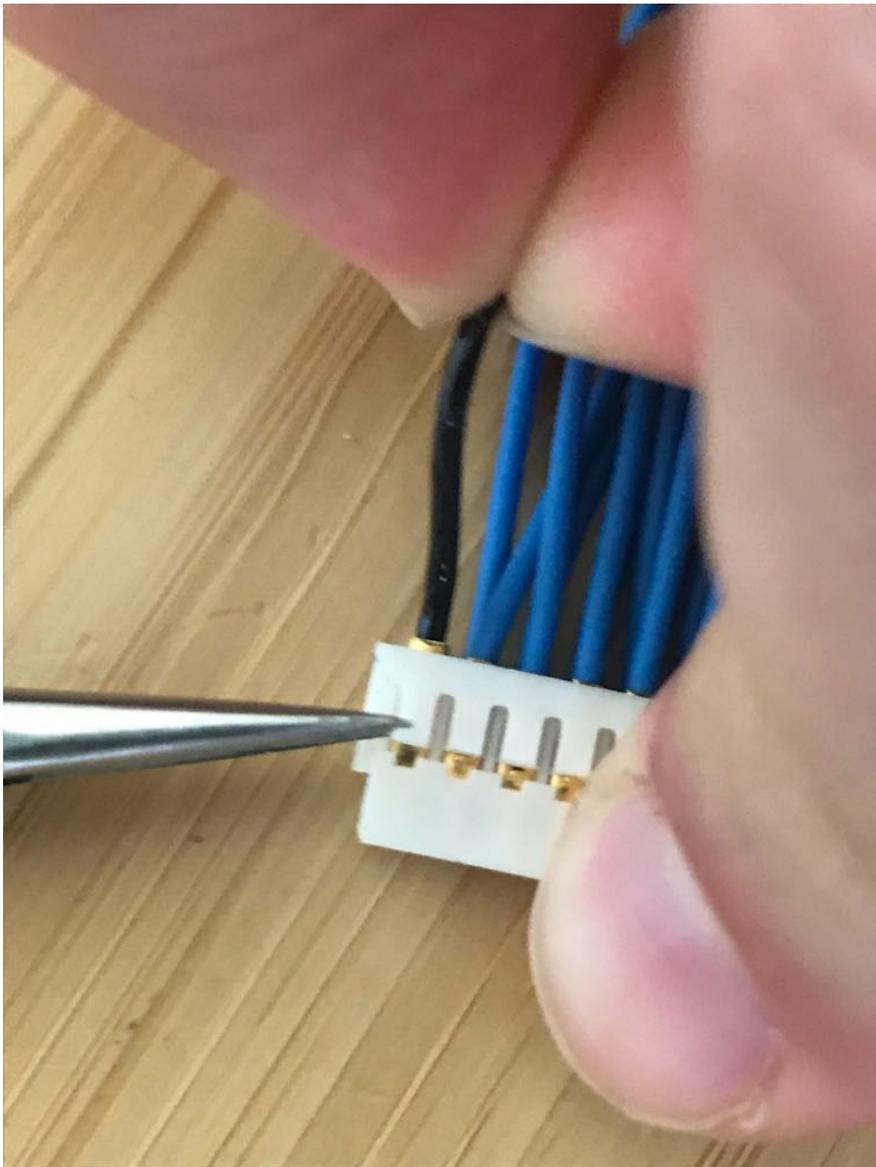
The EPOC Flex is flexible in wire position and number of sensors. By default all 32 sensors + 2 references are already fitted into the two connectors. As shown in the image below, 16 blue sensor wires + CMS a black wire is on the left. 16 red sensor wires + DRL a black sensor wire is on the right. The connector has one empty position above the references. EMOTIV has wired up the electrodes so that the electrode name A-Q matches the pin position shown below.



You can remove un-needed sensors if you experimental montage requires this. It is recommended to use a thin flat screwdriver or tweezers to lift up the plastic tab shown below.



Lifting this tab will release the crimp locking mechanism.



Pull on the wire until the gold of the crimp starts to be shown.



The reference wire shown above is removed.



Reinserting the wire into the connector make sure the crimp lock is facing upwards when inserting and pull on the wire to ensure it is locked in place.

Cleaning & Troubleshooting

Cleaning Gel Sensors & Cap

For gel sensor users: it is recommended to rinse the cap with the electrodes after each usage.

Note: You can clean a configured EPOC Flex cap by soaking or rinsing in warm water as detailed below but (1) unplug and remove the EPOC Flex Controller from the cap and (2) make sure the connectors do not get wet (by putting them into a zip lock bag and sealing with a rubber band for protection against accidental splashes and hold them out of the water) while cleaning the cap and electrodes. This way you can keep the electrode arrangement without having to remove and re-install the sensors.

Cap

The cap (without electrodes) can be cleaned in a washing machine at 30° Celsius, using a mild detergent and left to air dry. Please do not put in dryer or iron as this will reduce the life of the cap.

Under most circumstances, cleaning of caps and electrodes in mild detergent (such as childrens shampoo) with a toothbrush will suffice. Afterward, rinse the cap with water and the electrodes with distilled water. Finally, remove the excess moisture with paper towel and leave to air dry.

Note: Dishwasher detergents often leave a film and alter the electrode surface and disinfectants will react with the sensor material. Children's shampoo is a good choice for cleaning caps and electrodes.

Gel Electrodes

Clean the electrodes immediately after each use, best before the electrolyte gel or paste starts to dry and rinse the rest of the gel out of the sensors under a running tap.

In case of dried gels, please soak the electrodes for a short while (30s) and rinse again, or use a soft toothbrush. In case of more persistent or greasy stains you may use a mild detergent, such as pure soap or baby shampoo, and clean your cap and electrodes in luke-warm soap water. Always rinse with water after cleaning and dry the electrodes with a tissue or towel.

Note: Dried gel may reduce the capacity of the sensor to transduce signals and is a frequent reason for bad signals and impedance.

The electrode manufacturer explicitly warns:

- Do Not to soak electrodes in saline solution or chloride them, as corrosion of connections will result.
- Do Not to autoclave or use other hot sterilization methods as the wire insulation can be damaged.

Saline Electrodes

EMOTIV saline electrodes are only subjected to salt water in use which should be rinsed with clean water after each use to prolong the life of the sensor.

The sensors are silver / silver chloride plated which can be easily scratched by other metal parts.

The cap will inevitably get salt water on it and should also be rinsed and air dried between users for hygiene and comfort reasons.

Storage

Storage

It is best is to store the cap and electrodes in a dry and dark place.

Handling and Maintenance

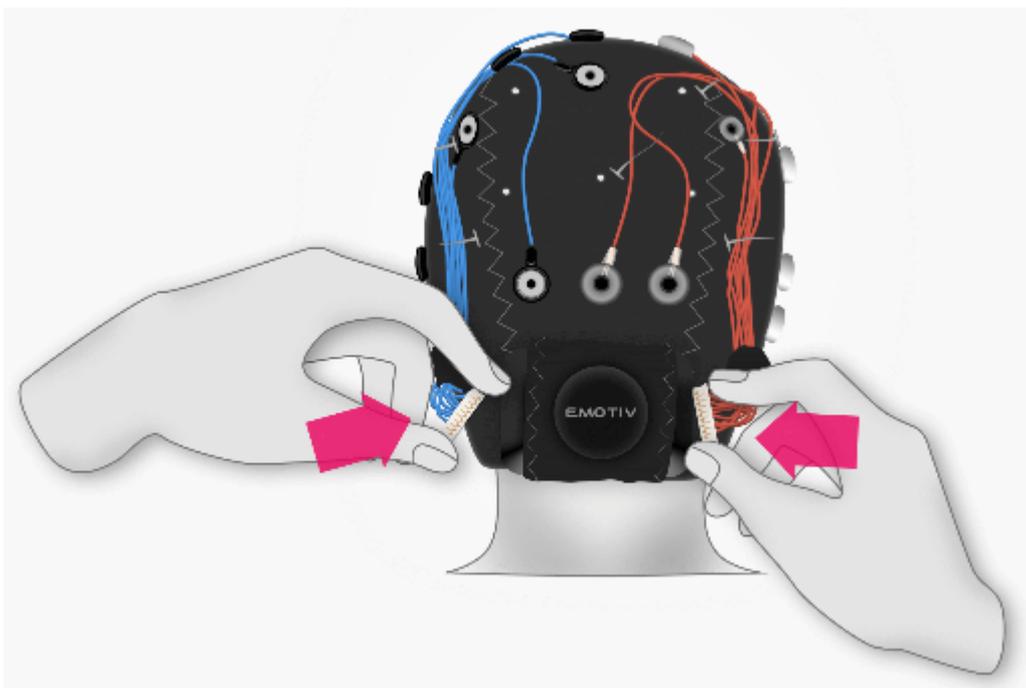
The lifespan of electrodes depends on the handling. The most critical spot for a gel electrode is where the cable enters into the solid electrode housing, and and the crimp into the plug – please do never overstretch or overbend this section.

Troubleshooting

The EPOC Flex is designed for expert users already comfortable with setup and use of EEG cap systems. Below is some easy troubleshooting steps we recommend following but for any further help please contact support via email or online chat.

Error: Unable to get CQ on any channel

This could be due to not having plugged in the electrode trees into the cap please follow the steps outlined below. Or the references are not connected to the body please check the contact for both DRL and CMS.



Plugging the cables

Error: Channel is always black

Please contact support and provide us with pictures of the electrode tree connectors, because the headsets are assembled by hand it is possible for mistakes to be made from time to time.