

# **INSIGHT Manual**

# Insight User Manual



EMOTIV INSIGHT

This document is intended to help you get started using the EMOTIV INSIGHT our 5-channel, prosumer EEG system using semi-dry polymer sensors. Designed for self-quantification, brain-computer interface, and field research, EMOTIV INSIGHT 5-channel mobile EEG boasts advanced electronics that are fully optimised to produce clean, robust signals anytime, anywhere.

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

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.

# Introduction

# Technical Specifications

| Headset Version                                      | Pre-2019   | 2019   | 2021   |
|--|--|--|--|
| <b>Number of Channels</b>                            | 5 (plus CMS/DRL reference on left mastoid)                                     | 5 (plus CMS/DRL reference on left mastoid)                                     | 5 (plus CMS/DRL reference on left mastoid)                                     |
| <b>Channel names (International 10-20 locations)</b> | AF3, AF4, T7, T8, Pz   | AF3, AF4, T7, T8, Pz   | AF3, AF4, T7, T8, Pz   |
| <b>Sampling Method</b>                               | Sequential sampling, single ADC  | Sequential sampling, single ADC  | Sequential sampling, single ADC  |
| <b>Sampling Rate</b>                                 | 128 SPS (2048 Hz internal)   | 128 SPS (2048 Hz internal)   | 128 SPS (2048 Hz internal)   |
| <b>EEG Resolution</b>                                | 14 bits 1 LSB = 0.51µV (16 bit ADC, 2 bits instrumental noise floor discarded) | 14 bits 1 LSB = 0.51µV (16 bit ADC, 2 bits instrumental noise floor discarded) | 14 bits 1 LSB = 0.51µV (16 bit ADC, 2 bits instrumental noise floor discarded) |
| <b>Bandwidth</b>                                     | 0.5 - 43Hz, digital notch filters at 50Hz and 60Hz                             | 0.5 - 43Hz, digital notch filters at 50Hz and 60Hz                             | 0.5 - 43Hz, digital notch filters at 50Hz and 60Hz                             |
| <b>Filtering</b>                                     | Built in digital 5th order Sinc filter   | Built in digital 5th order Sinc filter   | Built in digital 5th order Sinc filter   |
| <b>Dynamic Range (Input referred)</b>                | 8400 uV (pp)   | 8400 uV (pp)   | 8400 uV (pp)   |

| <b>Coupling Mode</b>          | AC coupled                                      | AC coupled                                      | AC coupled                                      |
|-------------------------------|---|---|---|
| <b>Connectivity</b>           | Proprietary 2.4GHz wireless (with dongle), BLE  | Proprietary 2.4GHz wireless (with dongle), BLE  | BLE   |
| <b>Battery Capacity</b>       | LiPo battery 480mAh                             | LiPo battery 450mAh                             | LiPo battery 450mAh                             |
| <b>Battery Life (typical)</b> | Up to 8 hours                                   | Up to 8 hours                                   | Up to 20 hours                                  |
| <b>Impedance Measurement</b>  | Real-time contact quality using patented system | Real-time contact quality using patented system | Real-time contact quality using patented system |
| <b>IMU Part</b>               | LSM9DS0   | ICM-20948                                       | ICM-20948                                       |
| <b>Accelerometer</b>          | 3-axis +/-8g                                    | 3-axis +/-4g                                    | 3-axis +/-4g                                    |
| <b>Gyroscope</b>              | 3-axis +/- 500 dps                              | Output as Quaternion                            | Output as Quaternion                            |
| <b>Magnetometer</b>           | 3-axis +/- 12 gauss                             | 3-axis +/- 4900 uTesla                          | 3-axis +/- 4900 uTesla                          |
| <b>Motion Sampling</b>        | 128 Hz  | 64 Hz   | 64 Hz   |
| <b>Quaternion Outputs</b>     | No  | Yes   | Yes   |
| <b>Motion Resolution</b>      | 14-bit  | 14-bit (dongle) / 8-bit (BLE)                   | 14-bit BLE                                      |
| <b>Sensor Material</b>        | Semi dry polymer                                | Semi dry polymer                                | Semi dry polymer                                |

# Regulatory Compliance

**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.**

The EMOTIV INSIGHT has been tested for EMC and Safety compliance as a consumer product against FCC, UL and CE standards.

FCC ID Number **2ADIH-INSIGHT02** and IC ID Number: **12769A-INSIGHT02**.

EMOTIV has undertaken testing and confirms:

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

## FCC

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference
- 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 causes 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

#### **FCC RF Exposure warning statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance.

#### **ISED**

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.

#### **ISED Radiation Exposure Statements**

[English] Radiation Exposure Statement: This equipment complies with the IC RSS-102 radiation exposure limits set forth for an uncontrolled environment.

[French] Énoncé d'exposition aux rayonnements: Cet équipement est conforme aux limites d'exposition aux rayonnements ioniques RSS-102 Pour un environnement incontrôlé.

**Please note that the changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.**

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## Quick Start

# Package Contents

Please remove the outer shipping box. Once you open, you will see the INSIGHT travel case and sleeve as shown below.



Remove the travel case from the sleeve by pushing the handle through the sleeve and then sliding the cardboard sleeve off the case. Unzip the case and you will see the following.



INSIGHT travel case open

In the top zippered section of the case, you will find the sensor pack, USB charge cable and a universal USB dongle. At the bottom, you have the headset and the removable headband which clips together as shown below.



# Setup

Setting up INSIGHT is very quick and easy. The sensors are made from a semi-dry polymer. If they are not in use, they should be kept in the sensor holder in the zip lock bag. For ease of setup, we have fitted the sensors for T7 and the reference arm and covered these with a protective film. Please remove the plastic film.



INSIGHT headset inner face with protective film as shipped

Please locate the sensor pack as shown below.



INSIGHT Sensor Pack contents

- Sensor holder has
  - 4 x Standard sensor
  - 1 x Three Prong sensor
  - 1 x T7 gummy
  - 2 x reference gummy
- Primer fluid bottle
- Allen key for reference and T7 covers



The sensor pack has an extra sensor, for users with thick hair, we recommend to use the three prong sensor. This is designed to have a better hair penetration and recommended to be fitted to the short arm Pz. Please keep the spare sensors within the sensor pack to ensure they do not dry out. Please fit the sensors to the headset as shown below.



Assembled INSIGHT headset

Before each use, we recommend that you prime the sensors with a small amount of fluid so that they are not dry.



The headset is turned on by pressing the power switch which is located between Pz and the headband; see the image below.



Power button

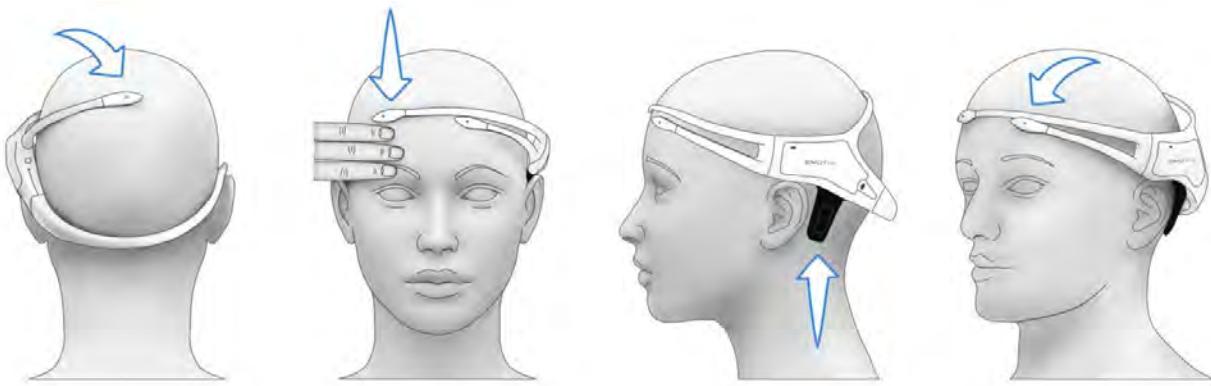
When the unit is on, the white indicator light turns on, its location is shown below. The headset can now be connected to the enclosed dongle or paired to your device via Bluetooth Low Energy (BLE) and it will start to stream data.



Power LED location

# Fitting the headset

Before fitting your headset, please add primer fluid from the sensor pack onto each of the five sensors and both references. Turn on the headset, ensuring the white LED on the front lights and connect it via BLE or to a USB dongle prior to fitting onto the head.



Fitting the INSIGHT

Gently slide the headset onto the head. The reference sensors, which are on the black arm, should make contact with the skin behind the ear. If necessary, gently bend the reference sensor arm so that the sensors make contact with the skin. The frontal sensors should be positioned about three finger widths above the eyebrows. Below are some shots of the placement for Pz, with the three prong gummy slide it back and forth to work the sensors through the hair to make contact with the scalp.





# Adjusting the headband



INSIGHT headset

The long arm is referred to as the headband and it is manufactured to fit a wide variety of head sizes. The arm is angled inwards so that the sensor when fitted is making contact with the T8 location and not the plastic arm. The headband can be adjusted for users with bigger heads where the shipped headband is not comfortable. This can be done at home using a hairdryer. The arm is made from two separate layers of plastic but can be adjusted by warming the plastic with a hairdryer until it becomes pliable and allows you to slowly adjust the headband and they both need to be warm or it could separate while adjustment.

Please do not try to bend when cold or the plastic could crack.

This method can be used on any of the arms if you feel they aren't making good contact onto the head.

## Tips and Tricks

# Obtaining Good Contact Quality

Placement of the reference arm is critical for successful operation. The reference arm is the black tab which sits directly behind the left ear. The arm is designed to bend and may be positioned to suit the user. The two sensors on the reference arm must make contact with the patch of bare skin directly behind the ear. The sensor should be positioned so that it follows the angle of the rear of the ear, sits flat and parallel on the skin and has light, but definite pressure so that it is not displaced by moving the head.

As the Insight sensors establish and maintain contact, it may take a minute or so for the signal quality to stabilize. If sensor indicators remain red or black, check that the sensors are making comfortable but firm contact with the scalp. Try parting the hair or gently working the sensor underneath the hair. Press and hold the sensor against the scalp for a few seconds to establish a better quality contact. If the contact quality does not improve, try moistening the sensor with the rehydration solution.

Although the majority of indicator lights are green, the detections will usually tolerate input if a few sensors are orange or red, even with one or two black sensors depending on the detection and which sensors are missing. Adjust the reference sensors so that their indicator lights are green.

# Charging

Plug the cable into the Insight (see photo below) ensuring the connector is fully inserted. Attach the cable to an active USB port on your PC or charger. There is a red and green LED located below the power button which will light orange when the charging and green when complete.



Charging Port & LED Indicator

Note the device requires 5V supply and it draws a maximum of 0.5 A from the charge port. If it is plugged into a USB port on your PC, the Insight will check for the maximum available current from the port up to a limit of 0.5 A. Note that if the port does not support extended power mode, Insight will draw 0.1 A and it will charge much more slowly. Try a different USB port if Insight takes more than 2 hours to reach full charge.