Electroencephalography (EEG)
Sensor Data Sheet

EEG 190918

SPECIFICATIONS

> **Gain:** 40000
> **Range:** ±41.25µV (with VCC = 3.3V)
> **Bandwidth:** 0.8-48Hz
> **Consumption:** ~3mA
> **Input Voltage Range:** 1.8-5.5V
> **Input Impedance:** >100GOhm
> **CMRR:** 100dB

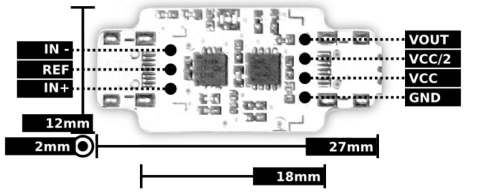

Fig. 1. Pin-out and physical dimensions.

FEATURES

> Single-channel sensor
> Bipolar differential measurement
> Pre-conditioned analog output
> Small form factor
> Raw data output
> Easy-to-use

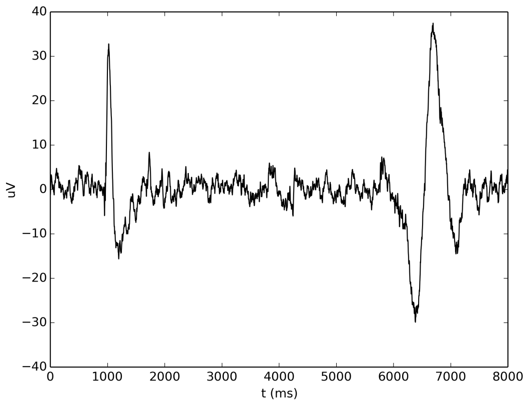

Fig. 2. Typical raw EEG data (acquired with BITalino (r)evolution) showing the influence of eye blinking (left spike) and eye movement (right spike).

APPLICATIONS

> Human-Computer Interaction
> Evoked potentials analysis
> Neurofeedback
> Sleep studies
> Neurophysiology studies
> Psychophysiology
> Biomedical devices prototyping

GENERAL DESCRIPTION

Our electroencephalography (EEG) sensor has been especially designed for both classic and localized EEG measurement. When a cap is too intrusive, only a limited number of channels are needed, or you want synchronous recording of EEG and non-EEG biosignals, this is the perfect solution. The bipolar configuration, with two measurement electrodes detects the electrical potentials in the specific scalp region with respect to a reference electrode (placed in a region of low muscular activity). The resulting signal is the amplified difference between these two leads, eliminating the common unwanted signals. Its convenient form factor enables a discrete placement in regions such as the forehead, occipital, and others.

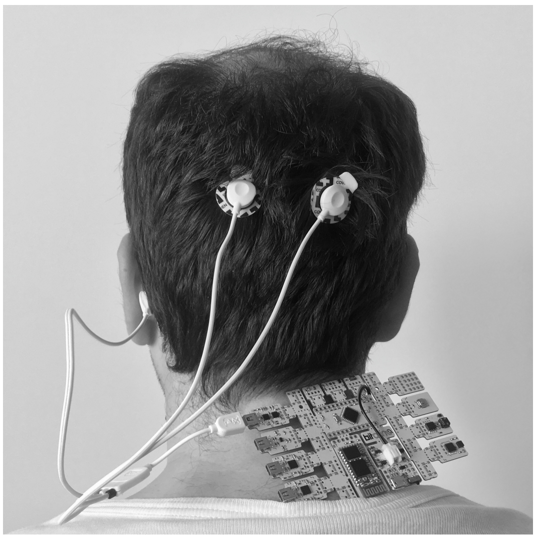

Fig. 3. Example sensor placement for localized EEG.

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REV A

BEWARE: DIRECT OR INDIRECT COUPLING TO THE MAINS MAY RESULT IN SHOCKING HAZARD

ELECTRODE PLACEMENT WITH DEFAULT ACCESSORIES

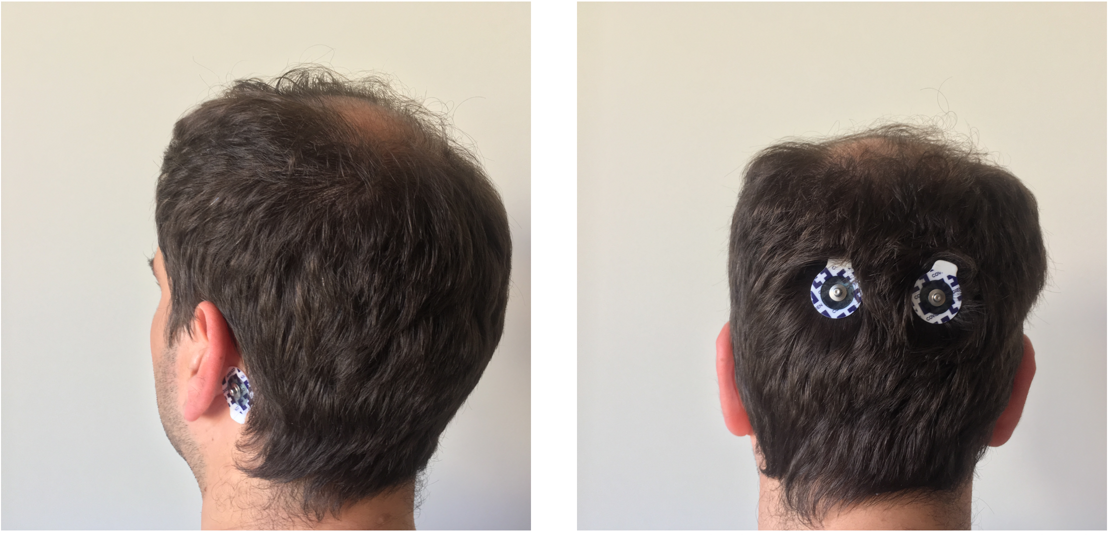

Fig. 4. Reference electrode placement on an electrically neutral location (left) and measurement electrodes (right) placed over the location of interest (the inter-electrode distance should not exceed 3 cm).

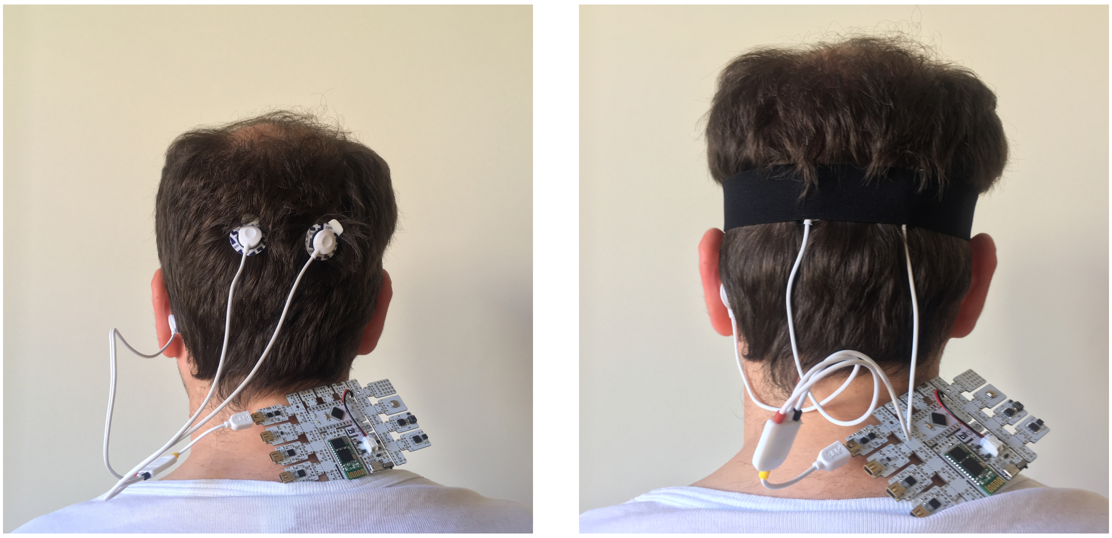

Fig. 5. The default accessories may suffice (left), but compressing the electrodes against the scalp (right) is advised (e.g. with a swim cap or elastic band), otherwise an adequate skin-electrode interface may not be achieved.

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RECOMMENDED ELECTRODE PLACEMENT PROCEDURE

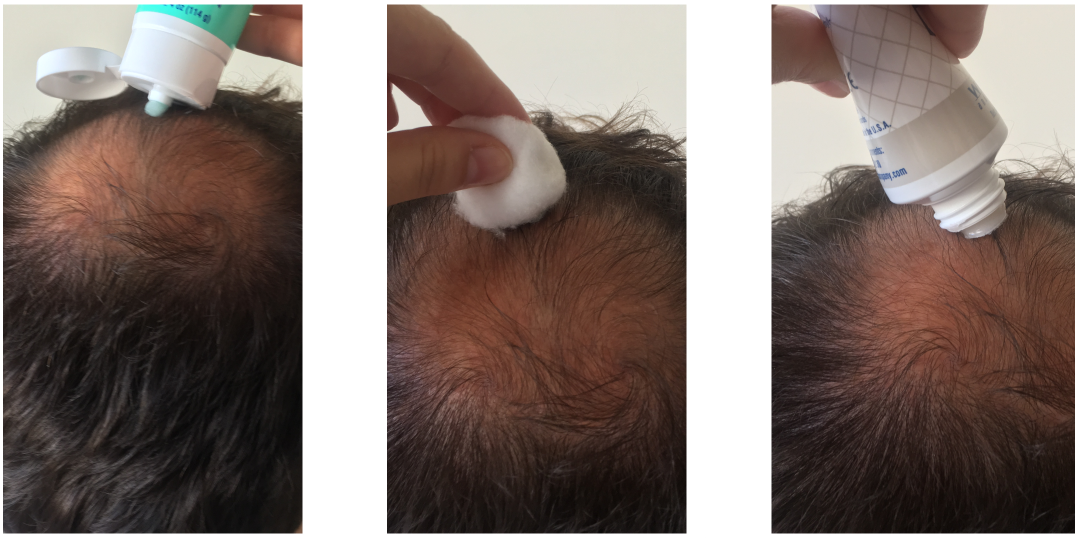

Fig. 6. Apply Nuprep skin preparation gel (left), exfoliate the scalp (center), and apply Ten20 conductive paste to improve the adhesiveness and conductivity... yes, bald spots are amazing for EEG ;)

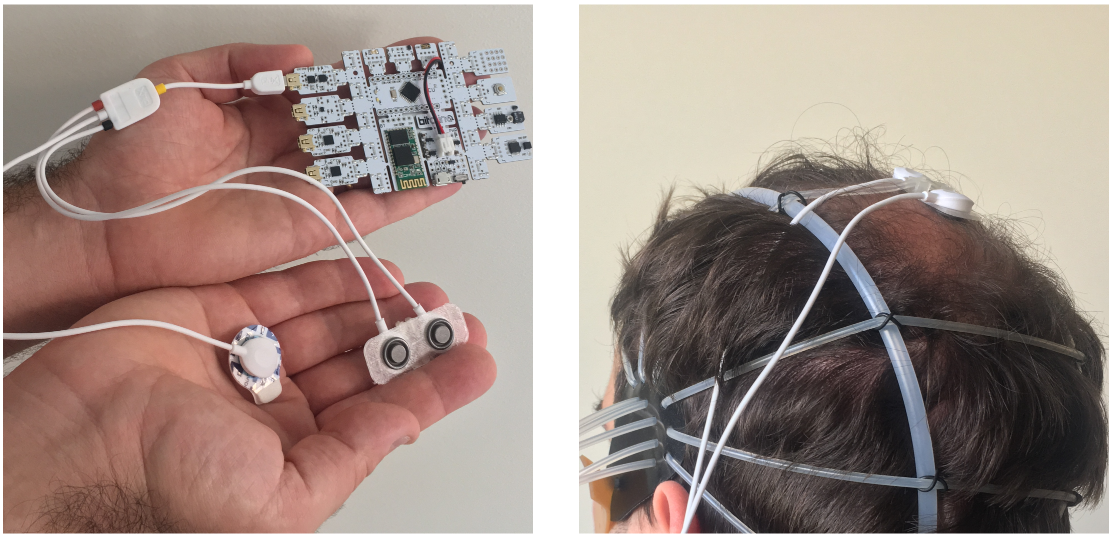

Fig. 7. Use non-gelled reusable Ag/AgCl electrodes and a 3D printed electrode holder for a consistent inter-electrode spacing (left); the electrode holder has a convenient slot to be used together with our adjustable silicon cap.

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WARNING

This sensor has a very high amplification gain, reason for which it is particularly sensitive to noise resulting electromagnetic and motion sources. For optimal performance, it is therefore recommended that data acquisition is done in an appropriate environment. Power supplies, lighting and other common household elements are prone to introduce parasite signals.

TRANSFER FUNCTION

[-41.25μV, 41.25μV]

$$EEG(V) = \frac{\left(\frac{ADC}{2^n} - \frac{1}{2}\right).VCC}{G_{EEG}}$$

$$EEG(\mu V) = EEG(V).1\times10^6$$

$VCC = 3.3V$ (operating voltage)
$G_{EEG} = 40000$ (sensor gain)

$EEG(V)$ – EEG value in Volt (V)
$EEG(\mu V)$ – EEG value in microvolt (μV)
ADC – Value sampled from the channel
n – Number of bits of the channel[1]

ORDERING GUIDE

Part #	Description
SENS-EEG-NC	Electroencephalography (EEG) sensor without connectors
SENS-EEG-UCE6	Electroencephalography (EEG) sensor with UC-E6 sockets on both sides for seamless plug & play connection to a BITalino (r)evolution Plugged or Core
SENS-EEG-SHER	Electroencephalography (EEG) sensor with a Molex Sherlock 4-pin socket on one side and a Molex Sherlock 3-pin socket on the other for easy power and signal cable connection or pin breakout using PCB wires

[1] The number of bits for each channel depends on the resolution of the Analog-to-Digital Converter (ADC); in BITalino the first four channels are sampled using 10-bit resolution ($n = 10$), while the last two may be sampled using 6-bit ($n = 6$).