

Electrocardiography (ECG) Sensor Data Sheet

ECG 151015

SPECIFICATIONS

- > **Gain:** 1100
- > **Range:** $\pm 1.5\text{mV}$ (with $V_{CC} = 3.3\text{V}$)
- > **Bandwidth:** 0.5-40Hz
- > **Consumption:** $\sim 4\text{mA}$
- > **Input Impedance:** 100GOhm
- > **CMRR:** 110dB
- > **Electrodes:** 3 or 2 (virtual REF)

FEATURES

- > Bipolar differential measurement
- > Pre-conditioned analog output
- > High signal-to-noise ratio
- > Small form factor
- > Raw data output
- > Easy-to-use
- > "On-the-person" and "off-the-person" use

APPLICATIONS

- > Heart rate & heart rate variability
- > Human-Computer Interaction
- > Biometrics
- > Affective computing
- > Physiology studies
- > Psychophysiology
- > Biofeedback
- > Biomedical devices prototyping

GENERAL DESCRIPTION

Heartbeats are triggered by bioelectrical signals of very low amplitude generated by a special set of cells in the heart (the SA node). Electrocardiography (ECG) enables the translation of these electrical signals into numerical values, enabling them to be used in a wide array of applications. Our sensor allow data acquisition not only at the chest ("on-the-person"), but also at the hand palms ("off-the-person"), and works both with pre-gelled and most types of dry electrodes. The bipolar configuration is ideal for low noise. Here are a few examples:

<http://vimeo.com/98075534h>

<https://www.youtube.com/watch?v=hQ3BUBV-BBMh>

<https://www.youtube.com/watch?v=IKWM2TL1toM>

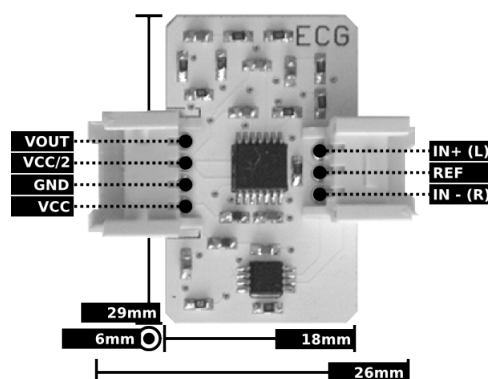


Fig. 1. Pin-out and physical dimensions.

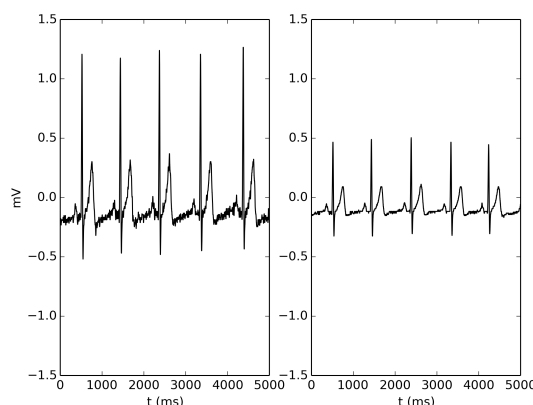


Fig. 2. Typical raw ECG data (acquired with BITalino) using 2 electrodes at the hands (left) and 3 electrodes at the chest (right).

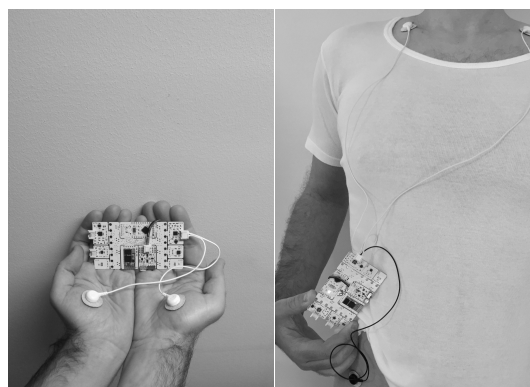


Fig. 3. Example of a 2 electrodes placement at the hands (left) and a 3 electrodes placement at the chest (right).

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REV A

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



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TRANSFER FUNCTION

$[-1.5mV, 1.5mV]$

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

$$ECG(mV) = ECG(V) \cdot 1000$$

$VCC = 3.3V$ (operating voltage)

$G_{ECG} = 1100$ (sensor gain)

$ECG(V)$ – ECG value in Volt (V)

$ECG(mV)$ – ECG value in millivolt (mV)

ADC – Value sampled from the channel

n – Number of bits of the channel¹

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 are sampled using 6-bit ($n = 6$).