

PHYSICAL ACTIVITY | TASK DESCRIPTION

The purpose of this technical note is to show a typical acquisition of an electrocardiogram.

An electrocardiogram (ECG) with 6m39s was recorded with a subject in an upright standing position. To assess the quality of the signal, the signal-to-noise ratio (SNR) was calculated.

SIGNAL CHARACTERISTICS

Typical Frequency Band:

- 0.5 to 100 Hz [Recommended]

SENSOR AND HARDWARE DESCRIPTION

There were used gelled self-adhesive disposable Ag/AgCl electrodes together with a single-lead local differential bipolar ECG sensor (Fig. 1).

SUBJECT DESCRIPTION

A 24-year-old male subject with no reported heart conditions (height: 1.70 m; weight: 75 kg - Fig. 2).

PROTOCOL OF ACQUISITION

The subject is comfortably sited before and during signal acquisition.

Steps enumeration:

1. Prepare the skin:
 - a. Use a razor to remove any hair from the skin where the electrodes will be placed;
 - b. Afterwards, rub the surface of the skin with an abrasive material;
 - c. Remove any dirtiness and fat from the skin surface with alcohol.
2. Place the electrodes in the V2 configuration of the 12-Lead ECG scheme (Fig. 3):
 - a. Positive electrode under the left nipple, near the interception of the 4th rib with the sternum;
 - b. Negative electrode over the left nipple, near the interception of the 4th rib with the sternum.

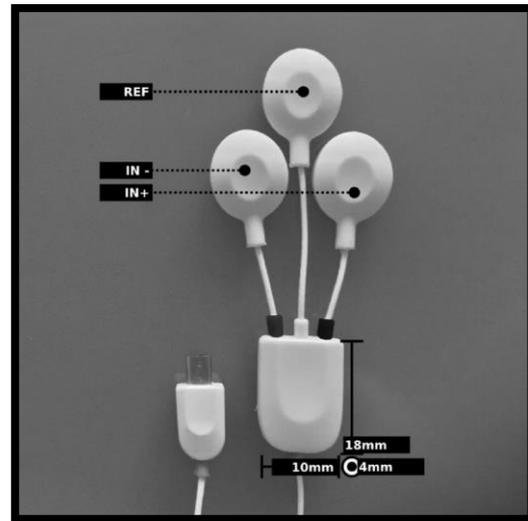


Fig. 1. Sensor Overview

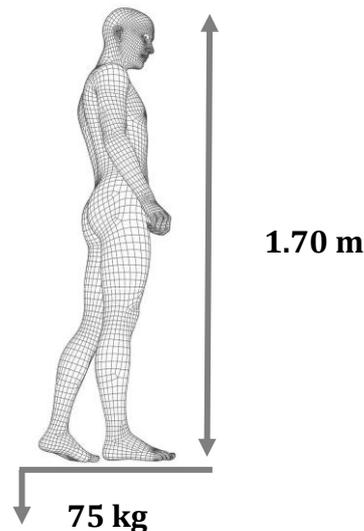


Fig. 2. Anthropometric Measures

3. Place the ground in a surface bone, like the ankle, the clavicle, or the sternum;
4. Stand in an upright position until receiving a new command from the supervisor (approximately 6m39s).



Fig. 3. Sensor Placement (V2 configuration)

NOISE EVALUATION PROCEDURE

Signal to Noise Ratio (SNR) is an important metric that classifies objectively the quality of the acquisition, and like the name suggests the relation between the intensity of the signal and the undesired noise in the acquired data (*acquired*), which is defined by:

$$SNR = \frac{V_{pp}^{signal}}{V_{pp}^{noise}} \quad (1)$$

being V_{pp}^{signal} and V_{pp}^{noise} the peak-to-peak amplitude of the *signal* and *noise* component, respectively.

To infer noise presence on the ECG signal, the signal-to-noise ratio (SNR) has been calculated with the following approach:

- 1) Measure the Peak to Peak Amplitude of the signal (V_{pp}^{signal});

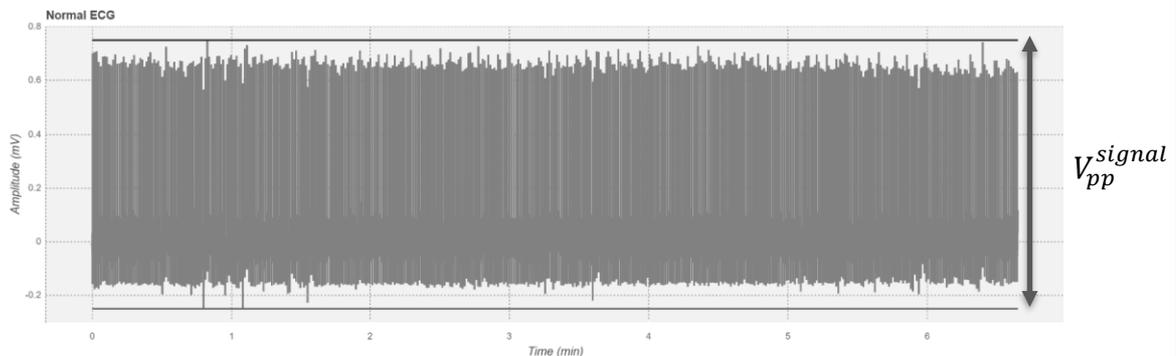


Fig. 4. ECG signal defining graphically the peak to peak amplitude (V_{pp}^{signal})

- 2) Measure the average peak-to-peak amplitude (V_{pp}^{noise}) from all the areas where there is no presence of ECG signal (Fig. 5);

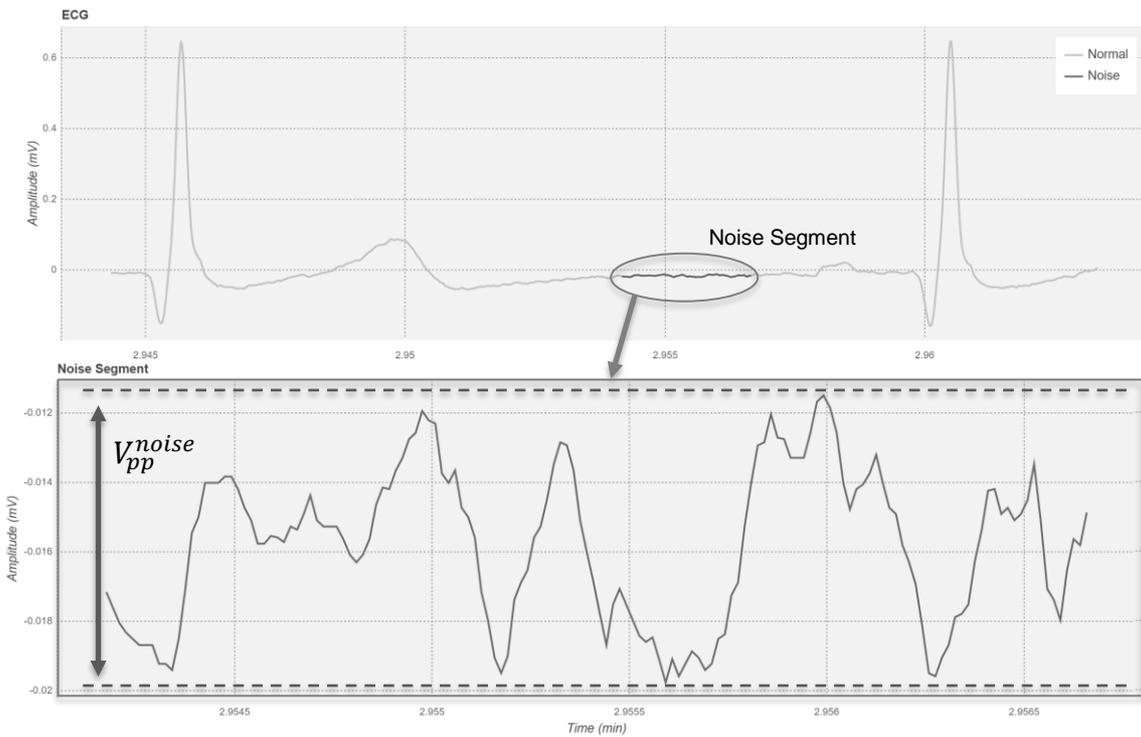


Fig. 5. Noise segment peak to peak amplitude (V_{pp}^{noise})

3) Calculate an estimate of SNR using the following formula:

$$SNR_{dB} = 20 \log_{10} \left(\frac{V_{pp}^{signal}}{V_{pp}^{noise}} \right) \quad (2)$$

For this example, the SNR value (taking into account the previous representative window) was approximately **42 dB**.