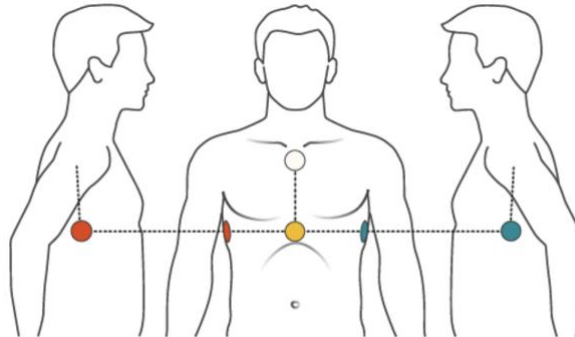


Electrode Permutation

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1. Electrode Positioning

CardioSecur operates correctly **only if** the electrodes are positioned on the patient's thorax according to the following diagram:



White electrode: at the **upper** end of the sternum (on the bone!)

Yellow electrode: at the **lower** end of the sternum (on the bone!)

Red electrode: in the middle of the **right axillae** taking the **patient's perspective**, at the same level as the yellow electrode.

Green electrode: in the middle of the **left axillae** taking the **patient's perspective**, at the same level as the yellow electrode.

Placing all the electrodes correctly will provide a standard ECG (PQRST-wave) as shown in fig 1.1.

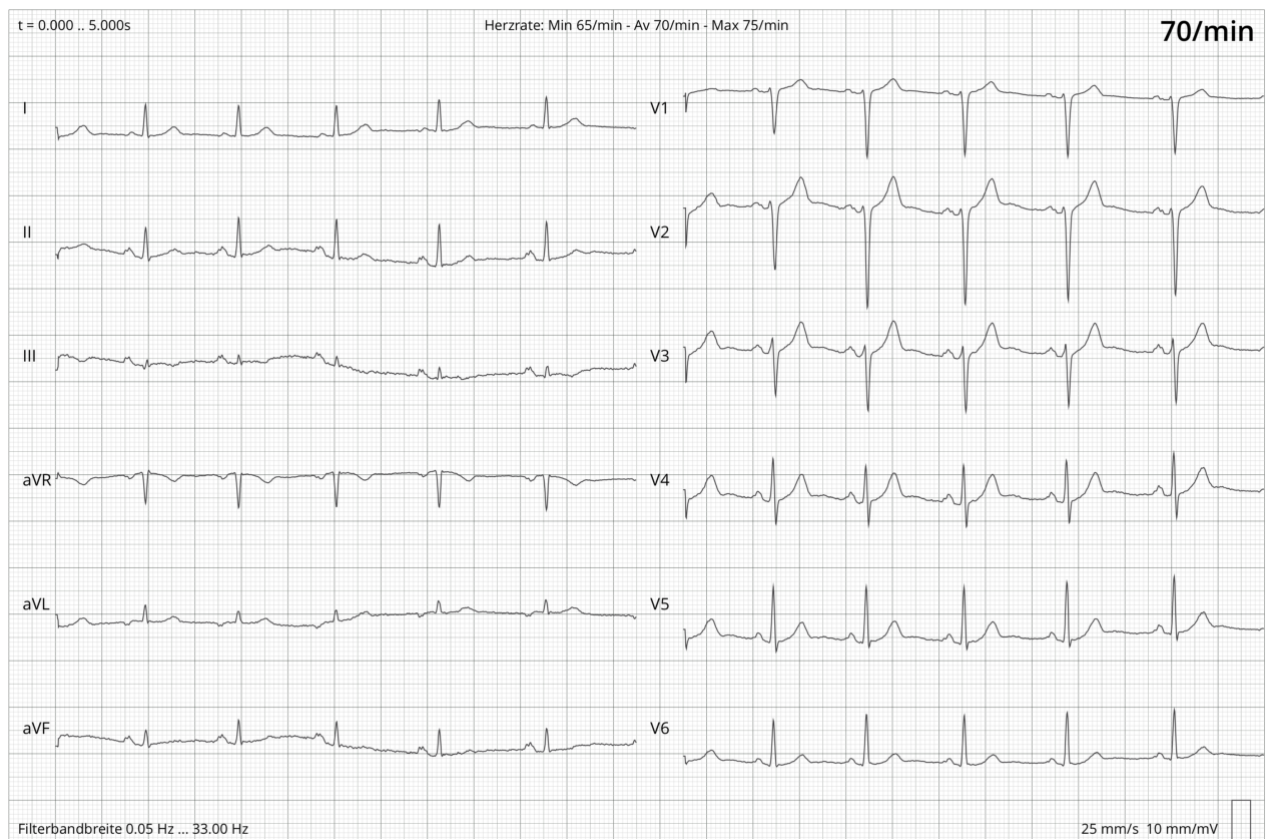


Figure 1.1: Normal ECG of correctly positioned electrodes

2. Identifying false electrode positioning

Interchanging the position of electrodes (permutation) will affect the obtained ECG and show a false picture. In fact, from the alterations observed in the PQRST waves, the mispositioning can be identified and should be corrected. The following cases illustrate mispositioning:

Case 1: Interchanging the **red and green** electrodes only

If the green and red electrode are interchanged while the white and yellow electrodes are correctly placed on the sternum, the R-wave of lead I is affected. The R-wave appears with a negative value (see fig. 1.2). The second consequence of falsely interchanging the red and green electrode is the missing R-wave progression in the chest leads.

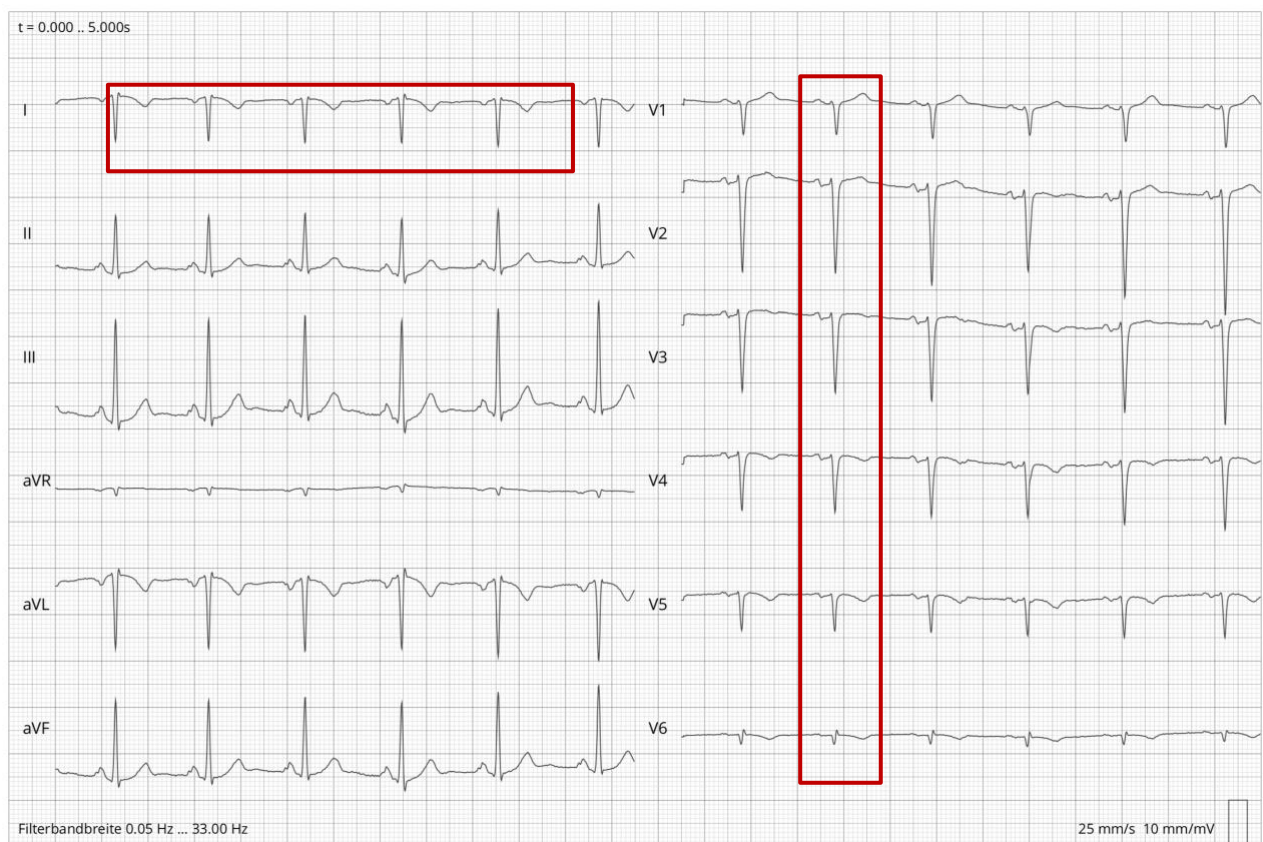


Figure 1.2: Case 1 ECG featuring negative R-wave

Case 2: Interchanging the white and yellow electrode only

If the white and yellow electrodes are interchanged the T-wave of the ECG is affected. It appears as a negative wave in leads I, II and aVF (see fig. 1.3), while no particular change occurs in the rest of the leads.

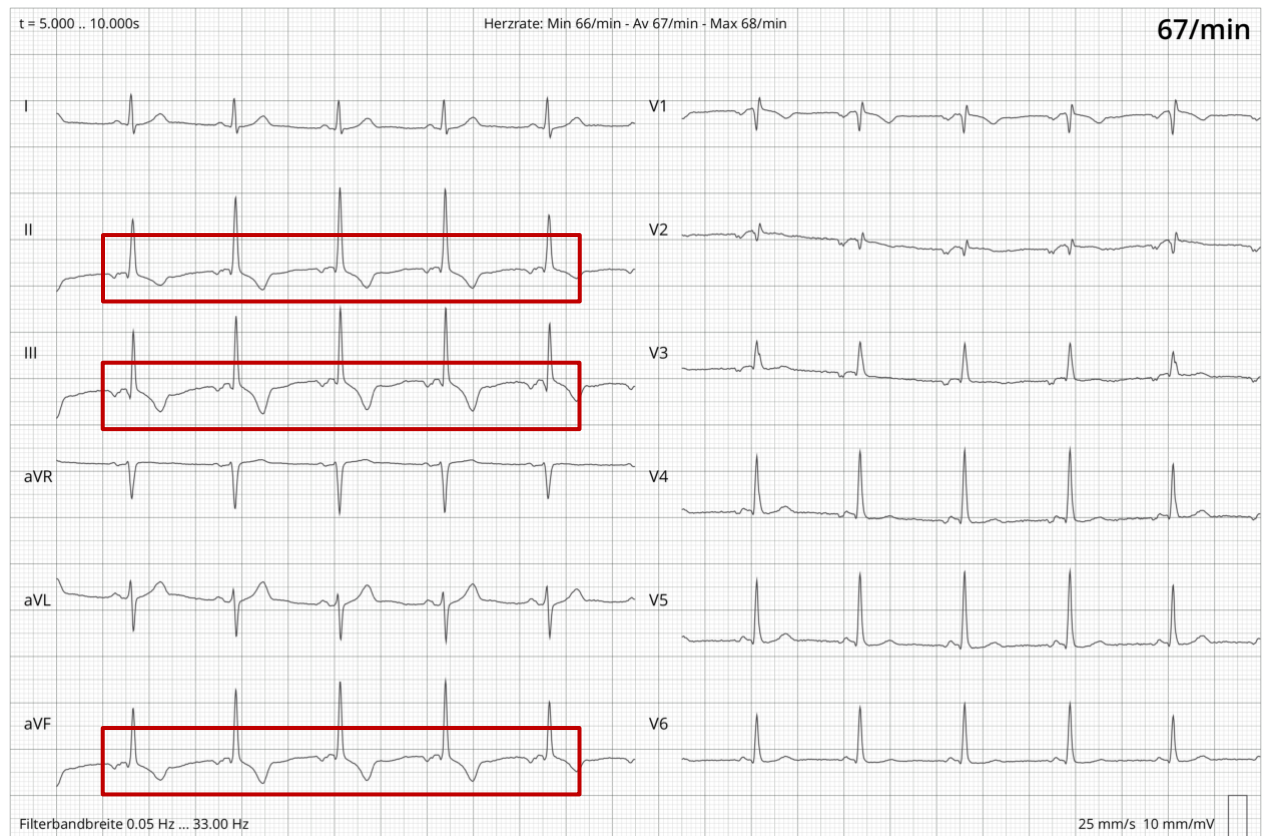


Figure 1.3: Case 2 ECG featuring negative T-wave

Case 3: Interchanging **all** electrode

When interchanging all electrodes (**red with green** and **white with yellow**) the R-wave is affected by appearing negative in lead I. The T-wave also appears negative in the chest leads, as well as the R-wave and the P-wave.

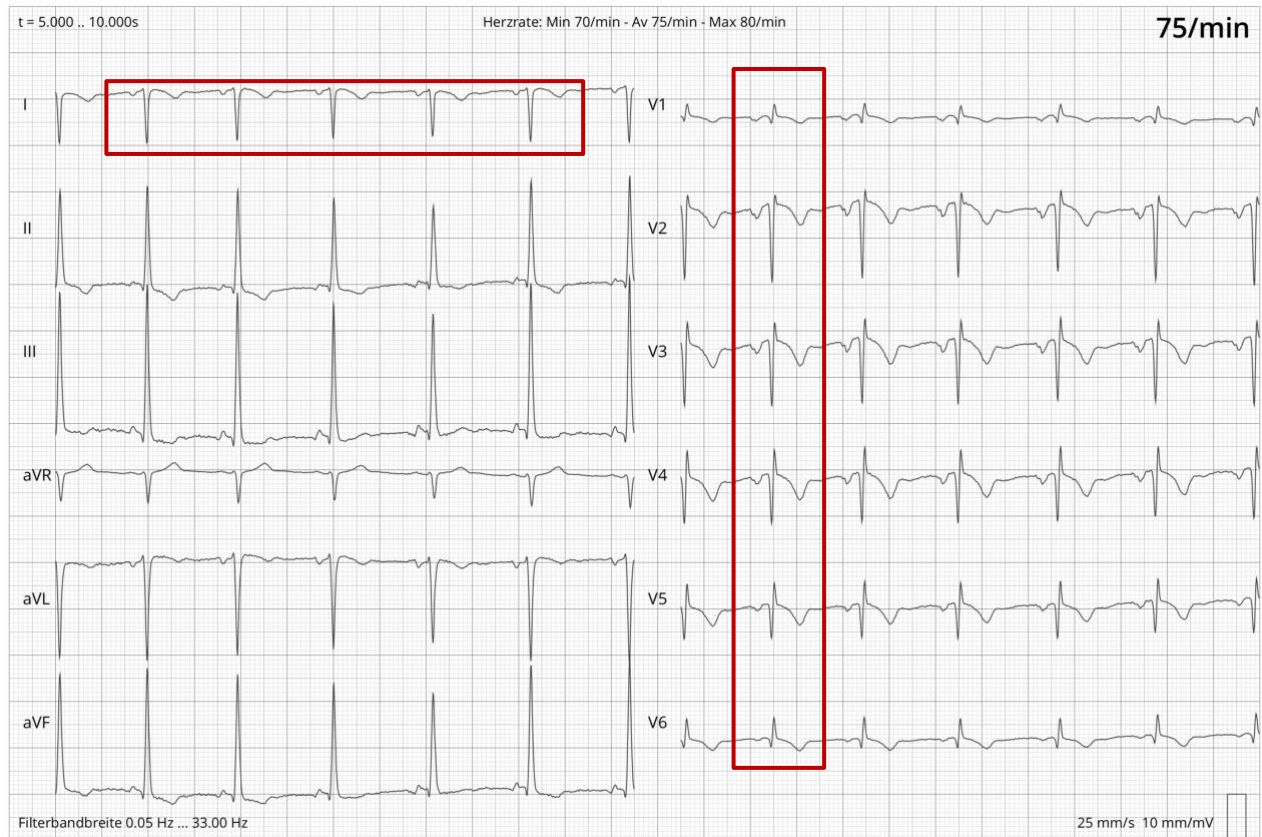


Figure 1.4 : Case 3 ECG featuring negative T and R waves

Please ensure at all times that electrodes are positioned correctly according to the CardioSecur instructions as given **above**, in the **user manual** or the **app menu** point "Intended Use".

For optimal signal quality also ensure that only fresh **wet gel** electrodes are used as validated by CardioSecur.