

Peripheral biosignal measurements with Neurobit Optima device

Preface

This document includes supplemental information. It is assumed that a user has got basic knowledge regarding planned physiological measurements, as well as has read:

- Neurobit Optima instruction manual,
- instructions attached to working materials and accessories (electrodes etc.),
- introduction to use of a selected software application.

Application of EEG electrodes is described in a separate document.

Neurobit Optima device has got versatile measurement channels. Each of them can be used to measure any modality (signal type) accessible for the unit. Channel function is specified in device settings window.

Sets of example designs of data processing and presentation for several software applications can be found in the *Designs* folder on CD delivered with the equipment.

The following picture shows an example of connection of snap electrode wires (product # 206012) to channel A. It can be used for trials with several modalities described later.



HR/HRV

Heart rate and heart rate variability is detected based on electrocardiogram (ECG). This signal is measured using:

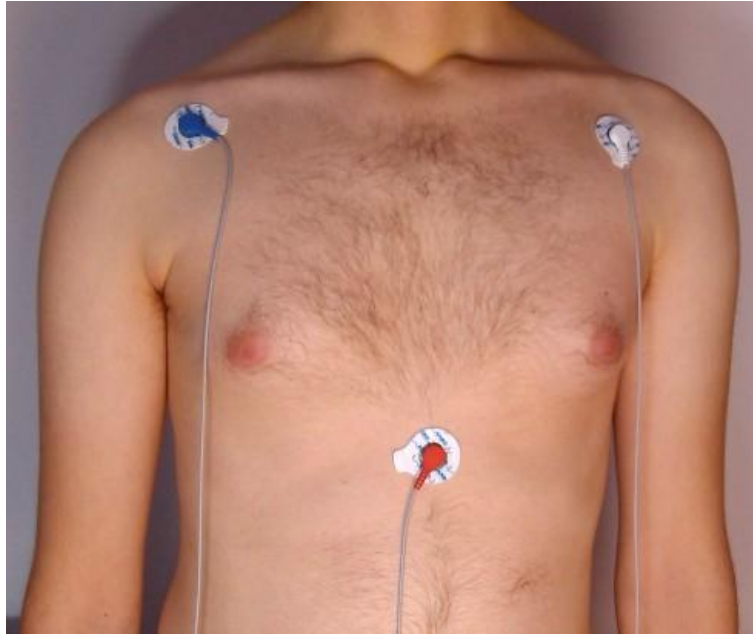
- self-adhesive, disposable electrodes, not requiring application of gel (for example product # 201046),



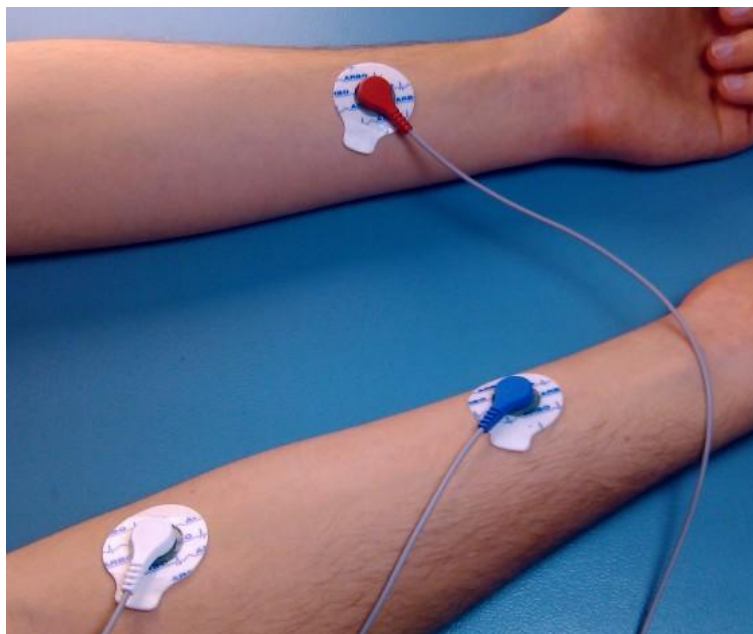
- electrode wires with snaps (e.g. product # 206010 or 206012).

Connection of the electrodes:

- “+” input of a selected channel: the electrode is applied in the vicinity of xiphoid process (lower end of the sternum);
- “-” input of the same channel: the electrode is placed on the front surface of the right shoulder;
- VG: the third electrode can be placed in any convenient body site, for example on the front surface of the left shoulder.

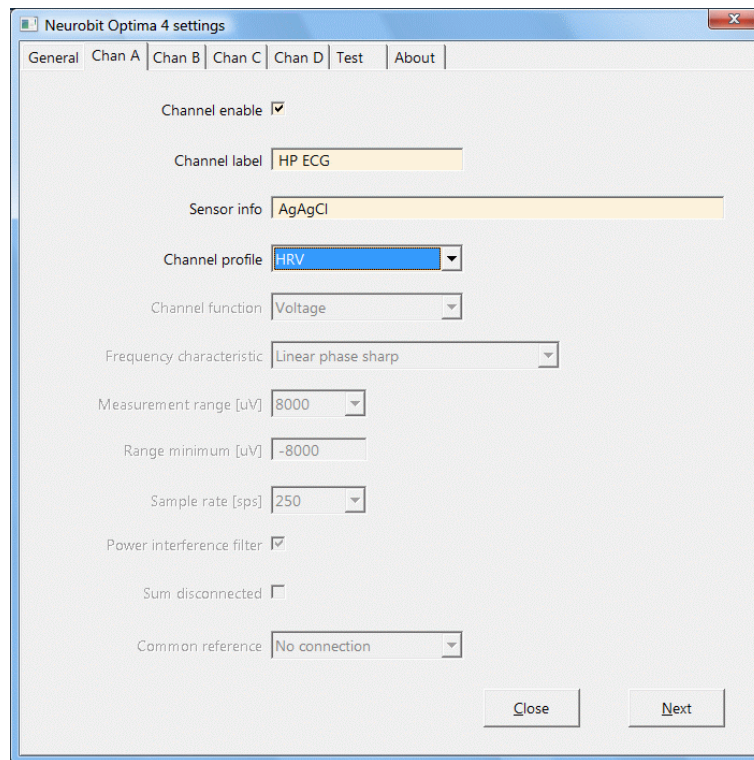


Alternatively, electrodes can be placed correspondingly on the left forearm, the right forearm and the right forearm.



Peripheral biosignal measurements

Selected measurement channel should be enabled and HRV profile should be selected on tab of the channel in the device settings window.



The next picture shows an example screenshot for HRV measurement.



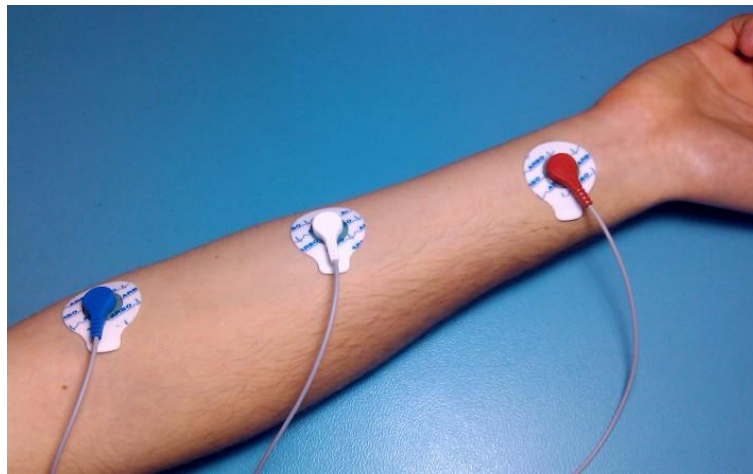
EMG

Electrical activity of muscles is measured using:

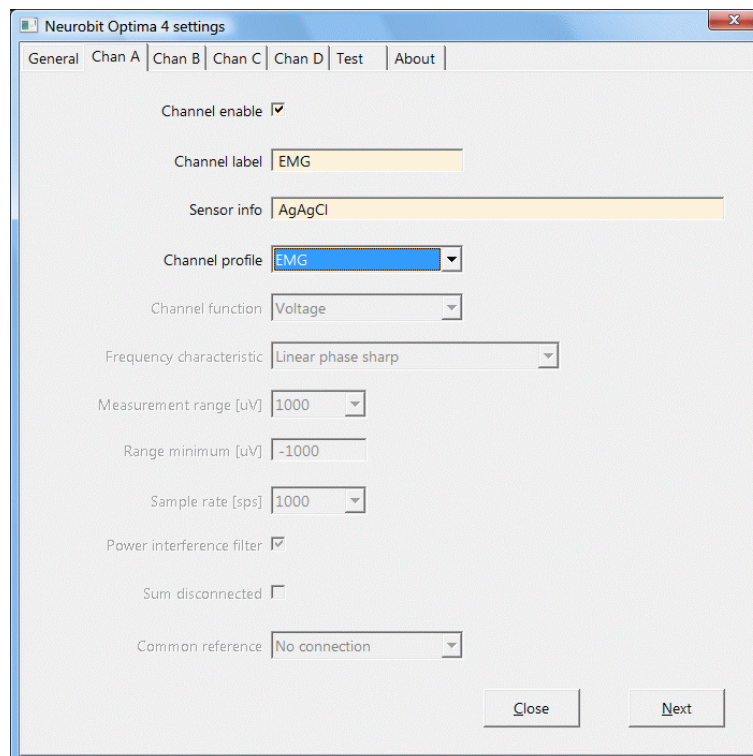
- electrode wires with snaps (e.g. product # 206010 or 206012) and
- self-adhesive, disposable electrodes, not requiring application of gel. They may be the same electrodes, as used for ECG (product # 201046).

The measurement can be one- or multi-channel and use any channels of the device (according to configuration in the device settings window). Electrode connections:

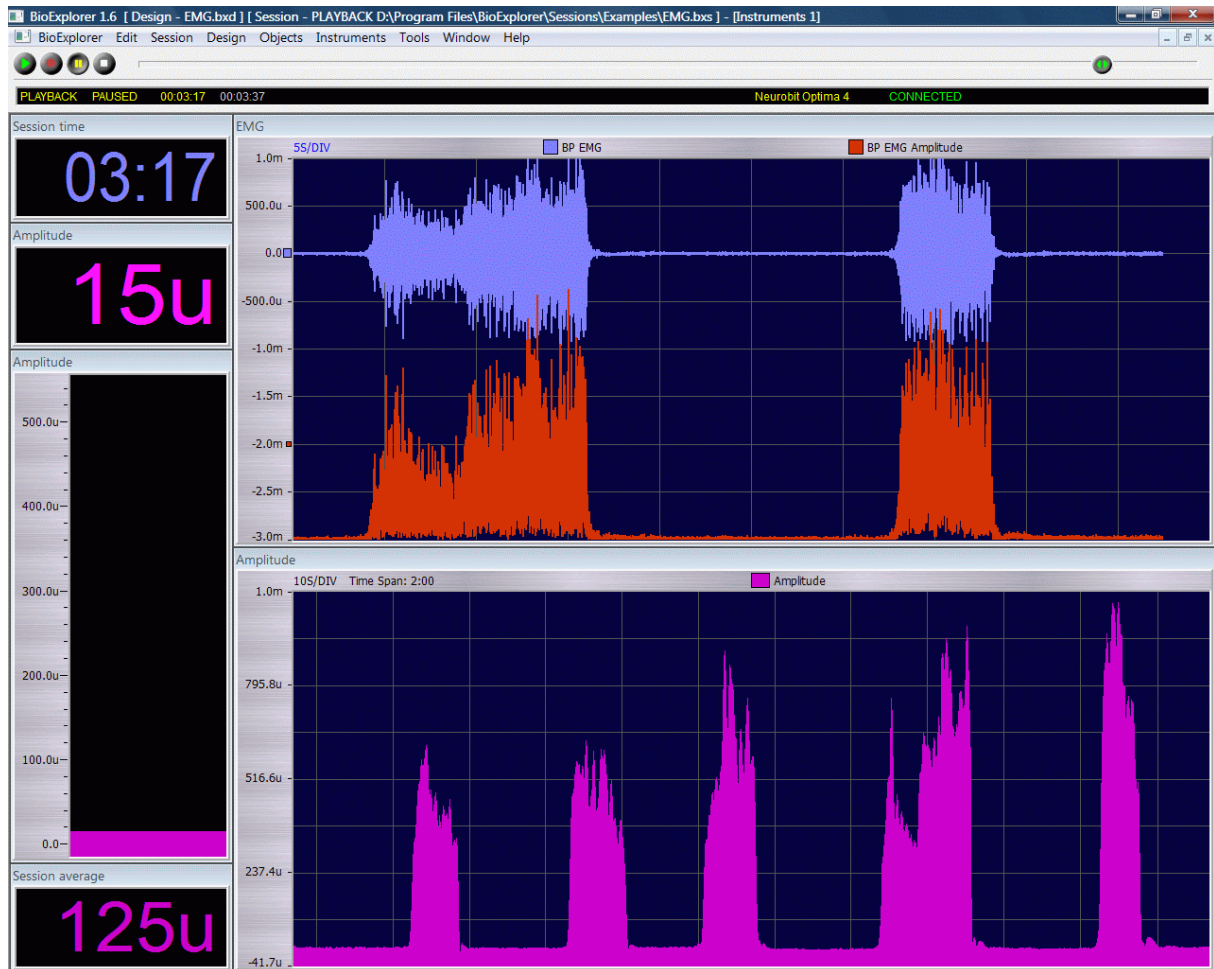
- “+” and “-” inputs of selected channel: electrodes placed on the skin at both ends of selected muscle.
- VG port: electrode can be placed in the middle of the muscle length (if it is over 10 cm) or in any convenient site of the body (apart from the vicinity of heart).



Selected measurement channel should be enabled and EMG profile should be selected on tab of the channel in the device settings window.



The next picture shows an example screenshot for EMG measurement.



GSR

Galvanic skin response is measured using:

- 3 reusable velcro electrodes (e.g. product # 201030) , without paste/gel;



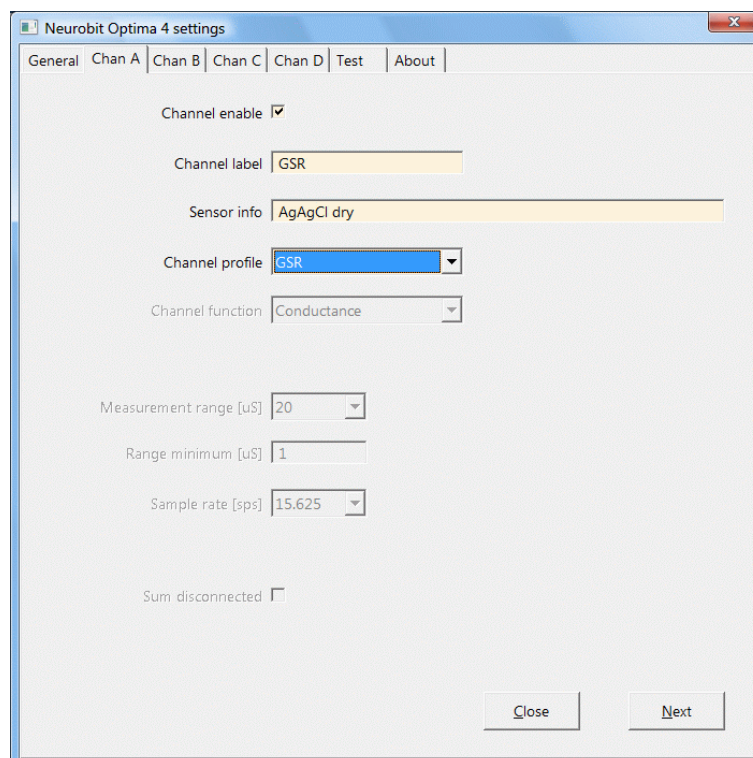
- electrode wires with snaps (e.g. product # 206010 or 206012).

Connection of the electrodes:

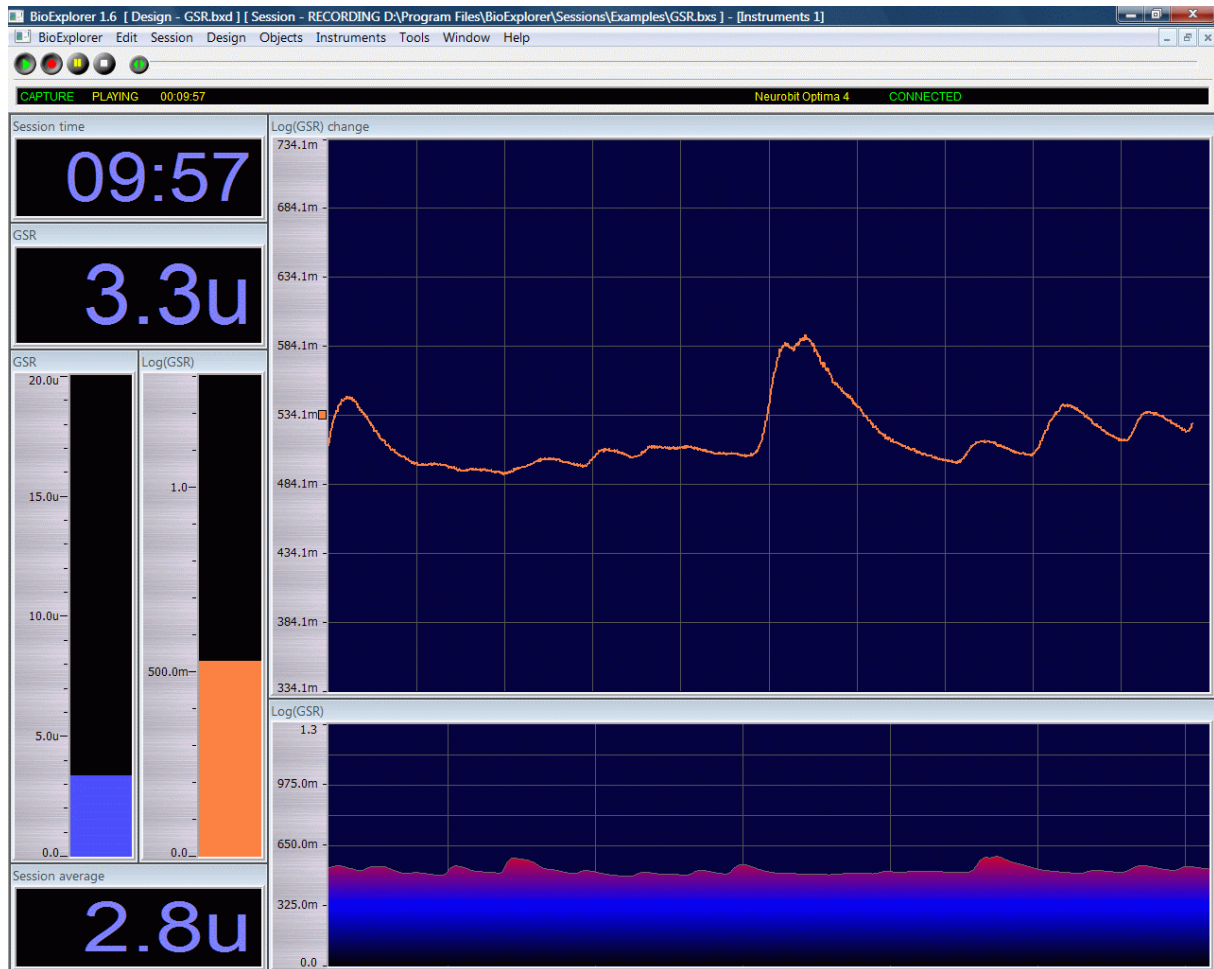
- “+” and “-” inputs of selected channel: electrodes should be placed on volar surface of fingertips (usually index and middle fingers of non-dominating hand) without paste or gel.
- VG port: electrode can be placed on the ring finger.



Selected measurement channel should be enabled and GSR profile should be selected on tab of the channel in the device settings window.



The next image shows an example screenshot for GSR measurement.



TEMP

Skin temperature is measured with a precise thermistor probe (product # 201050). Its connection:

- “+” and “-” inputs of selected channel: dark wires of the sensor;
- SH: gray wire.

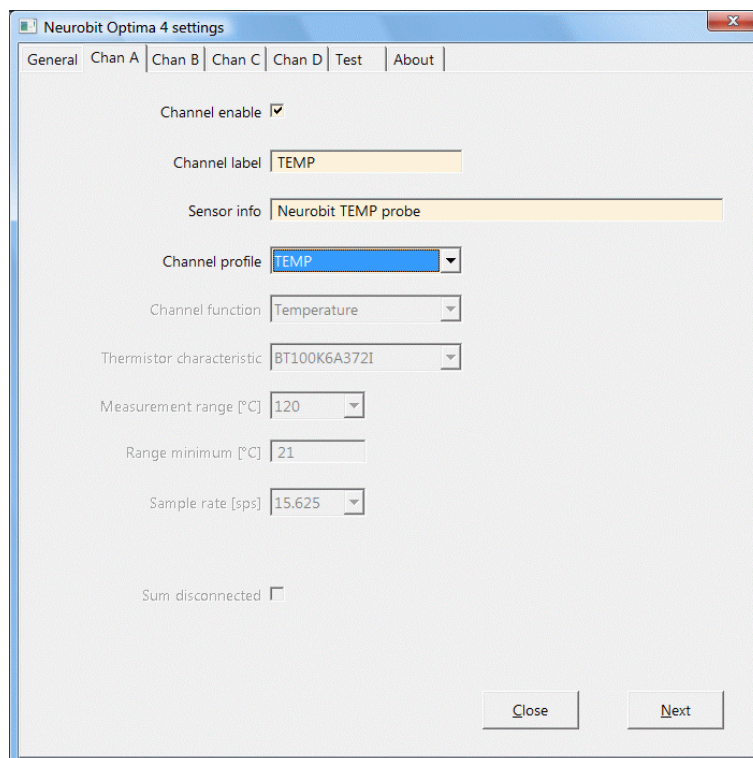
The next picture shows connection of the TEMP sensor to channel A.



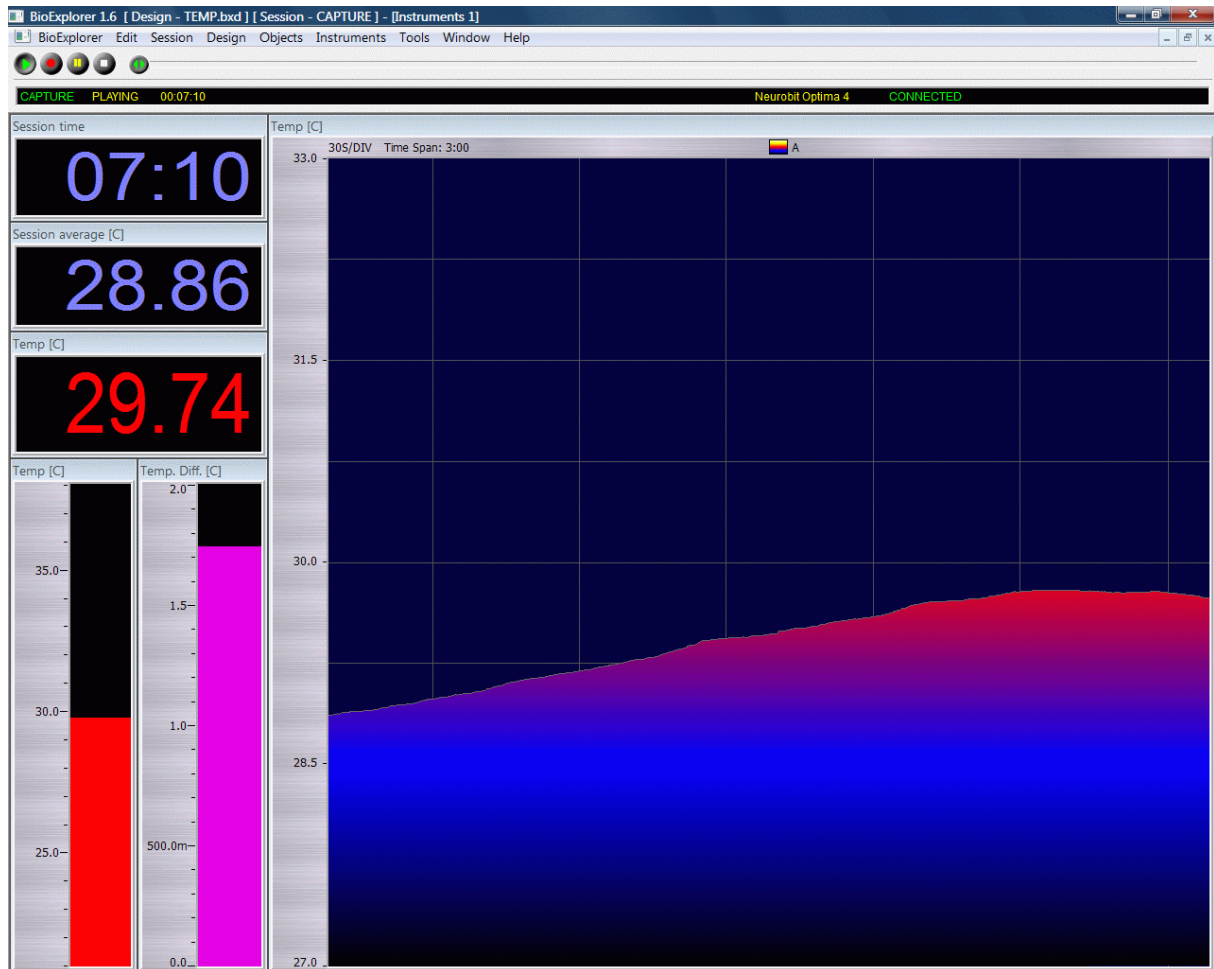
Temperature sensor is attached to one of the fingers. Typically the probe tip is taped on the dorsal side of a finger with hook & loop strip (soft side of the strip inwards). The tip should stick out of the strip a little (1-2mm). The strip should not grip the finger too much (it would limit blood circulation and lower the temperature).



Selected measurement channel should be enabled and TEMP profile should be selected on tab of the channel in the device settings window.



The next picture shows an example screenshot for skin temperature measurement.



Breath

The same temperature sensor can be also used to monitor breathing rhythm, based on temperature changes of exhaled and inhaled air. In this application the sensor is stuck under the nose, as shown on the next picture.



The following image depicts the measured signal. Temperature increases during exhalation, and drops after its end.



Final hints

- In cases, when electrodes are connected to several channels, any one connection of VG port to the body suffices. For example, for simultaneous measurement of HRV and GSR it suffices to connect VG to ECG electrode (on shoulder or forearm), and GSR electrode on the ring finger is not required.
- Measurement channels, which currently are not used, should be disabled (in the device settings window).
- BioExplorer software (ver. 1.6) does not save configuration of Neurobit Optima measurement channels in design files of data processing and presentation (*.bxd). For this reason, after opening of a design, which uses different modalities or different number of device channels, than so far, channel settings should be suitably modified (BioExplorer/Devices/Neurobit Optima*/Properties/"Optima Config Window").
In order to make such modifications easier, it is possible to save frequently used device settings (e.g. for HRV, EMG etc.) at the beginning, using Save button in the device settings window. In the future the settings can be quickly restored with Load button in the same window.
- BioExplorer software (ver. 1.6) requires that sub(set) of enabled channels includes subsequent channels starting from A, i.e. for example {A} or {A, B} or {A, B, C}, but not e.g. {B, D}.