

# The use of BioEra software with Neurobit devices.

## Quick start v 2.4

*For version 2.3.102 of the application.*

### Setup

1. Neurobit equipment wirelessly transmits data to a computer (Neurobit Optima uses Bluetooth standard, and Neurobit Lite uses IrDA link). If your computer is not equipped with appropriate built-in wireless port, suitable adapter for USB port is required. Necessary drivers are installed according to the adapter manual.
2. If you have got Neurobit Optima device, it should be paired (added to the list of Bluetooth devices configured to work) with your computer. If you have not completed this step yet, please follow the instruction in the manual of the device.
3. Install BioEra application delivered in USB license key or downloaded from its manufacturer website (<http://www.proatech.com/>). During the setup proceed in accordance with messages showing on the screen. After setup of a full version it may be necessary to install its newer update.

4. Upgrade Neurobit Driver used by BioEra:

[http://www.neurobitsystems.com/download/Neurobit\\_Runtime-versions.htm](http://www.neurobitsystems.com/download/Neurobit_Runtime-versions.htm)

Unpack the downloaded archive to drivers\neurobit subfolder of the main BioEra folder (overwriting existing files). The application should not be running during this step.

5. For users of earlier BioEra versions: IrComm2k driver required so far for Neurobit Lite devices is no longer used. If you have installed that driver, uninstall it completely from your system to avoid possible problems.

Note that Neurobit element of BioEra (and properties of Neurobit devices in DeviceSet element) has changed. Adjustment of existing BioEra designs for Neurobit Lite device may be necessary.

### Preparation to session

1. Place Neurobit device in the wireless communication range. Apply EEG electrodes and turn on the unit (however, for Neurobit Lite device do not use Start! command from the device's menu).
2. If you have a hardware license key of the software, it should be connected to USB port of the computer.

Launch BioEra application (choose "BioEra Pro" program in folder "BioEra Pro" of the Windows Start menu). The application will start with some default design.

(BioEra designs are block diagrams, which define signal processing and presentation. In the future you can modify example designs or create your own ones according to your needs.)

3. When you are launching BioEra the first time, it has set a Simulator as a signal source. It enables to test BioEra designs even without physical measurement device. In order to start real measurements or training it is necessary to switch signal source to Neurobit device. To do this, in Tools menu of the application choose „Device selection - manual“. Then, in appearing window, on Settings tab, in Source field select Neurobit instead of Simulator. Click Apply button.
4. In the “Device selection” window, on “Neurobit settings” tab select used Neurobit device model and click “Open” button.

In the device settings window of Neurobit Driver you can configure the device. For Neurobit Lite you can leave default settings at the beginning. For Neurobit Optima you should at least turn on measurement channels, which will be used (“Channel enable” fields on tabs of individual channels). By default Neurobit Optima channels are set for EEG measurements; if you wish to measure other signals (EMG, HRV etc.), you can select suitable “Channel profile” on a given channel tab. More information about device settings can be found in its manual or in Neurobit Driver help available on About tab of the window. When device configuration is completed, click Close button at the bottom of the window.

Click OK button at the bottom of the “Device selection” window and save the design with menu option System/Save.

By default the new signal source will apply to all next designs (as long as you do not change the source).

Hint: In order to test designs (for example playing video files and DVD described later) you can select again Simulation source at any time with the option „Tools/Device selection - manual“.

## Session with example design

1. Using BioEra menu option “System/Load design”, load one of predefined BioEra designs, for example design\examples\OneRewardMIDI.bpd (path in directory where BioEra was installed). In this design a level of brainwaves in selected frequency band (3 Hz wide) controls sound synthesizer. Move “Reward filter” slider at the bottom of BioEra runtime window to the right end in order to set the filter to 10 Hz - the middle of Alpha band, traditionally associated with relax.
2. Click “Start” button at the left upper corner of the window. Physical measurement should start. The device will indicate active data link to a computer. In the speakers/phones connected to audio output of the computer the feedback sounds should be played. Sound pitch is connected to amplitude of Alpha brainwaves (the higher Alpha the higher pitch). Apart from that, running graphs appear in the runtime window:
  - raw EEG signal at the top,
  - time course of Alpha amplitude in the middle and
  - 3-dimensional frequency spectrum of the EEG signal at the bottom (vertical axis of the spectrum graph corresponds to amplitude of individual wave components of the EEG, with frequencies given on the horizontal axis and time on “depth” axis.

(Session time and MIDI tone index are also displayed.)

3. If you need, you can change settings of processing or presentation elements, e.g.:
  - instrument playing feedback sounds (double click the “MIDI” element, select an item from the “Instrument” list and click “Apply” button to test the change),
  - tempo (double click “Tempo” element, set required period in “Time range” field (in milliseconds) and confirm with OK button).

After changes of element properties during session the measurement starts again.

You can save your changes with menu option “System/Save as”. Give a new file name or directory (to avoid rewriting of the original file).

When become skilled a little, you can modify the example block diagrams or build your own designs from scratch.

Another examples of data processing and presentation for biofeedback can be Pacman and Racer games controlled with EEG signal.

## Racer game

1. In BioEra menu choose command „System/Load design”, select project file design\examples\OneRewardOneInhibitRacerGame.bpd and click OK. The default source for this project is a demo file of measurement data. In order to view the game demo just click Start button under BioEra menu.
2. Running graphs will appear in the runtime window:
  - measured EEG signal (Oscilloscope graph at the top),
  - time course of level of rewarded brainwaves (green Reward graph on the left),
  - time course of level of inhibited brainwaves (red Inhibit graph on the right),
  - bars of current levels of both above brainwave bands (on the right), along with automatically changing thresholds of “reward” and “penalty” (horizontal lines). The bars are green when brainwaves in corresponding bands have desired levels (rewarded brainwaves (left bar) above the threshold, inhibited brainwaves (right bar) below the other threshold; otherwise bars are red.
  - 3-dimensional time-frequency distribution of EEG amplitudes (in the middle of the window). (Horizontal axis represents the frequency of measured brainwaves, vertical axis corresponds to the amplitude and depth represents time.)
  - sliders of “Reward filter” and “Inhibit filter”, which enable to set middle frequencies of rewarded and inhibited brainwave bands. By default, width of both bands is 3 Hz. For example, in order to choose rewarding of SMR waves in 12-15 Hz (middle frequency 13.5 Hz) and inhibition of Theta waves in 4.5-7.5 Hz (middle frequency 6.0 Hz) you should set the slider of “Reward filter” to 13.5 Hz, while “Inhibit filter” to 6.0 Hz. (Bands set this way are close to the bands used in the “Attention” protocol built-in into Neurobit Lite device.)

Remark: to raise a range of frequencies available on the slider of "Reward filter" (10 Hz by default), you should select "20 Hz" in "Reward" field on the buttons bar (at the top of the runtime window).

- "Trend" graph (at the bottom) of brainwave levels in rewarded (green) and inhibited (red) bands.
3. After a while a game window will appear. A car moves forward when rewarded brainwaves exceed above mentioned "reward" threshold and at the same time inhibited brainwaves are below "penalty" threshold. Thus, covering consecutive sections of route will correspond to moments of desired changes in brainwaves. Relief and encountered obstacles have additional influence on movement of the car. You can go around obstacles by additional control with computer keyboard:
    - ← - left turn of the wheel,
    - - right turn of the wheel,
    - ↓ - reversing.
  4. Hint: if you want to use this game to train only with rewarded brainwaves (without the use of inhibited band), you can remove the connection between "Auto Threshold 2" and "AND" elements (close to the center of block diagram window). To do this click the connection with right mouse button (the connection changes to green) and press Delete button on the keyboard. Next save the project with new filename, using "System/Save as" command from menu of the application.

(For example, with above modification and "Reward filter" parameter set to 13.5 Hz (i.e. brainwaves in band 12-15 Hz are rewarded), the resulting protocol will be similar to the "Peak" protocol built-in into Neurobit Lite device. )

Remark: because the training with Racer game may be quite exciting, this form of feedback is mainly useful for attention improvement, but is not suitable for training rewarding slower brainwaves (relax, meditation etc.)

## Using video files for biofeedback

1. Run BioEra application. Use menu option System/"Load design" and select an example design examples/OneRewardVideo.bpd.

(It is optional but recommended to change "Time ratio" parameter of "Time ratio" element in design window to 50. Click the element with right mouse button, select Properties, change content of "Time ratio" field and click OK.)

2. Click start button in BioEra design (or runtime) window. Example video file should start. By default biofeedback signal over (dynamic) threshold switches on the video progress.

Frequency band of signal controlling the video is 3Hz wide and its center frequency is set with a slider at the bottom of the Runtime window. Signal level in the band is shown with digital display and bar indicator in the runtime window. The bar changes its color from green to red when the level is below the threshold. (Please note, that in this example the level is not an amplitude in microvolt peak-to-peak ( $\mu\text{Vpp}$ ) or half amplitude, but it is calculated as an average of absolute (ABS) values of all samples in a given time window.)

Hint: to raise a range of frequencies available on the slider of "Reward filter" (10 Hz by default), you should select "20 Hz" in Reward field on the buttons bar (at the top of the runtime window).

3. To use your video file, in design window click Video element with right mouse button, select Properties from context menu, click button right to "Video file" field (on Settings tab), browse to select file location and name, click OK in Properties window.
4. Connections to other inputs of Video element in design window enable to control brightness and other parameters of the video.

If there is a problem with a specific video file format please test if it can be played in Windows Media Player. If not, additional plug-in for WMP may be required.

## DVD biofeedback

### DVD preparation

Correct DVD control depends on proper interoperation of a few software components from different manufacturers, especially:

- Microsoft Windows operating system,
- DVD decoder (often not included in the system, but purchased separately),
- BioEra application using DVD interface of the operating system.

Compatibility problems are often here.

1. First of all, ensure that you can play DVD in Windows Media Player (Microsoft software included in the system). Run the application (e.g. from your system Start menu). From the Play menu under the "DVD, VCD or CD Audio option", select the drive containing a DVD. The movie should start playing.

However, if you will see the message, that WMP cannot play DVD because no compatible DVD decoder is installed, you should purchase a software package for DVD, which includes a decoder for WMP. According to BioEra manufacturer, WinDVD 8.0 Gold package includes the decoder, which works with BioEra (in XP, Vista and 7 systems). WinDVD 8.0 Gold is not the latest version (newer versions may not work properly with BioEra). It can be bought on eBay, for example.

Alternatively, only a decoder could be purchased via Internet and downloaded. Some decoders compatible with WMP:

<http://www.microsoft.com/windows/windowsmedia/player/plugins.aspx#DVDDecoder>.

However, some of them may not work with BioEra.

2. Download an example design for DVD:  
<http://www.neurobitsystems.com/download/OneRewardWMDVD.bpd>.

Save it in design/examples in BioEra folder.

## DVD session

1. Insert DVD to drive.
2. Run BioEra. In menu of the application select System/"Load design" and choose the design OneRewardWMDVD.bpd.
3. Click Start button in BioEra design (or runtime) window. DVD should start. It is played whenever EEG signal in selected band is over the (dynamic) threshold, and stopped otherwise.

The band is 3Hz wide and its center frequency is set with a slider at the bottom of the Runtime window. Signal level in the band is shown with digital display and bar indicator in the runtime window. The bar changes its color from green to red when the level is beyond the threshold. (Please note however, that in this example it is not an amplitude in  $\mu\text{Vpp}$  (microvolt peak-to-peak) or half amplitude, but it is calculated as an average of absolute (ABS) values of all samples in a given time window.)

(Please take into account that if there is some starting sequence on DVD, such as advertisement etc., feedback control will be seen only during the actual movie.)

## Known issues

1. For Neurobit Lite device please remember that computer-based session is initiated from computer side, and not with Start! command from the device's menu. (For stand-alone trainings, initiated with Start! in the device, no data is transmitted to computer.)
2. If BioEra seems not react properly, try to reload a design using menu option "System/Reload design".

## Further information about BioEra

1. Designer's manual: <http://www.bioera.net/manual.html>.
2. BioEra forum: <http://www.bioera.net/support/>.
3. Technical support of BioEra manufacturer, Proatech LLC: <http://www.bioera.net/support/contact.jsp>.