

BioSemi ActiveTwo driver for OpenViBE

User Documentation

1 Introduction

This document describes how to use the OpenViBE driver for the *BioSemi ActiveTwo* amplifier. The documentation will cover the device capabilities, and the corresponding driver and server configurations.

2 Presentation of the device

The *ActiveTwo* amplifier has the following characteristics and capabilities:

- Up to 256+8 electrodes + 7 sensor channels
- 24-bit ADC per channel
- 16-bit trigger output and input
- 2, 4, 8 or 16kHz sampling frequency
- Fiber optic link
- USB connection through "USB2 RECEIVER" module
- Battery power supply



Figure 1: BioSemi ActiveTwo

2 versions of the *ActiveTwo* amplifier exist. First version is labelled **Mark I**; most recent version is **Mark II**. This driver is compatible with **both** versions.

For more information about the device, please look at the manufacturer website (<http://www.biosemi.com/>).

3 Speed Mode

The *ActiveTwo* amplifier has a key setting called Speed Mode. The Speed Mode can be set in the amplifier, by turning the corresponding **AD-box switch** in front of the device. The Speed Mode determines the sampling frequency and the maximum channel count during acquisition.

Regardless of the Speed Mode, note that sample values are always given in **uV** in OpenViBE.

Speed Mode value is between [0, 9]. For your information here is a transcription of BioSemi's documentation:

AD-box model MKI

AD-box switch	Sample-rate	Pin channels + EX channels + Sensor channels
0	2048 (2 kHz)	256+0+0
1	4096 (4 kHz)	128+0+0
2	8192 (8 kHz)	64+0+0
3	16384 (16 kHz)	32+0+0
4	2048 (2 kHz)	232+8+7
5	4096 (4 kHz)	104+8+7
6	8192 (8 kHz)	40+8+7
7	16384 (16 kHz)	8+8+7
8 (AIB-mode)	2048 (2 kHz)	AIB-mode
9	Reserved	Reserved

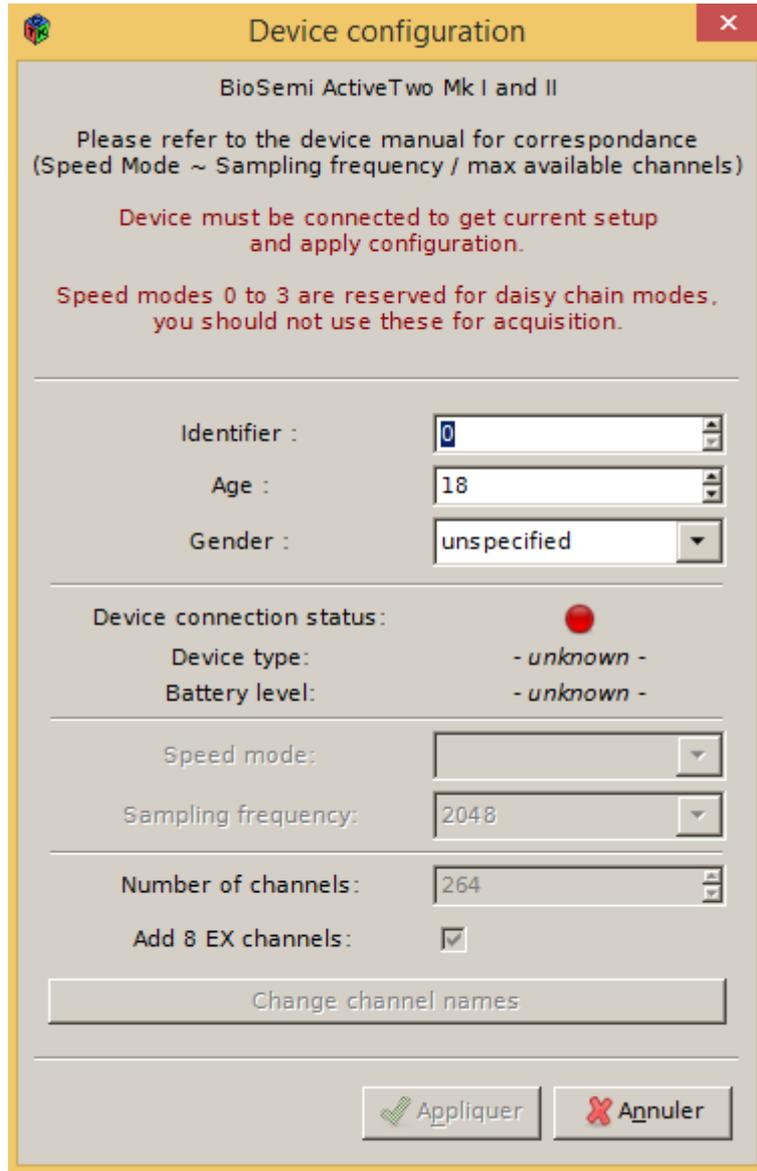
AD-box model MKII

AD-box switch	Sample-rate	Pin channels + EX channels + Sensor channels
0	2048 (2 kHz)	Daisy-chain mode:
1	4096 (4 kHz)	In speedmode 0 to 3, the AD-boxes work as up to 4 optical fiber 'daisy chained' boxes, each with a maximum of 128+8 channels+sensors @ 2 kHz, speedmode switch = box number. (0=Box1, 1=Box2, 2=Box3, 3=Box4). Daisy chain possibilities are not standard included in the base system price.
2	8192 (8 kHz)	
3	16384 (16 kHz)	
4	2048 (2 kHz)	
5	4096 (4 kHz)	128+8+7
6	8192 (8 kHz)	64+8+7
7	16384 (16 kHz)	32+8+7
8 (AIB-mode)	2048 (2 kHz)	256+8+7+32AIB
9 (ABR-mode)	16384 (16 kHz)	5

Please refer to manufacturer's manual for more details.

4 Driver configuration

The OpenViBE driver for the *BioSemi ActiveTwo* device can be configured to access most of the amplifier capabilities. Here is a snapshot of the driver configuration panel, when no device is connected :



Device configuration

BioSemi ActiveTwo Mk I and II

Please refer to the device manual for correspondance
(Speed Mode ~ Sampling frequency / max available channels)

Device must be connected to get current setup
and apply configuration.

Speed modes 0 to 3 are reserved for daisy chain modes,
you should not use these for acquisition.

Identifier : 0

Age : 18

Gender : unspecified

Device connection status: ●

Device type: - unknown -

Battery level: - unknown -

Speed mode: [dropdown]

Sampling frequency: 2048

Number of channels: 264

Add 8 EX channels:

Change channel names

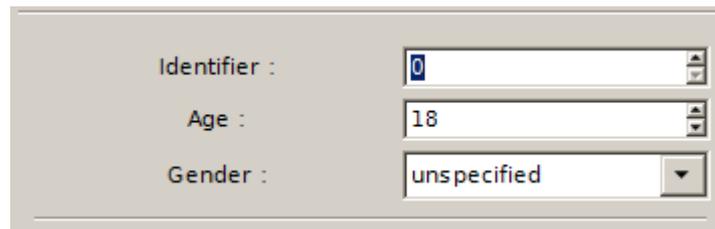
Appliquer Annuler

Figure 2 : driver configuration

The configuration panel is divided in three parts.

4.1 Experiment information

First is the experiment information, common to any OpenViBE driver, that we be send through the OpenViBE data stream for the records :

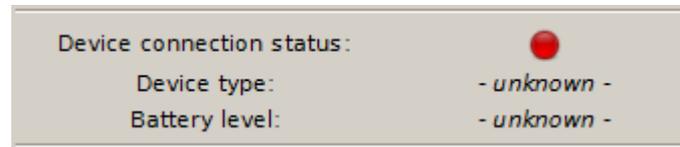


Identifier : 0
Age : 18
Gender : unspecified

Figure 3: Experiment information

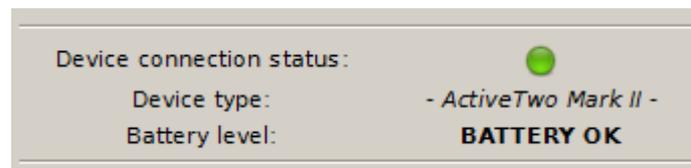
4.2 Connection status

Second part is the device connection status. This part of the configuration GUI depends on whether or not the device is plugged in: a red or green icon will tell you if the **device is connected**. If connected, this panel shows which **type of device** is detected (Mark I or Mark II). The **battery level** is also given (can be OK or LOW). See figures below for examples.



Device connection status: ●
Device type: - unknown -
Battery level: - unknown -

Figure 4: connection status: device not connected (USB cable unplugged)



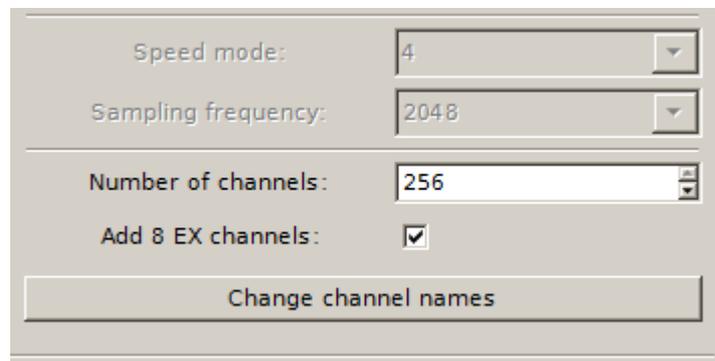
Device connection status: ●
Device type: - ActiveTwo Mark II -
Battery level: **BATTERY OK**

Figure 5: connection status: device connected (USB cable plugged in)

Please note that the program checks if a device is connected when you press "Driver Properties" in the Acquisition Server. If you connect the device while the configuration panel is shown, cancel current configuration and re-open the driver properties to trigger a new status check.

4.3 Channel & sampling frequency

The last part gives the current sampling frequency and allows to select channel and rename them.



Speed mode: 4
Sampling frequency: 2048
Number of channels: 256
Add 8 EX channels:
Change channel names

Figure 6: channel management

The **speed mode** is un-editable on the software. This value is only informative, as the speed mode should be changed on the device directly.

The **sampling frequency** will always remain un-editable. This value is actually deduced from the current Speed Mode, as described in section 3. Turn the Ad-box switch to change the sampling frequency, and go back to the driver properties to see the change.

The **channel count** can be set as a number between 1 and the maximum channel count, which is 256. Depending on the actual configuration of the electronics, the device will send data for a various number of channel (up to 264). This number of channel is deduced from the data stream itself, and depends on the hardware configuration and Speed Mode.

“**Add 8 EX channels**” offers the possibility to choose to display or not the 8 EX channels that are auxiliary channels sometimes available depending on the used device. If this option is chosen, then the 8 EX channels will be displayed.

If you select more channels (including the EX channels when the option is chosen) than what the electronic can give you, the channel in excess will give you **flat zero**.

5 Acquisition Server configuration

As with every OpenViBE driver, the Acquisition Server automatically detects drift and jitter in the physical sampling rate of the device compared to the theoretical rate (software expectations). This drift can be due to a significant difference between the 2 internal clocks (device and computer). Correcting the drift is very important in evoked potentials studies for example, where timings must be very precise.

Default parameters works good with devices with sampling frequency up to 512 Hz. As the *ActiveTwo* device acquires at minimum 2048Hz, the drift correction needs more samples to estimate the jitter, and avoid redundant corrections (e.g. removing 4 samples and adding 4 samples few milliseconds afterwards).

To work under good conditions, it is recommended to adjust the **jitter estimation count** to **512** samples.

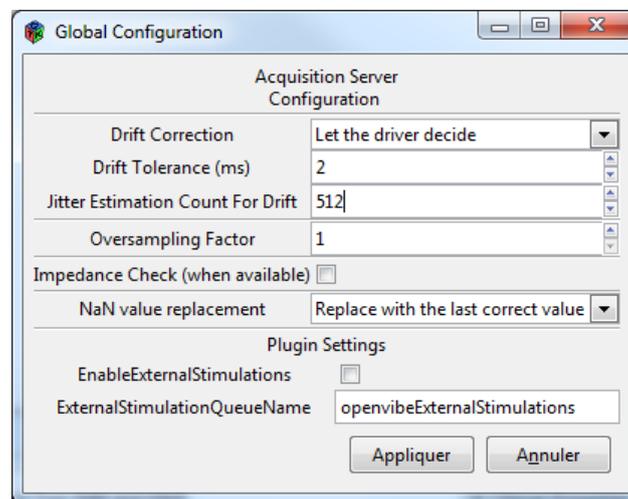


Figure 7 - Acquisition Server preferences

NB: Every test ran with these parameters on the *ActiveTwo* amplifier Mark II with OpenViBE 0.18.0 showed a very stable data stream, with almost no drift correction.

6 Triggers

The *BioSemi ActiveTwo* driver for OpenViBE handles the 16 input triggers as OpenViBE stimulations.

Whenever a trigger state changes, the Acquisition Server will send to every client a stimulation code **OVTK_StimulationId_Label_X** where X is the trigger index in [1,16].

This stimulation is the same for rising and falling edges, it's up to the user to memorize current trigger states if he needs to. The best solution is to use a *Lua scripting* box in your OpenViBE Designer scenario.

7 Contact quality: offset measures

While the ActiveTwo amplifier do not provide impedance measurements, contact quality can be measured by **visualizing the signals offset**. This can be done easily in the OpenViBE Designer by processing the signals through a **low-pass temporal filter**.

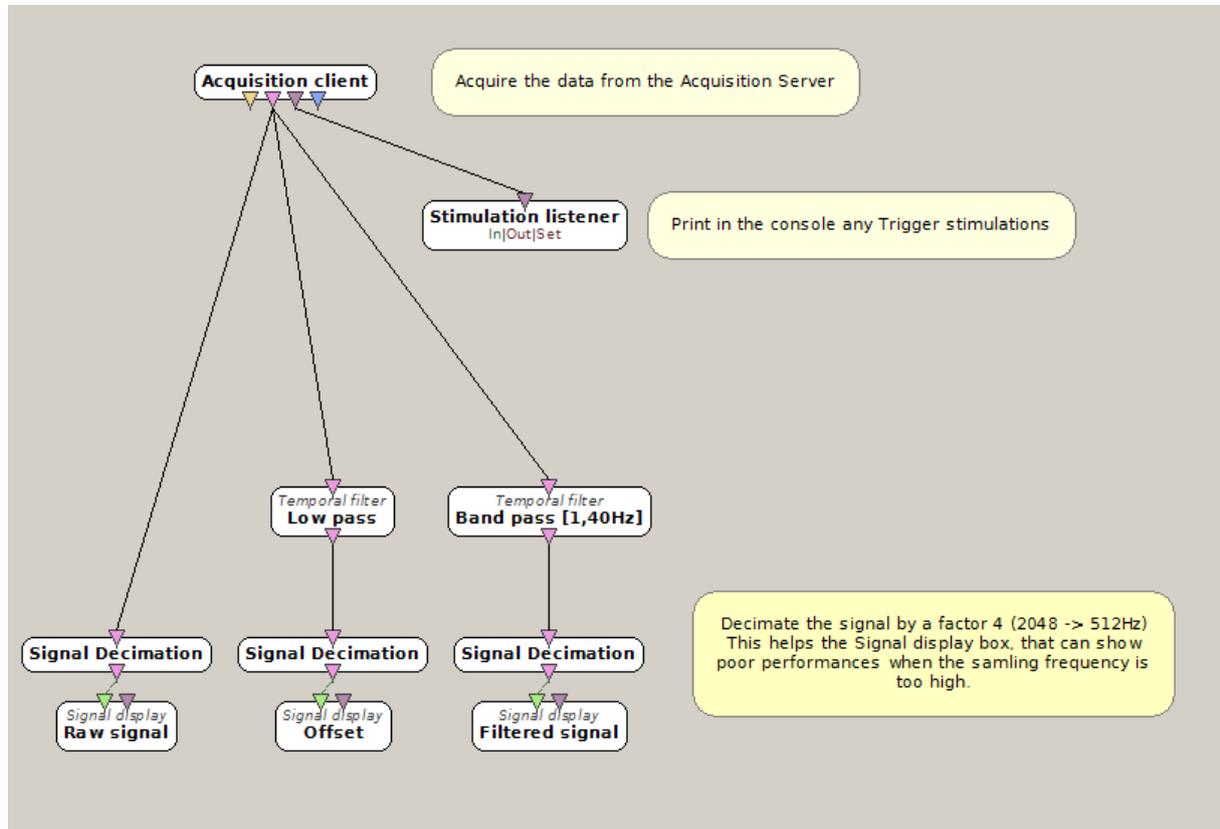


Figure 8 - Example of scenario in the Designer to display raw data, filtered signal and offset

Offset values should be between **-50 and +50 mV** to ensure good contacts. The driver gives raw values in μV , thus when displaying the offset make sure the values stay between -50000 and +50000 with respect to the signal display box vertical scale.

If an electrode is out-of-bound, please refer to the instructions provided by the manufacturer (typically: move the electrode around a bit, move the hair apart to reach the skin, add a bit more gel, etc.).

8 Troubleshooting

As usual when using OpenViBE in general and the Acquisition Server in particular, please pay attention to the **warning and error messages** that could be printed in the application **console**. In addition to this console messages, a window will open during the whole acquisition to provide information about the battery and the CMS/DRL connection, some important error messages are also displayed in this window.

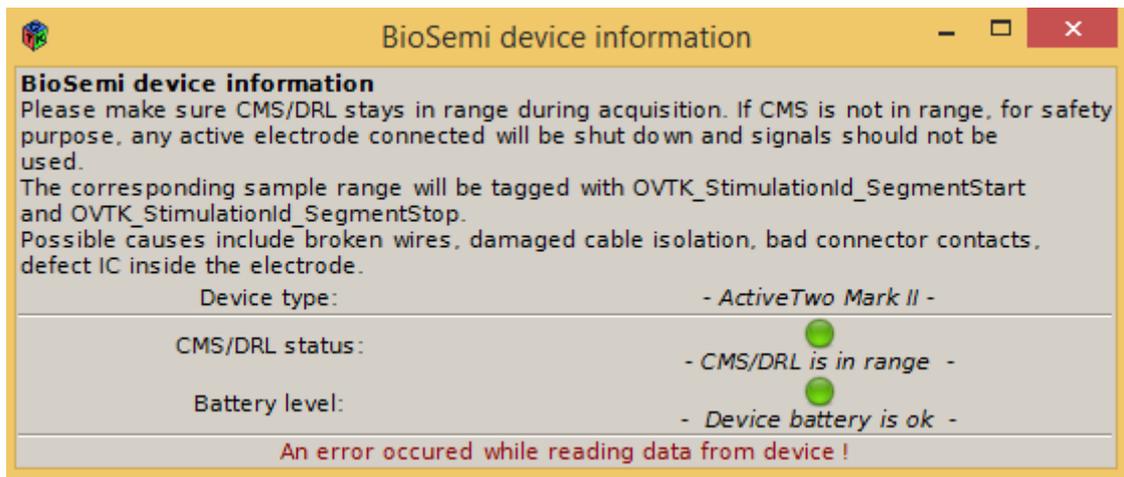


Figure 9 – Device information window displayed during the acquisition

Specifically, you may encounter the following issues:

8.1 No data received

If the device somehow stops sending data to the Acquisition Server, you will be notified in the console after a timeout (5 seconds) and the acquisition will naturally stops.

- Check for additional Warning or Error message in the console, they may provide more details; otherwise:
- If using a **battery**, please check the **charge level**.
- Check the USB cable and fiber: are they correctly plugged-in? damaged?

8.2 Low Battery

The BioSemi driver for OpenViBE checks the state of the battery continuously during acquisition. If the Battery is low, a warning message will be printed, and the information will be displayed in the device information window (see figure 9).

Consider changing the battery or switch to a wired power supply when such warning appears.

8.3 Synchronization is lost

If the synchronization in the data stream is somehow lost, you will be notified by an error message in the console, and the acquisition will stop. The most probable cause is a problem with the **fiber optic**:

- Check that the fiber optic is correctly plugged-in
- Fiber optic is damaged

8.4 Buffer overflow

The driver uses an internal buffer for the samples. If the acquisition process is too slow to consume the data, this buffer may overflow. A corresponding error message would be printed in the console.

- Check that your computer CPU and memory are not already heavily loaded
- Shutdown any unnecessary programs before retrying

8.5 CMS not in range

To comply with safety regulation (IEC 601), the ActiveTwo amplifier monitors the current flow via the DRL. If the current runs into a certain limit, the CMS/DRL circuit cannot keep the Common Mode value within its normal working range. The safety circuitry reacts on this error situation by **shutting the power supply to all active electrodes off**.

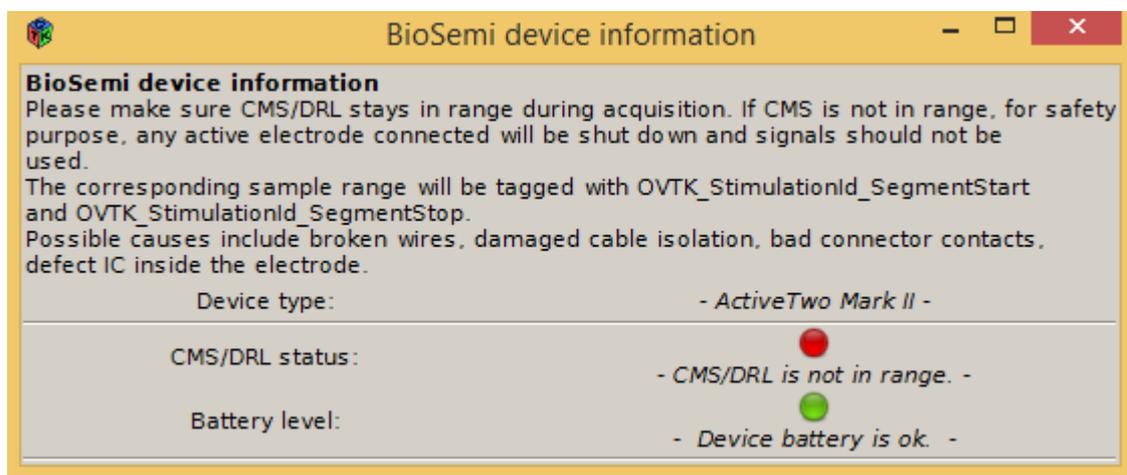


Figure 10 – Device information window displayed during the acquisition, when CMS/DRL is not in range

No meaningful signals on any active electrodes can be measured so long as CMS is not in range.

The device may give you this information on the hardware itself (e.g. CMS/DRL LED in front of the amplifier). Anyway, the Acquisition Server will print a warning message in the console if CMS is not in range, moreover the information will be displayed in the device information window as in figure 10. In that case, here are the possible causes:

- broken wires,
- bad connector contacts (pollution of connector with gel),
- defect IC inside the electrode,
- bare electrode wire contacting the subject (damaged cable isolation)

The corresponding sample range will be tagged in the signal between the stimulation codes **OVTK_StimulationId_SegmentStart** and **OVTK_StimulationId_SegmentStop**. You can use these stimulation to reject these samples in your OpenViBE scenarios if you want to.