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g.[®]USBamp
USB BIOSIGNAL AMPLIFIER

g.USBamp Driver

USER MANUAL V3.12.00

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Release Notes

Release notes help to learn about new features and changes of g.USBamp driver and tools when upgrading to a newer version of the driver.

New features

None since version 3.11.00

Related documents

gUSBampInstructionsForUse.pdf – a detailed hardware description of the device (sockets, labeling ...)

gUSBampSoftwareManual.pdf – additional API calls gives the programmer access to the new features of the amplifier

The intended function of the equipment

Measuring, recording and analysis of electrical activity of the brain (EEG) and/or through the attachment of multiple electrodes at various locations to aid in monitoring and diagnosis as routinely found in clinical settings for the EEG.

The device must not be used for patient monitoring. The device must not be used for the determination of brain death. Additional examinations are needed for diagnosis and no diagnosis may be done only based on using this device.

Before using g.USBamp

Before using the device make yourself familiar with the *gUSBampInstructionsForUse.pdf* manual and carefully read following sections

- The intended function of the equipment
- Safe operation of g.USBamp

Requirements and Installation

Hardware and Software Requirements

g.USBamp requires a PC compatible desktop, notebook workstation or embedded computer running Microsoft Windows.

The table below lists optimal settings:

Hardware	Properties
CPU	Pentium working at 2000 MHz
Hard disk	20-30 GB
RAM	1GB – 2 GB
USB 2.0 port (EHCI – enhanced Host controller interface)	one free USB port for each g.USBamp

The g.USBamp demo software package requires a Microsoft Windows operating system.

Software	Version
Windows	Windows 7 Professional English Win32 or Win64
Acrobat Reader	10.1.3

Make sure that your Microsoft Windows installation works correctly before installing the g.USBamp software. Other software packages except the packages listed above **MUST NOT** be installed on the Windows PC. During operation of g.USBamp other software as listed above **MUST NOT** be operated.

Installation of the g.USBamp driver

Perform the following steps for installation

1. If there is any old version of the g.USBamp driver package on your computer please uninstall it.
2. It is highly recommended to turn off the User Account Control (UAC) of the Windows 7 operating system. Please see Microsoft help how to do this.
3. Close all running applications.
4. Insert the g.tec installation CD open the g.USBamp\g.USBamp Driver folder double click gUSBampDriver.msi. Follow the instructions on the screen.



5. Choose the installation folder (default is C:\Program Files\gtec\) where the install routine copies all necessary driver files and press **Next**.

How to install g.USBamp hardware on your system

Perform the following steps in the correct order to successfully attach the g.USBamp hardware to your system.

Note: g.USBamp Driver has to be installed before attaching the device to your PC.

Windows 7 64-bit Driver Installation

Driver installation in Windows 7 64-bit is done automatically without user interaction.

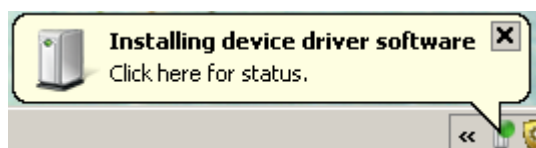
Windows 7 32-bit Driver Installation

1. Plug the power cable to your g.USBamp and switch it on. The green led on the front side of your amplifier will turn on.
2. Connect the USB cable to your amplifier and to a valid USB2.0 port of your computer. The plug and play manager will detect the new hardware and starts to install the "g.USBamp":



Click **Locate and install driver software (recommended)**.

3. If **User Account Control** is turned on an additional dialog asks for permission. Press **Continue**.
4. A notification icon indicates that the installation procedure started



5. Another dialog asks for permission. Click **Install this driver software anyway**.



6. When the installation has finished a notification icon appears.

Test your installation

Start your device manager to test the installation. Under **Universal Serial Bus controllers** the g.USBamp must be listed.



If you see a question mark beside the g.USBamp icon or g.USBamp is listed under “Other devices” the installation must be repeated. If g.USBamp is not connected to a USB 2.0 connector the following message appears: “USB device can perform faster if you connect it to a Hi-speed USB 2.0 port”.

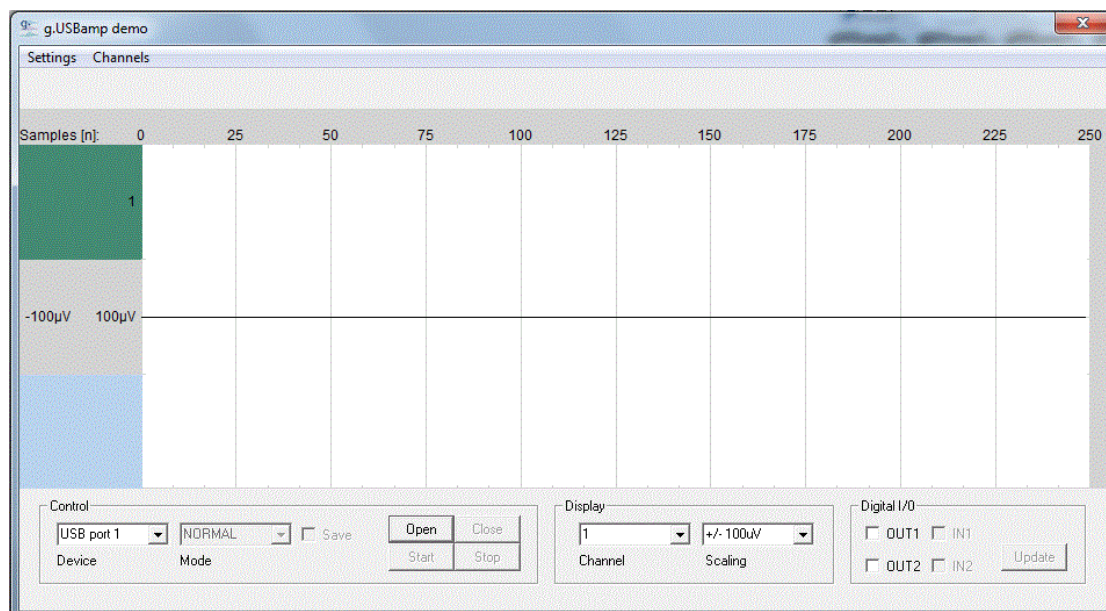
Acquisition Software g.USBamp Demo

To run the demo acquisition software press to the Windows **Start** menu button and start **g.USBamp Demo** in the **g.tec** -> **g.USBamp Driver** application directory.

The purpose of the demo program is to test and verify the correct installation and basic functioning of the g.USBamp device. g.USBamp demo cannot be used for data recording and data storage.

The program main window appears and shows the USB port where the amplifier is connected to. (e.g. USB port 2) in the **Control** field. If the g.USBamp cannot be found, click the pull-down menu to search for it.

Note: The appearance of the **Digital I/O** field reflects the capability of the attached amplifier. Here the fields for g.USBamp version 2 are shown.

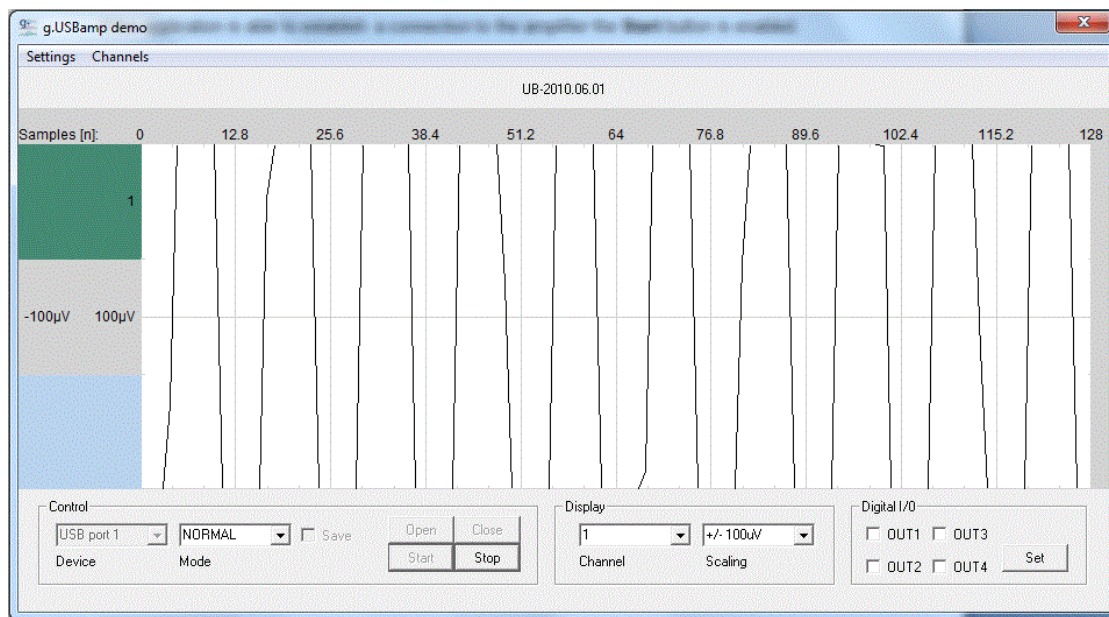


Data Acquisition

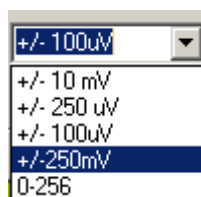
Press the **Open** button in the **Control** field to establish a connection with the g.USBamp device.

The application connects to the amplifier and the **Start** button is enabled.

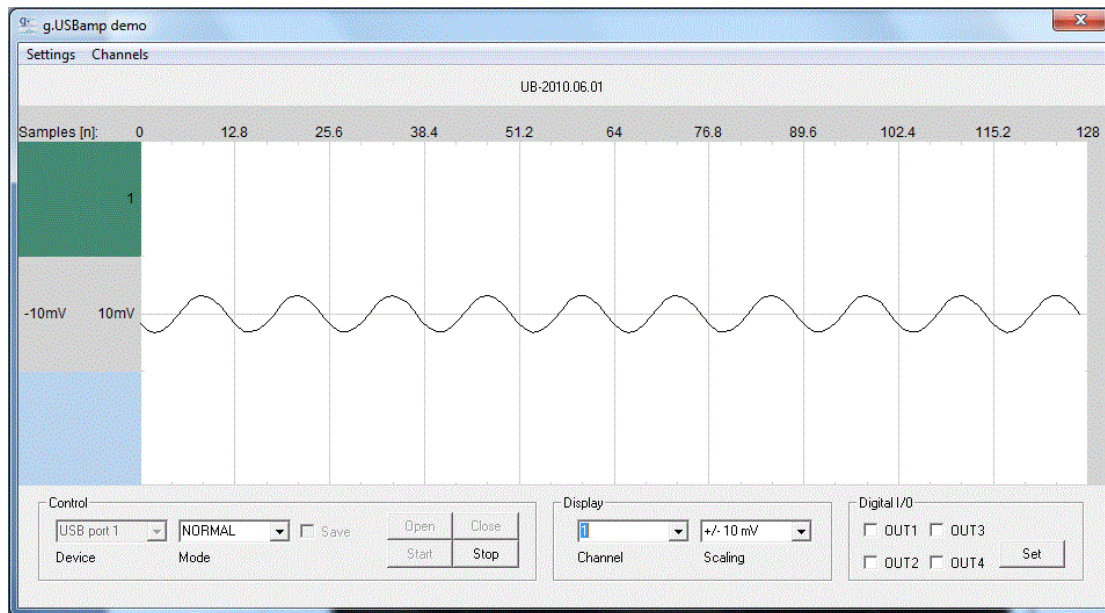
Press the **Start** button to begin the data acquisition and visualization. If e.g. a sine wave signal with 1 mV amplitude is applied to the input of channel 1, you should see a similar output on your screen.



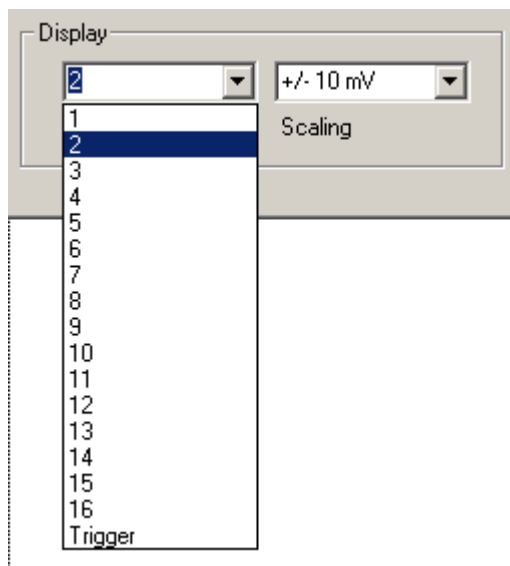
Change the **Scaling** of the graph in the **Display** field to +/-10 mV to view the sine wave correctly.



If the data transmission is interrupted the message **Data lost event occurred** appears.

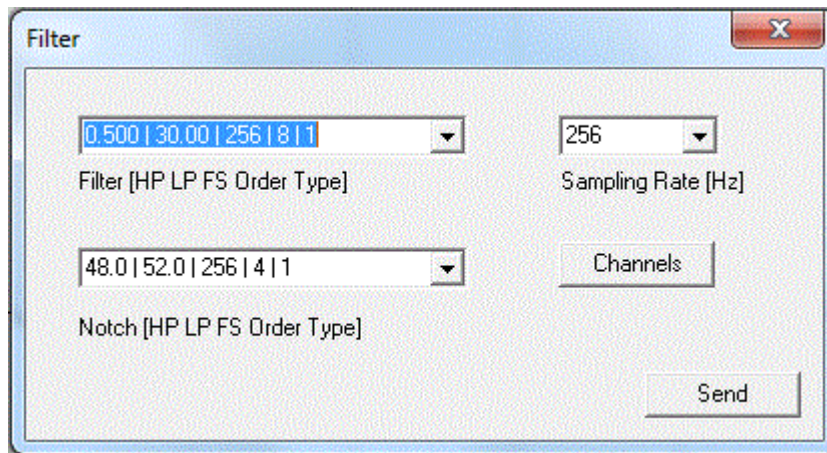


Use the **Channel** pull-down menu to select the channel that should be visualized in the graph.



If you select the trigger channel the scaling is automatically turned to 0-256. For g.USBamp version 3.0 the eight trigger inputs are coded on a single 8 bit value. Version 2.0 of the device has a single trigger input channel and its value can be 0 or 250000.

To change the sampling rate of the data acquisition stop the program with the **Stop** button in the Control field and open the Filter window under the Settings menu.



Set the **Sampling Rate** to 256 Hz, the band pass **Filter** to 0.500 | 30.00 | 256 | 8 | 1 and the **Notch** filter to 48.0 | 52.0 | 256 | 4 | 1. These settings perform a band pass filtering between 0.5 and 30 Hz (of order 8, Butterworth) and a band stop filtering between 48 and 52 Hz (order 4, Butterworth) to suppress the power line interference.

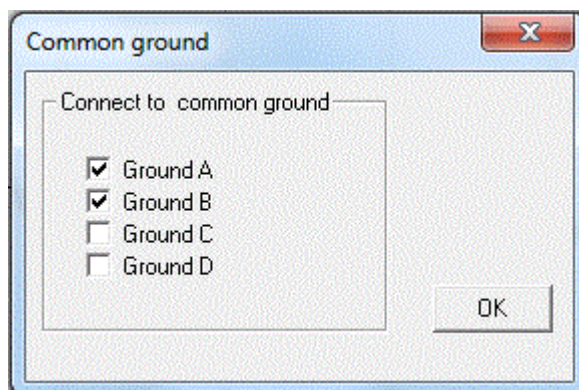
Use the **Channels** button to select the channels where these filter settings should be applied. If the channels are not specified the settings are only transmitted to channel 1.

Press the **Send** button to transfer the settings to the g.USBamp.

Close the window and press the **Start** button. g.USBamp acquires now the data with 256 Hz and performs a band pass and notch filtering of the data. If the sampling rates of the filters do not match, a warning is presented but the filter parameters are transmitted.

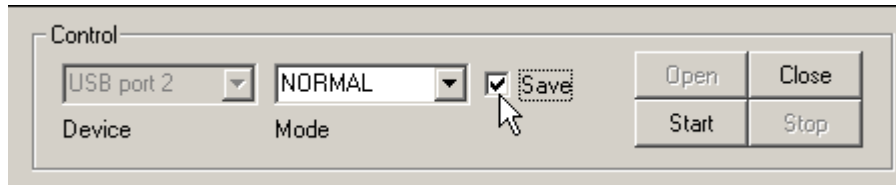
g.USBamp has 4 potential separated grounds. To connect the ground potentials of each group to a common ground potential perform the following steps:

Open the **Common ground** window from the **Settings** menu and check **Ground A** and **Ground B** to connect the ground potentials of groups A and B. Then press **OK** to close the window. This is useful if e.g. 8 EEG channels are acquired with the same ground electrode.



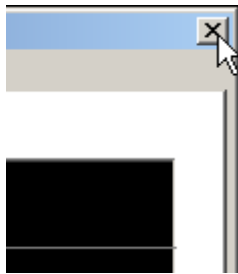
Open the **Common Reference** window and perform the same steps to connect the reference potentials of the groups A-D. If the references are connected the program connects also the ground potentials. References and grounds are disconnected when the program is restarted.

To save data check the **Save** check box and press **Start**. The program asks for a filename for the data storage. Enter the filename and press the **OK** button. The program streams now all the acquired data to hard disk.



To close the program press the **Stop** button and the **Close** button to disconnect the program from the g.USBamp.

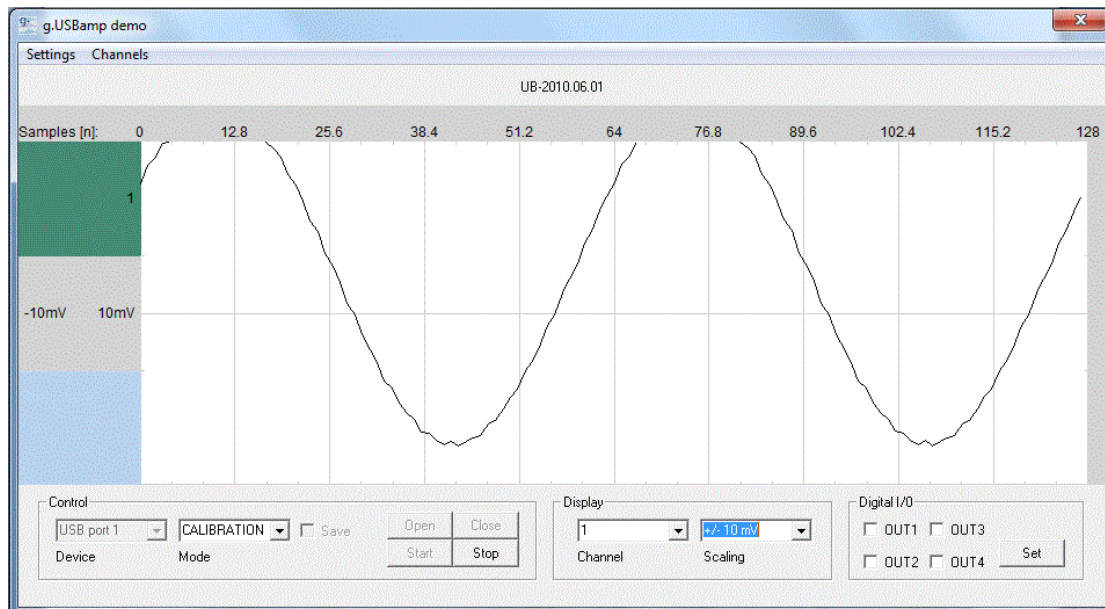
Now the program can be closed.



Calibration

Start the data acquisition with the **Start** button and select CALIBRATION under the **Mode** pull-down menu.

The program shows on each channel a 2 Hz calibration sine wave with ± 10 mV amplitude.



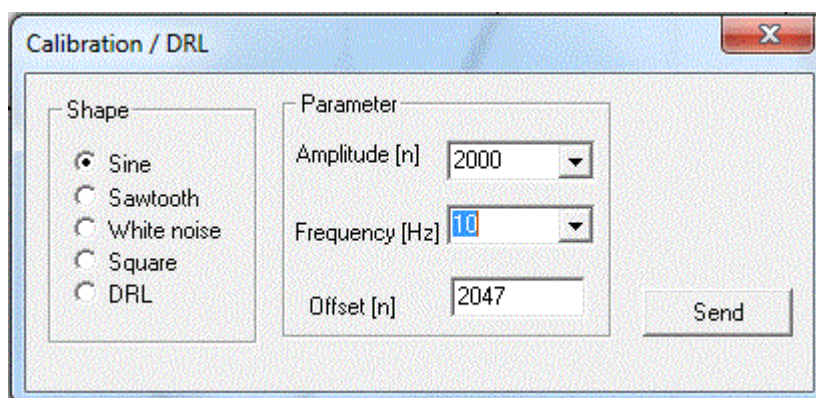
To change the calibration signal go to the **Calibration / DRL** window, which can be started, from the **Settings** menu.

The calibration signal is generated for sampling frequencies below 1200 Hz.

In calibration mode, all electrode input sockets are disconnected from the input amplifiers and the calibration signal is connected to the amplifiers.

The **Calibration / DRL** window allows selecting a **Sine** wave, **Saw tooth**, **White Noise** and a **Square** signal. Select the **Amplitude** 2000 and the **Frequency** 10 Hz and press the **Send** button to change the calibration frequency to 10 Hz.

Note: the DRL output is only for internal and maintenance purposes.



The **Offset** field allows adding an offset to the calibration signal.
The signal range for the test signal is 0-4096. To get values in mV [n] must be divided by 8.15.

To change the scaling go to the **Scaling** window, this can be started, from the **Settings** menu. When you open the window the actual values are retrieved from your amplifier and displayed. You can enter your own values and send them to hardware using the **Send** button. Values are stored in permanent memory of the device.

To reset **Offset** and **Factor** of all channels press **Reset** and all offset fields are set to 0 all factor fields are set to 1. Press **Send** to send data to the device.

Offset values have to be set in [μV], factor has no dimension. All acquired signals are scaled due to the formula:

$$y = (x - d) * k;$$

y ... values retrieved in [μV]
x ... acquired data
d ... offset value in μV
k ... factor

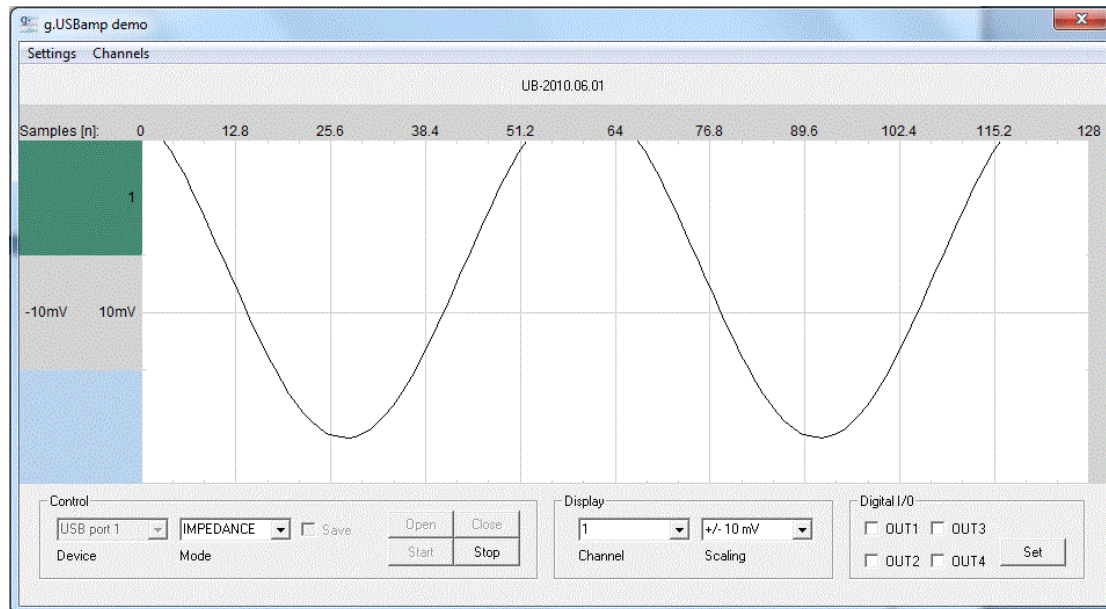
The screenshot shows a window titled "Scaling" with a close button (X) in the top right corner. Inside the window, there is a table with two columns: "Offset [μV]" and "Factor [1]". The table has 16 rows, labeled CH01 through CH16. Each row contains two input fields, one for the offset and one for the factor. All offset fields are currently set to 0, and all factor fields are currently set to 1. Below the table, there are two buttons: "Reset" and "Send".

	Offset [μV]	Factor [1]
CH01	0	1
CH02	0	1
CH03	0	1
CH04	0	1
CH05	0	1
CH06	0	1
CH07	0	1
CH08	0	1
CH09	0	1
CH10	0	1
CH11	0	1
CH12	0	1
CH13	0	1
CH14	0	1
CH15	0	1
CH16	0	1

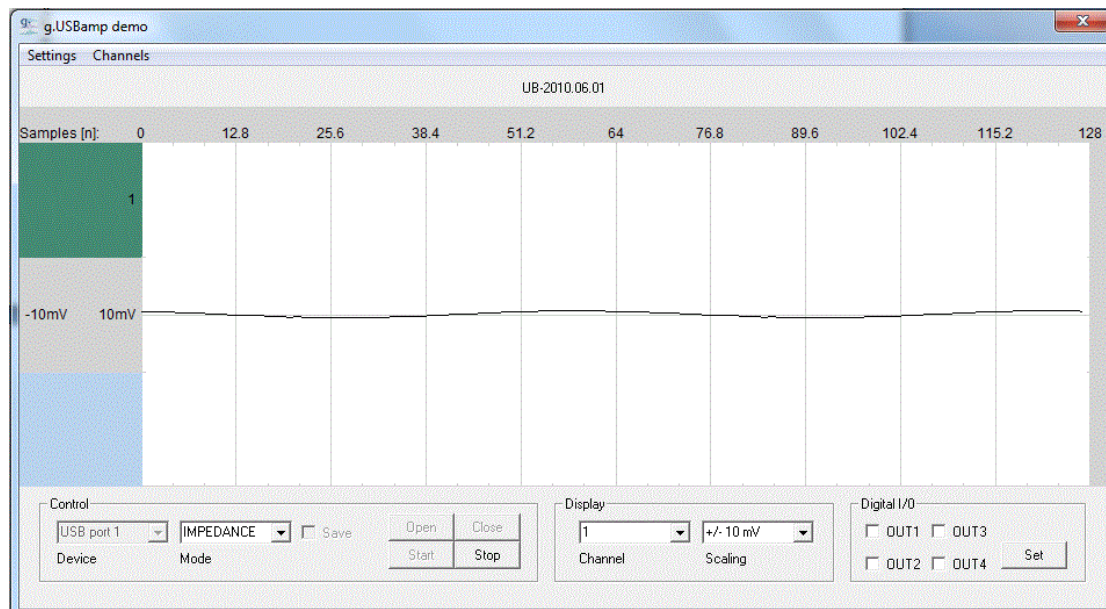
Reset Send

Impedance Measurement

To measure the electrode impedance start the program and select under **Mode** IMPEDANCE and select a **Channel**. If no electrode is connected to channel 1 in this case the calibration signal is visible on the graph.



If an impedance of 10 k Ω is connected to the input of channel 1 the amplitude of the impedance measurement signal appears smaller.



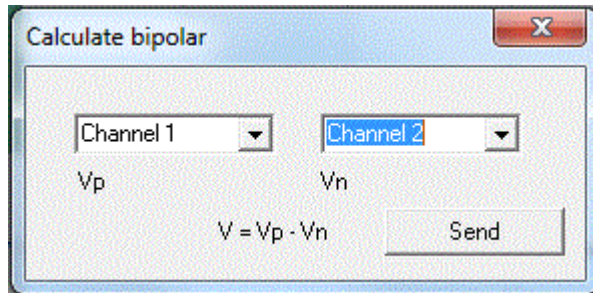
The following equation gives the impedance value:

$$Z_x = U_1 * 10^6 / (U_{cal} - U_1) - 10^4$$

With U_1 being the amplitude of the signal measured on channel 1 and U_{cal} being the amplitude of the signal applied to the electrode (e.g. 10 mV). U_{cal} can be measured if the electrode is not connected.

Bipolar Derivation

g.USBamp allows performing a bipolar derivation of two input channels. Open the Calculate bipolar window from the **Channels** menu and select the corresponding derivation. Then press the **Send** button to transmit the settings. Close the window.



Select as **Vn** `none` if no bipolar derivation should be performed.

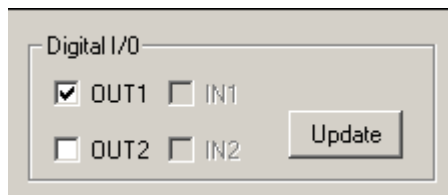
Digital I/O

The behavior and appearance of this field is different for g.USBamp version 2.0 (UA-xxxx.xx.xx) and version 3.0 (serial UB-xxxx.xx.xx)

g.USBamp version 2.0

This amplifier has 2 digital inputs and two digital outputs that can be set asynchronous to the data acquisition.

To set digital output 1 check the **OUT1** box and press the **Update** button. Simultaneously the digital inputs are read in and are visualized in boxes **IN1** and **IN2**. If **IN1** and **IN2** are not checked a logical low is applied to the inputs. If the boxes are checked a logical high is applied.



Digital I/O

☒ OUT1 ☐ IN1

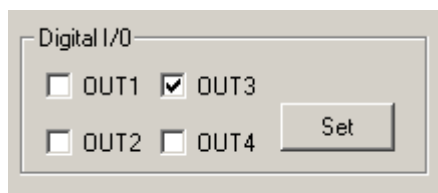
☐ OUT2 ☐ IN2

Update

g.USBamp version 3.0

This version of g.USBamp has 4 digital outputs.

To set digital output 3 check the **OUT3** box and press the **Set** button.



Digital I/O

☐ OUT1 ☒ OUT3

☐ OUT2 ☐ OUT4

Set

Data storage

The demo program stores the data in float32 format. Use the following MATLAB code to read in the data:

```
Channels=17;  
  
FileName='test.bin';  
  
fid=fopen(FileName,'rb');  
  
data=fread(fid,[Channels inf],'float32');  
  
fclose(fid);
```

How to enable higher sampling rates for g.USBamp

The factory setting for the maximum sampling rate for g.USBamp is set to 4800 Hz. If a higher sampling rate is required (9600 Hz, 19200 Hz, 38400 Hz) g.USBamp installation can be reconfigured. Advanced skills in operating Windows are recommended.

1. Close all applications using g.USBamp.
2. Start the registry editor (Start > Run > regedit)
3. Change the value for [HKEY_LOCAL_MACHINE\SOFTWARE\gttec\gUSBamp\Driver Enable 38kHz to "1".

Using g.USBamp at higher sampling rates

If you are using g.USBamp at sampling rates higher than 4800 Hz some additional constraints must be met:

	g.USBamp V2.0	g.USBamp V3.0
number of acquired channels	fs>4800Hz: must be 16	fs>4800Hz: can be <= 16 including trigger channel
trigger (synchronous digital input)	fs>4800Hz: disabled	fs>4800Hz: enabled but the sum of channels <=16
counter	fs>4800Hz: disabled	fs>4800Hz: enabled
filtering	fs>4800Hz: disabled	fs>4800Hz: disabled
bipolar	derivation fs>4800Hz: disabled	fs>4800Hz: disabled
test signal generator	fs>600Hz: disabled	fs>600Hz disabled



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