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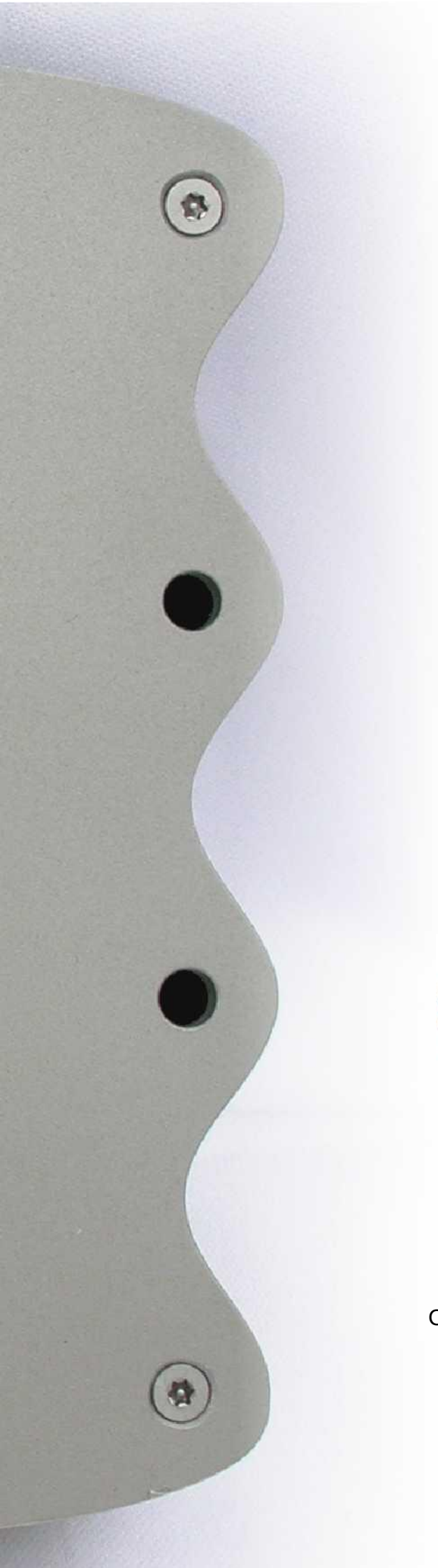

g.USBamp Driver

USER MANUAL V3.16.00

printed in May 2016

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Content

Release Notes

Release notes bring to your attention new features of, and changes to, the g.USBamp driver and tools when upgrading to a newer version of the driver.

New features

None.

Changes

- Supports Windows 10, 64-bit; Windows 7 and 32-bit support retired.
- Support of g.USBamp 2.0 (UA) retired.
- Removed 32-bit libraries.
- `GT_GetDriverVersion` returns 4.0 now.

Related documents

gUSBamp30_InstructionsForUse.pdf / *gUSBamp30_InstructionsForUse_CE.pdf* – a detailed hardware description of the device (sockets, labeling …); comes with the device

gUSBampCAPI.pdf – additional API calls give the programmer access to the amplifier; comes with the C API software package

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 *gUSBamp30InstructionsForUse.pdf* / *gUSBamp30InstructionsForUse_CE.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 or notebook workstation or an embedded computer running Microsoft Windows.

The table below lists optimal requirements:

Hardware	**Properties**
CPU	2 GHz or faster processor
Hard disk	20-30 GB
RAM	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 10 Pro English 64-bit
Acrobat Reader	DC 2015

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 the g.USBamp, other software as listed above MUST NOT be operated.

Installation of the g.USBamp driver

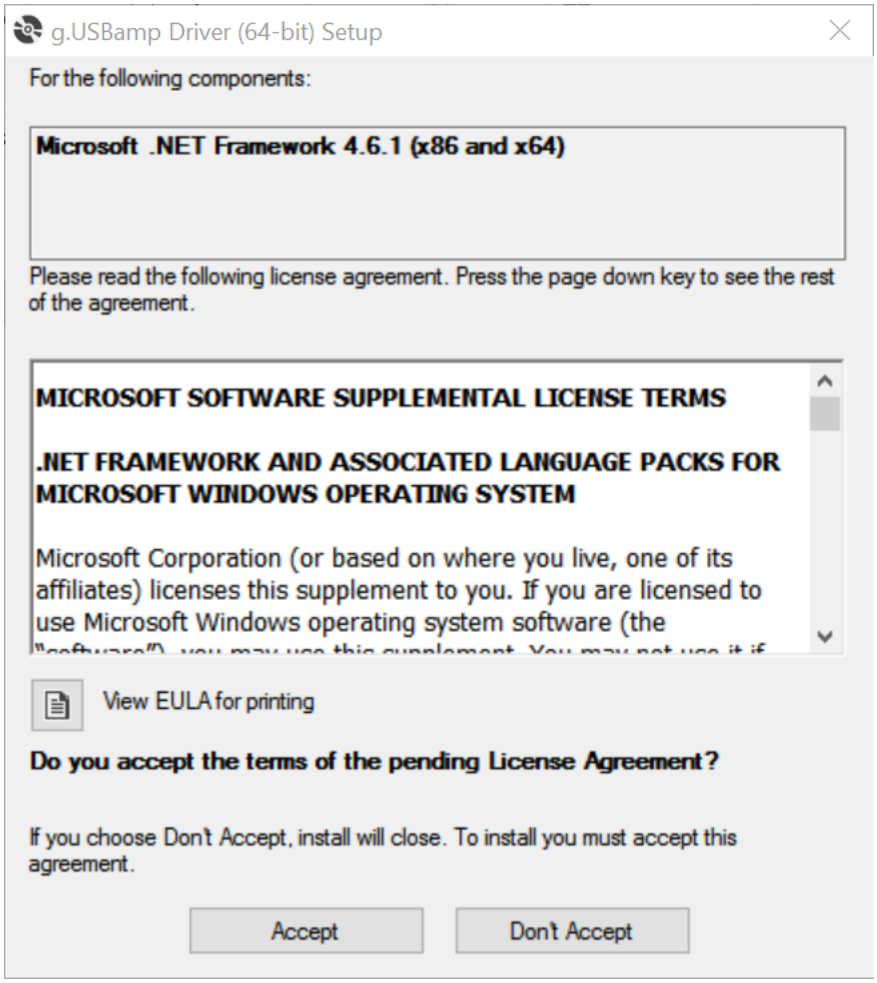
Perform the following steps for installation

1. Disconnect all connected g.USBamp devices from your computer.

2. If there is an old version of the g.USBamp driver package on your computer, please uninstall it.

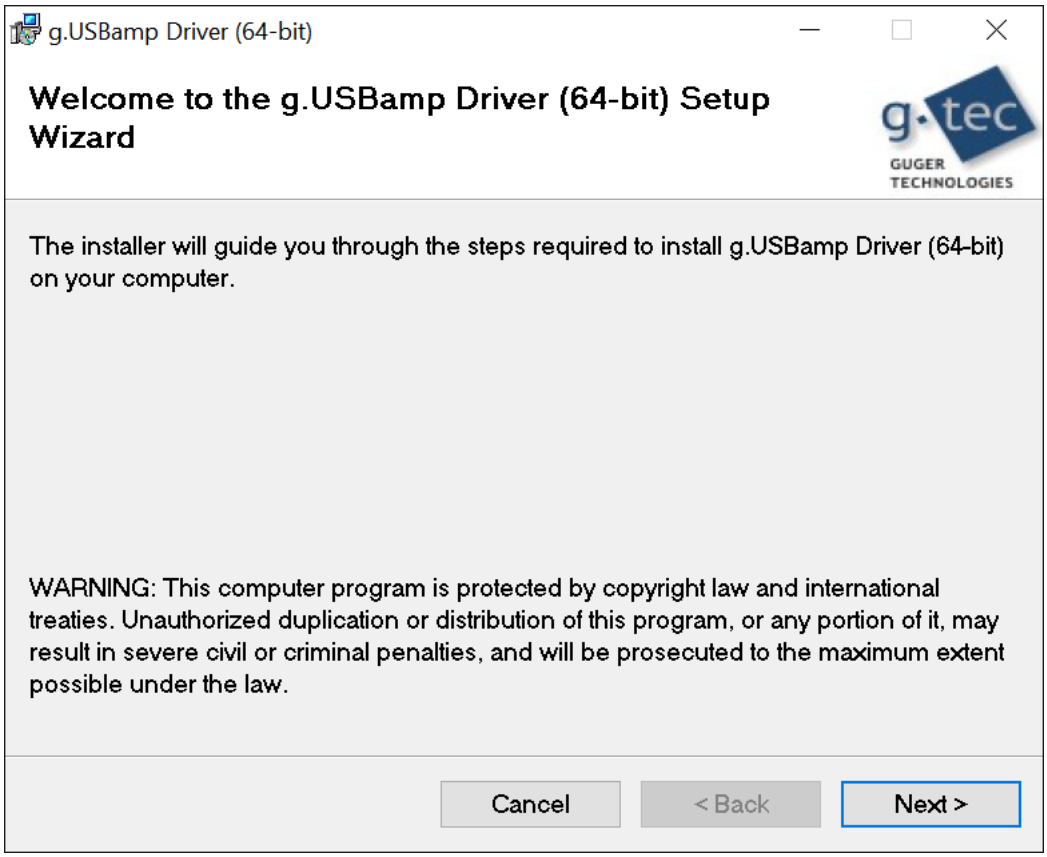
3. Close all running applications.

4. Insert the g.tec installation CD, open the `g.USBamp\g.USBamp Driver` folder, open the correct directory for the architecture of the PC (`Win64`) and double-click `setup.exe`. If setup asks you for installation of the **.NET Framework**, confirm the dialog by clicking the **Accept** button.



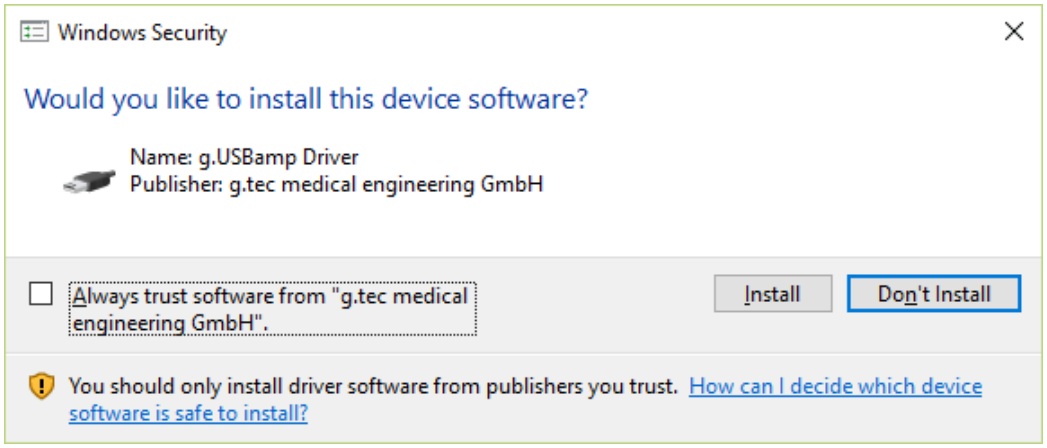
The installer will install the **.NET Framework** from the CD.

5. Follow the instructions on the screen. If **User Account Control** is turned on, additional dialogs may ask for permission. Confirm the dialogs to allow installation of the g.USBamp driver software through **User Account Control**.



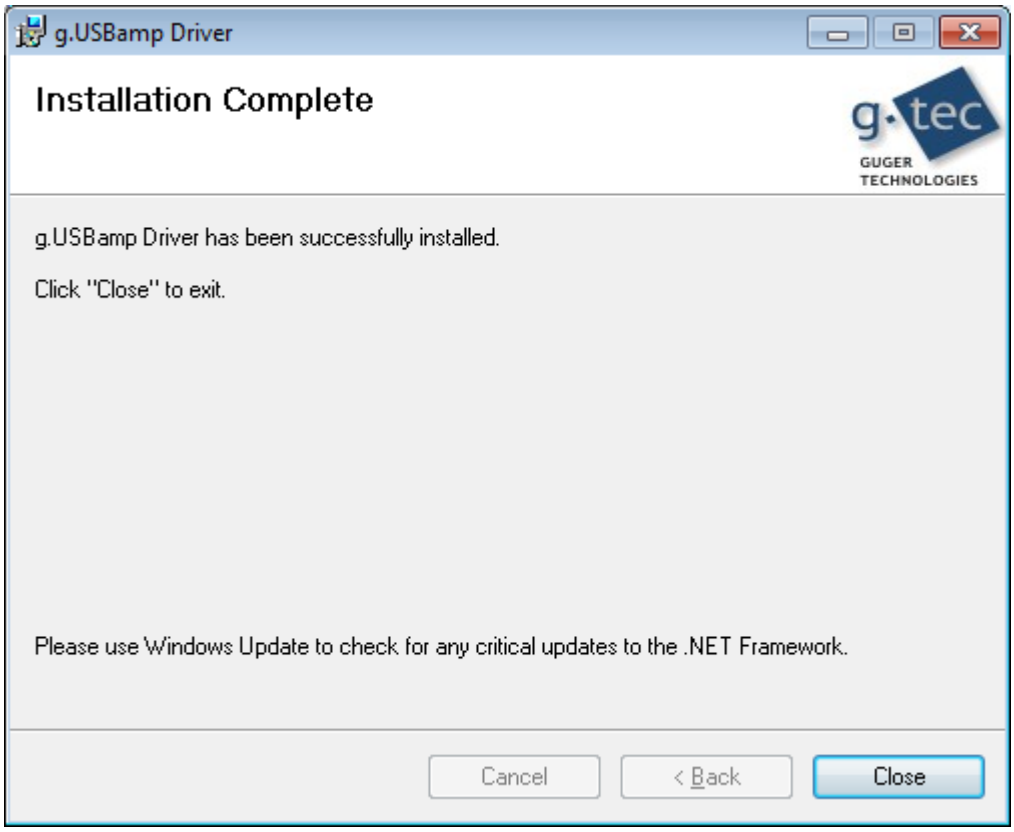
6. Choose the installation folder (default is `C:\Program Files\gtec\`) where the install routine copies all necessary driver files and press **Next.**

7. During installation of the g.USBamp driver, the following dialog might appear:



Click **Install** to continue and click the **Close** button to complete installation.

8. Follow the instructions on the screen. When the following window informs you about completion of the installation, click **Close** to complete.



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: The g.USBamp driver software has to be installed before attaching the device to your PC.

1. Plug the power cable into your g.USBamp and switch it on. The green led on the front side of your amplifier will turn on.

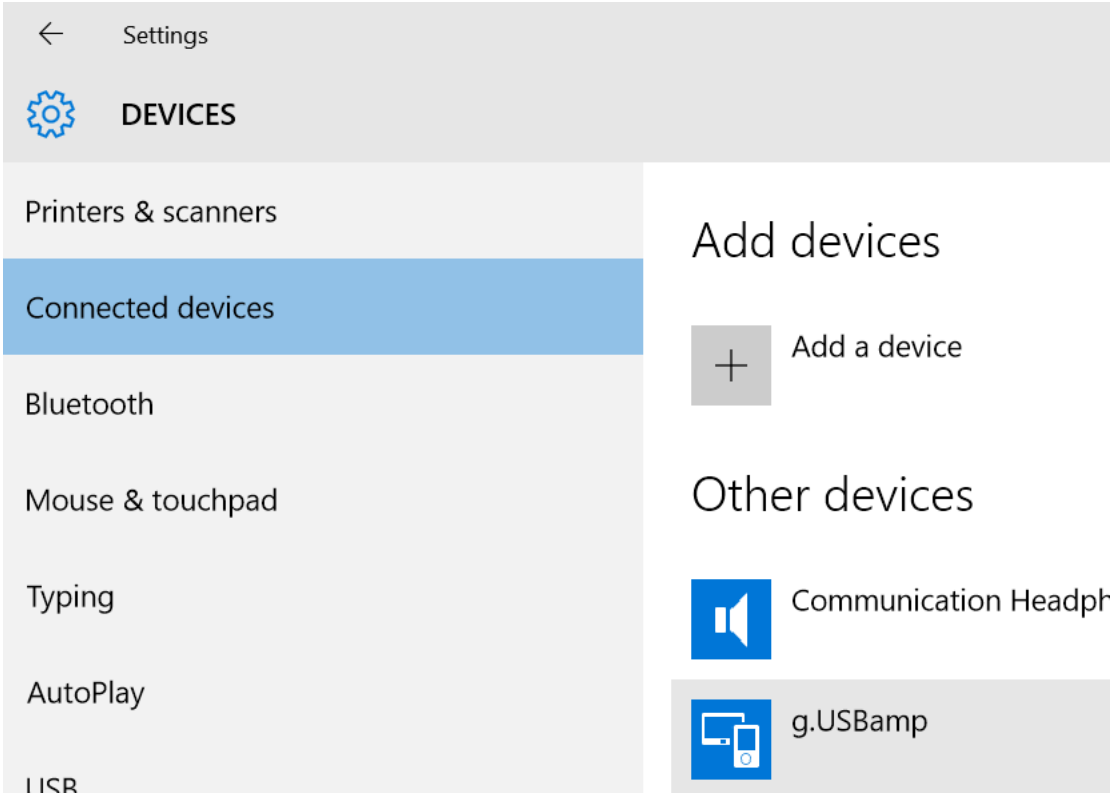
2. Connect the USB cable to your amplifier and to a valid USB 2.0 port on your computer. The plug and play manager will detect the new hardware and start to install the driver for “g.USBamp”:

3. If **User Account Control** is turned on, additional dialogs may ask for permission. Confirm the dialogs to allow installation of the g.USBamp driver software through **User Account Control**.

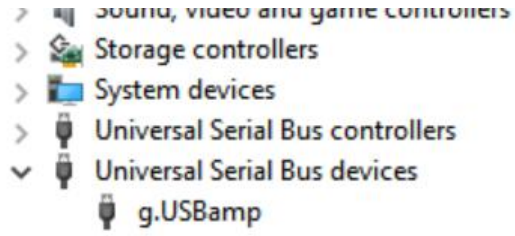
4. A notification icon in the task bar indicates that the installation procedure has completed:

Test your installation

Open the **Devices** tab from the Windows 10 **Settings** menu. The g.USBamp should be listed under **Connected devices**.



Alternatively, you can start the device manager to test your installation. Under **Universal Serial Bus devices,** 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 the 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”.

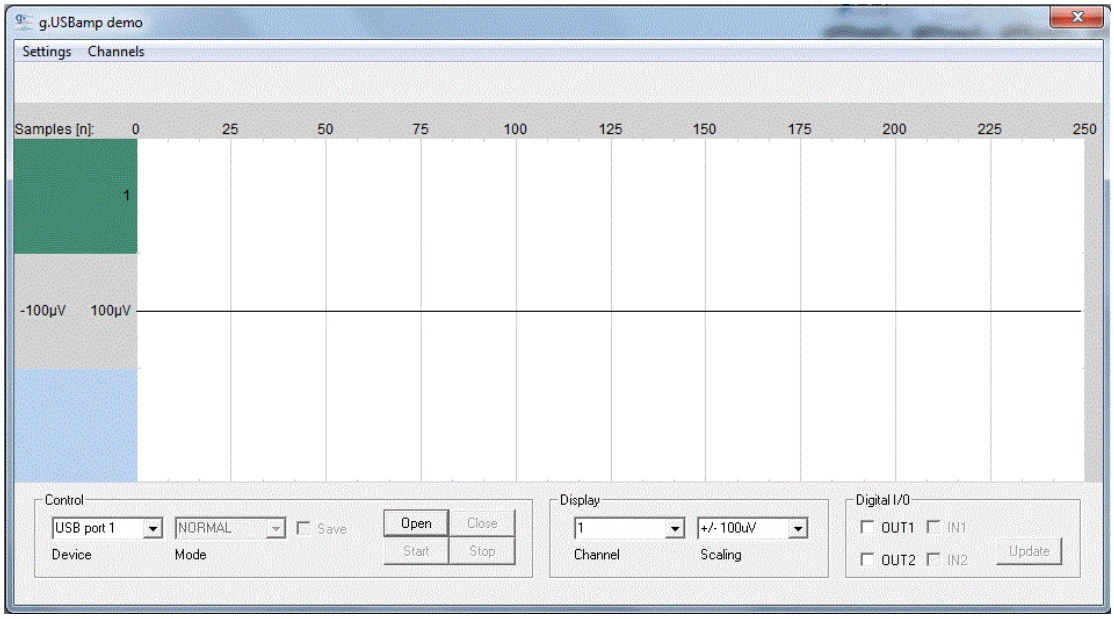
Acquisition Software g.USBamp Demo

To run the demo acquisition software press the Windows **Start** menu button and start the **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. The g.USBamp demo is not intended for data recording and data storage.

The program's main window appears and shows the USB port where the amplifier is connected (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.

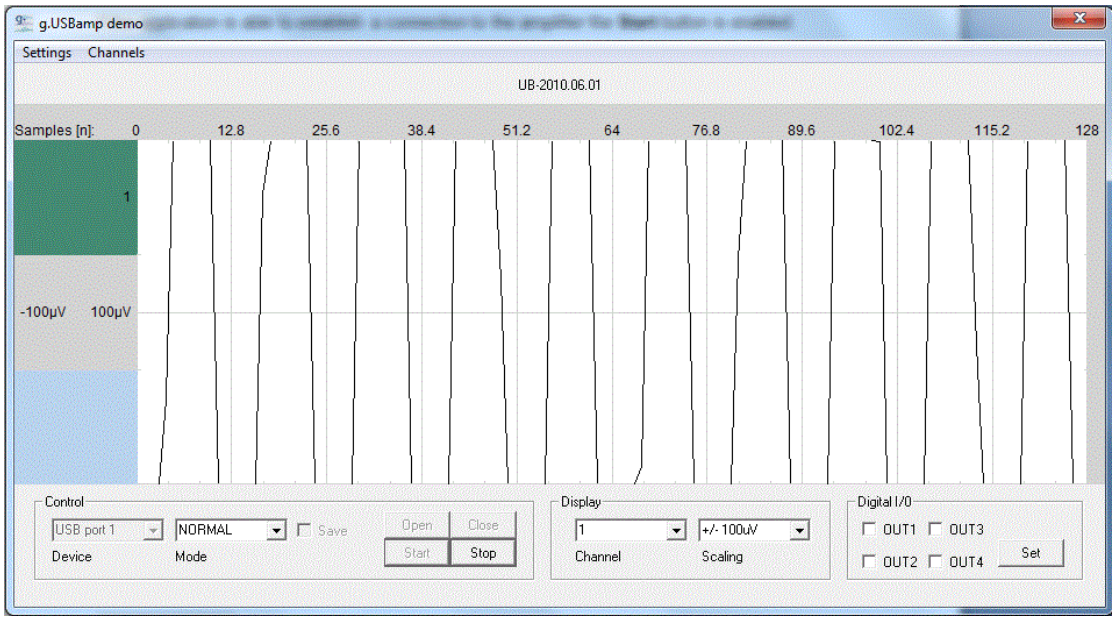


Data Acquisition

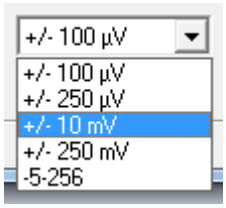
Press the **Open** button in the **Control** field to establish a connection to the g.USBamp device.

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

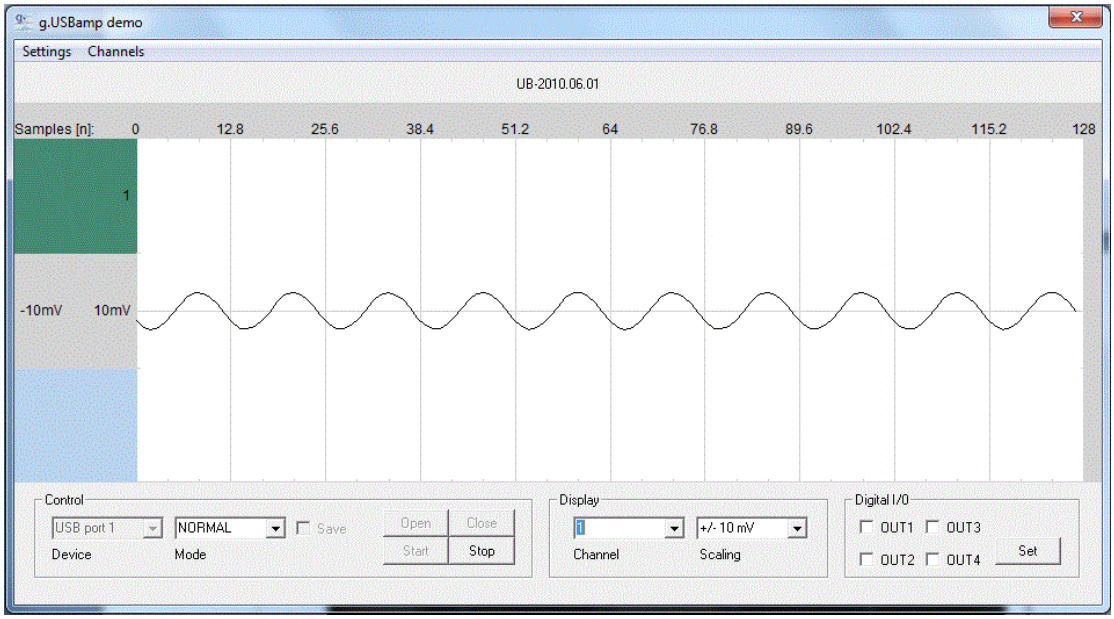
Press the **Start** button to begin the data acquisition and visualization. If e.g. a sine wave signal with 1 mV amplitude is applied to the input of channel 1, you should see a similar output on your screen.



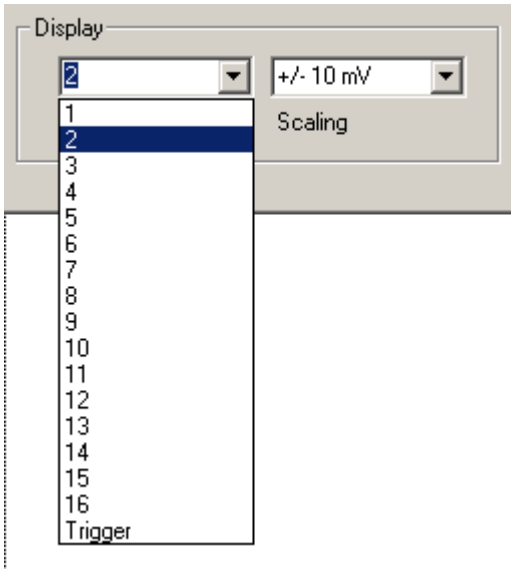
Change the **Scaling** of the graph in the **Display** field to +/-10 mV to view the sine wave correctly.



If the data transmission is interrupted the message **Timeout occurred** appears. The amplifier must be reset in this case by switching it off and on again.

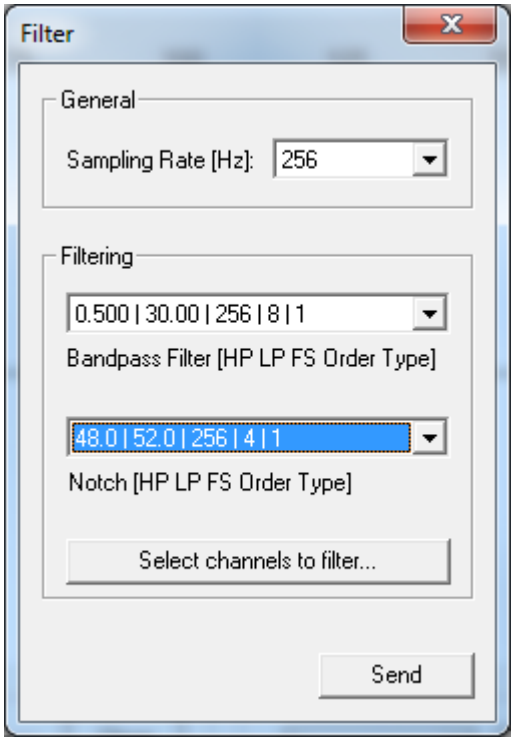


Use the **Channel** pull-down menu to select the channel that should be visualized in the graph.



If you select the trigger channel the scaling is automatically turned to -5-256. 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 either 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 (8^{th} order Butterworth) and a band stop filtering between 48 and 52 Hz (4^{th} order Butterworth) to suppress the power line interference.

In the g.USBamp demo application, only sampling rates up to 4800 Hz are supported.

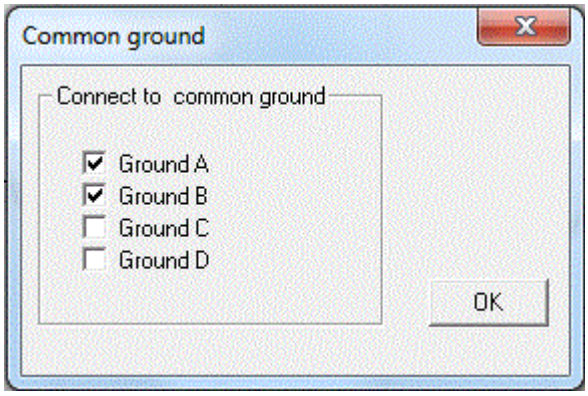
Use the **Select channels to filter…** button to select the channels where these filter settings should be applied. If the channels are not specified, the settings are transmitted to all channels.

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

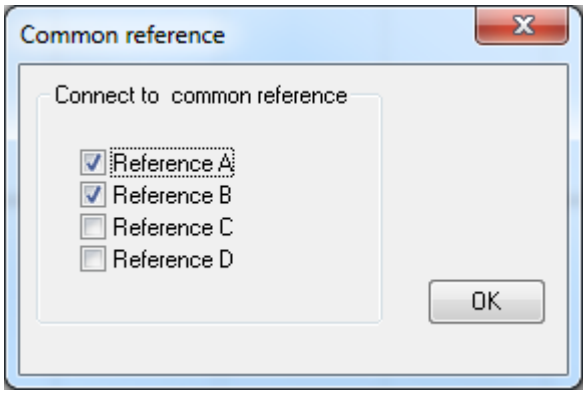
Close the window and press the **Start** button. The g.USBamp now acquires the data at 256 Hz and performs a band pass and notch filtering of the data. If the sampling rates of the filters do not match, a warning is presented but the filter parameters are transmitted.

The g.USBamp has four 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.

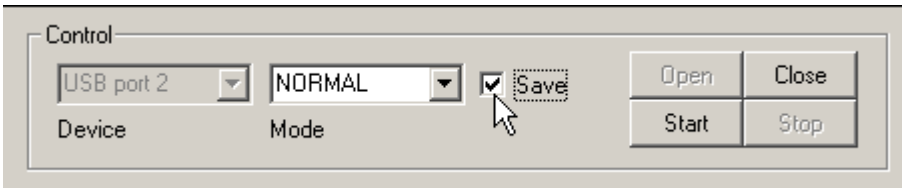


Open the **Common Reference** window and perform the same steps to connect the reference potentials of the groups A-D.



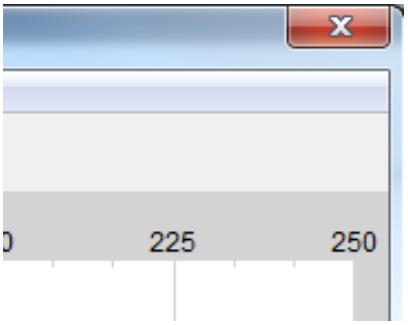
References and grounds are disconnected when the program is restarted.

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 now streams 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.

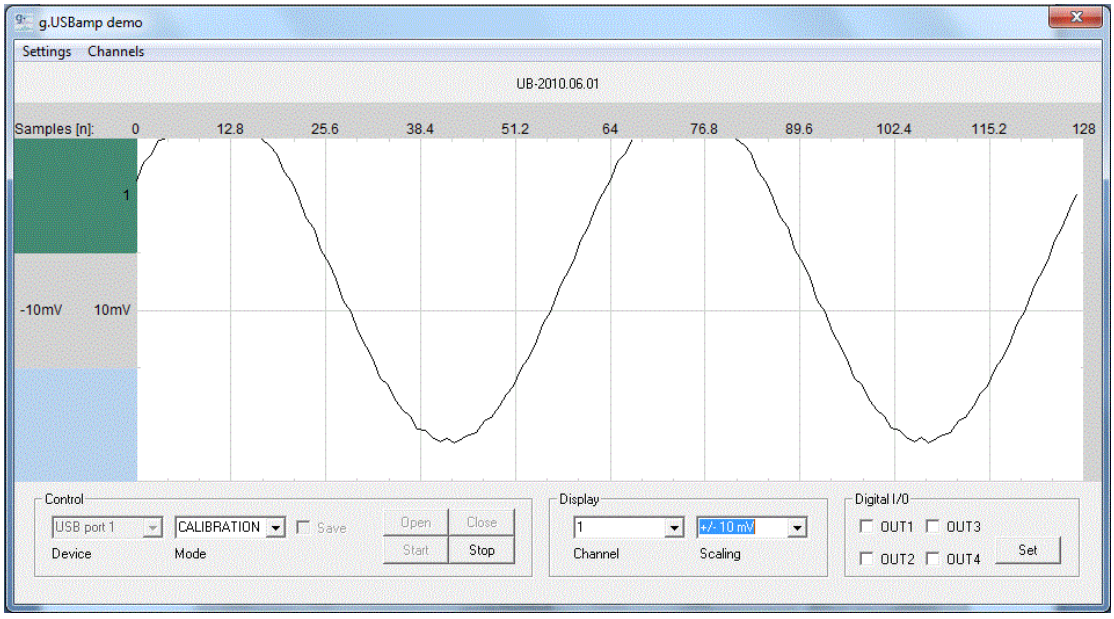


Calibration

Select CALIBRATION under the **Mode** pull-down menu and click the **Start** button to run data acquisition.

In calibration mode, all electrode input sockets are disconnected from the input amplifiers and a calibration signal is connected instead. Please note that the demo application does not provide the possibility to recalibrate the amplifier based on this signal.

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

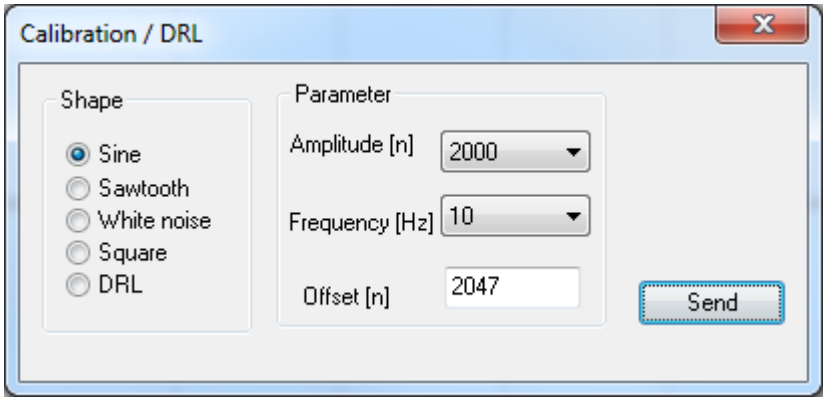


To change the calibration signal, go to the **Calibration / DRL** window, which can be opened from the **Settings** menu.

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

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

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

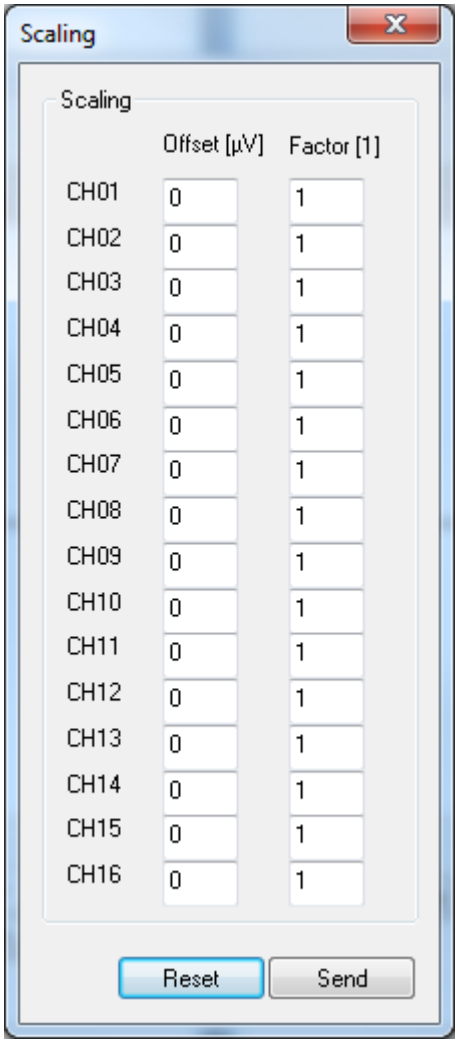


The **Offset** field allows for the addition of an offset to the calibration signal.
The signal range for the test signal is 0-4096. Divide the selected amplitude or offset value by 8.15 to get its corresponding voltage in mV.

To change the scaling, go to the **Scaling** window, which can be opened 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 the device using the **Send** button. Values are stored in permanent memory in the device.
To reset **Offset** and **Factor** for all channels, press **Reset** and all offset fields are set to 0 and 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:

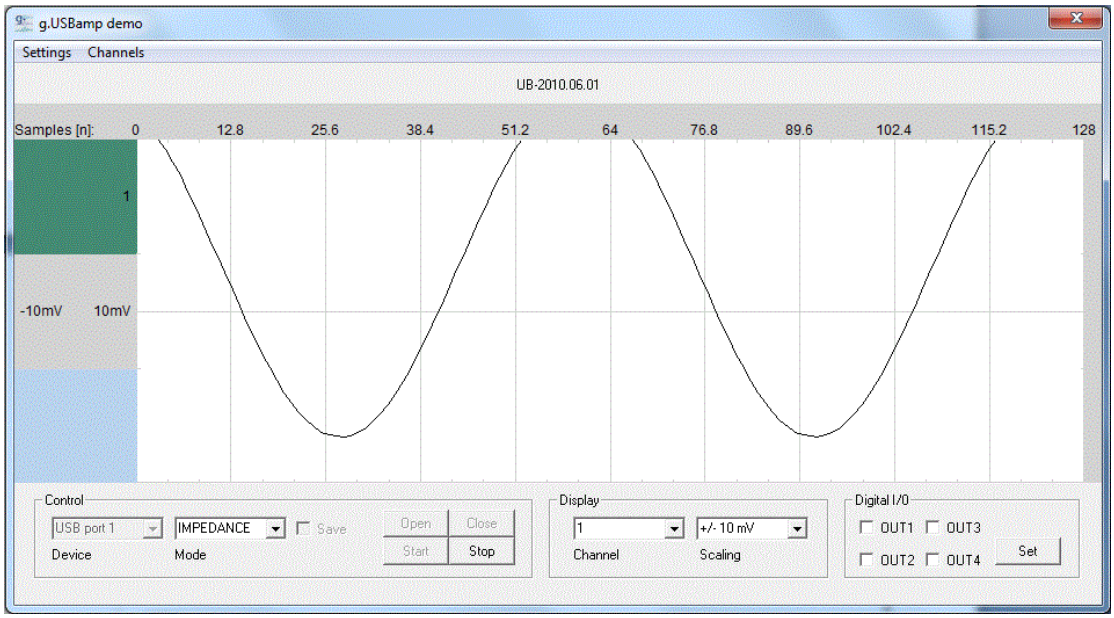
$$y = (x - d)*k;$$

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

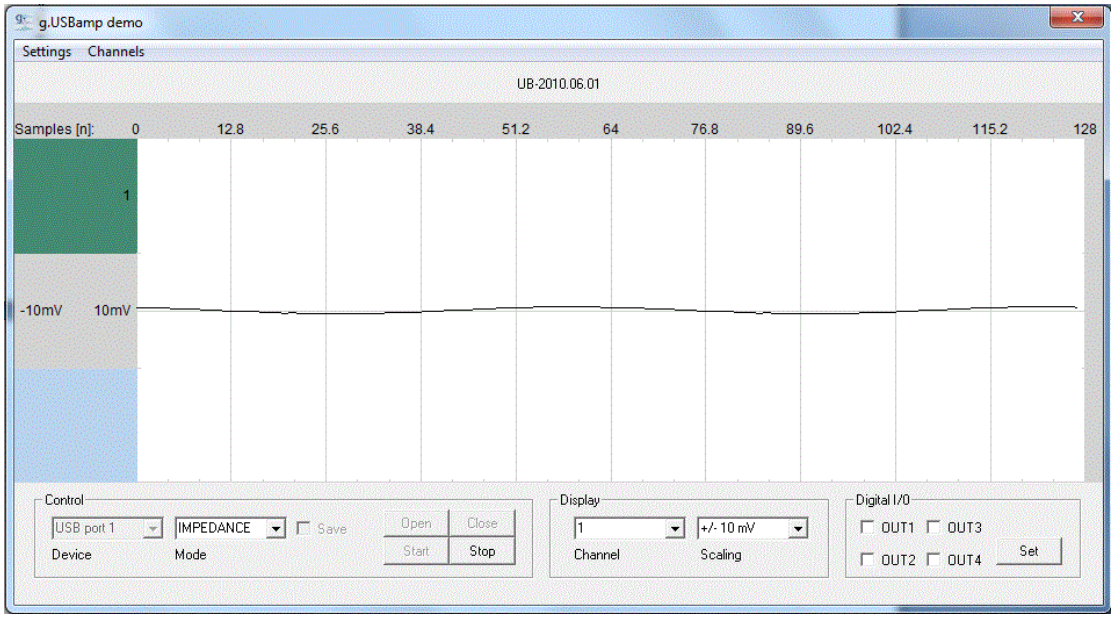


Impedance Measurement

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



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



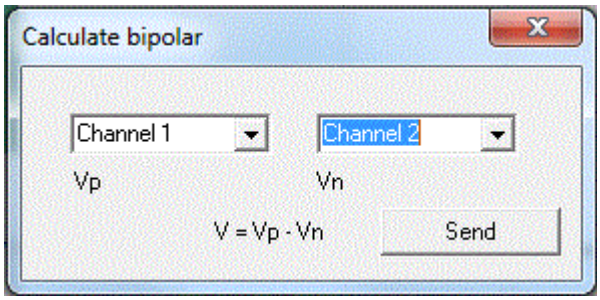
The following equation gives the impedance value:

$Zx = U1 * 10^6 /(U_{cal}-U1) – 10^4$

With U1 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

The g.USBamp allows bipolar derivations 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.



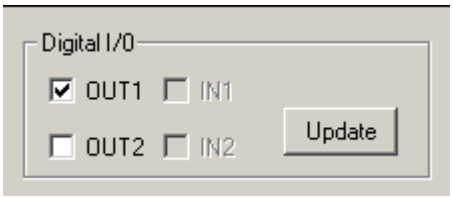
Select `none` as **Vn** if no bipolar derivation should be performed.

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)

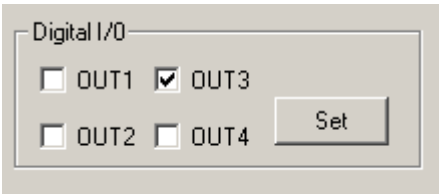
g.USBamp version 2.0

This amplifier has two digital inputs and two digital outputs that can be set asynchronously 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.



g.USBamp version 3.0

This version of g.USBamp has four digital outputs.
To set digital output 3, check the **OUT3** box and press the **Set** button.



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 the g.USBamp is set to 4800 Hz. If a higher sampling rate is required (9600 Hz, 19200 Hz, 38400 Hz), the 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\gtec\gUSBamp\Driver Enable 38kHz to “1”.

Using g.USBamp at higher sampling rates

If you are using a 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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