

V-Amp & ImpBox

Operating Instructions

Manual version 006

V-Amp | Operating Instructions

Manual version 006

October 2, 2014*

Imprint

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About these operating instructions

These operating instructions describe how to use *V-Amp* and how it is integrated into a measurement setup. The operating instructions form an integral part of *V-Amp*. They must be precisely adhered to in order to ensure that *V-Amp* is used as intended and operated correctly to guarantee the concomitant safety of test subjects, users and third parties. Make sure that these operating instructions are always available to the users.

No part of this document may be reproduced or distributed in any form without the express written permission of Brain Products. The operator may print this document to make it available for the users of the product. Please keep this document and Application Suite DVD in a safe place.

Make sure that you have the most recent operating instructions for your product or product revision. Please visit our website to download a more recent version: <http://www.brainproducts.com/downloads.php>.

Target group of the operating instructions

The operating instructions are intended for users in the psychological and neurophysiological research area as well as physicians and medical experts with experience in performing physiological data acquisition. Staff must also know how to work safely and reliably with the permitted amplifier and the associated recording software.

The structure of the operating instructions

The operating instructions are divided into the following chapters:

- ▶ [Chapter 1](#) introduces the *V-Amp* and *ImpBox* with their supplied accessories and also describes the basic functions.
- ▶ [Chapter 2](#) describes how to install the *V-Amp* drivers on your PC.
- ▶ [Chapter 3](#) describes how the *V-Amp* and *ImpBox* are incorporated in a measurement setup and covers the basic software configuration.
- ▶ [Chapter 4](#) describes the basic characteristics of the active electrodes.

- ▶ [Chapter 5](#) contains information on common sources of error and how to rectify these. You should first check whether any of these sources of error could be responsible for any problems you are experiencing before contacting our technical support team.
- ▶ [Chapter 6](#) contains information on care and maintenance and on the correct way of disposing of old units.

Conventions used in this document

Typographical conventions

Bold	indicates items on the user interface (menus, buttons, switches, connectors, options) and is used for emphases in the text
<i>Italic</i>	indicates titles of dialog boxes/tabs, file locations and is used to indicate product names
<u>Underscore</u>	indicates cross-references and web addresses
Monospaced	indicates text or characters to be entered at the keyboard

Symbols



Caution: This symbol indicates that incorrect use of the product(s) may result in a **health hazard** to the test subject, the user and/or a third-party. Failure to observe the information in this document constitutes incorrect use.



Notice: This symbol indicates that the incorrect use of the product(s) may bring about a risk of **damage to property**.



Note or Tip: This symbol draws your attention to important information relating to the current topic and to recommendations on how to use the product(s).



Cross-reference: This symbol indicates a reference to a related chapter, section or document.

New: This symbol indicates changes or new content at this point.

NEW

Revision History

Page Status Subject

viii	modified	Intended use
x	modified	New combinations with other products
xi	modified	Additional safety information



Product identification information

V-Amp

Product designation:	Brain Products V-Amp 8 Brain Products V-Amp 16
Manufacturer:	Brain Products GmbH Zeppelinstraße 7 82205 Gilching Phone: +49 (0) 8105 733 84 - 0 Fax: +49 (0) 8105 733 84 - 505 Website: http://www.brainproducts.com
Electrical safety according to IEC 60601:	Protection class II
Scope of delivery:	V-Amp Trigger cable V-Amp USB cable Application Suite DVD
Combinations with other products:	See Preface on page viii

The following labels are affixed to the *V-Amp* amplifier:

Observe the operating instructions.



MR unsafe: Products with this symbol are not safe for use in an MR environment.



This symbol indicates that defective products must not be disposed of with household waste. Dispose of in accordance with national regulations or return the product and its accessories to the manufacturer.



The manufacturer confirms that this product meets the requirements laid down in the Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility.



This symbol confirms compliance with the environmental requirements for electronic products (only applies to China).



Next to this symbol the name and address of the manufacturer is specified.

ImpBox

Product designation:	ImpBox
Manufacturer:	Brain Products GmbH Zeppelinstraße 7 82205 Gilching (Munich) Phone: +49 (0) 8105 733 84 - 0 Fax: +49 (0) 8105 733 84 - 505 Website: http://www.brainproducts.com
Electrical safety according to IEC 60601:	Protection class II
Scope of delivery:	ImpBox 2 Mignon AA batteries 1 battery charger
Combination with other products:	actiCAP active electrodes EP-PreAmp for V-Amp

The following labels are affixed to the *ImpBox*.

Observe the operating instructions.



MR unsafe: Products with this symbol are not safe for use in an MR environment.



Patient applied part of type BF. Although marking confirms a BF applied part according to 60601 (2nd ed.), this product is not a medical device.
Not for use in conjunction with a defibrillator!



This label indicates that defective products must not be disposed of with household waste. Dispose of in accordance with national regulations or return the product and its accessories to the manufacturer.



The manufacturer confirms that this product meets the requirements laid down in the Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility.

Next to this symbol the manufacturing date is specified.



Preface

The *V-Amp* manages a variety of signals like EEG, ERP, EOG, ECG, EMG as well as the full range of evoked potentials. Sensors for peripheral signals like GSR, blood flow, temperature also interface with the *V-Amp* auxiliary ports.

It has up to 16 data channels for passive and active electrodes. The EEG-signals acquired with the electrodes and sensors are amplified, digitized and transferred to a computer via USB for display and storage.

The *V-Amp* is a versatile amplifier for a wide range of applications (e.g. biofeedback experiments, teaching courses).

Intended use

V-Amp

NEW

V-Amp is intended to be used for amplifying and digitizing neuro-/electrophysiological signals (e.g. EEG, EMG, ECG, EOG).

***V-Amp* is not a medical device.** Use of *V-Amp* for diagnosis, therapy, monitoring of vital physiological processes (such as cardiovascular functions etc.) or other medical purposes is expressly forbidden.

ImpBox

The *ImpBox* is intended to be used for generating signals for the purpose of displaying impedance values.

***ImpBox* is not a medical device.** Use of the *ImpBox* for diagnosis, therapy, monitoring of vital physiological processes (such as cardiovascular functions etc.) or other medical purposes is expressly forbidden.

Correct use (V-Amp and ImpBox)

The *V-Amp* and/or *ImpBox* (in the following: *V-Amp/ImpBox*) are permitted to be used by users in the psychological and neurophysiological research area as well as physicians and medical experts.

The *V-Amp/ImpBox* is not permitted to be used by

- ▶ unqualified persons (e.g. laymen),
- ▶ persons who cannot read (e.g. due to visual impairment) or understand (e.g. due to a lack of language skills) the operating instructions.

The *V-Amp/ImpBox* can be used to record neuro-/electrophysiological signals from healthy and sick adults, children and animals.

The use of *V-Amp/ImpBox* for medical purposes is not permitted.

The *V-Amp/ImpBox* is permitted to be used in the following environments: Research institutes or other non-medical environments (e.g. at home) as well as hospitals, clinics or other medical environments, provided that all the other stipulations regarding the correct use are met and that the *V-Amp/ImpBox* is used in accordance with its intended use.

The *V-Amp/ImpBox* is not permitted to be used in the following environments:

- ▶ MR scanner environment,
- ▶ vicinity of explosive gases, as may be the case in operating theaters, for example,
- ▶ oxygen enriched atmospheres,
- ▶ underwater (e.g. sea, swimming pool, bath tub) or in environments which significant amounts of water could enter the *V-Amp/ImpBox* (e.g. under shower, under water-tap)

The user is solely liable for any risks to test subjects associated with the investigation, if the products are not used in accordance with the correct use.

Combination with other products

NEW Brain Products permits the user to combine the *V-Amp* with the following product families:

Product	Manufacturer
actiCAP active EEG electrode system (incl. splitter box and ControlBox)	Brain Products GmbH
EP-PreAmp (only with V-Amp 16)	Brain Products GmbH
Acceleration Sensor	Brain Products GmbH*
GSR Sensor	Brain Products GmbH*
Respiration Belt	Brain Products GmbH*
Photo sensor	Brain Products GmbH*
StimTrak	Brain Products GmbH
actiCAP Xpress	Brain Products GmbH
TriggerBox & TriggerBox Extension	Brain Products GmbH
Passive Ag/AgCl EEG electrodes/caps (e.g. Multitrode/Brain Cap)	EasyCap GmbH*
Electrode gel or paste	EasyCap GmbH*
Blood Pulse Sensor	Becker Meditec*
Temperature Sensor	Becker Meditec*
BrainVision Recorder	Brain Products GmbH

* Other manufacturers on request

Brain Products permits the user to combine the *ImpBox* with the following product families:

Product	Manufacturer
actiCAP active EEG electrode system	Brain Products GmbH
EP-PreAmp	Brain Products GmbH

Beside this general statement about permitted product combinations, the user must check, if all stipulations of each product are fulfilled for the specific combination and purpose of application (i.e. intended use and correct use).



Safety

NEW

- ▶ Never use force to connect or disconnect the connectors.
- ▶ Never disconnect cables by pulling on the cables. Always disconnect cables by pulling on the plug itself.
- ▶ Do not drop.
- ▶ Do not kink cables.
- ▶ The connectors on the products are intended for electrodes, electrode caps, sensors and triggers. Never insert probes, metal pins or any other items into these connectors.
- ▶ Heat, direct sunlight (UV beams), humidity, foreign material may impair the service life of the amplifier and accessories (see also [Appendix A](#)).
- ▶ Use the IEC 60601-1-1 standard to combine V-Amp with other products, such as computers, peripherals, triggers sources, etcetera.
- ▶ **This product is not suitable for use in an MR environment.**



Caution

- ▶ Not to be connected to a subject undergoing electro surgery or defibrillation.
- ▶ Take care in arranging the electrode and sensor cables to avoid risk of entanglement or strangulation.
- ▶ Auxiliary probes or probe sets must comply with the electrical safety according to IEC 60601. If used two probes with different functions and electrical connection to the subject (for example GSR and BIP2AUX) or one probe with a set of functions then a double or reinforced galvanic isolation between the function parts must be used.



Notice

- ▶ Only use the supplied cables. On no account use any longer cables that you may already have.
- ▶ Always fasten the fixation screws of the USB cable.
- ▶ **Explosion Hazard:** Do not use in the environment of explosive gases (e.g. flammable anesthetic mixture with air) or Nitrous Oxide, and oxygen-enriched atmospheres.

Special Care for Cleaning!

- ▶ No liquids must ingress the *V-Amp*, *ImpBox* and other products, such as the *actiCAP splitter box*.
- ▶ Always dry the electrodes in a way, that no water can enter the connectors or *actiCAP splitter box*!

Recording Quality

Do not use the products within 3 meters of an operating cellular phone, similar radio transmitting or other powerful radio interference producing sources such as radio thermal treatment equipment, x-ray machines, or equipment that produces electrical sparks. Otherwise the EEG recording might contain noise/artifacts.

The data recording and the quality of the recorded data lies within the responsibility of the user. For any queries about data recording and improving the quality, please contact the technical support (techsup@brainproducts.com). ●

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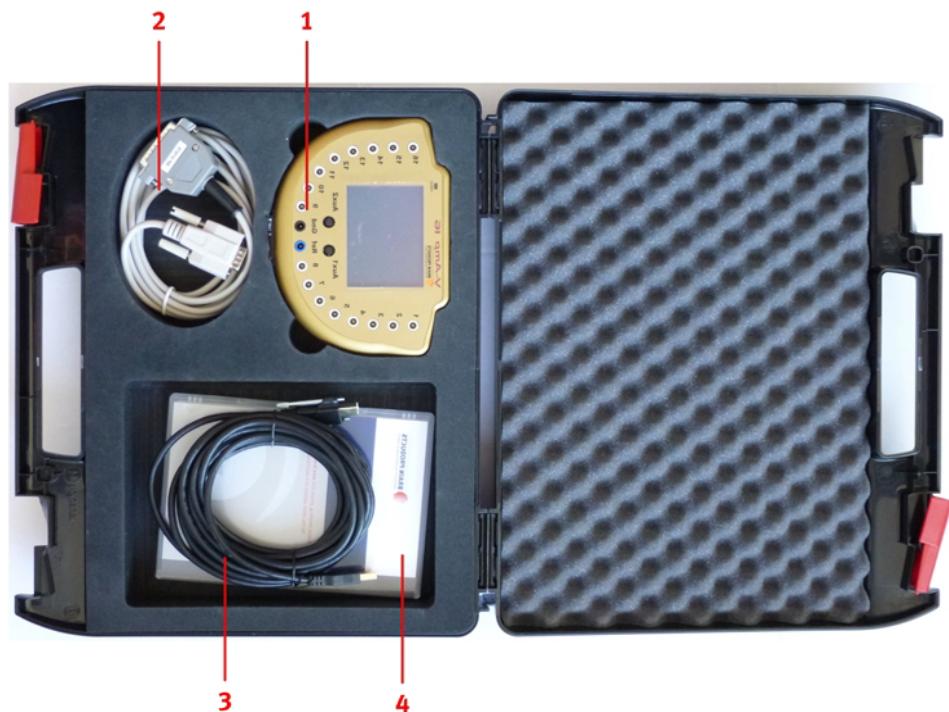
Chapter 1 Overview

1.1 V-Amp at a glance

Scope of delivery

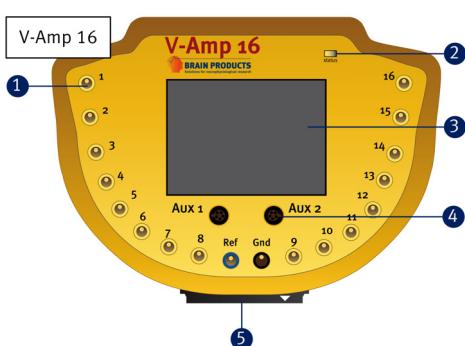
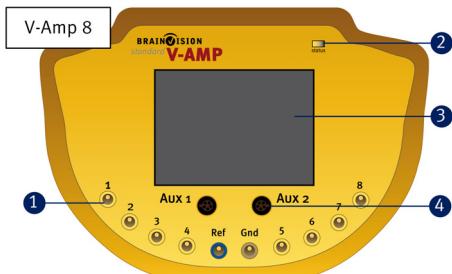
V-Amp is available as 8 or 16-channel version. The components listed below are included in the scope of delivery.

Upon receipt of the delivery, make sure that the product or package does not show any signs of damage, or that the delivery is incomplete:

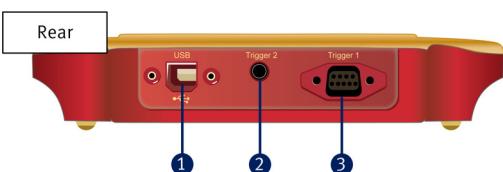


- 1 **V-Amp 16** (depicted) or **V-Amp 8**
- 2 **Trigger cable** (9/25 pin male)
- 3 **USB cable**, Type A/B
- 4 Application Suite DVD

Overview



- 1 8 / 16 touch-proof jacks for passive data electrodes, 2 touch-proof jacks for REF and GND
- 2 Status LED
- 3 LCD screen
- 4 AUX connectors for additional sensors
- 5 40 pin connector for active electrodes (only for V-Amp 16)



- 1 USB port for power supply and data interface
- 2 Trigger 2 (jack plug)
- 3 Trigger 1 (9 pin female)

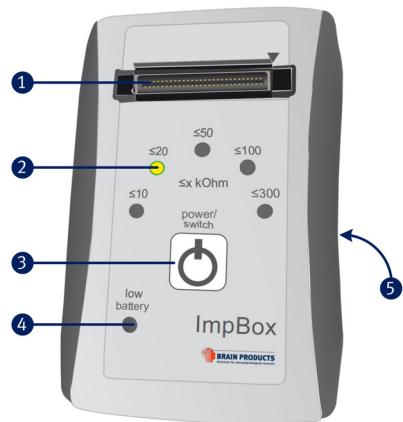
1.2 ImpBox at a glance

Upon receipt of the *ImpBox*, make sure that the product or package does not show any signs of damage, or that the delivery is incomplete.

Scope of delivery

- ▶ *ImpBox*
- ▶ 2 x rechargeable Mignon AA batteries (NiMH)
- ▶ Battery charger

Overview



- 1 40 way connector for *actiCAP splitter box* (pin out see [Appendix B](#))
- 2 LED, indicating the selected impedance range ([page 23](#) f)
- 3 **power/switch** button ([page 18](#))
- 4 **low battery** indicator ([page 18](#))
- 5 Rear: battery tray

Functions

The *ImpBox* is used to determine the impedances for *actiCAP* active electrodes and can also be used for the *EP-PreAmp*'s passive electrodes.

Active electrodes have their own impedance converters, which allow working with higher impedance values. When using active electrodes it is sufficient to measure the impedance in **ranges**, which is the reason why the *ImpBox* performs the impedance routine only in ranges instead of single values. The available ranges are ≤ 10 kOhm, ≤ 20 kOhm, ≤ 50 kOhm, ≤ 100 kOhm, ≤ 300 kOhm. LEDs in the active electrodes (or *EP-PreAmp* modules) will indicate, if the impedances are within the selected range or not (see also [Section 3.2.1](#)).



Details on the *actiCAP* active electrode system or the *EP-PreAmp* are available in the corresponding operating instructions. You can download these instructions from the manual section of our website: <http://www.brainproducts.com/downloads.php>.

Power/switch button

The power/switch button has three different functions:

- 1 On: Press once.
- 2 Select a range: Press repeatedly until LED indicates impedance range (from low to high).
- 3 Off: Press and hold for 3 seconds.

Low battery LED

The *ImpBox* is powered by two rechargeable Mignon AA batteries (supplied). If their charge becomes insufficient, a red battery low LED illuminates. In this case you must replace or recharge the batteries.



Note

The batteries must be sufficiently charged in order to achieve reliable results.

Batteries

To change the batteries, slide open the battery tray on the rear side of the *ImpBox*. The orientation of the battery positive and negative terminals are marked in the tray. Only use batteries of the supplied type (Mignon AA, NiMH, rechargeable). See also [Appendix A](#).





Chapter 2 Installation

Before you can use the *V-Amp* amplifier for recording EEG-data you must install the *V-Amp* driver on your computer.

2.1 Installing the driver

The complete installation comprises the following steps:

- 1 Install *BrainVision Recorder*.

The drivers for *V-Amp* will be installed with the software. Do not remove the *Application Suite DVD* during the installation procedure.

To manually install the driver, please refer to [Chapter 5](#).

- 2 Connect *V-Amp* to the computer with the supplied USB cable.

The driver will be initialized. Every time you connect *V-Amp* to another USB port the drivers will be initialized again.

Do not use USB hubs (e.g. on computer screens, keyboards etc). This can cause an instable working environment.

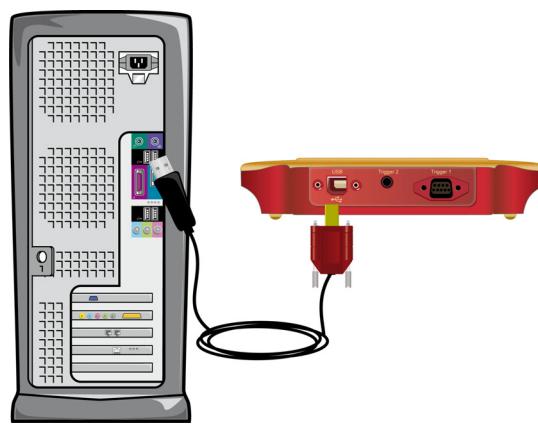


Figure 2-1. Connect the USB cable

- 3 Connect the dongle to the computer.
- 4 Start *BrainVision Recorder* and select the *V-Amp/FirstAmp* amplifier.

2.2 Confirm the installation

There are two ways to confirm the correct installation of *V-Amp*.

A) When you connect *V-Amp* to the computer, the start-up screen appears.

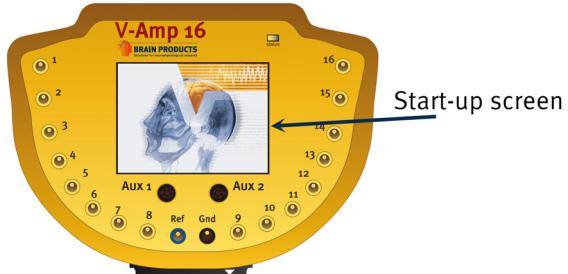


Figure 2-2. Confirm installation 1: start-up screen

B) Click on **Start > Control Panel > Device Manager**¹. *V-Amp* should appear in the list of installed devices.

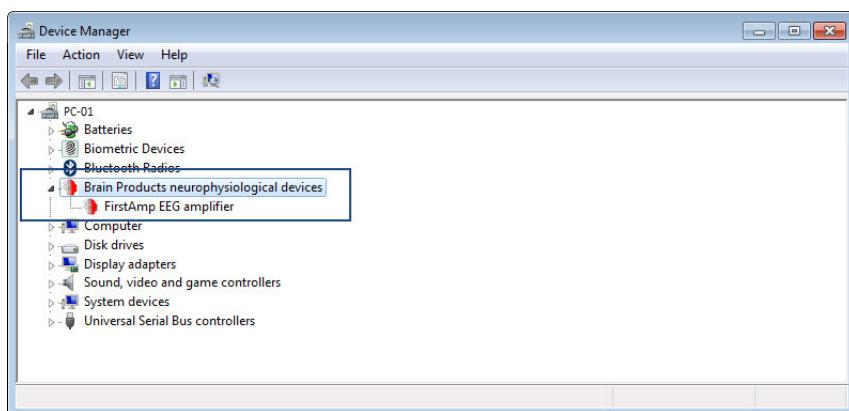


Figure 2-3. Confirm installation 2: Device Manager



For additional installation instructions please visit our website at www.brainproducts.com/downloads.php (set-up poster "How to Set-Up the *V-Amp* System").

1. You can also open the Device Manager by putting in the following location in a Windows Explorer address bar: **Control Panel\All Control Panel Items\Device Manager**



Chapter 3 Operation

3.1 Connecting electrodes

3.1.1 Passive electrodes

V-Amp has 8 or 16 touch-proof connectors for passive EEG-electrodes and connectors for the reference (blue) and ground (black) electrode. The connectors are located on the top.



Figure 3-1. Connectors for passive electrodes

3.1.2 Active electrodes

The V-Amp 16 models have a 40 way connector for active electrodes on the front. It carries the 16 EEG channels, the REF and GND channel as well as the power supply for the electrodes.

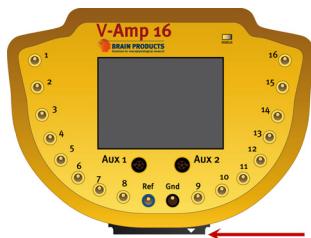


Figure 3-2. Connector for active electrodes

When you connect the splitter box to V-Amp, make sure that the clamps on the flat-ribbon cable are fully engaged.

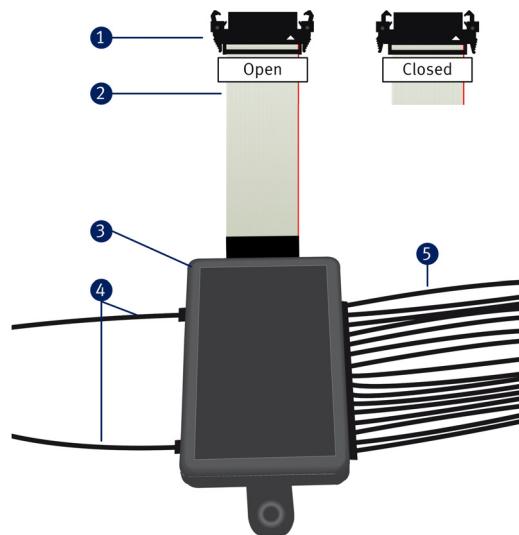


Figure 3-3. *actiCAP* splitter box for V-Amp

- 1 40-way connector
- 2 Flat-ribbon cable
- 3 Splitter box
- 4 Reference and ground electrodes
- 5 Data electrodes

To unplug the connector, press both clamps at the same time and carefully pull the connector from the plug.



Note

Never connect passive and active electrodes at the same time! This may result in a data loss.



For details about the *actiCAP* active electrodes, please refer to the *actiCAP Operating Instructions*. You can download the latest version of this manual from our website: <http://www.brainproducts.com/downloads.php>.

3.2 Operating modes

The *V-Amp* has three operating modes:

- ▶ impedance measurement ([page 23](#))
- ▶ monitoring ([page 25](#))
- ▶ test signal ([page 25](#))

Switching between these modes is performed in *Recorder*.

3.2.1 Impedance measurement

Depending on the electrode type, the electrode impedances are determined by different methods. For passive electrodes, *V-Amp* has its own impedance routine and for active electrodes, the *ImpBox* is used.

Passive electrodes

To measure the impedance of passive electrodes, do the following:

- 1 Prepare the electrodes on the test subject, e.g. by using abrasive paste and conductive gel.
- 2 Make the connections (electrodes to *V-Amp* and *V-Amp* to computer).
- 3 Start the **Impedance Mode** in *Recorder*.
- 4 Lower the impedances (if necessary)
 - ▷ First confirm that the impedance values of the REF and GND electrodes are in the 1-10 kOhm range.
 - ▷ Then lower the impedances of the EEG electrodes.
 - ▷ During the impedance routine, the exact impedance values are displayed in *Recorder* and also on the *V-Amp* LCD display.
- 5 When finished click on  or  to end the **Impedance Mode**.

The impedance values will be stored together with the EEG data. If you close *Recorder* before starting to record the EEG signals, the impedance values will be lost.

Active electrodes

Use the *ImpBox* to measure the impedances of active electrodes.

To conduct the impedance measurement with the *ImpBox* do the following:

- ▶ Connect the *actiCAP splitter box* to the 40 pin connector of the *ImpBox* (1).
- ▶ Turn the *ImpBox* on by pressing the **power/switch** button (3).
- ▶ Select a impedance range (levels) by repeatedly pressing the **power/switch** button (3). The selected value will be displayed by the corresponding LED (2).

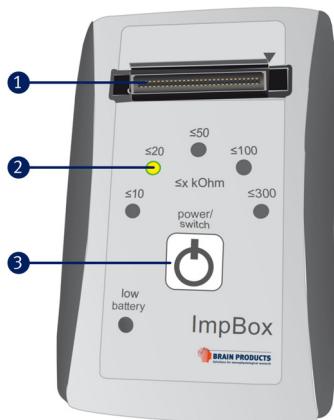


Figure 3-4. *ImpBox* - Overview

For active electrodes it is useful to start with a high impedance range and gradually select the next lower range until you have reached a satisfying result.

Whether the selected value is reached, is indicated by the LEDs on the electrodes. The colors correspond to different value ranges:



Green: Impedance value lies within selected value range.

Yellow: Impedance value above selected range, but less than 150% of the range.

Red: Impedance value more than 150% of selected level.



Note

V-Amp does not have an impedance routine for active electrodes. If you try to measure the impedances with *V-Amp* instead of the *ImpBox*, you will get unrealistic impedances of 0 kOhm for all electrodes.

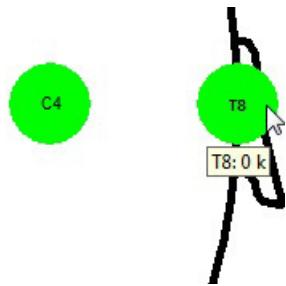


Figure 3-5. Example of wrong impedance



More information about handling the *actiCAP* active electrodes, please refer to [Chapter 4](#).

3.2.2 Monitoring

The monitoring mode is started by clicking on the button. Please note, that the EEG data and impedance values will only be stored when you click on the recording button .

3.2.3 Test signal

If you are in doubt of the functional state of your *V-Amp* you can perform a test of the physical channels (excluding the AUX channels). When you start the test mode, *Recorder* shows a square wave for all EEG channels.



Note

No electrodes must be connected during the test mode!

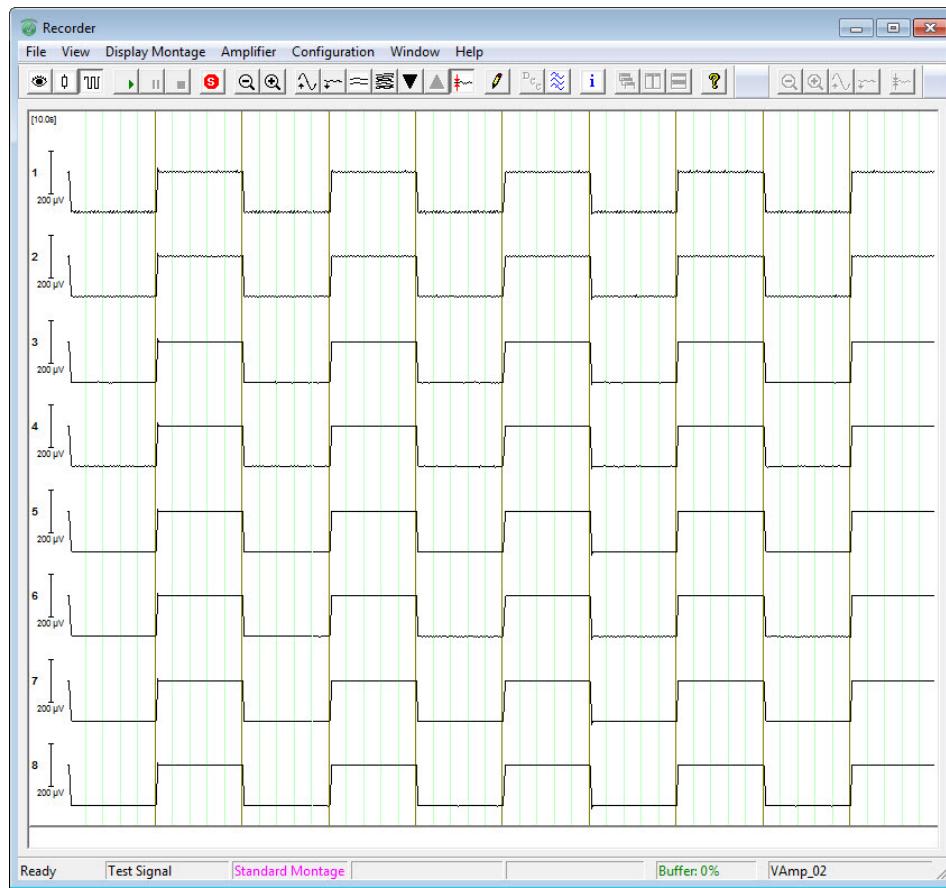


Figure 3-6. Example of a test signal

The square signal in the figure above contains noise. This is caused by an external power source with a 50 Hz mains hum. For your project you should remove any interference source before you acquire the EEG data, in order to obtain a high-quality EEG signal.

3.2.4 Auxiliary

V-Amp has two AUX inputs for sensors.



Figure 3-7. Location of AUX connectors



Note

The inputs **AUX 1** and **AUX 2** have a common ground. Please make sure that sensors with different functionalities are galvanically isolated from each other. The connected sensors must comply with the electrical safety according to IEC 60601.

3.3 Trigger ports and cables (digital ports)

The trigger ports on the *V-Amp* are used for recording events that are synchronous with the EEG, such as stimuli or test subject responses. *V-Amp* has two trigger ports located on the rear:

- ▶ **Trigger 1:** 9-pin D-Sub, Bits 1-8)
- ▶ **Trigger 2:** jack plug, Bit 0.

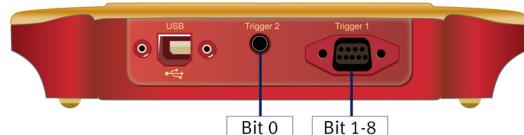


Figure 3-8. Location of trigger connectors and mapping of Bits 0-8

The cable of **Trigger 1** port is supplied as standard. It has a 9-pin and 25-pin male D-Sub connector. The cable for **Trigger 2** port is optionally available and it has a stereo jack on the one end and a BNC jack on the other end. For ordering these cables, please refer to [Appendix B](#).

You make the digital port settings in *Recorder*. Go to **Amplifier > Digital Port Settings...**



Note

A suitable ratio between the length of the trigger signal and the sampling rate is required to ensure that the TTL trigger signals are recorded without errors. You can select the appropriate sampling rate in the workspace.

Table 3-1 contains the recommended minimum trigger signal length for each sampling rate.

Sampling rate	Minimum length of trigger signal
100 Hz	25.0 ms
250 Hz	10.0 ms
500 Hz	5.0 ms
1,000 Hz	2.5 ms
2,000 Hz	2.5 ms
5,000 Hz	0.5 ms
10,000 Hz	0.5 ms
20,000 Hz	0.5 ms

Table 3-1. Recommended minimum length for trigger signals

If the sampling rate is not suitable for the trigger length, trigger information can be lost. Therefore, select a sampling rate matching the trigger length, in order not to lose any information.



For the pin-out of the connectors, please refer to [Appendix B](#).

For more information on trigger settings please refer to the *BrainVision Recorder User Manual* or to the user manual of your stimulus presentation software.





Chapter 4 Active electrodes

4.1 How the active electrodes work

The *actiCAP* electrodes possess high-quality Ag/AgCl pellets as well as "active" circuits that are integrated in the electrodes (impedance converters). These make it possible to perform recording at high impedances (e.g. 25 kOhm).

Alongside the integrated impedance converter, the electrodes also possess special electronic components which enable the *ImpBox* to measure the impedances between the electrode and scalp.

The LEDs which are integrated in the electrode housing indicate the impedance range of the current electrode impedance by means of different colors (red, green, yellow).

4.2 Preparing the *actiCAP* for acquisition

The *actiCAP* electrode set consists of a splitter box with 16 numbered electrodes (+ REF and GND) and a cap with numbered holders. The numbers enable you to assign the electrodes to the corresponding holders quickly. The cap also has two holders for the GND and REF electrodes that are marked with **GND** and **REF**.

Perform the following steps:

- 1 Insert the electrodes in the *actiCAP* holders.
- 2 In *BrainVision Recorder*, you can import the electrode position file (*.BVEF) that is supplied with the *actiCAP* or manually assign the physical channels to the electrode positions.
- 3 Place the cap on the test subject.
- 4 Fill the electrodes with gel (see [Section 4.3](#)).
- 5 Perform the impedance measurement.

You can also use the electrodes to acquire EOGs, EMGs or ECGs. When doing so, use the supplied *actiCAP* holders:

- 1 Insert the electrode in the holder.
- 2 Use an adhesive ring to apply the electrode to the required part of the body.
- 3 Fill the electrode with gel.



Figure 4-1. EOG electrode

4.3 Minimizing the impedances of the actiCAP electrodes

To minimize the impedance values, connect the *actiCAP splitter box* to the *ImpBox* and turn on the *ImpBox*. The LEDs of the electrodes now light up in red. Select the desired impedance range (e.g. ≤ 50 kOhm)

First minimize the impedances of the ground and reference electrode and only then minimize the impedances of the EEG electrodes.

Proceed as follows:

- 1 Carefully push the blunt needle of the syringe through the electrode aperture as far as the scalp.
- 2 Gently roughen the scalp by means of careful circular movements of the needle. This increases the contact area between the electrode gel and scalp.
- 3 Use the syringe to apply a small amount of gel (0.2 to 0.3 ml) directly to the scalp.
- 4 Then fill the remaining space in the electrode with gel, by slowly removing the syringe from the electrode.

In this way, you will easily achieve the impedance of 25 to 35 kOhm.

When the impedance value changes, the electrode LEDs change from red to yellow or green depending on the ranges you have set (see also [Section 3.2.1](#)).

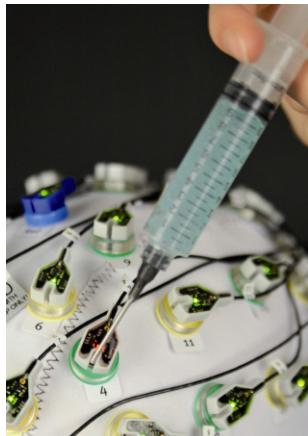


Figure 4-2. Filling the electrodes with gel

Using this procedure and with a little practice, you should be able to prepare 16 channels plus REF and GND in about five minutes.

The impedances improve with time: First of all, fill all the electrodes with gel as described above. Once you have prepared all the electrodes accordingly, perform a visual check of the impedances. Make sure that the GND and REF electrodes are in range.

If the impedance in one or more electrodes has not been sufficiently minimized (LED lit yellow or red), use the blunt needle in the nozzle to push through the electrode aperture again and roughen the scalp a little more by means of circular movements. If necessary, use a little more gel.





Chapter 5 Troubleshooting

5.1 Driver cannot be installed (Windows® XP and Vista)

If you are using Windows® XP or Vista, the driver might not install automatically. Therefore, when you connect V-Amp to your Windows® XP or Vista computer for the first time, a wizard for new hardware might open. If this is the case on your system, then do the following:

5.1.1 Windows® XP

- ▶ When prompted to connect to Windows® update, select **No, not this time** and click on **Next**.



Figure 5-1. Windows® XP, Wizard for new hardware (1)

- ▶ Then insert the *Application Suite DVD*.
- ▶ Select **Install the software automatically (Recommended)** and click on **Next**. This installs the V-Amp USB driver. In some cases this prompt appears a second time. If so, repeat the previous steps.

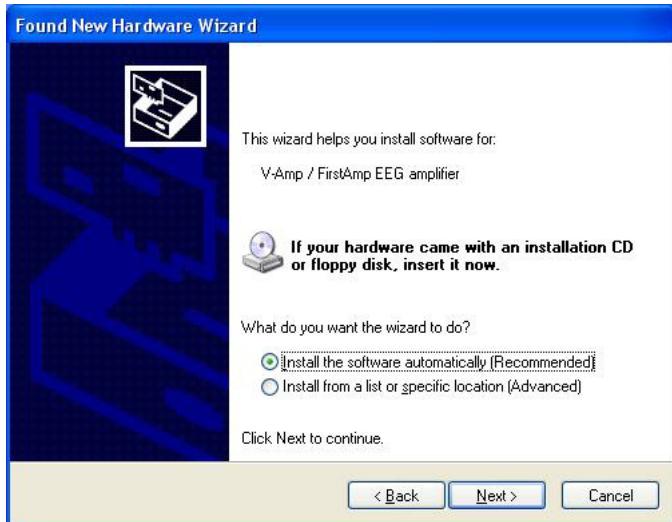


Figure 5-2. Windows® XP, Wizard for new hardware (2)

5.1.2 Windows® Vista

- ▶ Connect V-Amp to your computer. The hardware installation wizard.



Figure 5-3. Windows® Vista, Wizard for new hardware (1)

- ▶ Click on **Locate and install driver software (recommended)**. The following dialog appears:

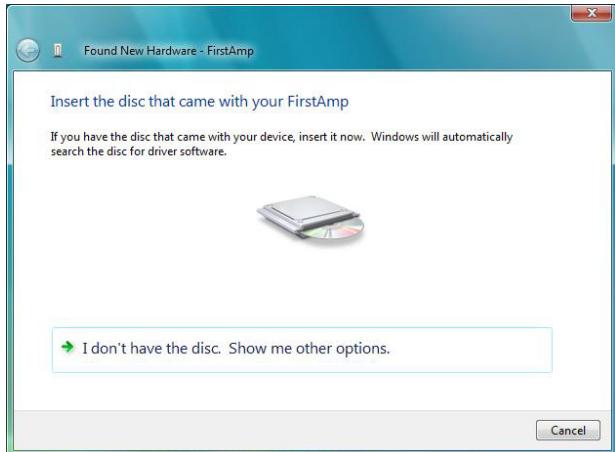


Figure 5-4. Windows® Vista, Wizard for new hardware (2)

- ▶ Insert the *Application Suite DVD*. If the driver was not installed automatically, then you can locate it on the DVD.

5.2 Error messages

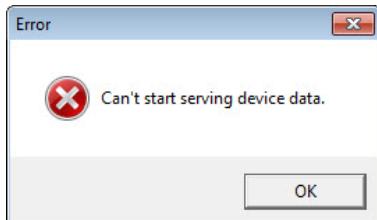


Figure 5-5. Warning message 'Can't start serving device data'

This error message in *BrainVision Recorder* can have the following cause: While *V-Amp* is connected to your PC, your PC switches into sleep mode. When you re-activate the PC, *V-Amp* will not show the start-up screen and *BrainVision Recorder* will display this error message if you access one of the three modes (*Monitor*, *Impedance Check*, or *Test Signal*).

To resolve this issue:

- ▶ Disconnect and re-connect the USB cable of *V-Amp*.
- ▶ Change the power saving settings of your PC so that your PC will never switch into sleep mode. (For details, please refer to the *BrainVision Recorder User Manual*.)

5.3 Replacing faulty electrodes

Proceed as follows to replace a faulty electrode:

- 1 Before replacing the electrode, disconnect the splitter box from the amplifier.
- 2 Remove the screw in the center of the cover.
- 3 Remove the cover.
- 4 Remove the metal bar on the side of the faulty electrode, by loosening the two small screws.
- 5 Carefully withdraw the faulty electrode from the splitter box. This is best done with a toothpick or small screwdriver as illustrated below:.

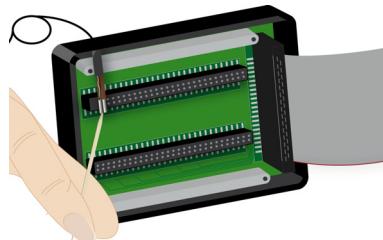


Figure 5-6. Remove a defective electrode from the splitter box

- 6 Carefully insert the new electrode. Ensure that the four metal pins engage correctly in the splitter and that the rubber sheathing is aligned and does not protrude.

If the electrode connector is not correctly seated, the electrode will not function.

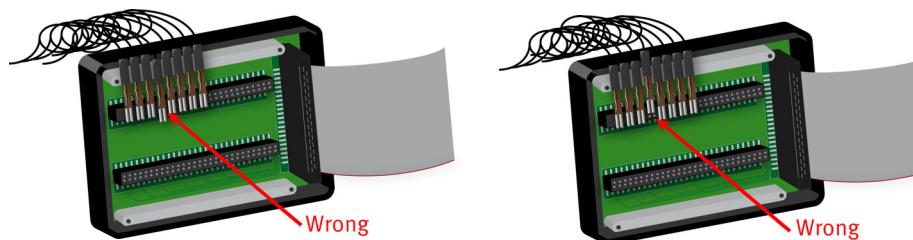


Figure 5-7. Mistakes when inserting an electrode in the splitter box

- 7 Set the metal bar back in place with the flat side facing down and secure it with the two small screws. Put the cover back onto the splitter box and secure it with the center screw.

If, during data acquisition, the corresponding channel signal is flat, or the impedance measurement is not possible or multiple electrodes exhibit defective signals, confirm that the electrode connector is seated correctly in the splitter box. Re-align if necessary.

Position of GND and REF electrode

If you replace a faulty GND or REF electrode, observe the positions of these electrodes as illustrated in the figure below.

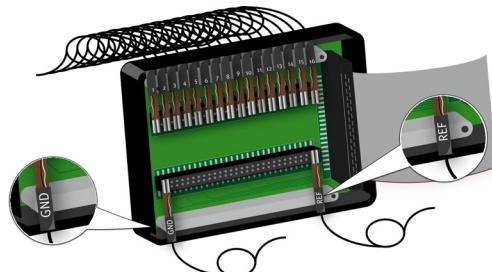


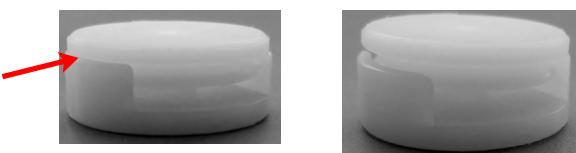
Figure 5-8. Insert the reference and ground electrode into the splitter box

The GND and REF electrodes are opposite the EEG electrodes, and have color-coded housings:
GND = black and **REF = blue**.

Notes on the cable clips

After replacing an electrode, the cable of the old electrode must be removed from the cable clips and the cable of the new electrode inserted. There are two round cable clips on each harness. A clip consists of a bottom and a top part.

- ▶ Carefully insert a small flathead screwdriver or utility knife into the small groove between the bottom and the top and lightly pry the top open until you here a click.



- ▶ With one hand, hold the bottom part and cables and with the other hand remove the top.
- ▶ Then remove the cable of the faulty electrode and insert the cable of the new electrode.
- ▶ Close the clip and do the same for the other clip.





Chapter 6

Maintenance, care and disposal

6.1 Maintenance

In principle, the amplifier is maintenance-free. However, it is recommended that you apply the test signal at regular intervals (e.g. once a month) in order to ensure that it is functioning correctly (see [Section 3.2.3](#)).

Factory testing and calibration ensure equipment accuracy and frequency response. Contact Brain Products GmbH for re-calibration if necessary.

Repairs or repeat testing as laid down in VDE 0751-1/IEC 62353 may only be carried out by Brain Products.

If any pins or connections on the product(s) are dirty or if you should notice any damage, return the product(s) to Brain Products.

6.2 Care

Use a soft, slightly moist cloth to clean the *V-Amp* and *ImpBox*.



Notice

- ▶ Never clean the amplifier and its accessories under running water.
- ▶ Do not use aggressive or corrosive cleaning agents.
- ▶ Do not sterilize the products.
- ▶ Never clean the products when the test subject is connected to them or the USB cable is still connected.

6.3 Disposal

As soon as the product, accessories and cables have reached the end of their service life, dispose of them in accordance with the applicable legislation. In the EU and EFTA, the WEEE Directive 2002/96/EC on Waste Electrical and Electronic Equipment applies. In Germany, for example, the "ElektroG" additionally governs electrical and electronic equipment.



Do not dispose of your products, accessories and cables with ordinary household waste.

On request, Brain Products will take back your old products, provided that they are original Brain Products parts.





Appendix A Technical data

V-Amp

Parameter	Value
Power supply	Via USB
Voltage	+5 V ±10 %
Current in stand-by mode	Less than 0.5 mA in USB suspend mode
Minimal current in active mode (recording off, LCD off) *	Typically 140 mA
Maximal current in active mode during recording *	Less than 450 mA (typically 370 mA)
Data transfer	USB 1.1 (USB 2.0) Connector: type A/B full-speed mode plug-and-play support
Supported OS	Windows® XP, Vista, 7, 8
Dimensions (mm)	170 x 125 x 30
Weight (g)	V-Amp 16: approx. 430 g V-Amp 8: approx. 400 g

*Power data for 16 CH models are described.

Ambient conditions

Parameter	Value
Operation	Temperature: 0 °C (32 °F) to +40 °C (104 °F) Humidity: 30 to 90 %, non-condensing Air pressure: 700 to 1,050 hPa
Transport	Temperature: -35 °C (-31 °F) to +65 °C (149 °F) Humidity: rel. 30 to 95 %, non-condensing Air pressure: 700 to 1,050 hPa
Storage	Temperature: -35 °C (-31 °F) to +65 °C (149 °F) Humidity: rel. 30 to 95 %, non-condensing Air pressure: 700 to 1,050 hPa

EEG channels for passive electrodes

Parameter	Value
Number of channels	8/16 EEG, ground, reference monopolar
Connectors type	Passive electrodes (8/16, ground, reference): 1.5 mm touch-proof jacks Active electrodes: 40-way socket for the actiCAP
Input range	±410 mV
Frequency range	0 Hz (DC) – 320 Hz/4 kHz (high-speed mode)
Sampling rates	100 Hz 250 Hz 500 Hz 1,000 Hz 2,000 Hz 5,000 Hz 10,000 Hz 20,000 Hz
Input noise	< 1 µVpp (0.5-30 Hz)
Input DC impedance	> 100 MΩ
CMRR	100 dB
Impedance Check (passive electrodes only)	Impedance measure independently for each electrode relative to GND electrode Range: 1-120 kΩ Tolerance: 10 %
Analog-to-digital conversion	Synchronous 2.56 MHz sigma-delta modulation synchronously for all channels, hardware digital filtration and decimation up to 20,000 Hz, 24 bit.
Galvanic isolation	Reinforced according to IEC60601-1 from PC side and double reinforced from auxiliary channels

Mapping of EEG channels (V-Amp 16)

EEG channel	Passive electrodes (touch-proof connectors)	Active electrodes (40 way connector)
1	1	6
2	2	3
3	3	4
4	4	1
5	5	5
6	6	8
7	7	7
8	8	10
9	9	12
10	10	11
11	11	14
12	12	13
13	13	16
14	14	15
15	15	18
16	16	17
REF	REF	19
GND	GND	35
Power -	-	2, 20, 38
Power +	-	9, 27

Auxiliary channels

Parameter	Value
Number of channels	2 bipolar
Input range	±5 V
Differential impedance	> 20 MOhm
Frequency range	0–150 Hz (-3 dB)
Analog-to-digital conversion	Multiplexing of auxiliary channels, sigma-delta modulation, hardware digital filtration and decimation up to 2,000 Hz, 24 bit.
Sensors power	+5 V and -5 V (±5 %) lines. Current up to 10 mA per channel.
Galvanic isolation	Reinforced according to IEC60601-1 from PC side and double reinforced from EEG channels No galvanic isolation between auxiliary channels.

Triggers

Parameter	Value
Input digital signals	9 Bits TTL level
Input trigger connector	3.5 mm jack plug for Bit 0 D-Sub 9, female for Bits 1-8
Triggers status	Synchronously with sample data max. tolerance +0.5 ms or +1 sample (whichever is greater)
Galvanic isolation	From PC side galvanic isolation is used for reducing the capacity to ground in case of connected external triggers sources. Isolation voltage is 200 VDC. Triggers are reinforced galvanic isolation from the test subject circuits (EEG and auxiliary channels).

ImpBox

Power supply

Parameter	Value
Power supply	2 x 1.5 V AA rechargeable battery
Max. operating duration	6 h

Technical data

Impedance measurement range	1 kOhm to 300 kOhm ($\pm 15\%$)
Injected current	< 20 μ A
Measurement cycle for up to 32 Ch	less than 1 sec.

Ambient conditions

Parameter	Value
Operating temperature	0 °C (32 °F) to +40 °C (104 °F)
Transport/storage temperature	-35 °C (-31 °F) to +65 °C (149 °F)
Humidity	rel. 30-95 %, non-condensing
Air pressure	700-1,050 hPa





Appendix B Pin-out

V-Amp

V-Amp is a digital DC amplifier with connectors for:

- ▶ 8 or 16 EEG channels for passive electrodes (plus REF and GND)
- ▶ 16 EEG channels for active electrodes (plus REF, GND and power supply) (*V-Amp 16* only)
- ▶ Auxiliary channels (Aux 1 and Aux 2)
- ▶ Triggers (Trigger 1 and Trigger 2)

Auxiliary connectors

Probes are connected to the AUX inputs.

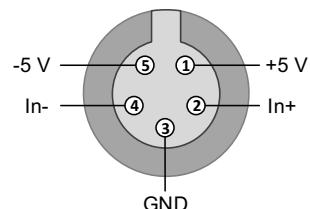


Figure B-1. AUX connector

Pin	Function
1	+5 V power for probe
2	positive terminal of differential input
3	Ground
4	negative terminal of differential input
5	-5 V power for probes

Trigger 1 port

The bits in the figures below correspond to the trigger bits in *BrainVision Recorder*.

For further information, please refer to the BrainVision Recorder User Manual.

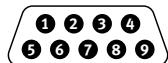


Figure B-2. Trigger 1, 9 way digital parallel port (view from top)

Pin	Function
1	Bit 1
2	Bit 2
3	Bit 3
4	Bit 4
5	Bit 5
6	Bit 6
7	Bit 7
8	Bit 8
9	GND

Trigger 2 port

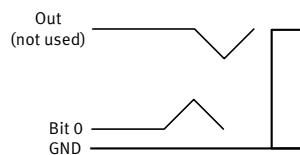
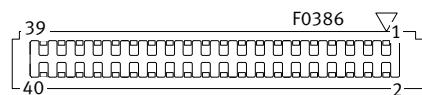


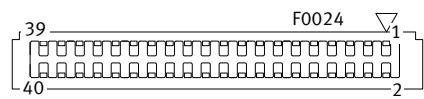
Figure B-3. Trigger 2, jack plug (illustrated)

USB Type B (power and data interface)***40 pin connector for actiCAP (V-Amp 16 only)***

Pin	Function
1	EEG Ch4
2	GND power supply
3	EEG Ch2
4	EEG Ch3
5	EEG Ch5
6	EEG Ch1
7	EEG Ch7
8	EEG Ch6
9	5 VDC power supply
10	EEG Ch8
11	EEG Ch10
12	EEG Ch9
13	EEG Ch12
14	EEG Ch11
15	EEG Ch14
16	EEG Ch13
17	EEG Ch16
18	EEG Ch15
19	REF
20	GND power supply
27	5 VDC power supply
35	Virtual Ground (2,5VDC)
38	GND power supply
39	GND power supply
40	
21-26, 28-34, 36-37	Not used

ImpBox

40 pin connector for ImpBox



Pin	Function
1	Reference for Impedance Measurement (EEG-channel 1)
2	GND power supply
9	3 VDC ±5% power supply
20	GND power supply
27	3 VDC ±5% power supply
35	Virtual GND (2,5VDC)
37	3 VDC ±5% power supply
38	GND power supply
39	GND power supply
40	Control signal
3-8, 10-19, 21-26, 28-34, 36	not used



Appendix C Ordering Codes

V-Amp System

V-Amp 8-channel Amplifier System

Article name	Article No.
V-Amp 8-channel amplifier	BP-01972
V-Amp USB cable	BP-01974
V-Amp trigger cable	BP-245-1550
V-Amp carrying box black	BP-01977
Application Suite DVD	BP-02000-cd

V-Amp 16-channel Amplifier System

Article name	Article No.
V-Amp 16-channel amplifier	BP-01973
V-Amp USB cable	BP-01974
V-Amp trigger cable	BP-245-1550
V-Amp carrying box black	BP-01977
Application Suite DVD	BP-02000-cd

V-Amp Amplifier System + Software

V-Amp 8-channel Amplifier System + BrainVision Recorder + BrainVision Analyzer

Article name	Article No.
V-Amp 8-channel amplifier	BP-01972
V-Amp USB cable	BP-01974
V-Amp trigger cable	BP-245-1550
V-Amp carrying box black	BP-01977
Application Suite DVD	BP-02000-cd
Recorder User Manual	BP-00070-me
Recorder & Analyzer V-Amp Edition 1st License, Recorder & Analysis Software USB only with V-Amp Systems	BP-00170-VA
Recorder & Analyzer USB dongle, black V-Amp Edition	BP-00172-VA

V-Amp 16-channel Amplifier System + BrainVision Recorder + BrainVision Analyzer

Article name	Article No.
V-Amp 16-channel amplifier	BP-01973
V-Amp USB cable	BP-01974
V-Amp trigger cable	BP-245-1550
V-Amp carrying box black	BP-01977
Application Suite DVD	BP-02000-cd
Recorder & Analyzer V-Amp Edition 1st License, Recorder & Analysis Software USB only with V-Amp Systems	BP-00170-VA
Recorder & Analyzer USB dongle, black V-Amp Edition	BP-00172-VA

BCI Package

Article name	Article No.
V-Amp 16-channel amplifier	BP-01973
18Ch active Electrodes Set	BP-04242-18
actiCAP active Signal electrode for Replacement	BP-04243-SIG
actiCAP BP 32Ch Standard Cap with holders (+ 2 add. holders) and chin belt without electrodes	BP-04251
actiCAP Starter Set: SuperVisc gel, chestbelt, measuring tape and syringe (with needle, washers and brush with needle, washers and brush)	BP-04259-VISC
V-Amp Impedance Box (ImpBox)	BP-01982
V-Amp USB cable	BP-01974
Trigger Cable	BP-245-1550
V-Amp carrying box black	BP-01977
BrainVision RecView Basis Module	BP-00051
Analyzer HASP HL USB Dongle red	BP-00160-U
Recorder USB Dongle blue	BP-00060-UR
BCI Package Add-On CD (with samples of BCI applications)	BP-02635
Application Suite DVD	BP-02000-cd