

V-Amp & ImpBox

Operating Instructions

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 Zeppelinstrasse 7 Phone: +49 (0) 8105 733 84 - 0
 82205 Gilching Fax: +49 (0) 8105 733 84 - 505
 Germany Web: www.brainproducts.com

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Contents

| | |
|--|-----------|
| About these operating instructions | 4 |
| About the product | 7 |
| Safety | 10 |
| Chapter 1 Overview | 14 |
| 1.1 V-Amp at a glance | 14 |
| 1.2 ImpBox at a glance..... | 16 |
| Chapter 2 Installation..... | 18 |
| 2.1 Installing the driver..... | 18 |
| 2.2 Confirm the installation..... | 19 |
| Chapter 3 Operation | 21 |
| 3.1 Connecting electrodes | 21 |
| 3.2 Operating modes | 23 |
| 3.3 Trigger ports and cables (digital ports)..... | 27 |
| Chapter 4 Active electrodes | 29 |
| 4.1 How the active electrodes work | 29 |
| 4.2 Preparing the actiCAP for acquisition | 29 |
| 4.3 Minimizing the impedances of the actiCAP electrodes..... | 30 |
| Chapter 5 Troubleshooting | 32 |
| 5.1 Driver cannot be installed (Windows® XP and Vista)..... | 32 |
| 5.2 Error messages | 34 |
| 5.3 Replacing faulty electrodes | 35 |
| Chapter 6 Maintenance, care and disposal..... | 37 |
| 6.1 Maintenance..... | 37 |
| 6.2 Care..... | 37 |
| 6.3 Disposal | 38 |
| Appendix A Technical data | 39 |
| Appendix B Pin-out | 44 |
| Appendix C Ordering Codes..... | 48 |

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 this document

This document is 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.

Structure of this document

This document is 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 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 **personal injury** 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

| | | |
|----|----------|---|
| 7 | modified | Product identification (CE marking) |
| 46 | modified | Pin-out of 40-way connector for actiCAP |

Support and reporting errors

We would ask you to report without delay any error you find in this document, any fault on the products or any malfunction that you observe when using this product. To do so, please contact your local dealer, who will also assist you in general questions about the product.



About the product

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).

Product identification

NEW

| | |
|--|---|
| Product designation: | Brain Products V-Amp 8 Brain Products V-Amp 16 ImpBox |
| 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 |
| CE marking | The Brain Products GmbH confirms the electromagnetic compatibility (EMC) of this product according to the Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the approximation of the laws of the Member States relating to electromagnetic compatibility. |
| Scope of delivery: | V-Amp: - V-Amp Trigger cable - V-Amp USB cable - Application Suite DVD |
| | ImpBox: - 2 Mignon AA batteries - 1 battery charger |

Combination with other products

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 |
| Computer | The computer to which you connect the amplifier must fulfill the IEC 60950-1 or EN 60950-1. |

* 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).

Markings on the products



Observe the operating instructions.



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



These symbols 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 Brain Products GmbH confirms the electromagnetic compatibility (EMC) of this product according to the Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 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.



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!



Next to this symbol the manufacturing date is specified.

Safety

Please read the following safety information carefully since it helps to prevent personal injury and damage to property. It is assumed that you have the required specialist knowledge in handling the product and accessories.

Brain Products will not accept any liability for loss or damage resulting from a failure to follow these operating instructions and, in particular, the safety instructions.

Intended use

► V-Amp

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.

General precautions

- ▶ 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). ●



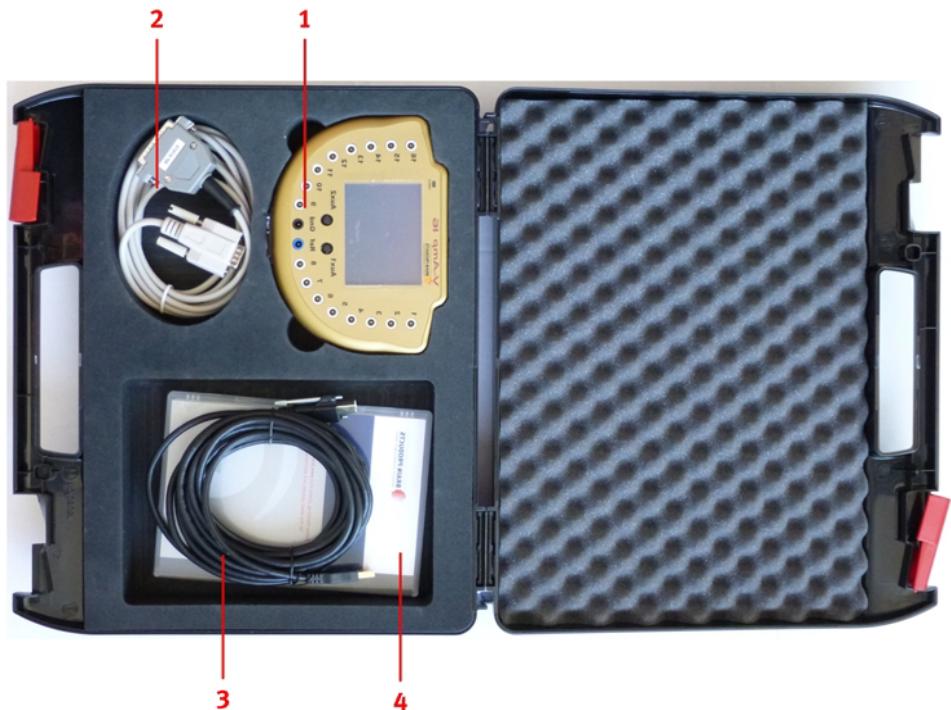
Chapter 1 Overview

1.1 V-Amp at a glance

Scope of delivery

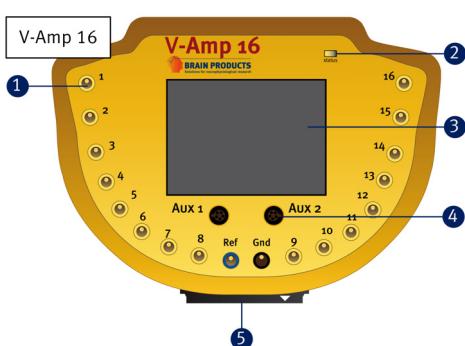
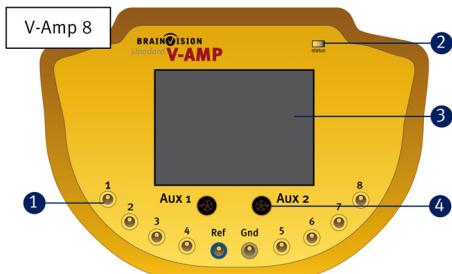
V-Amp is available as 8 or 16-channel version. The components listed below are included in the scope of delivery.

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:

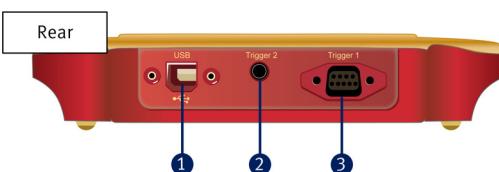


- 1 **V-Amp 16** (depicted) or **V-Amp 8**
- 2 **Trigger cable** (9/25 pin male)
- 3 **USB cable**, Type A/B
- 4 Application Suite DVD

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)

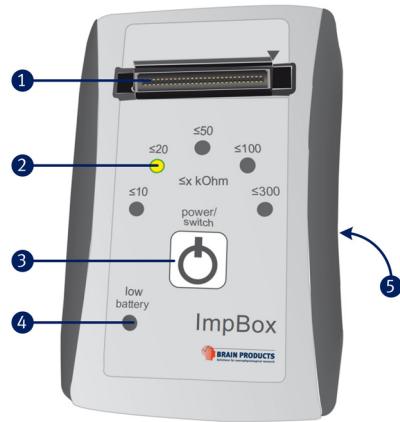
1.2 ImpBox at a glance

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 17](#))
- 4 **low battery** indicator ([page 17](#))
- 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.

Note: The computer to which you connect the amplifier must fulfill the IEC 60950-1 or EN 60950-1.

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.

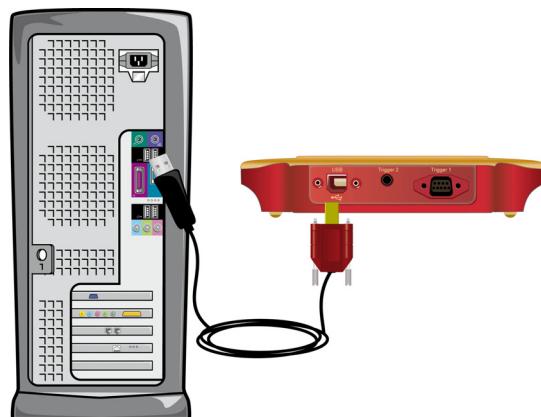


Figure 2-1. Connect the USB cable

- 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.

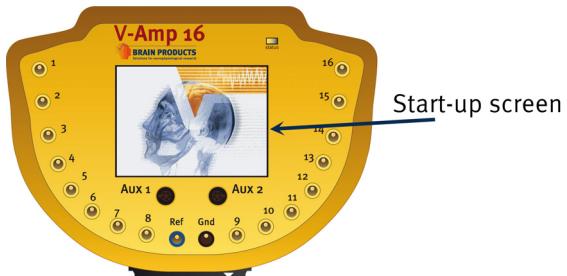


Figure 2-2. Confirm installation 1: start-up screen

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

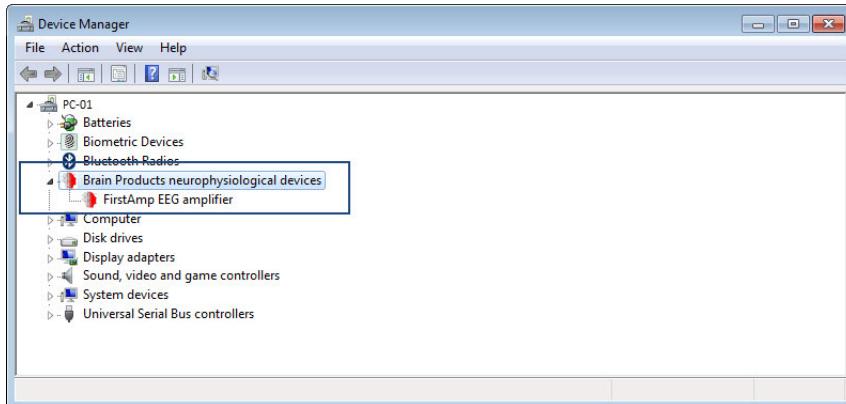


Figure 2-3. Confirm installation 2: Device Manager



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.

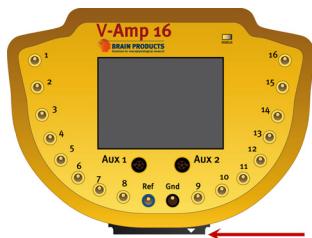


Figure 3-2. Connector for active electrodes

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

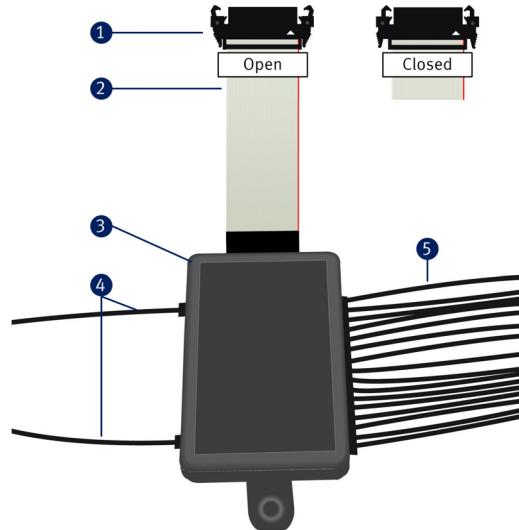


Figure 3-3. *actiCAP* splitter box for V-Amp

- 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).

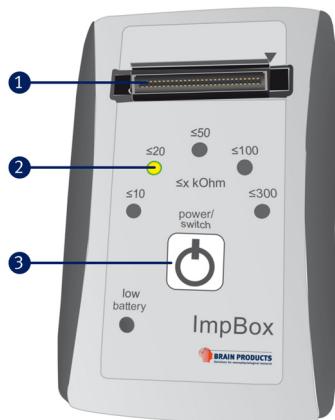


Figure 3-4. *ImpBox* - Overview

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.



Notes

- ▶ Switch off the *ImpBox* before you disconnect the electrodes.
- ▶ *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.

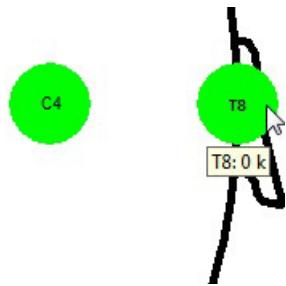


Figure 3-5. Example of wrong impedance



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!

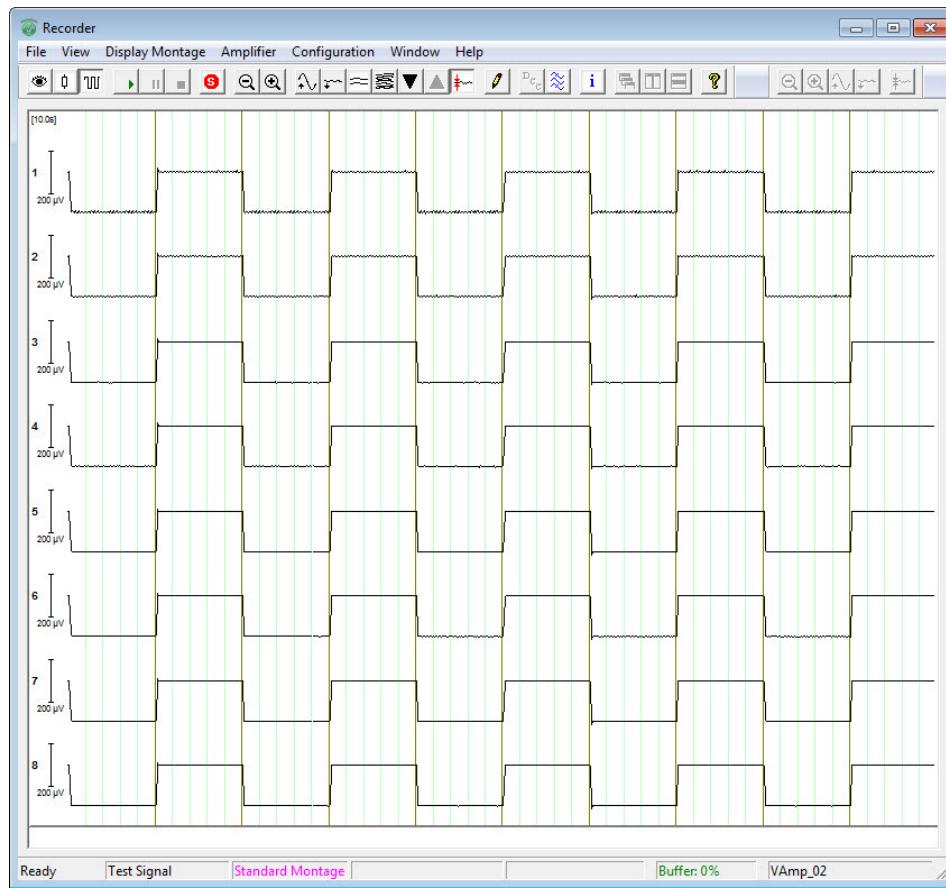


Figure 3-6. Example of a test signal

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.

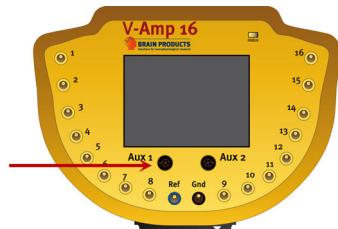


Figure 3-7. Location of AUX connectors



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.

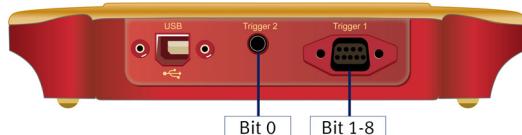


Figure 3-8. Location of trigger connectors and mapping of Bits 0-8

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:

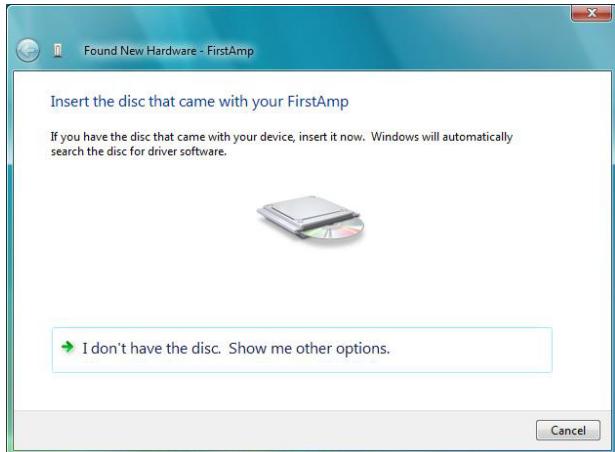


Figure 5-4. Windows® Vista, Wizard for new hardware (2)

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

5.2 Error messages

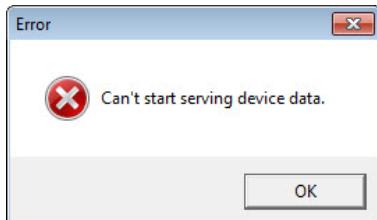


Figure 5-5. Warning message 'Can't start serving device data'

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:.

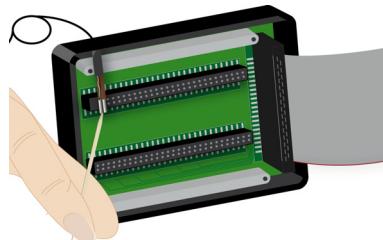


Figure 5-6. Remove a defective electrode from the splitter box

- 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.

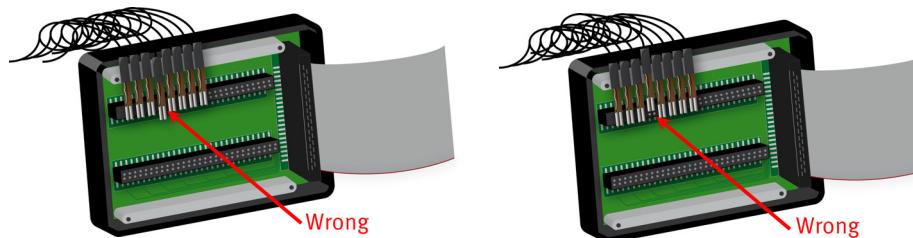


Figure 5-7. Mistakes when inserting an electrode in the splitter box

- 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.

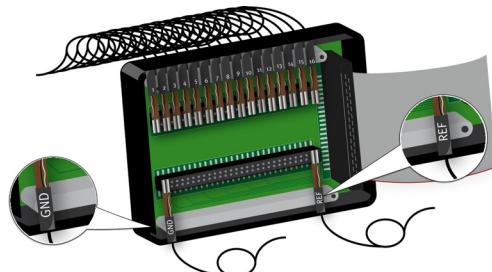


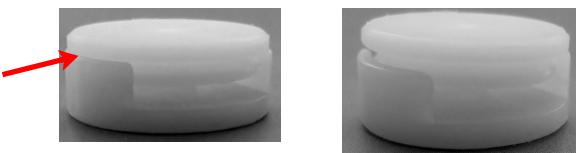
Figure 5-8. Insert the reference and ground electrode into the splitter box

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 | Trigger 1: D-Sub 9, female for Bits 1-8 Trigger 2: 3.5 mm jack plug for Bit 0 |
| 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.

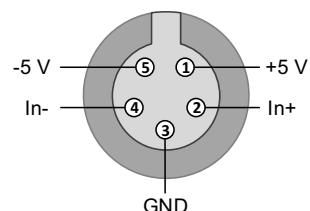


Figure B-1. AUX connector

| 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.

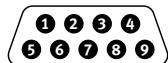


Figure B-2. Trigger 1, 9 way digital parallel port (view from top)

| 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

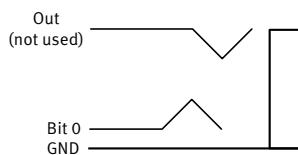
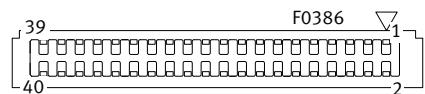


Figure B-3. Trigger 2, jack plug (illustrated)

USB Type B (power and data interface)

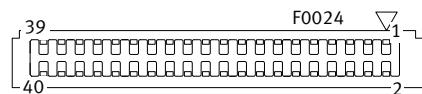


40 pin connector for actiCAP (V-Amp 16 only)



| Pin | Function |
|-----------------------------|-------------------------|
| 1 | EEG Ch1 |
| 2 | GND power supply |
| 3 | EEG Ch3 |
| 4 | EEG Ch2 |
| 5 | EEG Ch5 |
| 6 | EEG Ch4 |
| 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 |
| 21-26, 28-34, 36-37, 39, 40 | 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 |