BRAIN PRODUCTS
Solutions for neurophysiological research

LiveAmp

Operating Instructions

Product revision 04

www.brainproducts.com

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*Valid until publication of a new version of this document.

Contents

About the document

This document describes how to use LiveAmp and how it is integrated into a measurement setup. This document forms an integral part of the product. It must be precisely adhered to in order to ensure that the product is used as intended and operated correctly to guarantee the concomitant safety of test subjects, users and third parties. Keep this document in a safe place and make sure that it is always available to the users.

Make sure that you have the most recent version of this document for your product or product revision. You can find the most recent version on our website: http://www.brainproducts.com.

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: Scope of delivery.
- Chapter 2: Overview of the product and accessories and their main features.
- Chapter 3: Preparing the product for use.
- Chapter 4: Normal use of the product and accessories.
- Chapter 5: Cleaning and further activities after using the product.
- Chapter 6: Maintenance information.
- Chapter 7: Information about disposing of LiveAmp
- Chapter 8: Troubleshooting and frequently asked questions.
- Appendix A: Technical data.

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
Italic	indicates titles of dialog boxes/tabs, file locations and is used to indicate product names
Underscore	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**. Failure to observe the information in this document constitutes incorrect use.

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.

Revision history

Page	Status	Change
16	modified	New electrode connectors for LiveAmp
17	new	LiveAmp with rails for the connector of the electrode cap
25	modified	Connecting and disconnecting the electrode caps

Reporting errors and support

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

LiveAmp is an ultra-lightweight, wearable amplifier that can record either 32 referential EEG channels or 24 referential and 8 real bipolar channels. As it is wireless and allows you to store the data internally (exchangeable memory card), there are no mobility limitations. LiveAmp is easy and intuitive to use and extremely compact. Its technical specifications leave nothing to be desired and translate into outstanding signal quality. LiveAmp can be combined with all available Brain Products electrode types, passive/active or dry.

Product identification

Product designation	**LiveAmp wireless amplifier**
Article number	LiveAmp system: BP-100-3000
Manufacturer	Brain Products GmbH Zeppelinstrasse 7 82205 Gilching Germany Tel: +49 (0) 8105 733 84 - 0 Fax: +49 (0) 8105 733 84 - 505 Web: http://www.brainproducts.com Email: techsup@brainproducts.com
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 harmonisation of the laws of the Member States relating to electromagnetic compatibility.
Europe	R&TTE 1999/5/EC
USA / Canada	USA FCC-ID: PVH0946 Canada IC: 5325A-0946 USA FCC Federal Communications Commission: CFR 47, part 15.
Japan	MIC ID: R 204-210003 Japan Radio Equipment Compliance: Japanese Technical Regulation Conformity Certification of Specified Radio Equipment, Article 2, Paragraph 1, Item 19, ‘2.4 GHz band wide band low power data communication system’.
Warranty	http://www.brainproducts.com/contact.php

Combinations with other products

LiveAmp is permitted to be combined with the following products:

Product	**Manufacturer**
BrainVision Recorder (as of version 1.21)	Brain Products GmbH
BrainVision LiveAmp File Converter	Brain Products GmbH
EEG caps and electrodes	Brain Products GmbH Easy Cap GmbH
32 GB micro SD® card, class 10	Transcend®
Powerbank PA0083, 12,500 mAh (tested and approved)	LogiLink®
BNC push button	Brain Products GmbH
Computer	The computer to which you connect the amplifier must fulfill the IEC 60950-1 or EN 60950-1.

Beside this general statement about permitted product combinations the user must check, whether all stipulations of each product (e.g. regarding its MR compatibility) are fulfilled for the specific combination and purpose of application (i.e. intended use and correct use). Please observe the operating instructions of the respective products.

Markings on the products

The following markings are displayed on the products:

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 harmonisation 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).

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

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

Observe the operating instructions.

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

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected

Consult the dealer or an experienced radio/TV technician for help.

Japan: Specified Radio Equipment. Contains MIC ID: R 204-210003

Safety information

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

LiveAmp is intended to be used for amplifying and digitizing electrophysiological signals (for example EEG, EMG, ECG, EOG).

LiveAmp is not a medical device. It may be used in the context of non-medical applications in order to carry out fundamental or applied research on the basis of neurophysiological methodology and data. Use of LiveAmp for diagnosis, therapy, monitoring of vital physiological processes (such as cardiovascular functions etc.) or other medical purposes is expressly forbidden.

Correct use

LiveAmp is permitted to be used:

- by personnel in the psychological and neurophysiological research area as well as physicians and medical experts.
- in research institutes and other non-medical environments (e.g. at home), hospitals, clinics and other medical environments, provided that all other stipulations regarding the correct use are met and that the products are used in accordance with its intended use.

LiveAmp must not be used:

- by unqualified persons (e.g. laymen) and persons who cannot read (e.g. due to visual impairment) or understand (e.g. due to a lack of language skills) this document.
- in MR scanner environment.
- in vicinity of explosive gases, for example in operating theaters.
- in oxygen enriched atmospheres.
- under water (e.g. sea, swimming pool, bath tub) or in environments in which significant amounts of water could enter the products (e.g. under shower, in the rain).

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

CAUTION

Risk of burns

If water enters LiveAmp or if LiveAmp is completely submerged in water, or is otherwise damaged, swollen, cracked, or opened, the battery might be rendered defective. A defective battery can catch fire and cause burns.

In order to protect the battery:

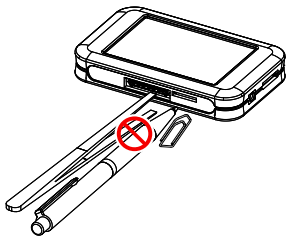
- do not drop LiveAmp.
- avoid impacts on the housing.
- do not open and do not modify LiveAmp.
- do not submerge in water or let water enter LiveAmp.

If you notice leakages or a swollen housing, immediately stop using LiveAmp and contact your local distributor. Do not ship damaged or potentially defective LiveAmps to your local distributor or Brain Products GmbH unless instructed otherwise.

NOTICE

Damage to connectors when using tools

If you use tools, for example to remove the memory card, you can accidentally touch the pins of the connectors. This can cause damage to LiveAmp.



Don’t use tools when removing or inserting the memory card.

Damage by water

LiveAmp is not splash-water protected. Water or liquids, even small amounts, can damage LiveAmp. This includes internal components, like the battery. Conditions in which liquids could enter LiveAmp are, for example:

- rain
- close to or in water
- sweat
- bathroom

This list is not exhaustive. Please contact your distributor for consultation.

Don’t use in conditions where liquids could enter LiveAmp.

NOTICE

Damage by mechanical force

A force applied to the housing of LiveAmp, for example strong impact, twisting, shaking, can result in damage to LiveAmp. This includes internal components, like the battery. A damaged battery can cause fire.

Don’t use in conditions where a force could be applied to LiveAmp.

NOTE

General precautions

- Do not open the LiveAmp and its accessories.
- Heat, direct sunlight (UV radiation), moisture, dust, liquids, conductive foreign matter and excessive radiation shorten the lifespan of the product.
- Use the supplied cables. Brain Products is not liable for damage caused by cables that are not supplied by Brain Products.
- Do not unplug connectors by pulling on their cable. Instead unplug a connector by releasing the locks (if applicable) and by pulling on the connector itself.
- Do not crush or kink the cables.

Data quality

- Only use the supplied memory card or a memory card that matches the specifications to avoid data loss.
- The user is responsible for the appropriate measurement setup and the quality of the recorded data.
- During operation, keep a minimum distance of three meters to cell phones or similar transmission equipment. Otherwise, signals may be distorted or contain artifacts.
- Do not attach the products to metallic surfaces. This will impair the wireless connection.

Storing and transporting LiveAmp

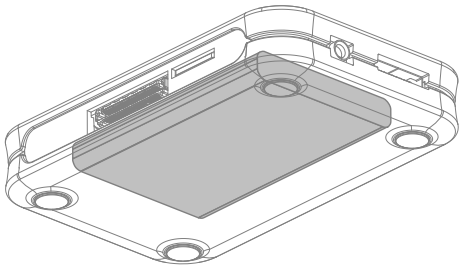
- Always store LiveAmp in the supplied case on a dark, dry place. Avoid direct sunlight (UV radiation), moisture and dust.
- Use the supplied case, when you transport LiveAmp.
- The temperature must be within 0 °C (32 °F) to 40 °C (104 °F).

NOTE

To prevent mechanical damage during transport, please pack the product in such a way, that it is not subject to vibration.

Note on the Lithium-Ion battery

Location of the battery

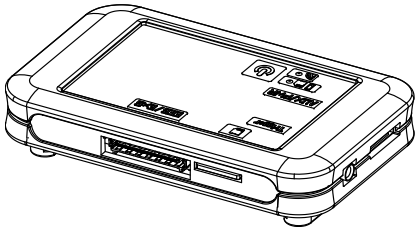


General data of the battery

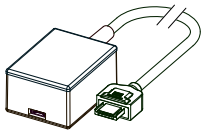
- Type: Lithium-Ion battery in shrink sleeve
- 1 cell with approx. 18 g
- Rated capacity: 1,000 mAh
- Watt-Hour rating: 3.7 Wh

1 Scope of delivery

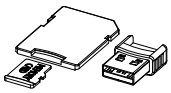
LiveAmp wireless amplifier
BP-200-3000



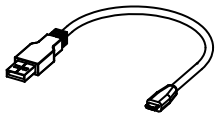
LiveAmp USB Adapter
BP-245-5020



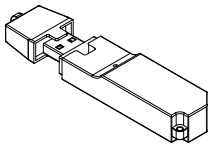
32 GB micro memory card & USB card reader
BP-350-6000 & BP-350-6010



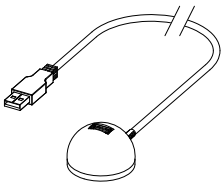
USB cable (15 cm / 6 in.)
BP-345-1045



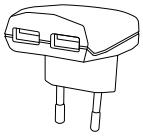
Wireless adapter (UBT21)
BP-310-6000



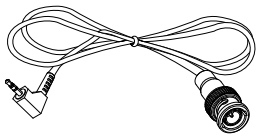
USB extension cable (150 cm / 59 in.)
BP-350-9010



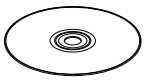
USB charger with adapter
BP-315-1010



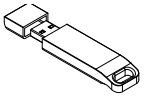
Trigger cable (80 cm / 31 in.)
BP-245-1200



Application Suite DVD
BP-270-6000



License dongle (black)
BP-00060-UR



LiveAmp Case (not illustrated)
BP-390-1040

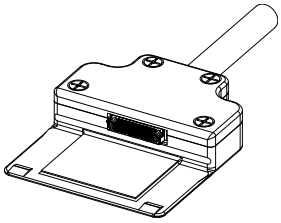
Accessories

Electrode caps

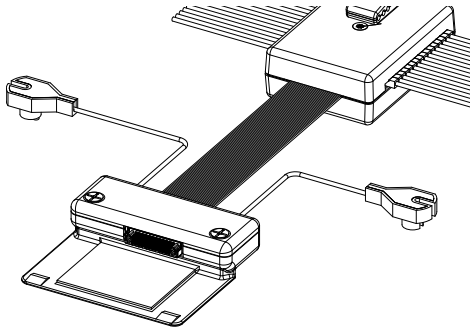
NEW

The following caps are available for LiveAmp:

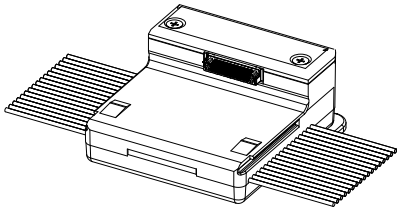
LiveCap 32-channels with multitrodes
BP-330-1300



actiCAP 32-channel active electrode system
BP-130-1100



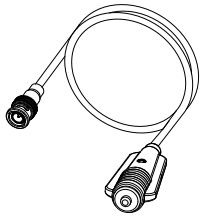
actiCAP Xpress Twist for LiveAmp
BP-130-1200



Optional accessories

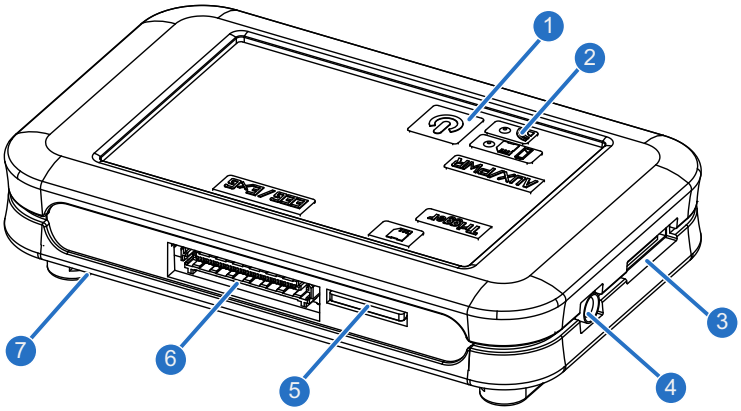
Trigger push button
BP-245-5040

BNC push button, 1.9 m (75 in.)
BP-345-9000



2 Overview of the product

NEW



1 I/O button (on/off)

2 Wireless LED, Battery/recording LED

3 Socket for charging the battery

4 Trigger input

5 Memory card slot

6 Electrode connector

7 Connector rails

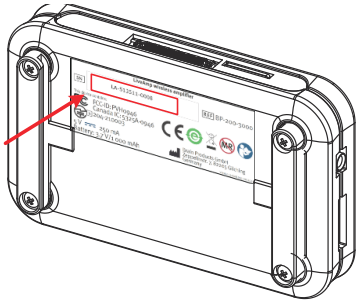
2.1 Identifying your LiveAmp

- Serial number:

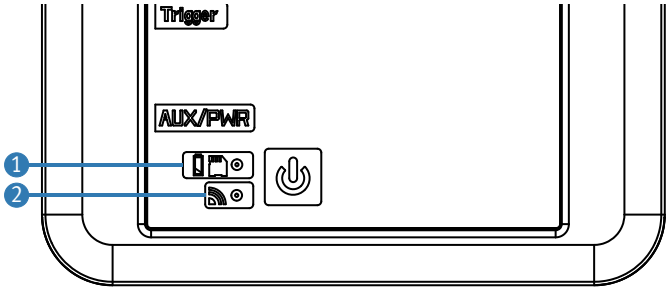
  You can identify your LiveAmp by the serial number. It is located on the type plate at the bottom of your LiveAmp.

- Revision number:

  Next to the serial number, you can find the revision number.



2.2 Understanding the LEDs



1 **Battery/recording LED**

Different colors indicate the battery state from green (= full) to red (= empty).

OFF	LiveAmp is OFF.
ON	LiveAmp is ON (any color), Charging completed (green) when connected to a power source
blinking slow, green	LiveAmp is charging.
blinking fast, any color	Recording to memory card

2 **Wireless LED**

This LED is blue.

OFF	Wireless module is OFF.
ON	Wireless module is ON, but LiveAmp is not connected with Recorder.
blinking	LiveAmp is connected with Recorder.

2.3 About the license dongle

The labeling of the license dongle consists of the license type and 5-digit serial number. License types are:

- U = Analyzer
- N = Network
- UR = Recorder
- URA = Recorder and Analyzer
- UC = CapTrak

For further information please visit: http://www.brainproducts.com/productreg.php

3 Before you begin

3.1 Check the scope of delivery

- LiveAmp wireless amplifier
- LiveAmp USB Adapter
- 32 GB micro memory card & USB card adapter
- USB cable
- Wireless adapter (transparent)
- USB extension cable
- USB charger with adapter
- Trigger cable
- Application Suite DVD
- License dongle (black)
- Electrode cap (optional)
- Trigger push button (optional)

3.2 Installing the software and drivers

Before the first use, install **BrainVision Recorder** and **BrainVision LiveAmp File Converter**. The installation of Recorder includes the recording software and all relevant drivers.

The latest version of Recorder is on the Application Suite DVD and also available on our website: http://www.brainproducts.com/downloads.php.

Quick installation procedure:

1 Insert the Application Suite DVD or USB stick into your computer.
The Welcome screen opens.
2 Install the BrainVision Recorder.
3 Install the BrainVision LiveAmp File Converter.

For details on installing Recorder, please refer to the Recorder user manual.

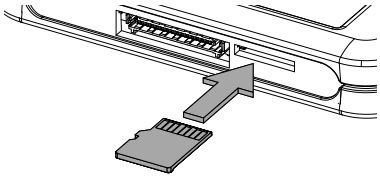
3.3 Insert the memory card

The memory card allows you to record data to LiveAmp.

Prepare:

- Micro memory card
- LiveAmp amplifier (it is switched off)

1 If applicable, switch off LiveAmp (all LEDs are OFF).



2 Insert the memory card into the card slot of the amplifier until you hear a click.

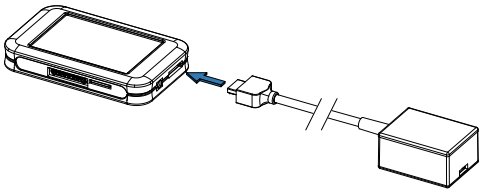
➔ You can now record data to the memory card in LiveAmp.

3.4 Charge the battery of LiveAmp

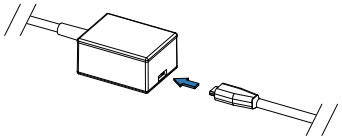
Before the first use and after each use, fully charge the battery of LiveAmp.

Prepare:

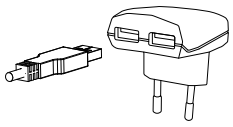
- LiveAmp amplifier
- USB cable (15 cm)
- USB adapter
- USB charger or computer with USB port



1 Connect the USB adapter to LiveAmp.



2 Connect the USB cable to the USB adapter.



3 Connect the USB cable to the USB charger, and plug the charger into the power socket.

Alternatively, connect the USB cable to an USB port of your computer.

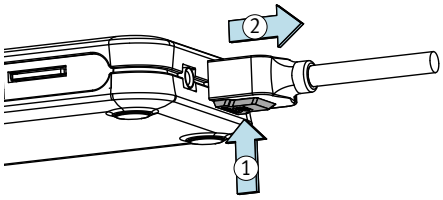
➔ The battery LED blinks green, when LiveAmp is charging.
When LiveAmp is connected with Recorder, the battery icon in the status bar blinks.

Fully charged

When fully charged, the battery LED is on continuously. It takes approximately four hours to charge a completely empty battery.

- ▶ When fully charged, disconnect LiveAmp.
- ▶ Do not leave connected to the charger, if LiveAmp is not in use.

Disconnect the USB adapter



1 Push and hold the release button on the connector.
2 Pull the connector from LiveAmp.

3.5 Prepare the recording environment

Prepare the recording environment, to avoid interferences with other radio devices and to improve the operating range of LiveAmp.

1 Remove obstacles in the signal path.

   For example, if there is a door between the recording computer and LiveAmp, then leave the door open. The same applies for movable walls, hatstands, etc.

2 Switch off devices that could cause interferences.

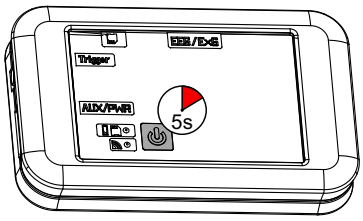
   LiveAmp uses the ISM band (2.4 GHz). Interference can be caused by equipment in the same band, for example:

   ▷ Bluetooth® (for example, keyboard, mouse, and mobile phones)
   ▷ Wi-Fi®
   ▷ mobile phones
   ▷ microwave oven

4 Using the product

4.1 Switch on/off LiveAmp

Switch on LiveAmp



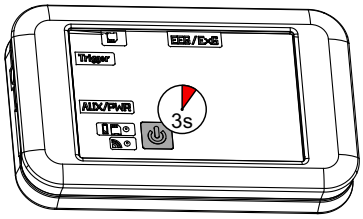
1 Press and hold the I/O button for five seconds.

The battery LED flashes.

2 When the battery LED lights continuously, release the I/O button.

➔ The wireless LED automatically comes on when LiveAmp is running.

Switch off LiveAmp



1 Press and hold the I/O button for three seconds.

2 When the battery LED flashes and the wireless LED goes off, release the I/O button.

➔ LiveAmp turns off after another three seconds.

➔ While charging, LiveAmp does not turn off completely.

4.2 Connect/disconnect an electrode cap

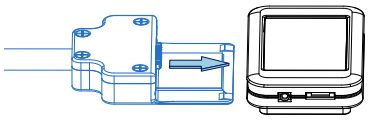
NEW

You can connect electrode caps with passive, active or dry electrodes to LiveAmp. Only use the dedicated electrode caps for LiveAmp.

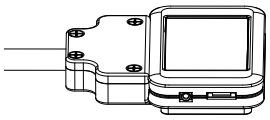
Prepare

- LiveAmp amplifier
- Electrode cap for LiveAmp

Connect the electrode cap

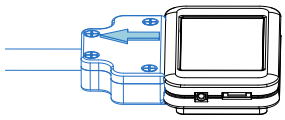


1 Switch off LiveAmp.
2 Slide the connector on the LiveAmp.



3 Push the connector as far as it will go.

Disconnect the electrode cap



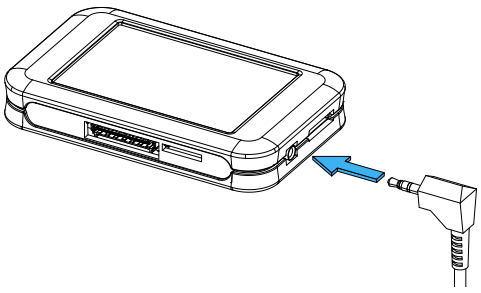
1 Switch off LiveAmp.
2 Slide the connector from LiveAmp.

4.3 Connect a trigger source (optional)

The LiveAmp amplifier has an input for one trigger bit. The trigger connector is connected via the 2.5 mm stereo jack using the supplied trigger cable. Note, that trigger signals must be TTL compatible.

Prepare

- LiveAmp amplifier
- trigger cable or the optional trigger push button



Connect the trigger cable to the Trigger input of LiveAmp.

Alternatively, you can connect the optional trigger push button.

➔ In Recorder, open the digital port settings (**Amplifier › Digital Port Settings...**) and make the relevant settings.

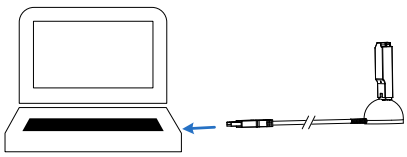
For more information refer to the technical data in Appendix A.

4.4 Connect LiveAmp with Recorder

To record data, LiveAmp must be connected **wirelessly** with Recorder. Use the supplied wireless adapter to make the connection.

Prepare

- USB extension cable
- Wireless adapter
- LiveAmp amplifier (with memory card)
- Computer with Recorder 1.21 or higher



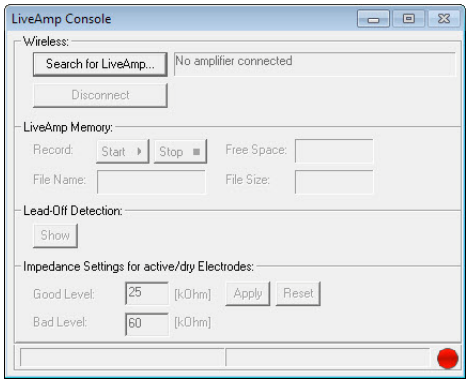
1 Connect the wireless adapter through the USB extension cable to your computer.

The computer initializes the drivers for the adapter. This may take up to two minutes.

2 Position the wireless adapter within line-of-sight of LiveAmp.

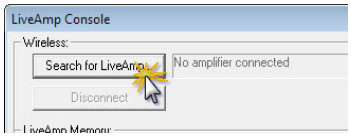
3 Start Recorder and select LiveAmp from the menu **Configuration** › **Select amplifier**...

(Start Recorder in administrator mode.)



➔ The **LiveAmp Console** opens.

4 Switch on LiveAmp.



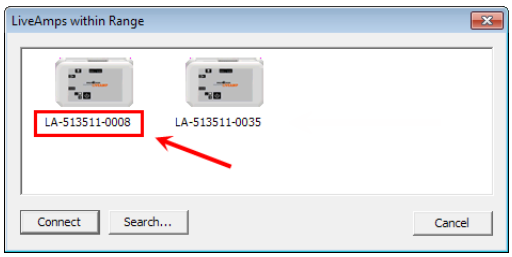
5 In the LiveAmp Console click on **Search for LiveAmp...**

6 Select the LiveAmp and click on **Connect**. (Identify your LiveAmp).

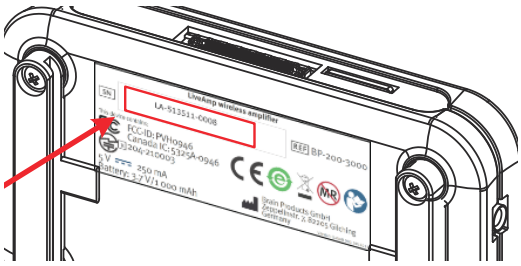
➔ The blue LED of the wireless adapter is ON. LiveAmp is now connected with Recorder.

Identify your LiveAmp

You identify the LiveAmps by their serial numbers. The serial number starts with ‘LA-’.



The LiveAmps within Range window lists all LiveAmp amplifiers with their serial numbers that were detected during the scan.

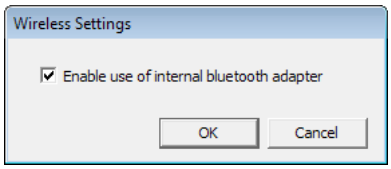


You can find the serial number on the type plate at the bottom of your LiveAmp.

To read the serial number, you can disconnect the electrode connector without turning off LiveAmp.

Change the wireless adapter

By default, Recorder uses the wireless adapter UBT21. To use the internal adapter of your computer instead, do the following:



1 Start Recorder (no amplifier connected).
2 Click on **Amplifier** › **Wireless Settings...**
3 The Wireless Settings window opens.
4 Select the check box and click **OK**.
5 Unplug the wireless adapter UBT21.

➔ You can now use the internal wireless adapter of your computer.

NOTE

We recommend to use the provided wireless adapter UBT21, to ensure reliable data transmission.

4.5 Record signals

LiveAmp allows you to record data to different locations.

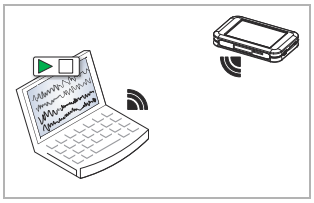
NOTE

You can practice the scenarios below without electrodes. To do so, select the passive electrodes in the Recorder workspace (leave active/dry electrodes deselected).

General prerequisites:

- memory card inserted
- LiveAmp connected with Recorder
- workspace created

Record to computer



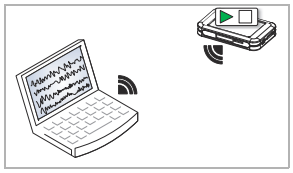
EEG data is recorded to the hard disk of the recording computer. To avoid sample losses, LiveAmp must stay in the range of the wireless connection.

1 Click on **Monitor** .

2 Click on **Start Recording** .

➔ To stop recording, click on **Stop Recording** .

Record to LiveAmp



EEG data is recorded to the memory card of LiveAmp only.

1 Click on **Monitor** .

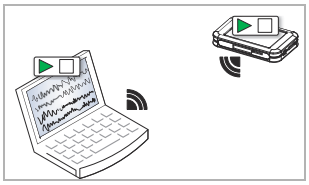
2 In the LiveAmp console, click on **Start** Start .

Data is recorded to the memory card, when the battery/recording LED blinks fast.

➔ To stop recording, click on **Stop** Stop in the LiveAmp console.

➔ After recording, the files of the memory card must be converted with the LiveAmp File Converter.

Record to recording computer and LiveAmp



EEG data is recorded to the computer and the memory card of LiveAmp. Recording to LiveAmp continues, even if you move out of the wireless range.

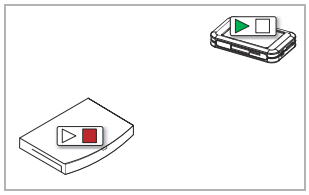
1 Click on the button **Monitor** .
2 In the Recorder main window, click on **Start Recording** .
3 In the LiveAmp console, click on **Start** Start .
Data is recorded to the memory card, when the battery/recording LED blinks fast.

➔ To stop recording do the following:

a In the LiveAmp console, click on **Stop** Stop .
b In the main window, click on **Stop Recording** .

➔ After recording, the files of the memory card must be converted with the LiveAmp File Converter.

Record to LiveAmp (offline, LiveAmp as holter)



EEG data is recorded to LiveAmp, while LiveAmp is disconnected from the recording computer. This is called the *holter* function of LiveAmp.

1 Click on **Monitor** .
2 In the LiveAmp console, click on **Start** Start .
Data is recorded to the memory card, when the battery/recording LED blinks fast.
3 In the main window, click on **Stop Monitoring** .
4 In the LiveAmp console, click on **Disconnect**.
The wireless LED on LiveAmp goes off after approximately 2 minutes.

➔ To stop recording do the following:

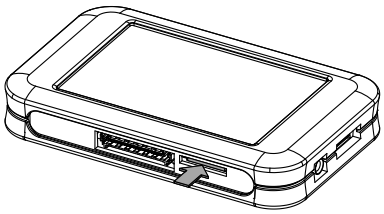
a Switch on the wireless module by pressing the I/O button on LiveAmp for one second.
b In the LiveAmp console, click on **Search for LiveAmp...** and connect to the LiveAmp.
c Then click on **Stop** Stop .

➔ After recording, the files of the memory card must be converted with the LiveAmp File Converter.

Please refer to the Recorder user manual for more details about setting up a workspace.

4.6 Eject the memory card

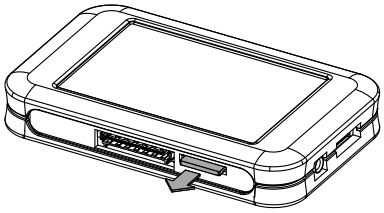
Eject the memory card from LiveAmp, if you want to download data to your computer or if you want to change the card.



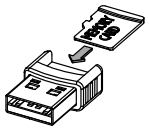
1 Switch off LiveAmp.

2 Push the memory card slightly into the slot to unlock it from the holder.

The card will pop out.



3 Pull the memory card from the slot.



➔ Insert the memory card into the USB reader and plug the unit into your computer.

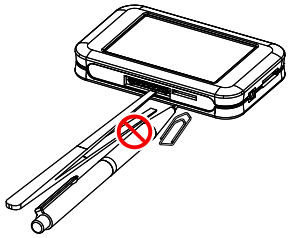
Alternatively, use the memory card adapter.

NOTICE

Damage to connectors when using tools

If you use tools, for example to remove the memory card, you can accidentally touch the pins of the connectors. This causes damage to LiveAmp.

Do not use tools when removing or inserting the memory card.

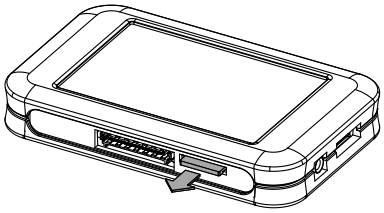


4.7 Download data to a computer

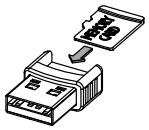
Make a copy of your data on your computer for analyzing and as a back-up.

Prepare

- USB card reader or memory card adapter



1 Eject the memory card from LiveAmp.



2 Insert the memory card into the USB card reader.

Alternatively, use the memory card adapter.

3 Plug the USB card reader into your computer, or insert the memory card adapter.

You find the memory card in:
Windows Explorer › **Computer** › **Removable Disk**.

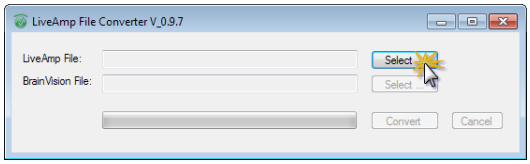
➔ You can now copy the data from the memory card to your computer.

4.8 Convert data

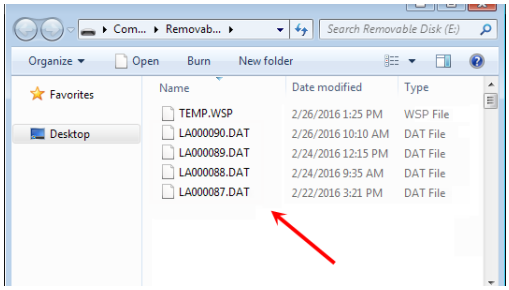
After the data acquisition, use the LiveAmp File Converter to convert the data from memory card.

Prepare

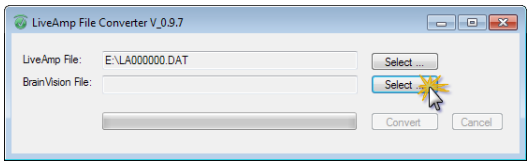
- Memory card with the EEG recording (in USB card reader or card adapter)
- Computer with BrainVision LiveAmp File Converter



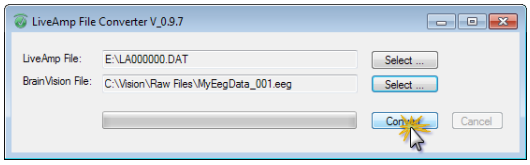
1 Open the LiveAmp File Converter.
Windows start button › All Programs › BrainVision › BrainVision LiveAmp File Converter.



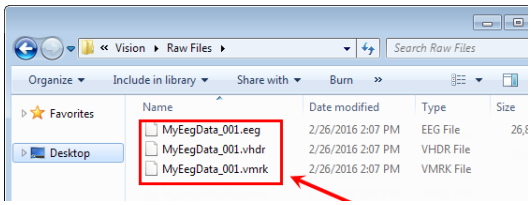
2 Select the source file.
- ▷ In the line ‘LiveAmp File’, click on **Select** and locate the EEG data.
  You are looking for the folder in which you have stored your EEG data. For example, on the memory card (‘Removable disc’).
- ▷ Click on the *.DAT file and then on **OK**.



3 Specify the target file.
- ▷ In the line ‘BrainVision File’, click on **Select** .
- ▷ Select a target folder.
- ▷ Rename the file, if required, and click on **OK**.



4 Finally, click on **Convert**.



5 Check the conversion.
Open the target folder and make sure that there is the EEG file (*.EEG), header file (*.VHDR) and marker file (*.VMRK).

➔ The converted EEG files can now be used in Analyzer.

4.9 Format the memory card

Recorder prompts you to format the memory card, when it is full or fragmented.

NOTES

- You must use the formatting function in Recorder to format the memory card. Do not use the Windows function to format the memory card.
- **Back-up the data, before formatting the memory card** (see 5.4 Back-up the data of the memory card). Otherwise your data are lost.

Prepare

- LiveAmp with memory card
- Recorder

1 Switch on LiveAmp.
2 Start Recorder.
3 Connect LiveAmp with Recorder (wireless).
4 In the Recorder main window, click on **Amplifier** › **Format LiveAmp Memory...**
5 Confirm the notification message.

➔ The memory card in LiveAmp is formatted and all data on the memory card are deleted.

4.10 About the accelerometer

LiveAmp has an integrated accelerometer. It shows the acceleration in the x, y, and z direction. The directions are as follows:

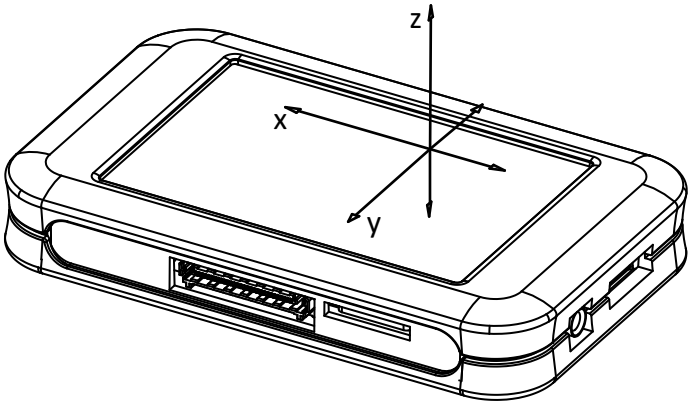


Figure 4-1. x, y, and z axes of the accelerometer

5 After using the product

5.1 Cleaning LiveAmp

NOTICE

Risk of damage during cleaning.

To avoid damages to LiveAmp during cleaning, take note of the following:

- Don’t clean the products and accessories under running water.
- Don’t use aggressive or corrosive cleaning agents and don’t sterilize the product.
- Don’t use hot liquids. The temperature of liquids must not exceed 40 °C (104 °F).

Before cleaning disconnect all cables. Connectors must not come into contact with moisture. Moisture causes corrosion.

Clean the products with a slightly damp cloth.

Using a disinfectant

For disinfecting the surfaces of the products, we recommend to use a cleaning agent based on propylalcohol, for example a solution containing 25 % Ethanol and 35 % Propane-1-ol. Adhere to the safety precautions of the manufacturer of the cleaning agent.

5.2 Cleaning the electrode cap

Detailed cleaning instructions are described in the following manuals, that are all available on the Application Suite DVD:

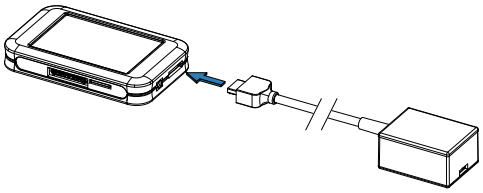
- active electrodes: actiCAP Operating Instructions
- dry electrodes: actiCAP Xpress Operating Instructions
- passive electrodes: BrainAmp Operating and Reference Manual for use in a laboratory environment

5.3 Charge the battery of LiveAmp

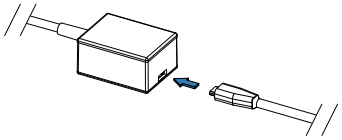
After each use, fully charge the battery of LiveAmp.

Prepare:

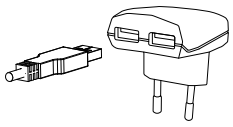
- LiveAmp amplifier
- USB cable (15 cm)
- USB adapter
- USB charger or computer with USB port



1 Connect the USB adapter to LiveAmp.



2 Connect the USB cable to the USB adapter.



3 Connect the USB cable to the USB charger, and plug the charger into the power socket.

Alternatively, connect the USB cable to an USB port of your computer.

➔ The battery LED blinks green, when LiveAmp is charging.
When LiveAmp is connected with Recorder, the battery icon in the status bar blinks.

Fully charged

When fully charged, the battery LED is on continuously. It takes approximately four hours to charge a completely empty battery.

- ▶ When fully charged, disconnect LiveAmp.
- ▶ Do not leave connected to the charger, if LiveAmp is not in use.

5.4 Back-up the data of the memory card

Make a copy of the memory card to ensure that you still have the recordings in case the memory card is lost or accidentally formatted.

Prepare

- LiveAmp with memory card
- memory card adapter, or the USB adapter with USB cable

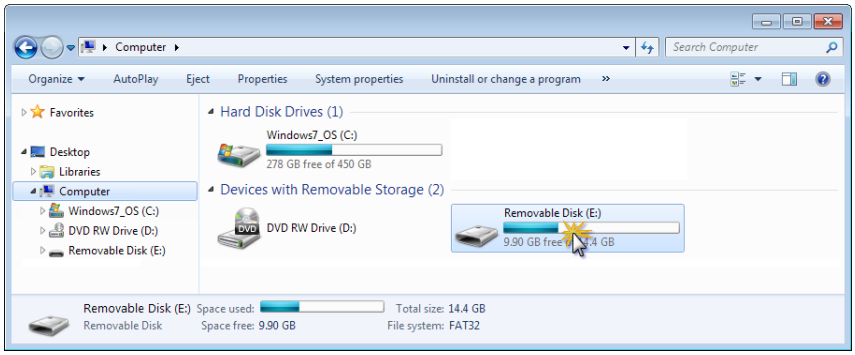
Method 1 - Copy data directly from the memory card

1 Switch off LiveAmp
2 Eject the memory card.
3 Insert the memory card into the USB card reader or adapter and plug the unit into your computer.
4 Open the Windows Explorer.
5 In the Windows Explorer, click on **Removable Disk**.
6 Copy the files to a directory of your choice.

Method 2 - Copy data from memory card in LiveAmp

1 Connect LiveAmp to your computer by using the USB adapter.
2 Open the Windows Explorer.
3 In the Windows Explorer, click on **Removable Disk**.
4 Copy the files to a directory of your choice.

➔ The memory card is shown as **Removable Disk** in the Windows Explorer. You can open, add and remove files from the memory card.



NOTE

We recommend to use Method 1, because it is faster.

Files on the memory card

LiveAmp saves the EEG data and the settings of the Recorder workspace on the memory card. These files have following names and extensions:

- Workspace: TEMP.WSP
- EEG, bipolar and trigger data: LA*000001*.DAT (the digit is automatically incremented)

6 Maintaining LiveAmp

6.1 Maintenance information

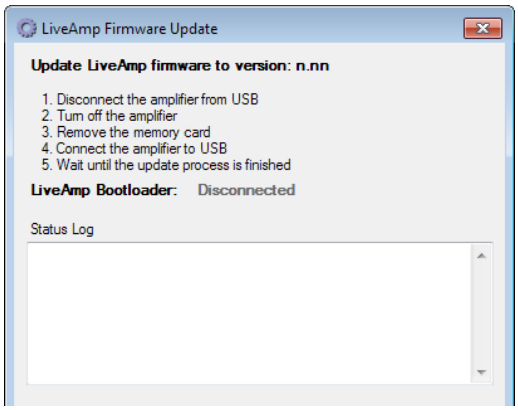
LiveAmp requires no maintenance. Repairs may only be carried out by Brain Products. Regularly inspect the products and accessories for damage and check that the connections are clean. In the event of any defects, please contact your local dealer.

6.2 Update the firmware of LiveAmp

If there is a firmware update for LiveAmp you will be notified by e-mail, through a newsletter or by your distributor. Firmware updates can enhance the performance of LiveAmp. Therefore, install an update whenever it is available.

Prepare

- LiveAmp
- USB adapter with USB cable
- computer with Internet connection



1 Download the firmware update from the Brain Products website or contact your local distributor.

2 Start the updater.

3 Follow the instructions on the screen.

4 Connect LiveAmp to the computer with the USB adapter.

➔ During the update, the battery LED LiveAmp flashes green.

7 Disposing of LiveAmp

CAUTION

Risk of burns by disassembling LiveAmp

By opening LiveAmp the battery can be damaged. When a Lithium-Ion battery is damaged, it can catch fire and cause burns. Only trained personnel may open and disassemble LiveAmp.

Do not open or disassemble LiveAmp and its accessories.

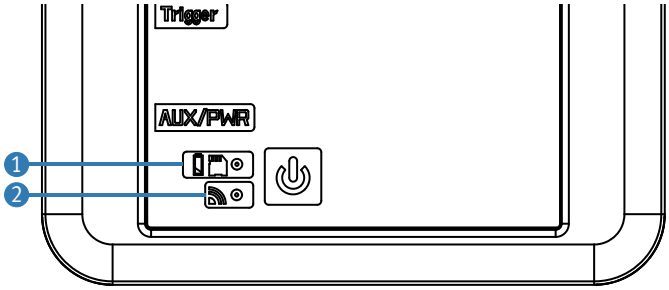
Do not dispose of products, accessories and cables with the household waste. Dispose of them in accordance with national regulations or return the product and its accessories to the manufacturer.

For example, in the EU and EFTA, the Directive on Waste Electrical and Electronic Equipment (WEEE) applies.

8 Troubleshooting

8.1 Knowing the status of LiveAmp

You can determine the operating status of LiveAmp by the LEDs and in the recording software.



1 **Battery/recording LED**

Different colors indicate the battery state from green (= full) to red (= empty).

OFF	LiveAmp is OFF.
ON	LiveAmp is ON (any color), Charging completed (green) when connected to a power source
blinking slow, green	LiveAmp is charging.
blinking fast, any color	Recording to memory card

2 **Wireless LED**

This LED is blue.

OFF	Wireless module is OFF.
ON	Wireless module is ON, but LiveAmp is not connected with Recorder.
blinking	LiveAmp is connected with Recorder.

Is my LiveAmp charging? (see page 47)

8.2 Troubleshooting charts

NOTE

Before you begin troubleshooting, check the log files for LiveAmp. You can find the log files on your local drive. By default they are stored under:
`C:\Vision\Recorder\Log`.

Symptom	Possible cause	Remedy
Blue LED (wireless) switched off during recording.	The wireless module turns off one minute after LiveAmp is out of range or was disconnected from the recording computer.	Press the I/O button for 1 second to switch on the wireless module.
Cannot switch on LiveAmp	Battery empty.	Charge the battery of LiveAmp.
Battery does not charge OR Battery does not charge fully	USB adapter not plugged in correctly.	Make sure that the USB adapter is plugged in correctly on both ends (LiveAmp and power socket). If the issue still exists after troubleshooting, contact your local distributor.
Cannot see signals in Recorder	Electrode connector not correctly connected.	Make sure that the electrode plug snaps into the LiveAmp connector.
	Out of range.	Move closer to the wireless adapter to ensure the highest possible signal strength.
	Input broken.	If the issue still exists after troubleshooting, contact your local distributor.
Battery LED blinks amber while connected to a power source	Power source too weak	Connect LiveAmp to the provided USB charger or a power bank. (The provided charging current should be 500 mA.)

Symptom	Possible cause	Remedy
Battery discharges too quickly	Battery was not fully charged.	Fully charge the battery. It takes around 4 hours to charge an empty battery. If the charging time seems to be too short, fully discharge LiveAmp and charge it again.
	Too long in impedance mode with active electrodes. **NOTE**: With active electrodes the impedance measurement consumes a lot of battery power.	▶ Connect LiveAmp with the USB adapter to a power source during impedance measurement in order to save battery power. ▶ Start the impedance measurement after preparing the cap.
Cannot attach cap to LiveAmp	Connector upside down. Cap with wrong connector.	▶ For connecting the cap refer to 4.2 Connect/disconnect an electrode cap. ▶ Make sure that you have the correct cap (see Chapter 1).
Recorder does not find my LiveAmp	No wireless adapter connected.	Connect the wireless adapter UBT21.
	Too far away.	Get LiveAmp closer to the wireless adapter.
	LiveAmp not switched on.	Switch on LiveAmp. The battery/recording LED is ON and lights green.
	LiveAmp connected with another computer (wireless LED blinks blue).	Disconnect LiveAmp on the other computer and search again.
LiveAmp switched off during recording	Battery is empty.	Charge the battery. When the battery LED is red, the remaining recording time is approximately three minutes.
	I/O button was pressed for 5 seconds or longer.	The EEG data that was recorded until LiveAmp was switched off is still usable.

Symptom	Possible cause	Remedy
Lost samples (markers)	Wireless adapter (UBT21) not used.	Use the wireless adapter UBT21 that is in the scope of delivery.
	Other wireless devices in range.	Make sure, that there are no interferences with other wireless devices. For example, switch off Bluetooth® of your mobile phone.
	Too far away from recording computer.	Get closer to the wireless adapter, to improve the signal strength.
	Too many channels for selected sampling rate.	If you selected more than 24 channels at a sampling rate of 1,000 Hz, lost samples might appear on the recording computer. Do one of the following: ▶ get closer to the recording computer. ▶ record to the memory card (no samples are lost when recording to the memory card). ▶ reduce the number of channels. ▶ reduce the sampling rate.
Lost samples on memory card	Wrong card type.	Only use the micro memory card as specified by Brain Products GmbH.
	Memory card is not formatted with Recorder.	Use Recorder to format the memory card.
Cannot open data in Analyzer	EEG data was not converted.	Refer to Section 4.8 for downloading and converting data.
Cannot find LiveAmp in Windows®	LiveAmp connected wireless (blue LED is flashing) and via USB adapter to the computer.	Press and hold the I/O button for at least 5 seconds to switch off the wireless adapter.

8.3 Frequently asked questions

Is my LiveAmp charging?

When LiveAmp is connected to a power source you can determine the status by the LED or in the recording software:

Your LiveAmp is charging:

- when the Battery LED blinks slowly

  OR

- when connected with Recorder and the battery icon in the status bar of Recorder blinks.

NOTE

When you recording to the memory card, while LiveAmp is not connected with Recorder, you cannot determine if LiveAmp is charging.

Where is my EEG data?

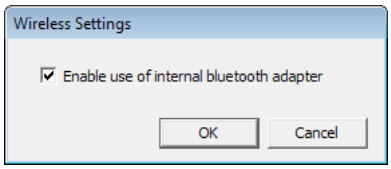
- If you record to the memory card, then your data is stored on the memory card. To access the data, see 4.8 Convert data.
- When simultaneously recording to the memory card and computer, approximately the first ten seconds on the memory card will be missing. This is due to LiveAmp preparing the memory card when a recording is started.

LiveAmp was switched off during the recording. Is my EEG data lost?

No. The EEG-files on the recording computer and memory card contain the data until LiveAmp was switched off.

Can I use the Bluetooth® adapter of my computer?

By default, Recorder uses the wireless adapter UBT21. To use the internal adapter of your computer instead, do the following:



1 Start Recorder (no amplifier connected).
2 Click on **Amplifier** › **Wireless Settings...**
3 The Wireless Settings window opens.
4 Select the check box and click **OK**.
5 Unplug the wireless adapter UBT21.

➔ You can now use the internal wireless adapter of your computer.

NOTE

We recommend to use the provided wireless adapter UBT21, to ensure reliable data transmission.

I lost my memory card. Can I record data?

Yes, but only to the recording computer. If you want to record data to LiveAmp you must insert the supplied memory card into LiveAmp. Note: You must only use memory cards, that match the specifications:

Card type: micro SD® card, class 10

Size: 32 GB

Appendix A Technical data

Ambient conditions

Operation	Temperature: 10 °C to 40 °C (50 °F to 104 °F) Relative humidity: 45 % to 85 %, non-condensing Atmospheric pressure: 700 hPa to 1,050 hPa
Storage and transport	Temperature: 0 °C to 40 °C (32 °F to 104 °F) Relative humidity: 45 % to 85 %, non-condensing Atmospheric pressure: 700 hPa to 1,050 hPa
Charging	Temperature: 10 °C to 30 °C (50 °F to 86 °F)
To prevent mechanical damage during transport, please pack the product in such a way, that it is not subject to vibration.	

Technical data

EEG/ExG channels

Number/type of channels	▶ Max. 32 referential EEG/ExG channels (passive/active electrodes) or ▶ Max. 24 referential EEG/ExG channels and max. 8 bipolar ExG channels (passive electrodes only)
Measurement range	±341.6 mV
Gain factor	12
Input noise	‹ 2 μV_{pp} (0.01 Hz to 65 Hz at 250 Hz sampling rate) measured with internal battery and shorted inputs
Input impedance	› 200 MOhm (at DC) impedance of EEG/ExG channels to GND
Differential input impedance	› 400 MOhm (at DC) impedance between two EEG/ExG channels or bipolar EEG/ExG channels
Common-mode rejection (CMR)	› 80 dB (at 50/60 Hz)
Signal coupling	DC (there is no high pass filter in amplifier hardware)
Low pass filter in amplifier	Third order sinc filter with -3 dB frequency depending on the sample rate: ▶ 1,000 Hz: 262 Hz ▶ 500 Hz: 131 Hz ▶ 250 Hz: 65 Hz
A/D conversion	24 bit
Resolution	Approx. 40.7 nV / bit (= 2*341.6 mV / 2^{24} bit)
Acceleration sensor	Built-in 3-axis acceleration sensor Three separate channels (x, y, z) Measurement range: ±2 g Resolution: 1 mg/bit, 12 bit Error: ±0.2 g (±10 % of full scale)
Hardware sampling rates	▶ 1,000 Hz: 32 EEG/ExG channels (or 29 EEG/ExG plus 3 acceleration channels) NOTE: This combination only works free of sample losses for recordings to the memory card (LiveAmp). Recording to hard disk (HDD) with this combination can lead to sample losses, if the conditions are not optimal. Therefore, for recordings to hard disk, we recommend to use either 24 EEG/ExG or 21 EEG/ExG and 3 acceleration channels at 1000 Hz. ▶ 500 Hz: 32 EEG/ExG channels and up to 3 acceleration channels ▶ 250 Hz: 32 EEG/ExG channels and up to 3 acceleration channels

Data storage

Data storage	▶ On recording computer via wireless transmission ▶ On micro memory card ▶ On recording computer and on micro memory card
Card type	micro SD® card, class 10
Size of memory card	32 GB
Maximum file size on memory card	4 GB
Data format on internal memory card	Proprietary format; can be converted to generic Brain Products data format with converter software provided by Brain Products

Wireless transmission

Wireless data transmission	In 2.402-2.480 GHz ISM band worldwide no restrictions for using this ISM range
Radio frequency output power	Max. 13 dBm (approx. 20 mW)
Wireless transmission range	Indoor: Up to 10 m (depending on environment) Outdoor: Up to 30 m

Electrodes

Compatible electrodes	▶ Passive Ag/AgCl based electrodes ▶ Active actiCAP electrodes
Impedance measurement	Available for passive and active electrodes and integrated in amplifier.
Impedance measurement range	Up to 500 MOhm

Battery and power supply

Power supply	Built-in rechargeable battery Capacity: 1,000 mAh. Power bank can be used for charging or as power supply during operation.
Current consumption	Max. 250 mA
Charging time	Approx. 4 hours at 500 mA (for example, USB port of a computer)
Uninterrupted recording time with built-in battery (when fully charged)	› 3 hours (wireless data transfer only and passive electrodes) › 4.5 hours (storage on memory card only and passive electrodes)

Further data

Built-in trigger/marker input	Yes, 3-pin 2.5 mm phone jack; TTL compatible; active low
LED indicators	Battery/status LED: green, yellow, red Wireless LED: blue
Dimensions (W x D x H)	83 mm x 51 mm x 14 mm
Weight	Approx. 60 g (incl. built-in battery)

LiveAmp USB adapter

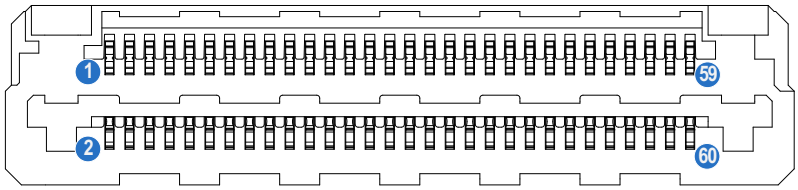
USB communication	Data rate: 12 MBit/s USB 2.0 compatible
Input and output voltage	5 V
Maximum power transfer	5 W
Galvanic isolation	2,500 VDC
Dimensions (W x D x H)	40 mm x 30 mm x 20 mm
Weight	approx. 30 g
Cable length	approx. 50 cm, not detachable

System requirements for the LiveAmp

Operating system	Windows® 7, 32 and 64 bit Windows® 8.1, 64 bit
Software requirements	BrainVision Recorder as of version 1.21.0001 .NET 4
USB port	USB 2.0 or higher

Pin assignment

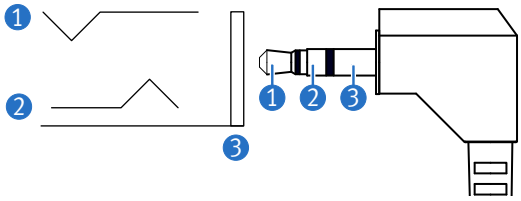
Electrode connector



Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	GND	**16**	In 27+	**31**	In 23	**46**	In 16
2	MP1	**17**	VGND	**32**	In 24	**47**	In 13
3	MP2	**18**	In 27-	**33**	In 21	**48**	In 14
4	5 V	**19**	N	**34**	In 22	**49**	In 11
5	MP3	**20**	In 28+	**35**	In 19	**50**	In 12
6	3 V	**21**	VGND	**36**	In 20	**51**	In 9
7	In 29+	**22**	In 28-	**37**	In 17	**52**	In 10
8	In 29-	**23**	REF	**38**	In 18	**53**	In 7
9	In 30+	**24**	NC	**39**	NC	**54**	In 8
10	In 30-	**25**	VGND	**40**	NC	**55**	In 5
11	In 31+	**26**	NC	**41**	NC	**56**	In 6
12	In 31-	**27**	In 26+	**42**	NC	**57**	In 3
13	In 32+	**28**	In 26-	**43**	NC	**58**	In 4
14	In 32-	**29**	In 25+	**44**	NC	**59**	In 1
15	NC	**30**	In 25-	**45**	In 15	**60**	In 2

GND = Ground
VGND = Virtual Ground
REF = Reference
IN = Input signal
MP = Multi-purpose
NC = Not Connected

Trigger connector (2.5-mm phone jack)



Pin	Function
1 (tip)	Not used
2 (ring)	Trigger in
3 (sleeve)	Ground (GND)