

# actiCAP slim electrode

Operating Instructions

Product revision 01

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## Contents

1. About this document	5
1.1 Target group.....	5
1.2 The structure of this document.....	5
1.3 Conventions in this document.....	6
Typographical conventions.....	6
Symbols.....	6
1.4 Revision history.....	6
1.5 Reporting errors and support.....	6
2. About the actiCAP slim active electrode	7
2.1 Product identification.....	8
2.2 Combinations with other products and components.....	8
2.3 Markings on the products.....	9
3. Safety information	10
3.1 Intended use.....	10
3.2 Correct use.....	10
3.3 Notes on the safe use.....	11
4. The system at a glance	13
4.1 Scope of delivery: actiCAP slim electrodes with the actiCAP slim electrode cap.....	13
4.2 Scope of delivery: actiCAP slim electrodes with the actiCAP snap electrode cap.....	15
4.3 Explaining the actiCAP slim electrode cap.....	17
4.4 Explaining the actiCAP snap electrode cap.....	18
5. Before you begin	19
6. Using the product	20
6.1 Put on the cap.....	20
6.2 EOG, EMG and ECG.....	21
6.3 Minimize the impedance values.....	22
6.4 Connect the actiCAP slim electrodes to an amplifier.....	23
Connect to actiCHamp.....	23
Connect to actiCAP ControlBox.....	23
Connect to LiveAmp.....	23
7. Cleaning the actiCAP slim electrodes and the electrode caps	25
7.1 Cleaning the actiCAP slim electrode cap.....	25

## Contents

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7.2 Cleaning the actiCAP snap electrode cap.....	28
Cleaning the electrode cap.....	29
Cleaning the electrodes.....	30
7.3 Using a disinfectant.....	32
 8. Maintenance and Disposal	 33
8.1 Maintenance.....	33
8.2 Disposal.....	33
 9. Troubleshooting	 34
9.1 Troubleshooting charts.....	34
9.2 Identifying faulty electrode sets.....	34
9.3 Eliminating problems related to the actiCAP ControlBox power supply via USB.....	35
9.4 Identifying a faulty electrode.....	36
Identifying a faulty electrode by LED signalisation using the actiCAP ControlBox.....	36
Checking the electrode impedance.....	36
Checking the electrode signal.....	37
9.5 Replacing a faulty electrode.....	38
 10. Appendix	 40
10.1 Technical data.....	40
10.2 Environmental conditions.....	40

## 1. About this document

These Operating Instructions describe the actiCAP slim active electrode and two types of compatible electrode caps. The Operating Instructions are part of the product and software and the accessories supplied by Brain Products GmbH.

These Operating Instructions must be precisely adhered to in order to ensure that the product and software are employed as intended and are operated correctly, and to guarantee the safety of test subjects and operators.

### 1.1 Target group

The Operating Instructions are intended for users in the psychological and neurophysiological research area as well as physicians and medical experts.

### 1.2 The structure of this document

The Operating Instructions consist of these chapters:

- ▶ [About this document](#) provides an overview of this document.
- ▶ [About the actiCAP slim active electrode](#) provides general information about the product and the manufacturer.
- ▶ [Safety information](#) provides information on handling the actiCAP slim electrodes and associated accessories safely.
- ▶ [The system at a glance](#) provides an overview of all components.
- ▶ [Before you begin](#) provides tips on preparing a measurement
- ▶ [Using the product](#) provides information on using the product.
- ▶ [Cleaning the actiCAP slim electrodes and the electrode caps](#) provides information on cleaning.
- ▶ [Maintenance and Disposal](#) provides information on maintenance and disposal.
- ▶ [Troubleshooting](#) provides information on troubleshooting.

### 1.3 Conventions in this document

#### *Typographical conventions*

**Italic** Italic text is used to identify menus, menu commands, dialog boxes, buttons, options and the names of files and folders. Italic font is also used to highlight portions of running text.

**Underscore** Underscored text indicates a cross-reference or a web address.

#### *Symbols*

##### CAUTION

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

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

Draws your attention to important information relating to the current topic and to recommendations on how to use the product(s).

### 1.4 Revision history

??

### 1.5 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.

## 2. About the actiCAP slim active electrode

Compared with conventional passive electrodes, the actiCAP slim active electrode makes it possible to substantially reduce the time taken to prepare test subjects up to the start of the EEG recording, in particular in the case of acquisition with a large number of channels (32 channels or more).

The sensors integrated in the housing consist of high-quality Ag/AgCl (sinter) and are perfectly suited for DC acquisition. "Active" circuits which are integrated in the electrodes (impedance converters) permit recordings at high impedance (up to 20 kOhm) and minimize ambient noise, interference due to electrical effects and artifacts due to cable movement.

This technology significantly improves the signal to noise ratio even without abrasive impedance minimization and additional cleaning of the skin using alcohol or cleaning products.

The different color LEDs which are integrated in the electrode housing indicate the current electrode impedance. Threshold values (red, yellow, green) and additional functions can be programmed using the supplied actiCAP ControlSoftware and displayed on a computer screen or by using BrainVision Recorder.

The actiCAP slim active electrode is extremely versatile and can be used in combination with the following EEG amplifier models by Brain Products: actiCHamp, LiveAmp, actiCAP ControlBox (e.g. for BrainAmp). The actiCAP slim active electrode can also be used in combination with third party amplifiers by connecting the Brain Products actiCAP ControlBox.

The actiCAP slim active electrodes are used with the actiCAP slim and actiCAP snap electrode caps. The slim, flat and robust design of the actiCAP slim electrode cap make it the ideal solution for EEG co-registration with Transcranial Magnetic Stimulation (TMS).

## 2.1 Product identification

<b>Product designation</b>	actiCAP slim electrode
<b>Software</b>	BrainVision Recorder as of Version 1.20 actiCAP ControlSoftware as of Version 1.2
<b>Manufacturer</b>	Brain Products GmbH Zeppelinstraße 7 82205 Gilching Germany Phone: +49 (0) 8105 733 84 - 0 Fax:+49 (0) 8105 733 84 - 505 Web site: <a href="http://www.brainproducts.com">http://www.brainproducts.com</a> Email: <a href="mailto:techsup@brainproducts.com">techsup@brainproducts.com</a>
<b>CE marking</b>	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.
<b>Warranty</b>	The terms of warranty can be found on our web site at: <a href="http://www.brainproducts.com/contact.php">www.brainproducts.com/contact.php</a>

## 2.2 Combinations with other products and components

Brain Products permits to combine actiCAP slim electrodes with the following product families:

Product	Manufacturer
actiCHamp	Brain Products GmbH
LiveAmp	Brain Products GmbH
actiCAP ControlBox (e.g. for BrainAmp)	Brain Products GmbH
BrainVision Recorder	Brain Products GmbH
actiCAP ControlSoftware	Brain Products GmbH
Computer	The computer to which you connect the ControlBox must fulfill EN 62368-1.

Beside this general statement about permitted product combinations, the user must check if 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).

### 2.3 Markings on the products



Observe the manual.



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



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 devices (only applies to China).



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



The name and address of the manufacturer are specified next to this symbol.



No contact with liquids: Make sure that liquids do not enter the enclosure (e.g. splitter box).

### 3. Safety information

Please read the 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.

#### 3.1 Intended use

actiCAP slim electrodes are intended to be used for acquiring neuro-/electrophysiological signals (e.g. EEG, EMG, ECG, EOG). They 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 actiCAP slim electrodes for diagnosis, therapy, monitoring of vital physiological processes (such as cardiovascular functions etc.) or other medical purposes is expressly forbidden.

#### 3.2 Correct use

actiCAP slim electrodes must only be used:

- ▶ by personnel in the psychological and neurophysiological research area as well as physicians and medical experts.
- ▶ in hospitals, clinics, other medical environments, research institutes and other non-medical environments (e.g. at home), provided that all the other stipulations regarding the correct use are met and that the products are used in accordance with their intended use.
- ▶ to record neuro-/electrophysiological signals from healthy adults and children.

actiCAP slim electrodes 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) the Operating Instructions.
- ▶ on sick children and adults.

Irrespective of any liability on the part of the manufacturer, the relevant national stipulations for operators and other relevant national legislation must be observed.

The user is solely liable for any risks if the product is not used in accordance with the correct use as described. Brain Products GmbH provides no guarantee and accepts no liability for the results obtained with actiCAP ControlSoftware or BrainVision Recorder.

### 3.3 Notes on the safe use

Read the following safety information carefully since it will help prevent personal injury and damage to property. It is assumed that as the operator, you have the required specialist knowledge in handling the hardware and software. The manufacturer shall not be liable in the event of any failure to observe the safety information set out below.

The actiCAP slim active electrodes are to be used in the intended environment and in accordance with the intended use. You should particularly avoid exposing the product to direct sunlight, high humidity levels or water.

 **CAUTION**

Do not use the actiCAP slim electrodes in MR environments.

 **NOTICE**

No tampering.

- ▶ Do not open any component of the actiCAP slim electrodes or related components by force.
- ▶ Do not unnecessarily remove the electrodes from the actiCAP slim or the actiCAP snap electrode cap.
- ▶ When handling the actiCAP snap electrode cap and/or when replacing an electrode holder, ensure that the small plastic tag on the electrode holder showing the electrode number does not break.
- ▶ Do not carry out repairs yourself except when replacing an electrode (for details refer to [Replacing a faulty electrode](#)).

 **NOTICE**

Take care when cleaning.

For detailed information on cleaning the actiCAP slim and actiCAP snap electrode caps refer to [Cleaning the actiCAP slim electrodes and the electrode caps](#).

- ▶ Remove all actiCAP slim electrodes from the actiCAP snap electrode cap before cleaning.
- ▶ Always ensure that the plugs and sockets are clean. You can clean them with compressed air if this becomes necessary.
- ▶ Do not bring the plugs and sockets in particular into contact with moisture (never wipe the plugs and sockets with a damp cloth).
- ▶ To avoid damage to the splitter box, never let it come into contact with water.

**! NOTICE**

Take care when connecting and disconnecting the equipment

- ▶ Only connect the actiCAP slim electrode sets to amplifiers for which they are intended.
- ▶ Only connect or disconnect the actiCAP slim electrodes while the corresponding amplifier or actiCAP ControlBox is switched off.
- ▶ Always ensure that the splitter box and amplifier are connected to the correct channel group on the actiCAP ControlBox or, in case of actiCHamp, that the splitter box is connected to the correct channel group on the amplifier.
- ▶ Do not force the plugs into the sockets.
- ▶ Never remove the plugs from the sockets by pulling the cables.
- ▶ Never pull the electrode cables to remove the actiCAP slim electrodes from their holders in the actiCAP snap electrode cap. Instead, take the electrode head between your thumb and index finger and slide it carefully out of the holder.

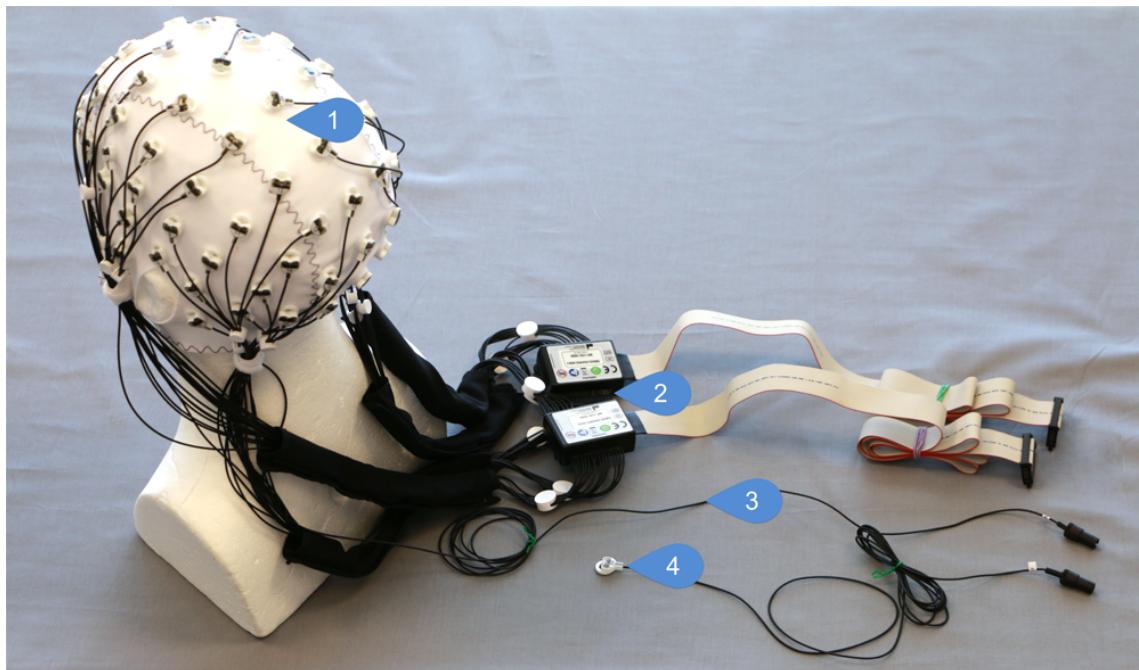
**Note**

Always use the most recent version of BrainVision Recorder and the actiCAP ControlSoftware.

## 4. The system at a glance

### 4.1 Scope of delivery: actiCAP slim electrodes with the actiCAP slim electrode cap

The delivery scope contains the following items:



Item no.	Description
1	actiCAP slim electrode cap with embedded active electrodes (shown here: actiCAP slim electrode cap 64-channels), consisting of a fabric cap and two actiCAP slim 32-channel electrode sets (100 cm flat ribbon)
2	Between one and five actiCAP slim 32-channel electrode sets (100 cm flat ribbon)
3	Ground electrode (160 cm)
4	Reference electrode (160 cm)

#### ! NOTICE

In the actiCAP slim electrode cap all electrodes are embedded and should not be removed from the cap unless it is absolutely essential; for example if a faulty electrode requires replacement. Removing the electrodes unnecessarily may cause damage to the actiCAP slim electrode cap.



**Note**

**Routing electrode cables with the actiCAP slim electrode cap**

When you are using the actiCAP slim electrode cap you may have to re-arrange or re-route the electrode cables in a specific direction in order to achieve the required setup, e.g for Transcranial Magnetic Stimulation (TMS). In this case use the small VELCRO® straps and secure the electrode cables as needed.

## 4.2 Scope of delivery: actiCAP slim electrodes with the actiCAP snap electrode cap

The delivery scope contains the following items:



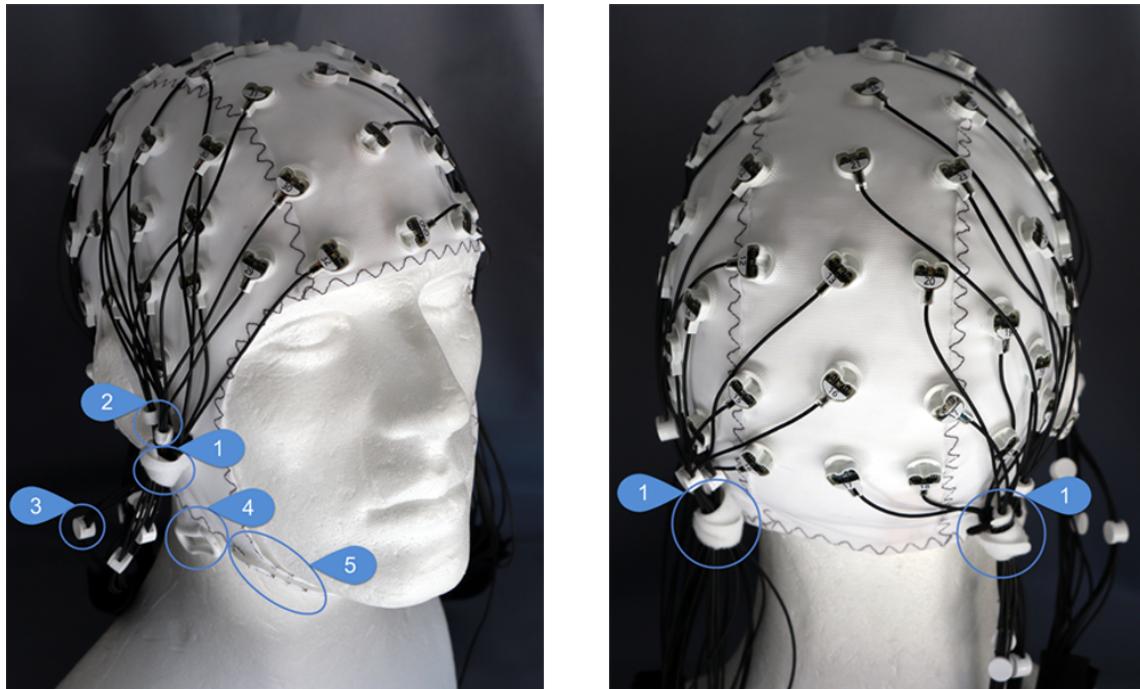
Item no.	Description
1	actiCAP snap electrode cap with slide-in electrode holders (shown here: actiCAP snap electrode cap 64-channels)
2	actiCAP slim 32-channel electrode set (100 cm flat ribbon)
3	Ground electrode (160 cm)
4	Reference electrode (160 cm)

In the actiCAP snap electrode cap the electrode holders are color-coded to facilitate the assignment of the matching electrode set. The tags on the holders show either the electrode type or, in the case of the data electrodes, the electrode number which is supposed to be attached to that particular holder.

Electrode	Holder	Description
		Ground electrode and corresponding electrode holder
		Reference electrode and corresponding electrode holder
		Data electrode and corresponding electrode holder (example)

### 4.3 Explaining the actiCAP slim electrode cap

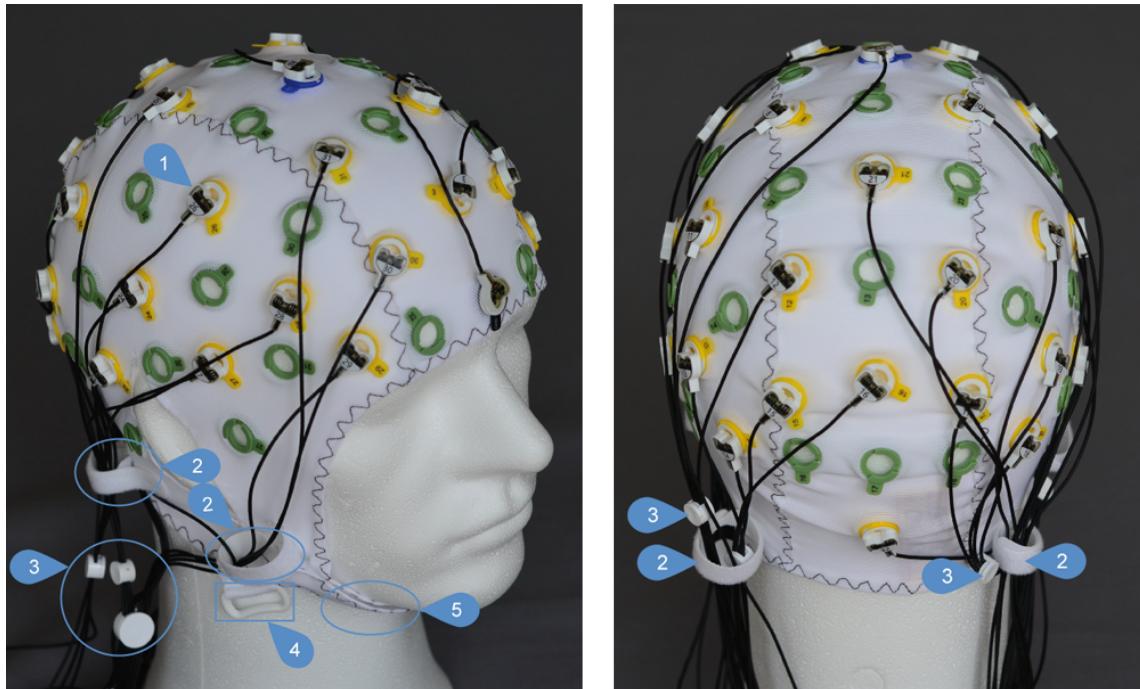
The actiCAP slim electrode cap includes the following items:



No.	Description
1	VELCRO® straps to secure electrode cables
2	Small VELCRO® straps to route electrode cables as required
3	Cable guides
4	Loop for additional chest or chin strap (not included)
5	VELCRO® chin strap

#### 4.4 Explaining the actiCAP snap electrode cap

The actiCAP snap electrode cap includes the following items:



No.	Description
1	Color-coded electrode holders
2	VELCRO® straps to secure electrode cables
3	Cable guides
4	Loop for additional chest or chin strap (not included)
5	VELCRO® chin strap

## 5. Before you begin

Familiarize yourself with the operation of the actiCAP slim electrodes and carry out some test measurements before you start acquiring signals. In all cases, it is essential to observe the [Safety information](#) in the corresponding chapter.



### Note

#### Requirements relating to the test subject

In principle, it is possible to perform acquisition with any test subject. However, before performing an acquisition, make sure that the test subject is not sensitive to the materials in the actiCAP slim or the actiCAP snap electrode cap including electrodes and the electrode gels.

The delivery documentation contains details of the respective specifications for the actiCAP slim or actiCAP snap electrode caps.

## 6. Using the product

The images in this chapter show the actiCAP slim electrode cap as an example.

### 6.1 Put on the cap

1. If you are using the actiCAP snap electrode cap, insert the electrodes into the electrode holders in the cap before actually putting the electrode cap on the test subject's head. To attach the electrodes to the holders, follow the pattern outlined below:

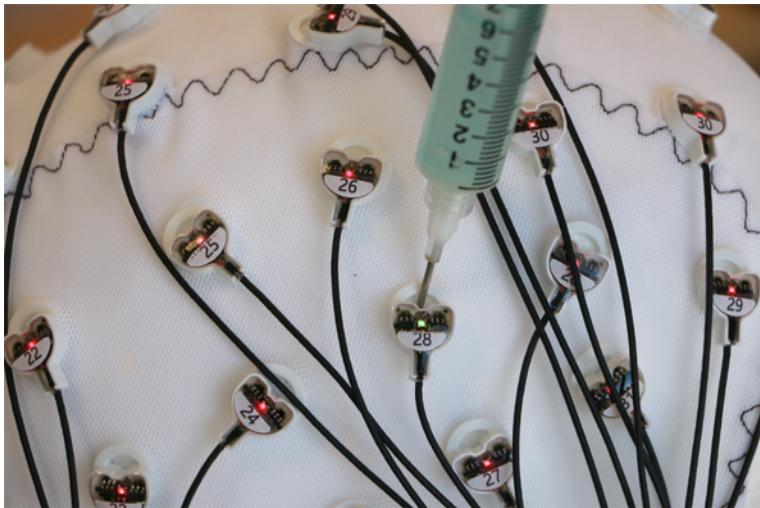
Electrode set no. ...	... goes into electrode holders with this color:
1	green
2	yellow
3	red
4	white
5	light blue

2. Place the respective electrode cap on the test subject. Ensure the cap is correctly positioned and the chin strap fastened.
3. Attach the splitter box to the cap by using the crocodile clamp(s). Alternatively, attach it to the clothes of the subject.
4. If you want to reposition the white cable guides, slide them along the cables or open and move them. When sliding the white cable guides, do not pull on the cables. Otherwise electrode cables will be damaged or disconnected from the splitter box.
5. Fill the electrodes with gel ensuring that the gel has contact with the electrode sensor and the subject's head skin. The electrode sensor is below the LED.



#### Note

If you are using the actiCAP slim electrode cap, gently tilt the electrodes back when you fill them so that the space underneath is completely filled with gel.



6. Connect the actiCAP slim amplifier connection cable to the amplifier as described in [Connect the actiCAP slim electrodes to an amplifier](#), then continue with step 7.
7. In BrainVision Recorder, assign the physical channel to the electrode position (e.g. FP1). The first electrode of the first electrode set has the physical channel 1 and the first electrode of the second electrode set has the physical channel 33, for instance. Refer to the BrainVision Recorder Operating Instructions for more information.
8. Perform the impedance measurement to determine if electrode impedances still have to be minimized. First minimize the impedances of the ground and reference electrodes and only then minimize the impedances of the data electrodes.

## 6.2 EOG, EMG and ECG

1. Use an adhesive ring (part number FMS-060231) to apply the electrodes to the required part of the body.
2. Fill the electrodes with gel ensuring that the gel has contact with the electrode sensor and the subject's head skin. The electrode sensor is below the LED.

### 6.3 Minimize the impedance values

1. Carefully insert the blunted needle of the syringe through the electrode aperture as far as the test subject's head skin.
2. Using the blunted needle of the syringe, gently roughen the test subject's head skin by means of careful circular movements. This increases the contact area between the electrode gel and the skin of the head.
3. Use the syringe to apply a small amount of gel (0.2 to 0.3 ml) directly to the skin of the head.
4. Fill the remaining space in the electrode with gel ensuring that the gel has contact with the electrode sensor and the subject's head skin. The electrode sensor is below the LED.

In this way you will easily achieve the impedance of 25 to 35 kOhm that is required in order to perform measurements with the actiCAP slim active electrodes.

 **Note**

If you are using the actiCAP slim electrode cap, gently tilt the electrodes back when you fill them so that the space underneath is completely filled with gel.

 **Note**

For more detailed information on checking impedances with the actiCAP ControlSoftware, refer to the BrainAmp Operating and Reference manual or refer to the BrainVision Recorder Operating Instructions.

When the impedance value changes, the electrode LEDs changes from red to yellow or green depending on the ranges you have set.

Using this procedure and with a little practice, two people should be able to prepare 32 channels in 4 to 5 minutes or 64 channels in approximately 8 minutes.

5. The impedances improve with time: To start with, fill all the electrodes with gel as described above. Once you have prepared all the electrodes accordingly, perform a visual check of the impedances.
6. If the impedance in one or more electrodes has not been sufficiently minimized (LED lit yellow or red), use the blunted needle in the syringe to push through the electrode aperture again and roughen the test subject's head skin a little more by means of circular movements. If necessary, use a little more gel.

## 6.4 Connect the actiCAP slim electrodes to an amplifier

The images in this chapter show the actiCAP slim electrode cap as an example.

### *Connect to actiCHamp*

Connection pattern for actiCHamp	Connect splitter box no. ...	... to actiCHamp module no.
	1	1
	2	2
	3	3
	4	4
	5	5

### *Connect to actiCAP ControlBox*

Connection pattern for actiCAP ControlBox	Connect splitter box no. ...	... to ControlBox input color
	1	green
	2	yellow
	3	red
	4	white

#### Note

- ▶ For more details on the actiCHamp, refer to the separate actiCHamp Operating Instructions.
- ▶ For more details on the actiCAP ControlBox refer to the BrainAmp Operating and Reference Manual.

### *Connect to LiveAmp*

To connect the actiCAP slim electrodes to the LiveAmp refer to the LiveAmp Operating Instructions and follow the procedures used for actiCAP.



## 7. Cleaning the actiCAP slim electrodes and the electrode caps

We recommend that you clean the actiCAP slim electrodes and the corresponding electrode cap immediately after every use. When doing this, always first disconnect the electrode sets from the amplifier or actiCAP ControlBox and remove the electrode cap from the subject's head.

### ! NOTICE

Observe the following instructions to prevent property damage:

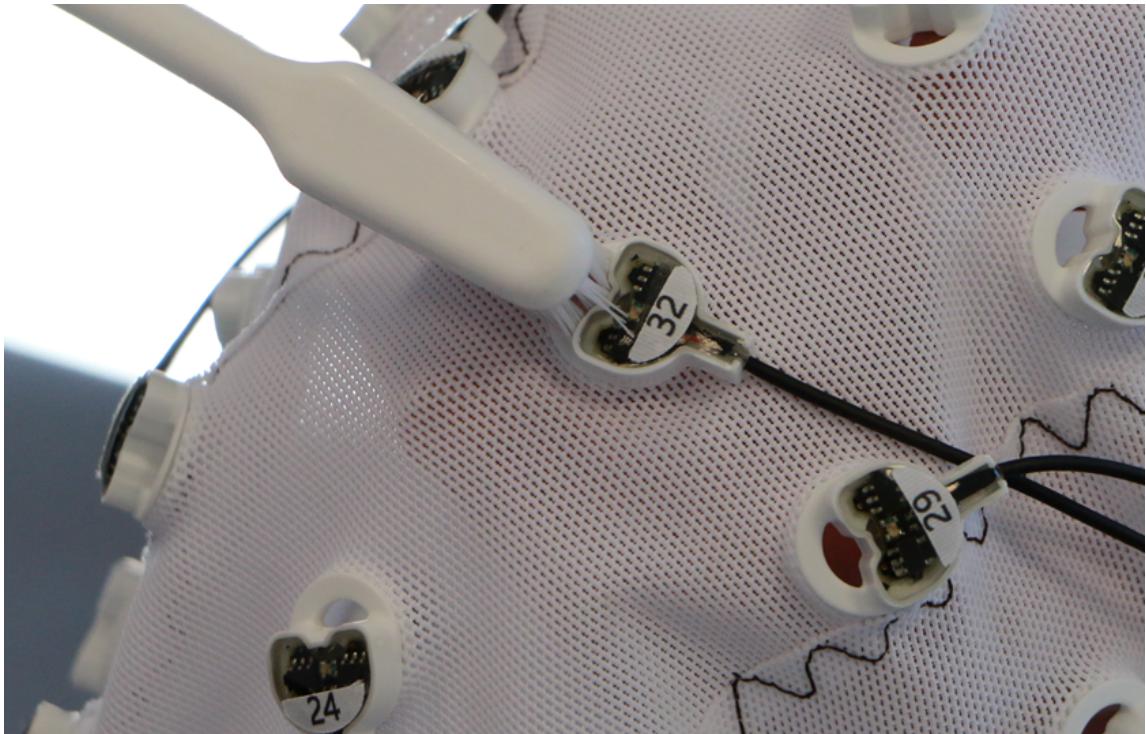
- ▶ Do not leave the actiCAP slim electrodes and the fabric electrode caps to soak in water for more than 30 minutes.
- ▶ Do not allow liquids to penetrate the splitter box.
- ▶ Do not allow electrical connectors to come into contact with liquids.
- ▶ Do not chlorinate the actiCAP slim electrodes as this may result in corrosion.
- ▶ Do not use any hot sterilization methods (e.g. autoclave) as this may damage the cable insulation.

### 7.1 Cleaning the actiCAP slim electrode cap

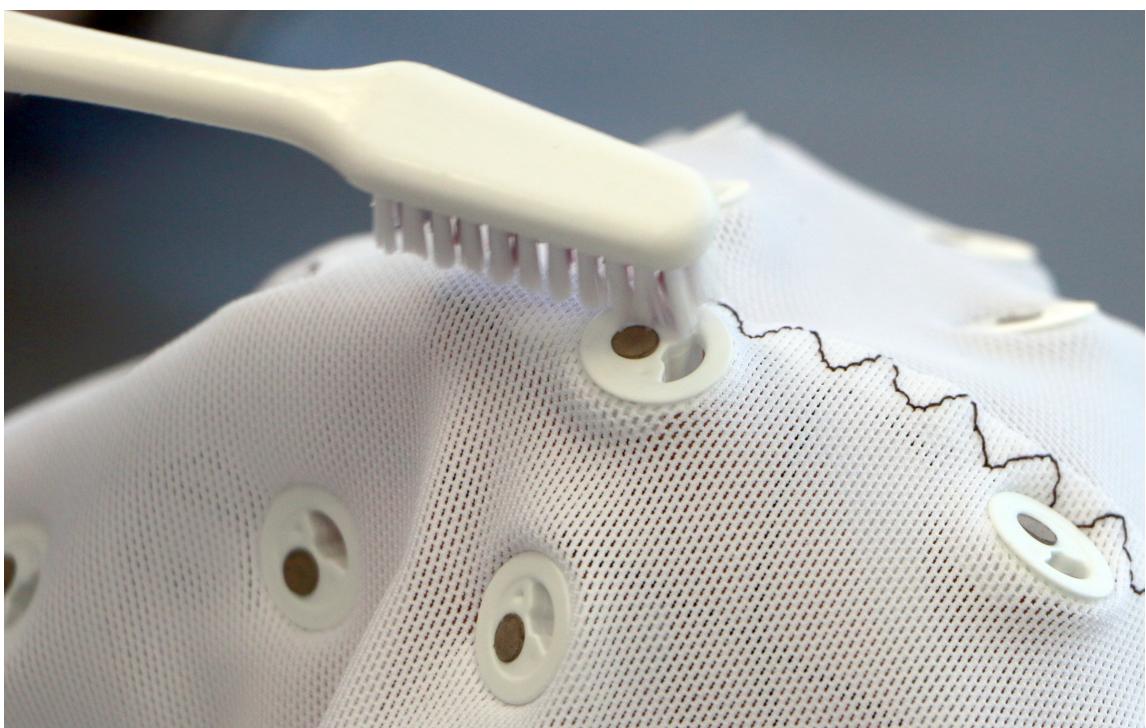
### ! NOTICE

Do not remove the embedded electrodes from the actiCAP slim electrode cap when cleaning the cap.

1. Fill a plastic bowl with lukewarm water. Do not use hot or boiling water. The water temperature must not exceed 50 °C (122 °F). Do not use a metal bowl as this can cause damage to the sensitive electrodes.
2. Place the actiCAP slim electrode cap in the water bath and let it soak for approx. 10 minutes.
3. Gently clean the electrodes with a toothbrush to remove any residue. If the electrodes are particularly dirty, you can use a mild cleaning agent. However, note that many dishwashing agents can leave a film on the electrodes. Baby shampoo has proved to be the most suitable product.



4. Turn the actiCAP slim electrode cap inside out and repeat step 3.



5. Cover the splitter box with a towel, then remove the electrodes from the bowl.

**! NOTICE**

Make sure that the splitter box does not come into contact with water.



6. Rinse the actiCAP slim electrode cap by filling the bowl with clean, lukewarm water ( $\sim 32^{\circ}\text{C}/90^{\circ}\text{F}$ ) and submerge the electrode cap for about one minute. Repeat as necessary to remove any residue left by the cleaning agent.
7. Remove the actiCAP slim electrode cap from the bowl and remove excess water by slightly pressing the cap with your hands.
8. Put the actiCAP slim electrode cap onto a clean, dry towel and gently pat to remove excess water.



9. Turn the actiCAP slim electrode cap inside out and repeat step 8.
10. If necessary, you can wipe the electrode cables and splitter box using a damp cloth.
11. Hang the actiCAP slim electrode cap to dry on a drying rack.

**! NOTICE**

Make sure that the cables and especially the splitter box are placed higher than the electrode cap to prevent any water from dripping from the cap into the splitter box and connectors.

## 7.2 Cleaning the actiCAP snap electrode cap

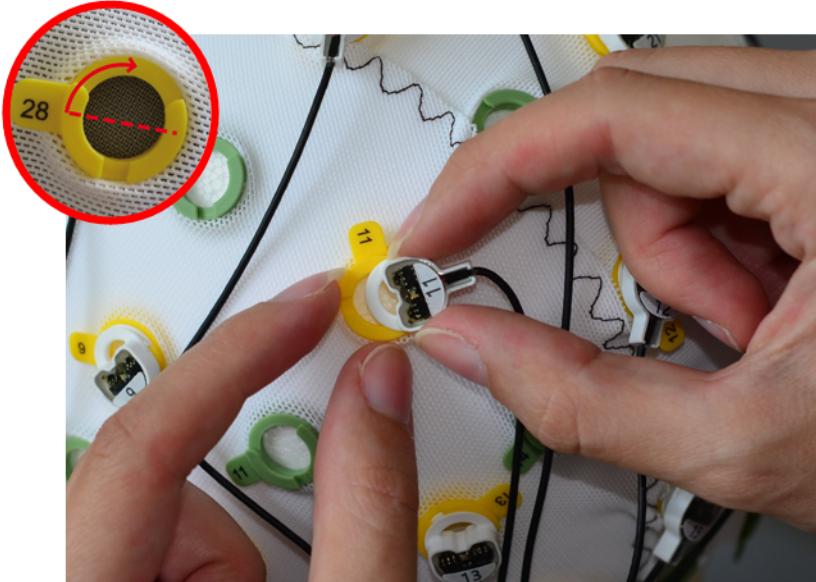
**! NOTICE**

Never pull the electrode cables to remove the actiCAP slim electrodes from their holders in the actiCAP snap electrode cap. Instead, take the electrode head between your thumb and index finger and slide it carefully out of the holder. Alternatively, you can put your index finger into the hole in the electrode head and slide the electrode head out of the holder this way.

#### Cleaning the electrode cap

1. Remove all electrodes from the actiCAP snap electrode cap. To do so, slide the electrodes out of the electrode holders in the electrode cap and set the electrode set aside. Do not remove the electrode holders.

Use the tag on the electrode holder as an orientation: The opening is located at a 90° angle to the tag. Slide the electrode head out of the holder in this direction.



2. Fill a plastic bowl with lukewarm water.

Do not use hot or boiling water. The water temperature must not exceed 50 °C (122 °F). Do not use a metal bowl, as this can cause damage to the sensitive electrodes.

3. Place the actiCAP snap electrode cap in the water bath and let it soak for approx. 10 minutes.
4. Gently clean the electrode holders with a toothbrush to remove any residue. If the actiCAP snap electrode cap is particularly dirty, you can use a mild cleaning agent. Baby shampoo has proved to be the most suitable product.



5. Turn the actiCAP snap electrode cap inside out and repeat step 4.
6. Remove the actiCAP snap electrode cap from the water.
7. Rinse the actiCAP snap electrode cap by filling the bowl with clean, lukewarm water ( $\sim 32^\circ\text{C}/90^\circ\text{F}$ ) and submerge the electrode cap for about one minute. Repeat as necessary to remove any residue left by the cleaning agent.
8. Remove the actiCAP snap electrode cap from the bowl and remove excess water by slightly pressing the electrode cap with your hands.
9. Put the actiCAP snap electrode cap onto a clean, dry towel and gently pat to remove excess water.



10. Turn the actiCAP snap electrode cap inside out and repeat step 9.
11. Hang the actiCAP snap electrode cap to dry on a drying rack.

#### ***Cleaning the electrodes***

1. To proceed with cleaning the electrodes, fill a plastic bowl with fresh lukewarm water. Do not use hot or boiling water. The water temperature must not exceed  $50^\circ\text{C}$  ( $122^\circ\text{F}$ ). Do not use a metal bowl, as

this can cause damage to the sensitive electrodes.

2. Place the electrodes in the water bath and let them soak for approx. 10 minutes. Ensure that the splitter box does not come in contact with water.
3. Gently clean the electrodes with a toothbrush to remove any residue. If the electrodes are particularly dirty, you can use a mild cleaning agent. Baby shampoo has proved to be the most suitable product.



4. Cover the splitter box with a towel, then remove the electrodes from the bowl.

**! NOTICE**

Make sure that the splitter box does not come into contact with water.



5. Rinse the electrodes by filling the bowl with clean, lukewarm water ( $\sim 32^\circ\text{C}/90^\circ\text{F}$ ) and submerge them for about one minute. Repeat as necessary to remove any residue left by the cleaning agent.
6. If necessary, you can wipe the electrode cables and splitter box using a damp cloth.
7. Hang the electrode set to dry.



### NOTICE

Make sure that the cables and especially the splitter box are placed higher than the electrodes to prevent any water from dripping from the electrodes into the splitter box and connectors.

### 7.3 Using a disinfectant

For disinfecting product surfaces we recommend using a cloth moistened with a disinfectant based on propyl alcohol, for example a solution containing 25% Ethanol and 35% Propan-1-ol. Adhere to the safety precautions of the disinfectant manufacturer.

## 8. Maintenance and Disposal

### 8.1 Maintenance

actiCAP slim electrodes require no maintenance. Regularly inspect the product and accessories for damage and check that the connections are clean. In the event of defects, please contact your local dealer for returning a defective product to Brain Products.

### 8.2 Disposal

Dispose of the product, accessories and cables 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 product, accessories and cables with ordinary household waste.

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

## 9. Troubleshooting

This chapter contains test scenarios and recommendations that should assist you when conducting tests and localizing faults before you contact our technical support team.

### 9.1 Troubleshooting charts

Symptom	Possible cause	Remedy
Noise on all channels	<ul style="list-style-type: none"> <li>▶ Impedance of ground or reference electrode too high.</li> <li>▶ Ground or reference electrode broken.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Minimize the impedance of the ground or reference electrode.</li> <li>▶ Replace the faulty ground or reference electrode.</li> </ul>
All channels show the same signal	<ul style="list-style-type: none"> <li>▶ Impedance of ground or reference electrode too high.</li> <li>▶ Ground or reference electrode broken.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Minimize the impedance of the ground or reference electrode.</li> <li>▶ Replace the faulty ground or reference electrode.</li> </ul>
No signal on one electrode	<ul style="list-style-type: none"> <li>▶ No contact</li> <li>▶ Electrode broken</li> </ul>	<ul style="list-style-type: none"> <li>▶ Make sure that the electrode contacts the scalp. Clean and roughen the scalp.</li> <li>▶ Replace the electrode.</li> </ul>

### 9.2 Identifying faulty electrode sets

It is possible that the actiCAP ControlSoftware does not correctly detect the individual electrode sets, even though there is no hardware fault. To exclude this problem, check that you observed the sequence of the installation steps specified in [Using the product](#):

1. First connect the splitter box(es) and the amplifier to the actiCAP ControlBox.
2. Only after you have done this, connect the actiCAP ControlBox to your computer using the supplied USB cable.
3. Open the actiCAP ControlSoftware and check that all the electrode sets that are present are listed correctly in the software.

### 9.3 Eliminating problems related to the actiCAP ControlBox power supply via USB

It is possible that the actiCAP ControlBox does not work correctly when it is powered from the USB port. It is not immediately evident whether it has been deactivated by the operating system or there is a fault in the actiCAP ControlBox.

#### Background

If you are running other devices on a USB port alongside the actiCAP ControlBox, there is a risk that insufficient power is available for the ControlBox to operate correctly.

A USB port on a computer can generally supply 500 mA at 5 V. All devices on the USB port are uniformly assigned 100 mA. After the device has registered at the USB port, the device driver on the computer attempts to switch the device to a configuration where it can function correctly. The controller of the USB port then decides whether sufficient power is available for this. If this is the case, the connected device operates correctly. Otherwise the original configuration (uniform consumption  $\leq$  100 mA) is retained to avoid overloading the power supply and the device that is consuming more power than is assigned to it is switched off by the controller.

#### Our recommendation

To ensure that your actiCAP ControlBox works without problems, you should observe the following recommendations:

1. Only power the actiCAP ControlBox via USB during impedance measurement and software-controlled tests (*Label Check* for checking the electrode positions, *Electrode Groups* for creating electrode sets and *Impedance Check* for checking the impedance values). You should use batteries to supply the actiCAP ControlBox with power when you are actually acquiring data.
2. When performing impedance measurement, always run the actiCAP ControlBox on an active USB hub with a separate power supply.

If you still have any problems with the actiCAP ControlBox, contact our technical support team. For contact details refer to [Product identification](#).

## 9.4 Identifying a faulty electrode

### *Identifying a faulty electrode by LED signalisation using the actiCAP ControlBox*

1. Insert the batteries in the actiCAP ControlBox.
2. Place all electrodes including the reference electrode and ground electrode in a saline bath (approx. 3 tablespoons of salt to 1 liter of water). Only ever use a plastic bowl for this.
3. Press the Impedance button **Z** on the actiCAP ControlBox.
  - If the LEDs in the electrodes are working correctly, they light up green.
  - If one or more data electrodes do not light up green, these electrodes are faulty.
  - If the LEDs of all the electrodes light up red, the reference electrode or ground electrode is faulty.

### *Checking the electrode impedance*

1. Connect the actiCAP slim electrodes to the amplifier or actiCAP ControlBox and then connect to the computer.
2. Place the actiCAP slim electrodes including the reference electrode (if applicable) in a saline bath (approx. 3 tablespoons of salt to 1 liter of lukewarm water). Only ever use a plastic bowl for this.

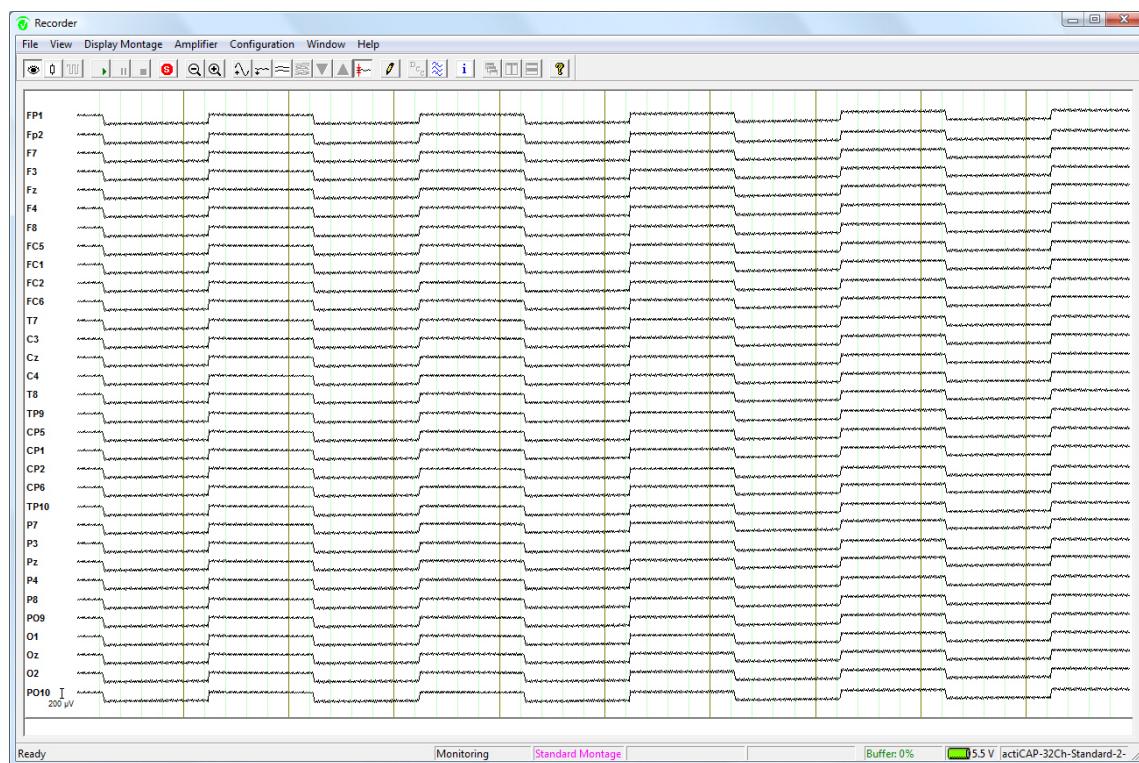
**!** **NOTICE**

If you know that your tap water contains significant amounts of iron ions, better use distilled water in order to avoid damage to the Ag/AgCl electrode pellets.

3. Open BrainVision Recorder or the actiCAP ControlSoftware and check the impedances. Refer to the BrainVision Recorder Operating Instructions, or for the actiCAP ControlSoftware refer to the actiCAP Operating Instructions.
4. Depending on the salinity of the water bath, the impedance values should be between 0 kOhm and 5 kOhm. If the value for an electrode is above 20 kOhm, this electrode is in all probability faulty. Gently brush the sensor with a toothbrush or clean the surface of the sensor with fine sandpaper to check if the electrode impedance decreases to a normal value.

### Checking the electrode signal

1. Connect the actiCAP slim electrodes to the amplifier or actiCAP ControlBox and then connect to the computer.
2. Place the actiCAP slim electrodes including the reference electrode (if applicable) in a saline bath (approx. 3 tablespoons of salt to 1 liter of lukewarm water). Only ever use a plastic bowl for this.
3. Open the BrainVision Recorder software.
4. Start the impedance measurement, refer to the BrainVision Recorder Operating Instructions
5. If all channels are working properly, a square-wave signal (see image below) is shown on all channels in the Recorder. If this is not the case the electrode is in all probability faulty. Gently brush the sensor with a toothbrush or clean the surface of the sensor with fine sandpaper to check if the electrode impedance decreases to a normal value.



## 9.5 Replacing a faulty electrode

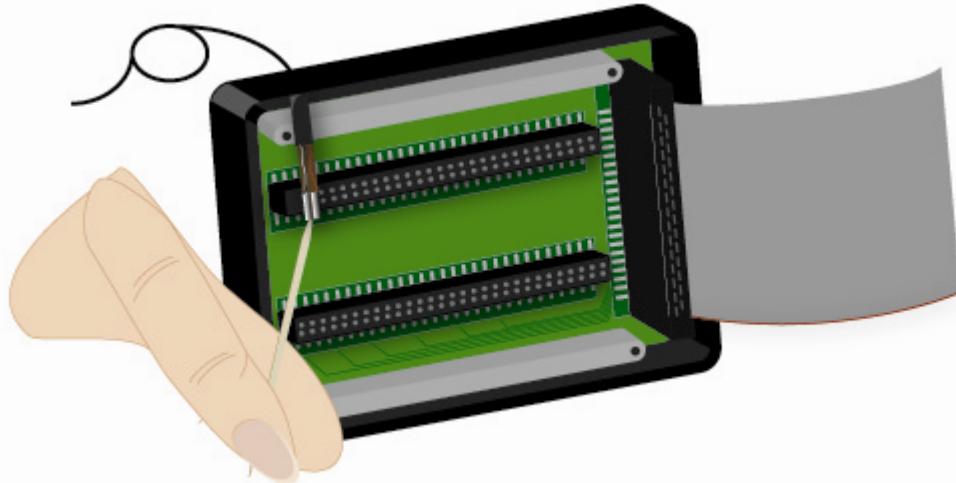


### Note

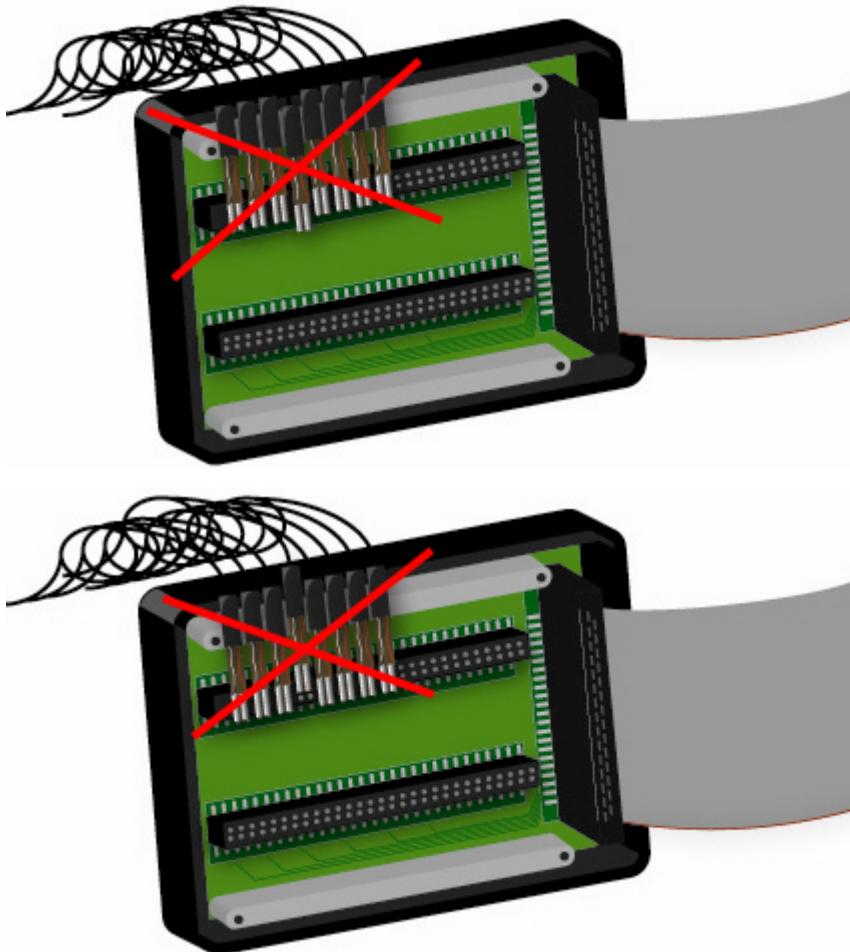
Electrodes may only be replaced by persons authorized to do so by Brain Products. Please contact our technical support team in this regard (for the contact details refer to [Product identification](#)).

Proceed as follows to replace a faulty electrode:

1. Before the electrode is replaced, disconnect the actiCAP slim electrodes from the amplifier.
2. Gently remove the faulty electrode from the actiCAP slim or the actiCAP snap electrode cap and from the electrode set.
3. Open the splitter box by unscrewing the screw in the center under the label (1 to 32, 33 to 64 etc.).
4. Remove the splitter box cover.
5. Unscrew the metal bar on the side of the faulty electrode, by releasing the 2 small machine screws at each end of the bar.
6. Carefully withdraw the faulty electrode. This is best done by taking a toothpick or screwdriver, for instance, and carefully removing the front part of the electrode from the splitter (see image below).



7. Carefully insert the new electrode. Ensure that the four metal teeth engage correctly in the splitter and that the rubber sheathing is aligned and does not protrude. Avoid incorrectly positioned electrodes as shown below.



8. Replace the metal bar with the flat side facing down and secure it with the screws.
9. Put the cover back onto the splitter box and secure it with the small screw in the middle. Affix the label to the splitter box again.
10. Insert the new electrode into the electrode set.
11. Gently insert and embed the new electrode in the actiCAP slim electrode cap or insert the new electrode into the respective electrode holder in the actiCAP snap electrode cap.

 **Note**

If the EEG curve obtained for an acquisition is very flat, check that the plug is seated correctly (repeat from step 3 onwards, paying special attention to the procedure described in step 7).

## 10. Appendix

### 10.1 Technical data

Acquisition mode	
Amplification	1
Input impedance	> 200 MΩ
Operating frequency	DC - 5000 Hz
Inherent noise (including electrode noise):	< 2 µVpp for 0.1 - 35 Hz band
Dynamic range	± 1000 mV
Offset voltage	< 20 mV (incl. electrode offset) measured in 0.9% saline (NaCl)

Electrode dimensions	
Height of electrode	Approx. 6 mm
Width of electrode	Approx. 13 mm

### 10.2 Environmental conditions

The actiCAP slim active electrode and its accessories may only be used in environments that are not exposed to sunlight, humidity, water, dirt, conducting contaminants and extreme radiation (EMC, HF sources).

The following environmental conditions must be satisfied for the operation, transport and storage of the actiCAP slim active electrode and its accessories:

Operation	Temperature range: 0 °C to 40 °C (32 °F to 104 °F) Relative humidity: 30% to 90%, non-condensing Atmospheric pressure range: 700 hPa to 1050 hPa
Transport	Temperature range: -35 °C to 65 °C (-31 °F to 149 °F) Relative humidity: 30% to 90% Atmospheric pressure range: 700 hPa to 1050 hPa
Storage	Temperature range: -35 °C to 65 °C (-31 °F to 149 °F) Relative humidity: 30% to 90% Atmospheric pressure range: 700 hPa to 1050 hPa