



EASYCAP

EEG Recording Caps and Related Products

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EIB64-DUO

Electrode Input Board / Quick-Connect-Interface
Converter-Adaptor - Multi-Input-Adaptor

A Versatile Interface between Touchproof Safety Sockets
and EEG Amplifiers like actiCHamp Plus, BrainAmp, and
Others



Manual

Valid until publication of a new version of this document.

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1. About this Document

These Operating Instructions describe the electrode input board EIB64-DUO. The Operating Instructions are a component of the device and its accessories supplied by EasyCap GmbH. They must be precisely adhered to in order to ensure that the device is used as intended and operated correctly and to guarantee the concomitant safety of test subjects, users and third parties. Make sure that these Operating Instructions are always available to users.

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1.1 Target Group

The Operating Instructions are intended for professional users in the psychological and neurophysiological research area, in education, and other applications where signals of biopotential origin are employed, like Brain-Computer-Interfaces, Neuro-Marketing, Neuro-Ergonomics, Self-Optimization, Serious Gaming, etc.

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1.2 Conventions in this Document

In Chapter 4 “Instructions for Use” the explaining text is written in *Italics* while the mere instructions are Plain Text.

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1.3 Revision History

No.	Date	Section	Subject	Reason

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1.4 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.

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2. About EIB64-DUO

EIB64-DUO is a connector for up to 64 channels which allows many different connections and conversions between 1.5mm touchproof safety sockets (as on many EEG and other biopotential electrodes) and 50pinned or 40pinned connectors as on BrainAmp- or actiCHamp Plus EEG amplifiers.

Besides connecting different connectors with each other it can also serve as a Quick Connect Interface by leaving the many single connectors in the EIB permanently and dis-/connecting only the one or two multi-channel 40- or 50-pin connectors.

By using still further connector adaptors, the EIB64-DUO can be used with still further input sources and amplifier brands.

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2.1 Product Identification

Product designation Electrode Input Board EIB64-DUO

Manufacturer Easycap GmbH
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Website <https://www.easycap.de>
Email: info@easycap.de

Conformity fulfills the essential requirements of EC directive 2011/65/EC and it's amendmends up to 2015/863/EU.

Warranty The terms of warranty can be found on our web site at:
<https://www.easycap.de>

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2.2 Combinations with Other Products and Components

EIB64-DUO is permitted by Easycap GmbH to be combined with the following product families:

- EEG Electrodes, ECG Electrodes, EMG Electrodes
- BrainAmp family, connected with 50pin flat-ribbon-cables
- actiCHamp Plus, connected with 40pin flat-ribbon-cables and Ground (GND)-cable KB-B4P-B4P-20

It may be also used to conduct other biological or artificial signals of less than 1 Volt and 100 mAmpere into respective registration devices.

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2.3 Markings on the Product



Observe the manual.



MR Unsafe: An item which poses unacceptable risks to the subject, medical staff or other persons within the MR environment.*



No contact with liquids: Make sure that liquids do not enter the enclosure.



Easycap GmbH confirms that this device fulfills the essential requirements of EC directive 2011/65/EC and its amendments up to 2015/863/EU.



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.

* Definitions from ASTM international standard F2503-13

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2.4 Scope of Delivery

The catalogue number EIB64-DUO designates only the bare electrode input board.

For operation further connector cables are necessary. Their type and number depends on the environment and what is already available with previously purchased devices.

Please see the most common accessories in chapter "Catalogue-Numbers of EIB64-DUO and Accessories"

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3. Safety Considerations when Using EIB64-DUO

Read the following safety information carefully. It will help prevent personal injury and damage to property. The manufacturer shall not be liable in the event of any failure to observe the safety information set out below.

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3.1 EIB64-DUO Intended Use

The EIB64-DUO is intended to deliver biopotential and comparable artificial signals into appropriate registering devices, like EEG amplifiers.

The use of the EIB64-DUO is limited to research, education, and other applications where signals of biopotential origin are employed, like Brain-Computer-Interfaces, Neuro-Marketing, Neuro-Ergonomics, Self-Optimization, Serious Gaming, etc. The use for diagnosis, therapy, alleviation of human diseases, i.e. medical use, is expressly forbidden.

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3.2 EIB64-DUO Correct Use

The EIB64-DUO is permitted to be used by users with a background in psychological and neurophysiological research, persons with basic knowledge about electrical engineering, and other professionals in areas where signals of biopotential origin are employed.

The EIB64-DUO is not permitted to be used by

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

The EIB64-DUO can be used to deliver neuro-/electrophysiological signals from healthy and sick adults, children and animals.

The use of EIB64-DUO for medical purposes is not permitted.

The EIB64-DUO is permitted to be used in the following environments: Research institutes, and other non-medical environments (e.g. at home), hospitals, clinics and other medical environments, provided that all the other stipulations regarding correct use are met and that the devices are used in accordance with its intended use.

The EIB64-DUO is not permitted to be used in the following environments:

- MR scanner rooms
- In vicinity of explosive gases as may be the case in e.g. operating theaters
- oxygen enriched atmospheres.

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

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3.3 Notes on the Safe Use

Only use the EIB64-DUO and its accessories in the environment for which it is intended and in accordance with its intended use.

Under no circumstances should you do any of the following:

- Never open the device.
- Do not repair the device yourself.
- Do not connect the device to electrical connections which are not compliant with the relevant standards.
- Avoid exposure to direct sunlight, high levels of humidity or liquids.
- Do not use the EIB64-DUO together with a defibrillator.

Protection of Test Subjects, Users and Third Parties

Use only the cables, electrodes, accessories provided or released by Easycap GmbH.

You need to be very careful to know what you are doing when using EIB64-DUO outside an EEG environment.

If a test subject suffers from discomfort or injury, always have the subject medically examined immediately. If necessary, ensure that the subject receives appropriate care.

Inform Easycap GmbH immediately to clarify the exact circumstances in which the discomfort occurred to prevent the same thing from happening in the future. You will find the contact details for our technical support team in chapter 'Product Identification'.

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4. Applications of EIB64-DUO and Combinations with Different Cap- and Amplifier Types - Instructions for Use

4.1 Input-Output Assignment and Connectors

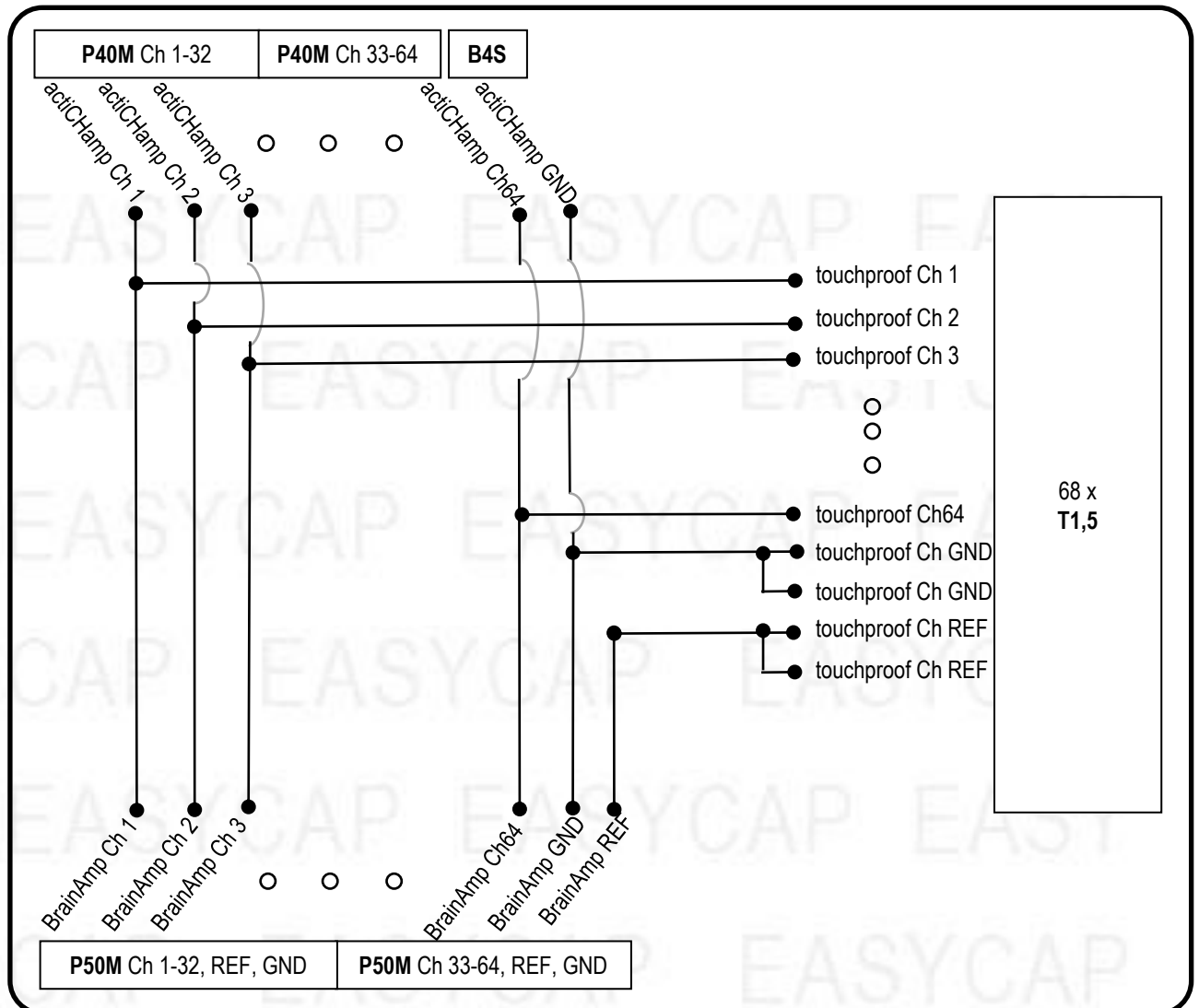


Fig. 1

- P50M 50pin-connector, matching 50pin BrainAmp flat ribbon cable
- P40M 40pin-connector, matching 40pin actiCHamp flat ribbon cable
- B4S 4pin-Binder socket, matching 4pin-Binder plug
- T1,5 touchproof 1.5mm jack, matching touchproof 1.5mm socket (DIN 42802)

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4.2 General Considerations

Please find a list of all mentioned accessories and their abbreviations in chapter 'Catalogue-Numbers of EIB64-DUO and Accessories'.

All 3 ends of each channel are connected internally except "REF" (Reference) which connects only P50M (connector to BrainAmp) and T1,5 (touch proof jacks).

Signals may flow in any direction.

All EEG amplifiers accept 1 to N channels and GND. Some EEG amplifiers require an extra electrode as REF, whereas others create an internal REF. Correspondingly there are EEG Recording Caps with or without a dedicated Ref electrode. The correct connections will differ depending on which type of cap should be connected to which type of amplifier. The next chapter explains most of the possible combinations.

For caps/amplifiers with more than 64 channels, 2 or more Electrode Input Boards (EIB) can be chained together by connecting their REF and/or GND with jumper cables. Again, the correct method depends on how the Reference issue, described above, is handled.

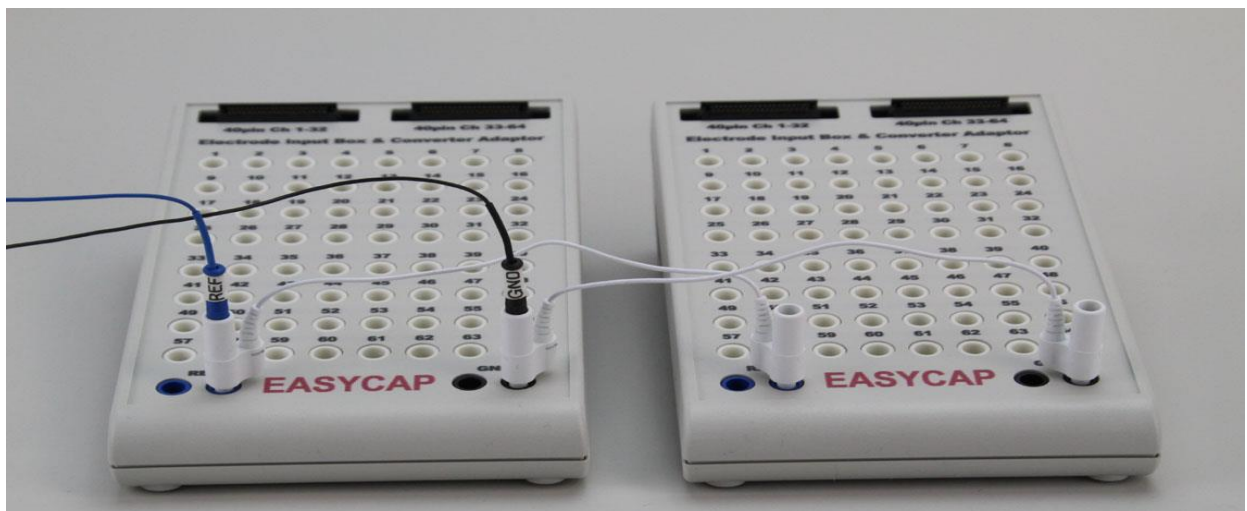


Fig. 2 Two or more EIB64-DUO can be combined by chaining their GND – and REF, if applicable – with E75

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4.3 Usage of EIB64-DUO as Electrode Input Board / 'Quick-Connect-Interface'

4.3.1 Single Electrodes onto actiCHamp Plus

The electrodes might be in a cap or solitary. Anyway, mount them on the subject.

Plug electrodes 1 to N into corresponding T1,5 jacks

Plug electrode GND into T1,5 GND

Plug E81-22 into P40M Ch 1-32, and, if applicable, E81-25 into P40M Ch 33-64

Plug KB-B4P-B4P-20 into B4S

Plug the other ends into actiCHamp Plus

Note: *The electrodes can be plugged into EIB64-DUO permanently. This saves time and avoids plugging errors. To connect/disconnect, only separate the EIB from E81 and KB-B4P-B4P-20. This set-up turns the EIB into a 'Quick-Connect-Interface'. One EIB is necessary per set of electrodes. The set of E81(s) and KB-B4P-B4P-20 are necessary only once per amplifier.*

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4.3.2 Single Electrodes onto BrainAmp

The electrodes might be in a cap or solitary. Anyway, mount them on the subject.

Plug electrodes 1 to N into corresponding T1,5 jacks Plug electrode(s) REF into T1,5 REF

Plug electrode GND into T1,5 GND

Plug the first E80 into P50M Ch 1-32, and, if applicable, the second E80 into P50M Ch 33-64

Plug the other end into the BrainAmp(s)

Note: *The electrodes can be plugged into EIB64-DUO permanently. This saves time and avoids plugging errors. To connect/disconnect, only separate the EIB from E80. This set-up turns the EIB into a 'Quick-Connect-Interface'. One EIB is necessary per set of electrodes. The E80 is necessary only once per amplifier.*

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4.3.3 Single Electrodes onto other Amplifiers which have Inputs for Single Electrodes

Here an EIB is not a technical necessity, as all electrodes could be plugged directly into the amplifier. However, cleaning or storing electrodes requires them to be disconnected from amplifiers, which are typically stationary devices. For practical convenience, the EIB64-DUO can be used as a 'Quick-Connect-Interface', whereby the electrodes can be plugged into the EIB only once and left permanently inserted. To subsequently connect the EIB to an amplifier, only the one, or both multi-channel connectors can be connected with appropriate cables, instead of all individual sockets, up to 66 electrodes.

If the amplifiers requires no REF plug the electrodes of channels 1 to N into the EIB64-DUO as described in 4.3.1 . Do NOT plug the GND electrode into EIB64-DUO.

The single 1.5mm touchproof sockets of an E104 (without Ref) except GND can be plugged permanently into the amplifier.

Connect EIB64-DUO to E104 using E81: Plug the GND-electrode directly into the amplifier, i.e. bypassing EIB64-DUO.

If the amplifiers requires a REF plug the electrodes into the EIB64-DUO as described in 4.3.2 .

The single 1.5mm touchproof sockets of an E105 can be plugged permanently into the amplifier.

Connect EIB64-DUO to E105 using E80

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4.3.4 Single Electrodes onto other Amplifiers which are connected with a Multi-Channel-Connector

Here the EIB is necessary to accept the electrodes. Then a connector adaptor matching the amplifier input is necessary to connect EIB and amplifier. In most cases we will be able to build such a customized connector adaptor.

Plug the electrodes into the EIB64-DUO as described in 4.3.1 if the amplifiers requires no Ref.
Connect EIB64-DUO with custom adaptor with E81

Plug the electrodes into the EIB64-DUO as described in 4.3.2 if the amplifiers requires a Ref.
Connect EIB64-DUO with custom adaptor with E80

Note: Whether necessary, like in 4.3.4, or optional, like in 4.3.3, owning one EIB for each set of electrodes allows the electrodes to remain plugged in permanently, which thus saves time and avoids plugging errors.

Note: *The BrainAmp ExG is a special use case: although it is possible to feed the electrodes for 8 bipolar channels into BrainAmp ExG using an EIB64-DUO, there is no advantage in doing so. To connect single electrodes (and auxiliary sensors) to BrainAmp ExG use EIB-Aux.*

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4.4 Usage of EIB64-DUO as Converter Adaptor

Most EEG Recording Caps belong to a certain type of EEG amplifier. Accordingly they come with a multi-channel-connector which connects directly to the respective amplifier.

For use with BrainAmp there is the family of gel-based EEG Recording Caps called BrainCap (BC), and the saltwater-sponge-based R-Net for BrainAmp (RNP-BA). Accordingly for actiCHamp Plus there is the BrainCap for actiCHamp Plus (BCA) and R-Net for actiCHamp Plus (RNP-AP).

Normally these caps/nets are connected directly to their respective amplifier, to BrainAmp with an E80 (50pin BrainAmp-Flat Ribbon Cable), and to actiCHamp Plus with an E81 (40pin actiCHamp Flat Ribbon Cable) and an additional cable for GND, KB-B4P-B4P-20.

However, in some circumstances a BrainAmp-cap/net may need to be connected with an actiCHamp Plus, or an actiCHamp-cap/net with BrainAmp. In these cases, the EIB64-DUO can be used as a converter adaptor. Most of the possible combinations are explained below:

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4.4.1 Using Caps/Nets for BrainAmp with actiCHamp Plus

4.4.1.1 Using Caps/Nets for BrainAmp with actiCHamp Plus by skipping REF

With this connection style the REF-electrode in the cap/net will not be registered or used in any way. The electrode does not need to be filled with electrolyte gel.

This connection style is equivocal to connecting a BrainAmp cap/net to actiCHamp Plus by using 40-50 PIN ADAPTER KIT. Note that 40-50 PIN ADAPTER KIT can be used ONLY for this case, but not for the cases described below in 4.4.1.2, 4.4.2.1, 4.4.2.2.

Connect the cap/net with P50M by using E80
Connect P40M with actiCHamp Plus by using E81
Connect BS4 with actiCHamp Plus by using KB-B4P-B4P-20

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4.4.1.2 Using Caps/Nets for BrainAmp with actiCHamp Plus Using the Signal Coming from REF

With this connection style the signal from the REF-electrode is registered as another EEG channel, just like the others. This can be employed if the REF lies over a region of interest within an investigation and may not be skipped. Note that instead of REF another electrode needs to be skipped. This skipped electrode may not be filled with electrolyte gel (in case of R-Net the sponge needs to be removed).

This connection style may depend on individual, lab-specific factors and should be tested first. Technically, what arrives at the amplifier is the averaged signal from the REF- and the empty, skipped electrode. The empty electrode will act as an antenna to environmental noise. Usually this contribution will be negligible, but this should be verified first. As a workaround the cable of the skipped electrode can be cut near the connector, and re-connected later when the electrode is needed again.

Note for Sales/Distributors: if you encounter a frequent interest in this connection style the next revision of EIB64-DUO can be built with switches to connect/separate each channel individually from the BrainAmp leg.

Connect the cap/net with P50M by using E80
Connect T1,5 Ref with E75 to the T1,5 of the electrode you want to skip
Connect P40M with actiCHamp Plus by using E81
Connect BS4 with actiCHamp Plus by using KB-B4P-B4P-20

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4.4.2.1 Using Caps/Nets for actiCHamp Plus with BrainAmp by Using an Existing Electrode as Ref

Caps/nets for actiCHamp Plus come short of a REF electrode, which are required for BrainAmp amplifiers. To remedy this, any of the existing electrodes can be short-circuited with a jumper cable to REF on the EIB64-DUO, which will feed this channel into the BrainAmp as REF.. This electrode should be deleted from BrainVision Recorder's workspace. Otherwise, it will appear as a flat line on the ongoing EEG screen, and signal will appear with 0 at all samples in the data file.

Connect the cap/net with P40M by using E81
Connect the T1,5 of the electrode you declared as Ref to T1,5 Ref by using an E75
Connect P50M with BrainAmp by using E80

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4.4.2.2 Using Caps for actiCHamp Plus with BrainAmp by Adding an Additional Electrode for Ref (does not work with R-Net)

An additional electrode or pair of electrodes can be placed on the skin (e.g. nose or earlobe(s) or mastoid(s)), or can be added at a free space into the cap, either directly or by using a holder. All EasyCap electrodes with sintered Ag/AgCl sensors are compatible with each other, so this additional electrode can have a different shape/housing than the other cap electrodes. Special electrode shapes e.g. for nose are available, and also ear clips or ear clamps for ear lobes with corresponding electrode shapes are available. Please inquire about this with us or with your local distributor.

Connect the cap with P40M by using E81
Mount an additional single electrode on subject or cap and plug it into T1,5 REF
Connect P50M with BrainAmp by using E80

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4.5 Usage of EIB64-DUO as Multi-Input-Adaptor

Speaking generally it is possible to feed signals into EIB64-DUO using different inputs. Several configurations are possible. Always carefully observe how REF & GND need to be handled, depending on the type of respective amplifier.

Here only one representative example is explained, for others please inquire. This example assumes the availability of a 32Ch BrainCap, several additional single electrodes (e.g. for ECG, EMG, EOG), and a 64Ch actiCHamp Plus. With this connection style the REF-electrode in the cap/net will not be registered or used in any way, as in 4.4.1.1. The REF electrode does not need to be filled with electrolyte gel:

Connect the cap to P50M by using E80
Connect the single electrodes to any of T1,5 33 thru 64
Connect both P40M with actiCHamp Plus by using E81
Connect BS4 with actiCHamp Plus by using KB-B4P-B4P-20

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5. Catalogue-Numbers of EIB64-DUO and Accessories

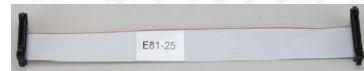
EIB64-DUO 64-Channel-Electrode Input Box for BrainAmp & actiCHamp Plus with additional functions
- converter-adaptor
- multi-input-adaptor

The following items are not included and need to be purchased separately. Whether they are necessary depends on the equipment already available. If you are unsure, please contact us with details of your set-up and we would be happy to consult you about which items are required for your desired solution.

E81-22 40pin actiCHamp Flat Ribbon Cable, 22cm



E81-25 40pin actiCHamp Flat Ribbon Cable, 25cm



KB-B4P-B4P-20 4pin-Binder on both ends, pinning 1:1, length 20cm, with ferrite-core



E80 50pin BrainAmp-Flat Ribbon Cable, 29cm



E104 Electrode Board Adaptor from P40M onto 33 touchproof 1.5mm sockets



E105 Electrode Board Adaptor from P50M onto 34 touchproof 1.5mm sockets



E75 1.5mm stackable shorting socket, length 15cm



Note: If your electrodes do not come with touchproof 1.5mm sockets, appropriate converter-adaptors are available. We can also make appropriate connector-adaptors for other existing equipment you may have.

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6. Maintenance, Cleaning and Disposal

6.1 Maintenance

Observe the correct connector orientation. The P50 and P40 meet correctly when the white triangles on connector and flat-ribbon-cable point at each other.



Fig 3: Correct orientation while plugging flat-ribbon-cables

Take care that no electrolyte gel/paste, e.g. from fingers, enters the insides of any connectors. As electrolytes are usually salty, this will lead to corrosion of the metallic portion of the connectors. Furthermore, dried electrolyte gel is no longer conductive. Both these corrosion and pollution mechanisms will severely hamper the noise-free electrical conduction, and thereby negatively impact the signal quality of your data.

Apart from this, the EIB64-DUO is maintenance-free.

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6.2 Cleaning

“Cleaning” means the removal of pollution with the help of water. For “disinfecting” see section 6.2.

Water is used to moisten cloth, cotton swabs, or other cleaning media. Neither should the EIB64-DUO itself be exposed to water, nor should the cleaning aids be more than damp. “Damp” means an extent of moisture, that does not leave visible water drops or traces on the device.

If necessary, especially when grease or dirt requires removal, cleaning can be enhanced by adding some soap (or other mild surfactant) to the water. However, soap suds or residue should also be removed with a cloth dampened with soap-free water..

- Before cleaning the EIB64-DUO, disconnect it from the test subject and its attachments.
- Clean the EIB64-DUO, electrodes and cables only with a soft, damp cloth.
- Ensure that the device, connectors and sockets do not come into contact with any amount of moisture.
- Dry the EIB64-DUO carefully with a cloth after cleaning it.
- Use utmost caution when cleaning the insides of connectors. In case of any stubborn or difficult pollution, return the EIB64-DUO to Easycap GmbH.

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6.3 Using a disinfectant

For Electrodes

For active and passive electrodes, electrode caps and sensor electrodes, using “Perfektan TB” disinfecting agent (within the EU) and “Envirocide” disinfecting agent (outside of the EU) is recommended. Please adhere to the recommended exposure time and safety precautions as stated by the manufacturer of these products. Be sure to always rinse equipment thoroughly after disinfection procedures and let air dry. Please note that using stronger disinfection agents come at the cost of faster deterioration of our products.

For Surfaces

For disinfecting the surfaces of products (amplifiers, batteries, adapter boxes, etc.), we recommend wiping them down with disinfection wipes or tissue moistened with a hand-sanitizer. Neither wipes nor sanitizer should contain more than 20% alcohol. The exposure time should last at least 30 seconds.

If you are unable to purchase the products mentioned above in your region, disinfecting products with similar properties and active ingredients would be recommended. If in doubt, inquire at Easycap GmbH.

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6.4 Disposal

As soon as the device, accessories and cables have reached the end of their service life, dispose of them in accordance with the relevant national regulations. In Germany, for example, the legislation governing electrical and electronic equipment (known as the ElektroG) is applicable. In the EU and EFTA, the WEEE Directive 2012/19/EU on Waste Electrical and Electronic Equipment applies.

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

Subject to the provision that only original equipment supplied by Easycap GmbH is involved, Easycap will accept return of the equipment and handle disposal on request.

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Appendix A Environmental conditions

The EIB64-DUO 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 EIB64-DUO 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

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Appendix B Technical data

Electrical Data

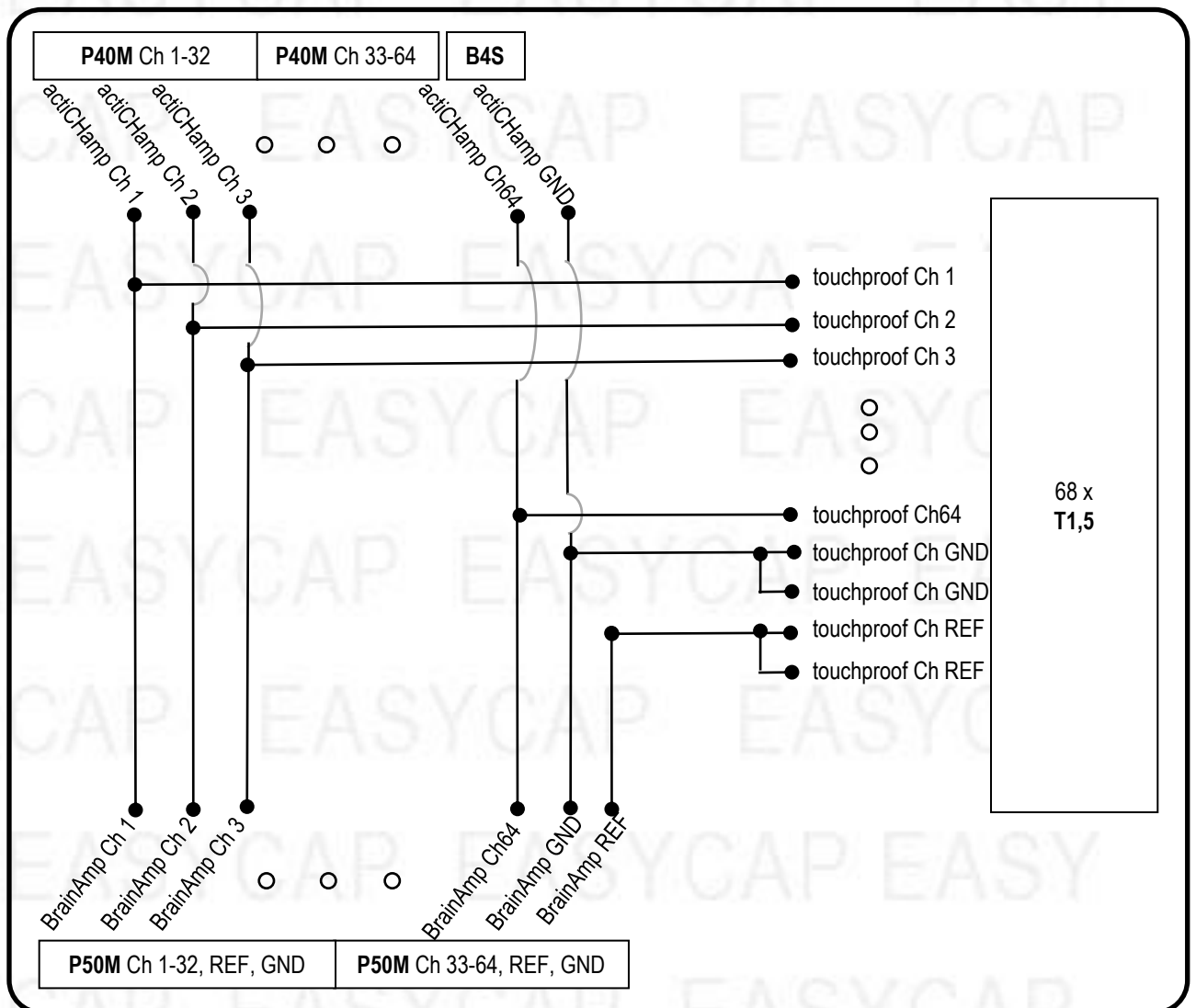
Maximum Current 100 mA

Mechanical Data

Dimensions (H x W x D) 177 x 105 x 55 mm

Weight 279 gr

Input-Output Assignment



Connectors

P50M 50pin-connector, matching 50pin BrainAmp flat ribbon cable

P40M 40pin-connector, matching 40pin actiCHamp flat ribbon cable

B4S 4pin-Binder socket, matching 4pin-Binder plug

T1,5 touchproof 1.5mm jack, matching touchproof 1.5mm socket (DIN 42802)

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