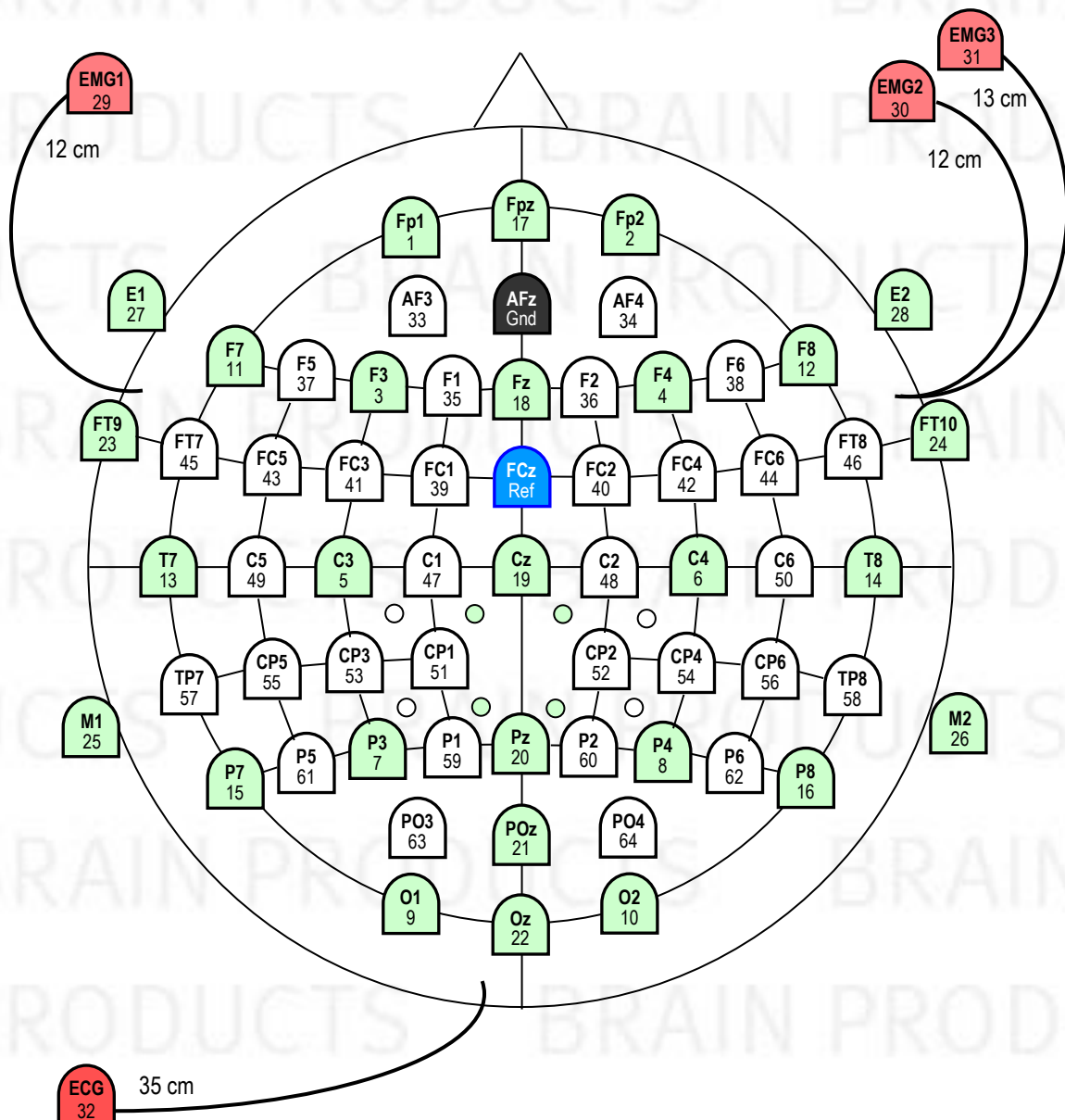




64Ch BrainCap MR for Sleep Recordings during fMRI

With EOG for reference against FPz

Electrode Layout and Channel Assignment



- M1 / M2 are approximately at mastoid positions (TP9' / TP10')
- FCz offers a reliable online recording reference; please reference offline to mastoid position e.g. M2
- E1/Fp and E2/Fp may be used for EOG, they are integrated in the cap for better signal quality

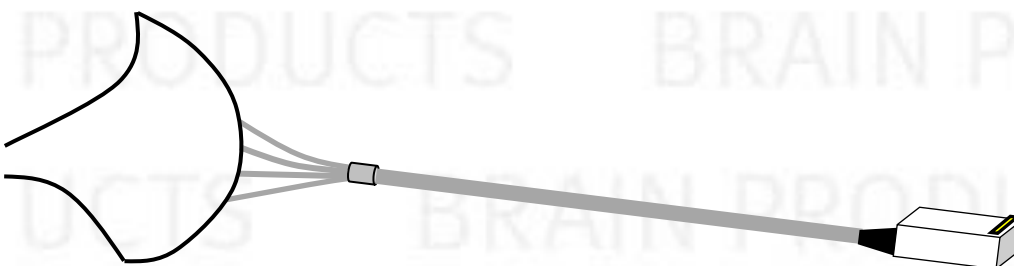
More Details for Users

Exit Point of Cable Tree

In BrainCap-MRS the exit point of the cable tree can be either fronto-central



or centro-parietal.



Upon ordering one of these options needs to be chosen. The decision depends upon the headcoil used.
(All BrainCap-MRS built before October 2019 have the centro-parietal exit point.)

Ordering Information

For ordering please give **Article Number, Cap Cut, Exit Point, and Size**
(e.g. BC-MRS-64, C-Cut, Exit FFCz, 56):

- Article Number: **BC-MRS-64**
- Cap Cut: **C-Cut** or **A-Cut**
- Exit Point: **Cable Tree Exiting at FFCz** or **Cable Tree Exiting at CPz**
- Size (given in cm head circumference):
 - Adult caps: **54, 56, 58, 60, 62, 64** (average male: 58, average female: 56)
 - Children caps: **50** (3-4 years), **52** (5-10 years), **54** (11-14 years)
 - Infant caps: **42, 44** (7 month), **46, 48** (2 years)

The catalogue-number comprises the cap as described. For further information about accessories or consumables, please visit our website or contact our local distributor.

Cap

Standard Cap: Sublunion Cap with integrated chin belt, white

Standard Fabric: Sizes 52 – 64 made from High Precision Fabric, Sizes 50 and smaller High Comfort Fabric

Options: C-Cut or A-Cut, Exit Point, Size. For further variations, please contact us.

Electrodes

All electrodes are Multitrodes for MR with sintered Ag/AgCl sensors. They are buttoned directly into the cap (total height less than 3,5 mm) or can be attached to the skin with washers (= double-sided adhesive rings).

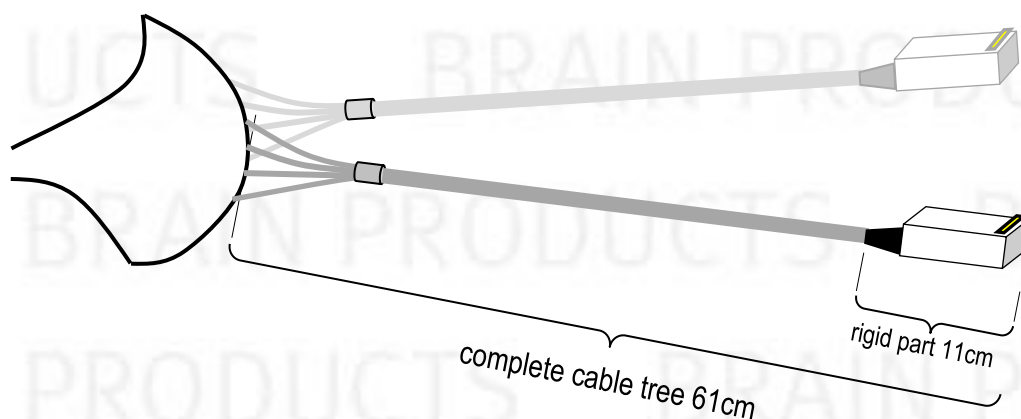
All electrodes in the cap are with 5 kOhm-resistors directly after the sensor. The drop-down electrodes (EMG for chin EMG, and ECG) are with 15 kOhm resistor.

Electrode housing colours are according to the above figure. All cables are white, except Ch 29-32 red, REF = blue cable, GND = black cable. All electrodes are name-labelled (Fp1, Fp2, ...) near sensor.

The drop-down electrode cable parts outside the cap are covered waterproof wherever possible in silicone - or if more suitable in spiral tube - to avoid direct contact to skin.

All cables go on the outside of the cap directly to the leaving point of the cable tree. Cables are fixed with double-T-nylon threads. The cables part from the cap in branches of approx. 8 cables. These branches leave radially from the area around FFCz or CPz and straight/tight to a uniting point after approx. 5 cm. After the uniting point, one cable tree continues to the BrainCap-connector-box.

The length of the cable tree until the end of the connector box is approx. 61 cm.



Termination

The cable tree is led into a Connector box. From here the caps are connected to BrainAmp-MR with 30 cm-flat-ribbon-cables. These flat ribbon cables come with the BrainAmps. They can be re-ordered from BrainProducts (Cat-No. BP-02400-NN) or from Easycap (Cat.-No. E80).

Inside the connector box there is another 5 kOhm-resistor on each channel, REF, GND..

The top side of the connector box is labelled "BrainCap-MR". The bottom side label states

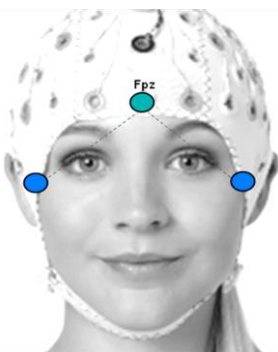
- 10k Ω in cap electrodes (5k Ω : tip + 5k Ω : box)
- 20k Ω at drop-down (15k Ω : tip + 5k Ω : box)
- Amp1, Amp2

Theta / Phi Coordinates for BC-MRS-64

Channel-Number	Name	Theta	Phi
1	Fp1	-90	-72
2	Fp2	90	72
3	F3	-60	-51
4	F4	60	51
5	C3	-45	0
6	C4	45	0
7	P3	-60	51
8	P4	60	-51
9	O1	-90	72
10	O2	90	-72
11	F7	-90	-36
12	F8	90	36
13	T7	-90	0
14	T8	90	0
15	P7	-90	36
16	P8	90	-36
17	Fpz	90	90
18	Fz	45	90
19	Cz	0	0
20	Pz	45	-90
21	POz	67	-90
22	Oz	90	-90
23	FT9	-113	-18
24	FT10	113	18
25	M1	-121	18
26	M2	121	-18
27	E1	-121	-30
28	E2	121	30
29	EMG1	-	-
30	EMG2	-	-
31	EMG3	-	-
32	ECG	-	-
REF	(FCz)	23	90

EEG data can be referenced offline to mastoid position, e.g. M2, as recommended in AASM manual.

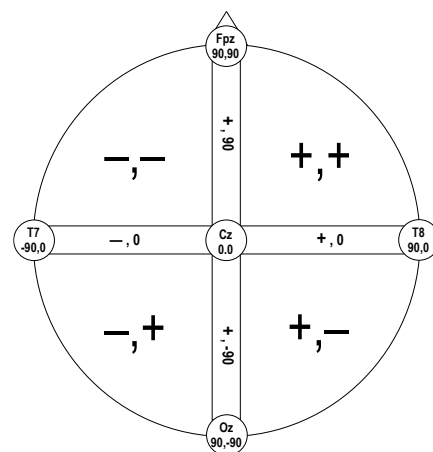
For EOG, please reference the "E1" and "E2" channel offline to Fpz, for EOG left/right:



Channel-Number	Name	Theta	Phi
33	AF3	-74	-68
34	AF4	74	68
35	F1	-49	-68
36	F2	49	68
37	F5	-74	-41
38	F6	74	41
39	FC1	-31	-46
40	FC2	31	46
41	FC3	-49	-29
42	FC4	49	29
43	FC5	-69	-21
44	FC6	69	21
45	FT7	-90	-18
46	FT8	90	18
47	C1	-23	0
48	C2	23	0
49	C5	-68	0
50	C6	68	0
51	CP1	-31	46
52	CP2	31	-46
53	CP3	-49	29
54	CP4	49	-29
55	CP5	-69	21
56	CP6	69	-21
57	TP7	-90	18
58	TP8	90	-18
59	P1	-49	68
60	P2	49	-68
61	P5	-74	41
62	P6	74	-41
63	PO3	-74	68
64	PO4	74	-68
GND	(AFZ)	67	90

These values are standardized to a Theta of 90° for the plane through Fpz, T7, T8, Oz.

The signs follow this convention:



Summary of Safety Rules for BrainCap MR

Together, the BrainCap MR and the BrainAmp MR / MR plus form a MR-conditional system according to ASTM 2503-20 and IEC 62570:2014.



In this context, the term MR-conditional means that restrictions from the manufacturer regarding field strength and imaging sequences apply to the product. A detailed explanation of the conditions for use can be found in the document '*Performing simultaneous EEG-fMRI measurements - Conditions for the safe use of BrainAmp MR amplifiers and accessories in the MR environment*'. A hard copy can be ordered from Brain Products (BP-265-4000) or it can be downloaded from the Brain Products website.

A summary of the main safety related points can be found below.

Any safety rules stipulated by the manufacturer of the MRI-Scanner and the local scanning facility must also be followed.

Scanner field strength and MR-sequences:

The BrainCap MR is designed and approved for field strengths up to 3T.

For MRI sequences used with the BrainCap MR there is a maximum allowed RF power; at 3 T B1+rms must not exceed 1 μ T.

All other conditions specified in the BrainAmp MR user manual must also be met.

Cable Routing:

No loops in connection cables or electrode leads are allowed. When recording in the MR environment all cables between the BrainCap MR and the BrainAmp MR / MR plus must be routed as straight as possible and must never form loops or similar (e.g. meander).

Amplifier protection:

To protect amplifiers from RF overload it is important that all connected electrodes have low impedance values during measurements in the MR scanner. Impedance values can be verified by means of the impedance mode in BrainVision Recorder.

This also applies if the BrainCap MR is used for measurements on imaging phantoms; all electrodes must be connected and have a low impedance. This can be achieved by covering the entire phantom surface with electrode gel and filling all electrodes with gel. Never perform phantom measurements with the BrainCap MR connected to the amplifier with unterminated electrodes.

Repair:

The cap may not be altered by the customer. For any repair the cap must be sent to Brain Products via the local Brain Products distributor.