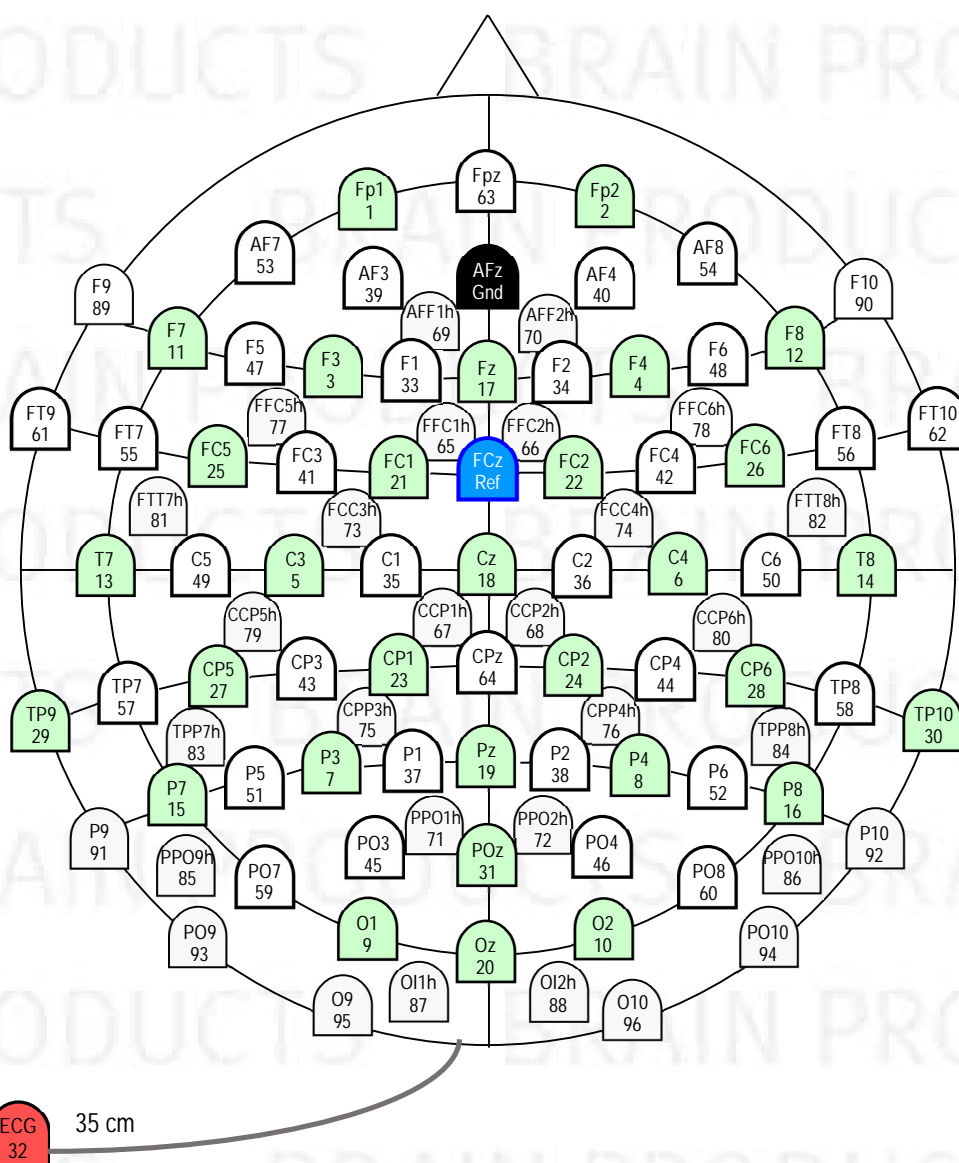




## 96Ch Standard BrainCap-MR for 3 Tesla

### Electrode Layout and Channel Assignment:

Green: Channels 1-31  
Red: Channel 32, ECG  
White bold: Channels 33-64  
White: Channels 65-96



Electrode Nomenclature according to:  
Oostenveld, R. & Praamstra, P. The five percent electrode system for high-resolution EEG and ERP measurements. *Clinical Neurophysiology* 2001; 112: 713-719

## Cap

Standard: SubUnion Cap with integrated chin belt, white

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

Options: *Caucasian or Asian, Size*

## 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 come with current-limiting resistors on both ends, sensor and connector. Drop-down electrodes are made from resistive carbon leadwire. This results in these overall resistor values for each electrode:

- Ch1-31, 33-96      10kOhm
- Ch32 (ECG)        20 kOhm
- Ref                  15kOhm
- Gnd                 15kOhm

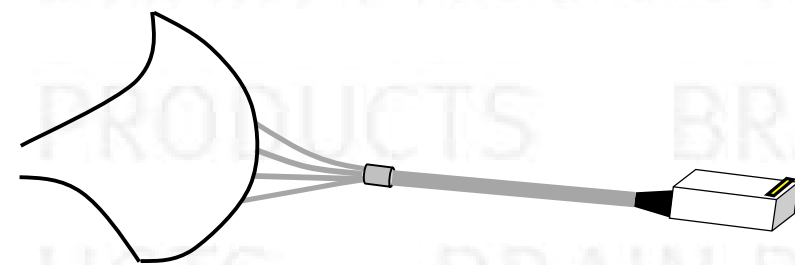
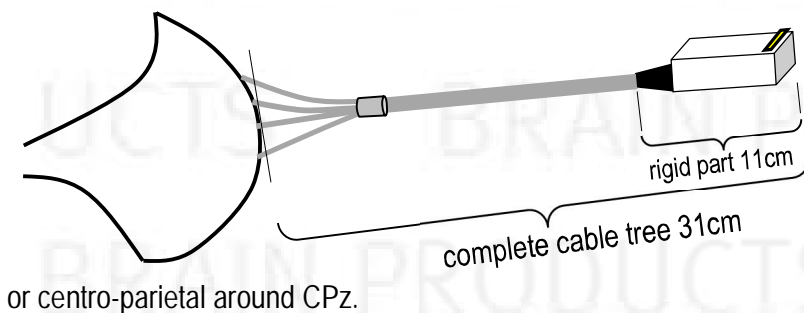
The electrode housing colours are according to the above figure. All cables are white, except Ch32 = red sensor and carbon leadwire, REF = blue cable, and GND = black cable. REF & GND come with 3 cables each, one for each amplifier. All electrodes are name-labelled (Fp1, Fp2, ...) near sensor.

The cable parts of drop-down electrodes outside the cap is covered wherever possible in silicone - or if more suitable in a spiral tube - to avoid direct contact with the skin.

All cables are routed on the outside of the cap directly to the exit point of the cable tree. Cables are fixed with double-T-nylon threads. The cables leave radially from the area around FFCz or CPz in small branches, leading straight/tight to a uniting point after approx. 5 cm. After the uniting point, one cable tree continues to each BrainCap-connector-box. The overall length of the cable tree is approx. 31 cm.

## Exit Point of Cable Tree

In BrainCap-MR3 the exit point of the cable tree can be either fronto-central around FFCz



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

Options: *Exit FFCz, Exit CPz*

## Termination

Each cable tree leads to a Connector box. From here the caps are connected to BrainAmp-MR with 10 cm round ribbon-cables. These round ribbon cables are delivered with the BrainAmp MR system (from April 2020; prior to April 2020 30 cm flat ribbon cables were delivered). The 10 cm round ribbon-cables can be re-ordered from BrainProducts (Cat-No. BP-345-2000) or from EasyCap (Cat.-No. KB-P50F-P50F-R-10).

## Ordering Information

For ordering these details are necessary: Article Number, Cap Cut, Exit Point, and Size (e.g. *BC-MR3-96, Caucasian, Exit FFCz, 56*):

- Article Number: *BC-MR3-96*
- Cap Cut: *Caucasian* or *Asian*
- 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: *52* (5-10 years), *54* (11-14 years)

The catalogue-number comprises the cap as described, serial number, and this document; all packed in a labelled cardboard box. For further information about accessories or consumables, please visit our website or contact our local distributor.

## Optional Options against Surcharge

- Carbon Wire Loops

The 96Ch BrainCap MR for 3 Tesla can be equipped with carbon wire loops (CWL) for better artefact correction in 3D space. They will terminate into a BrainAmp ExG.

To order them please add "with CWL", e.g. *BC-MR3-96, Caucasian, Exit FFCz, 56, with CWL*.

- KRIOS Compatibility

KRIOS by Northern Digital Instruments NDI is an infrared camera system including software to digitize individual, real-life electrode positions. In order to work with KRIOS system the electrodes will be equipped with permanent reflectors in a high quality and precise manner.

To order this please add "KRIOS", e.g. *BC-MR3-96, Caucasian, Exit FFCz, 56, KRIOS*

# Theta / Phi Coordinates for BC-MR-96

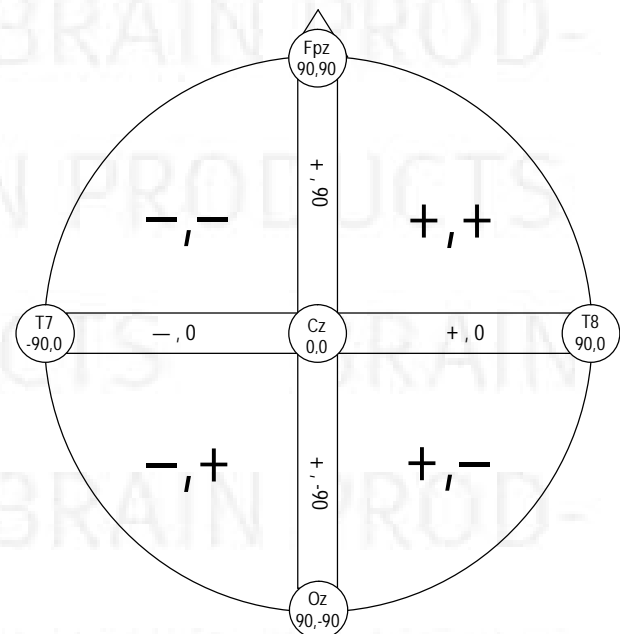
Channel-Number	Name	Theta	Phi
1	Fp1	-90	-72
2	Fp2	90	72
3	F3	-60	-51
4	F4	60	51
5	C3	-45	0
6	C4	45	0
7	P3	-60	51
8	P4	60	-51
9	O1	-90	72
10	O2	90	-72
11	F7	-90	-36
12	F8	90	36
13	T7	-90	0
14	T8	90	0
15	P7	-90	36
16	P8	90	-36
17	Fz	45	90
18	Cz	0	0
19	Pz	45	-90
20	Oz	90	-90
21	FC1	-31	-46
22	FC2	31	46
23	CP1	-31	46
24	CP2	31	-46
25	FC5	-69	-21
26	FC6	69	21
27	CP5	-69	21
28	CP6	69	-21
29	TP9	-113	18
30	TP10	113	-18
31	POz	67	-90
32	ECG	-	-

Channel-Number	Name	Theta	Phi
33	F1	-49	-68
34	F2	49	68
35	C1	-23	0
36	C2	23	0
37	P1	-49	68
38	P2	49	-68
39	AF3	-74	-68
40	AF4	74	68
41	FC3	-49	-29
42	FC4	49	29
43	CP3	-49	29
44	CP4	49	-29
45	PO3	-74	68
46	PO4	74	-68
47	F5	-74	-41
48	F6	74	41
49	C5	-68	0
50	C6	68	0
51	P5	-74	41
52	P6	74	-41
53	AF7	-90	-54
54	AF8	90	54
55	FT7	-90	-18
56	FT8	90	18
57	TP7	-90	18
58	TP8	90	-18
59	PO7	-90	54
60	PO8	90	-54
61	FT9	-113	-18
62	FT10	113	18
63	Fpz	90	90
64	CPz	22	-90

Channel- Number	Name	Theta	Phi
65	FFC1h	-35	-73
66	FFC2h	35	73
67	CCP1h	-16	45
68	CCP2h	16	-45
69	AFF1h	-57	-82
70	AFF2h	57	82
71	PPO1h	-57	82
72	PPO2h	57	-82
73	FCC3h	-35	-19
74	FCC4h	35	19
75	CPP3h	-46	48
76	CPP4h	46	-48
77	FFC5h	-62	-35
78	FFC6h	62	35
79	CCP5h	-57	12
80	CCP6h	57	-12
81	FTT7h	-79	-10
82	FTT8h	79	10
83	TPP7h	-81	29
84	TPP8h	81	-29
85	PPO9h	-101	45
86	PPO10h	101	-45
87	OI1h	-101	81
88	OI2h	101	-81
89	F9	-113	-36
90	F10	113	36
91	P9	-113	36
92	P10	113	-36
93	PO9	-113	54
94	PO10	113	-54
95	O9	-112	72
96	O10	112	-72

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-MR3**

Together, the BrainCap MR and the BrainAmp MR / MR plus form a MR-conditional system according ASTM 2503-05.



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 1.5  $\mu$ T. Note that a 10 cm round ribbon-cable must be used to attach the BrainCap MR to the BrainAmp MR / MR plus. If a longer cable is used a B1+rms limit of 1 $\mu$ T applies.

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.