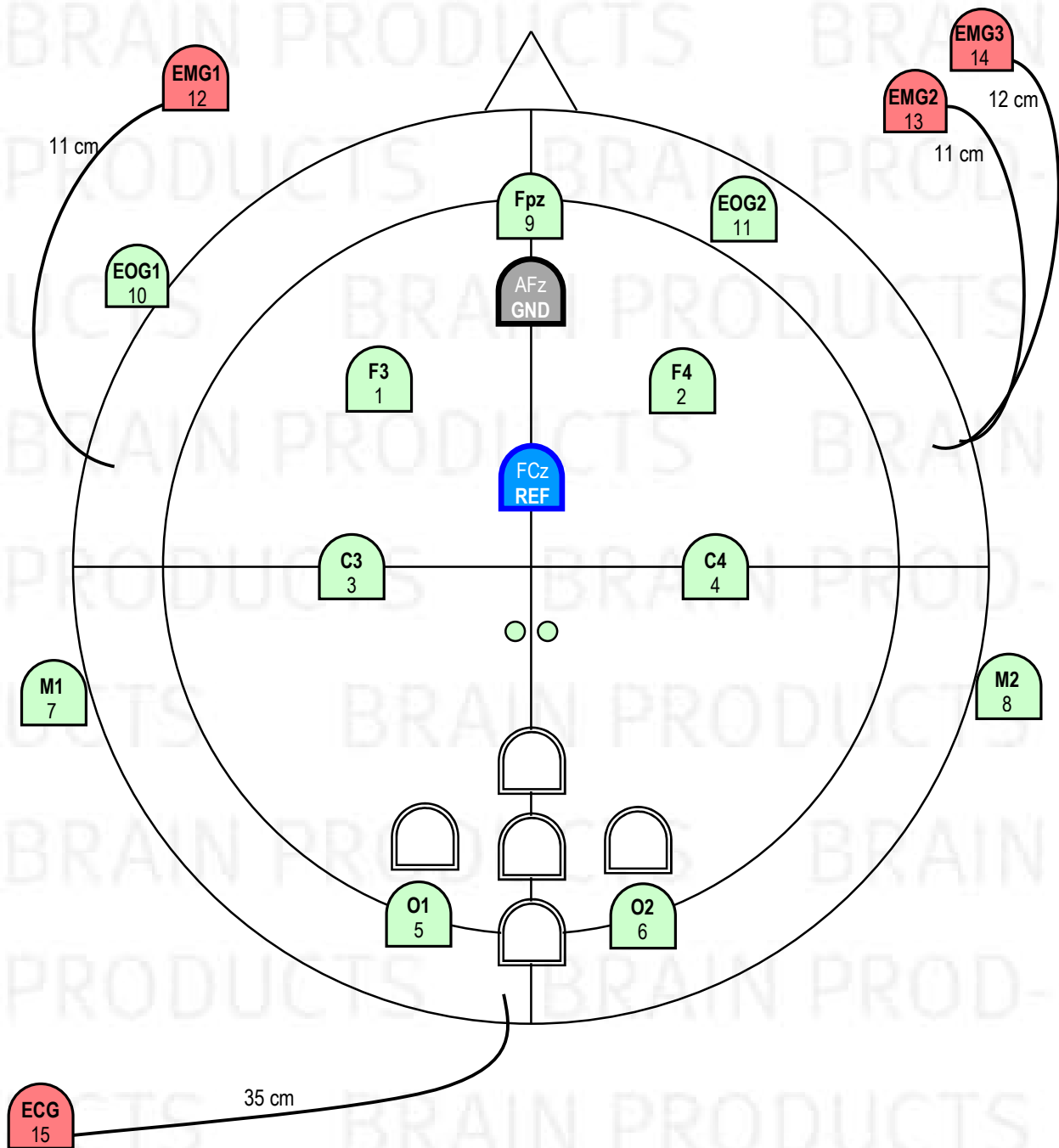




## 15Ch BrainCap MR for Sleep Recordings during fMRI

V2 - with EOG for reference to right mastoid M2

### 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
- EOG1/M2 and EOG2/M2 may be used for EOG, they are integrated in the cap for better signal quality
- Additional rings in occipital area offer higher comfort

## Details for Users

### Ordering Information

For ordering please give **Article Number, Cap Cut, and Size**  
(e.g. *BC-MRS-15-V2, Caucasian, 56*):

- Article Number: **BC-MRS-15-V2**
- Cap Cut: **Caucasian** or **Asian**
- 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: **34, 36** (*newborn*), **38, 40** (*3 months*), **42, 44** (*7 month*), **46, 48** (*2 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.

### Cap

Standard: Sublunion 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). In the parieto-occipital area, empty electrode housings (double border lines in the layout) provide more comfort.

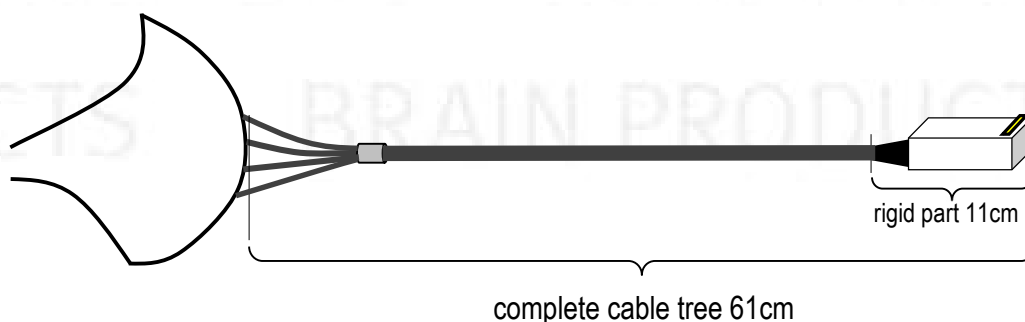
All electrodes in the cap are with 5 kOhm-resistors directly after the sensor. The drop-down electrodes (EMG for chin EMG, and ECG) are with 15 kOhm resistor.

Electrode housing colours are according to the above figure. All cables are white, except Ch 12-15 red, REF = blue cable, GND = black cable. All electrodes are name-labelled (F3, F4, ...) 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 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.

**All unused channels are short-circuited to GND in the connector box.**

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

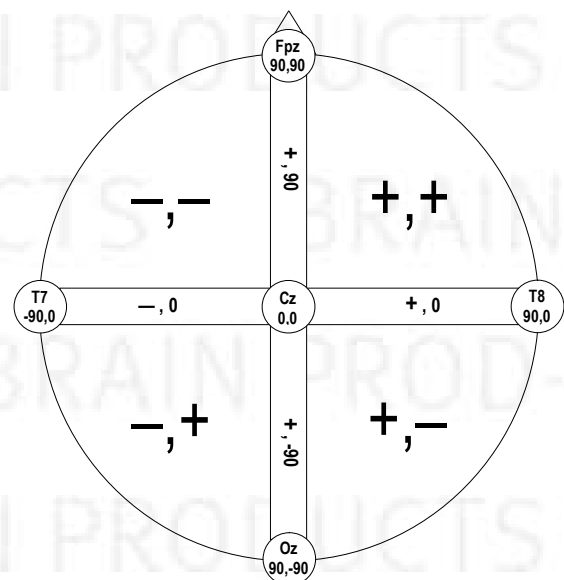
- 10k $\Omega$  in cap electrodes (5k $\Omega$ : tip + 5k $\Omega$ : box)
- 20k $\Omega$  at drop-down (15k $\Omega$ : tip + 5k $\Omega$ : box)

## Theta/Phi Coordinates for BC-MRS-15-V2

Channel-Number	Name	Theta	Phi
1	F3	-60	-51
2	F4	60	51
3	C3	-45	0
4	C4	45	0
5	O1	-90	72
6	O2	90	-72
7	M1 (TP9')	-121	18
8	M2 (TP10')	121	-18
9	Fpz	90	90
10	EOG1 (F9')	-121	-30
11	EOG2 (AF8')	105	54
12	EMG1	-	-
13	EMG2	-	-
14	EMG3	-	-
15	ECG	-	-
Ref	FCz	23	90
Gnd	Afz	67	90

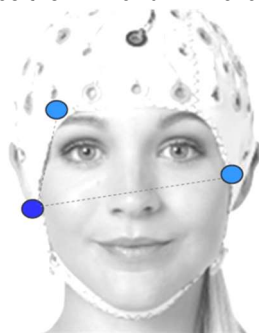
These values are standardized to a Theta of 90° for the plane through Fpz, T7, T8, Oz.

The signs follow this convention



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 M2, for EOG left/right:



## **Summary Safety Rules**

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. Detailed advice is provided in the safety measures chapter in the BrainAmp MR operating instructions. Alongside the above, any safety rules stipulated by the manufacturer of the MRI-Scanner must be followed.

### **Scanner field strength and MR-sequences:**

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

MR sequences involving higher SAR (FSE, TSE, FLAIR, Multi Band, Multi Echo, spin labeling, customized sequences etc.) are NOT allowed. Use of these sequences is only allowed after the cap has been removed from the subject.

Restrictions regarding allowed MR techniques and field strength are explained in the BrainAmp MR operating instructions.

### **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:**

If the BrainCap MR is used for measurements on imaging phantoms, the connected amplifiers must be protected from RF overload. This means that all electrodes need to be connected with a low impedance. This must be achieved by covering the entire phantom surface with electrode gel, filling all electrodes with gel, and verification of the low impedance state by means of the BrainAmp MR impedance mode. 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.