

# DC-STIMULATOR MR

## Measuring and Modulating Brain Activity

for neuroscience applications



### Programmable direct and alternating current stimulator

The DC-STIMULATOR MR combines the DC-STIMULATOR PLUS and the use for application in fMRI scanners. The DC-STIMULATOR PLUS is a stimulator for use in scientific research. It provides a stimulation with weak currents, either direct or alternating, (transcranial Electrical Stimulation - tES), within non-invasive Interventional Neurophysiology.

The electrical charge and current density applied through a constant current source are far below the threshold for releasing a stimulus. Depending on the duration, the used current, the current density, and the frequency the stimulation has a modular effect on existing neuronal elements by either activating or inhibiting cortical activity.

The DC-STIMULATOR MR allows to apply tES during functional magnetic resonance imaging (fMRI) to localize the exact position of cortical activation.

### Advantages of the DC-STIMULATOR MR:

- highest patient safety standards due to multistage monitoring of the current path, automatic termination of the stimulation as well as continuous monitoring of the electrode impedance
- intuitive menu navigation via display and four buttons
- individual setting and saving of the stimulation parameters
- programmable treatment schedule and limited menu access\*
- study mode for double-blind active and sham stimulation\*
- signal output for online-correction of the EEG signal during tDCS or tACS/tRNS\*

\* optional

### Stimulation modes

- stimulation mode "tDCS": continuous stimulation, adjustable, fade in and fade out
- stimulation mode "Pulse": cyclic turning on/off of stimulation, adjustable pulse width and interval)
- stimulation mode "Sinus": (bipolar sinus wave, offset, frequency, phase and oscillation period adjustable)
- stimulation mode "Noise": normally distributed broad band, low- and high-frequency noise, offset and duration adjustable
- study mode for "blind" operation of real and sham stimulation, encoded from a code list of 200 codes, independently adjustable settings (which can be saved in order to avoid accidental modification of the study parameters)\*
- schedule mode: for secure and controlled use by the patient without the possibility of modifying the parameters intentionally or accidentally\*

### DC-STIMULATOR MR Features

- microprocessor-controlled constant current source
- 1 channel, unipolar (DC) and bipolar (AC) stimulation possible
- use during fMRI, no interference of the fMRI images during EPI sequence
- suitable for 1.5 and 3 Tesla systems
- high safety standard through multistage monitoring of the current path
- external trigger input\*
- external trigger output\*

\*optional



### DC-STIMULATOR MR technical specifications

- adjustable current (DC) up to 4,500  $\mu\text{A}$  in increments of 25  $\mu\text{A}$
- adjustable current (AC) up to 3,000  $\mu\text{A}$  (peak-to-peak)
- additional MRI protective resistor of approx. 5 kOhm in each electrode
- internal 16bit D/ A conversion
- internal time resolution < 1 ms (sample rate 2,048 sps)
- stimulation mode "tDCS": duration 15-1,800 s, increment 15 s, duration of fade in / fade out 1-120 s, increment 1 s
- stimulation mode "Pulse": duration of complete pulse cycle/interstimulus interval (ISI) 300-2,000 ms, increment 100 ms, pulse width 200- (ISI-100), increment 100 s, number of pulse cycles 1-500
- stimulation mode "Sinus": adjustable current up to 3,000  $\mu\text{A}$  (p-p) in 25  $\mu\text{A}$  increments, offset of 0 to  $\pm 1,000$   $\mu\text{A}$ , increment 10  $\mu\text{A}$ , frequencies up to 250 Hz, increment 0.01 Hz, adjustable phase 0-360° in 5° steps, application time adjustable up to 30 min
- stimulation modes "Noise", "Noise LF", "Noise HF": adjustable current up to  $\pm 1,500$   $\mu\text{A}$  (p-p), offset of 0 up to  $\pm 1,000$   $\mu\text{A}$ , increment 50  $\mu\text{A}$ , duration 0-1,800 s\*\* in 5 s increments, current adjustable over period of 0-120 s to reach and leave oscillation level
- max. voltage limitation  $\pm 20$  V / 35 V\*
- power supply from built-in rechargeable batteries
- approx. 6 h stimulation time at 1 mA, approx. 7 h for complete recharging
- alphanumeric display with backlight, membrane keypad with 4 keys
- contact-protected electrode connection in accordance with DIN 42802-2 ( $\varnothing$  1.5 mm)
- power consumption approx. 1.2 W (depends on display brightness and applied current)
- dimensions in cm: 13.5 x 22.5 x 5.5 (W x D x H), weight incl. batteries 0.8 kg

\* optional

### Further options:

- Trigger module to connect external triggers safely
- phase-synchronous trigger output when sinus stimulation used

### DC-STIMULATOR MR Setup



hard cover case for MRI compatible electrodes, cable, „INNER BOX“, „OUTER BOX“



only the „INNER BOX“ is placed inside the scanner room

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