

# BrainProducts ExG/EEG, MR

## ■ BrainAmp ExG MR

The BrainAmp ExG amplifier is a bipolar amplifier which can be used to record EMG, ECG, EOG and polygraphic channels such as GSR (Galvanic Skin Response), acceleration, temperature and blood pulse with an extremely compact design.

### Basic specification:

- All signals can be recorded with a sampling rate up to 5000 Hz and a broad hardware bandwidth ranging from DC to 1000 Hz. The ExG has been conceived as an extension to all the other BrainAmp amplifiers but it can also be used as a fully independent unit.
- The BrainAmp ExG MR enable the recording of bipolar and polygraphic signals in the MRI environment. The BrainAmp ExG MR can be used inside the MRI chamber and placed right next to the subject. This allows to keep the length of the cables which are used as short as possible, thus ensuring highest data quality and fulfillment of all safety requirements.

### Technical specification:

- Number of channels: 16
- Channel type: 8 bipolar + 8 AUX
- Input impedance: 10 MOhm (for DC)
- Input noise:  $\leq 2 \mu\text{Vpp}$
- Common-mode rejection (CMR):  $\geq 100 \text{ dB}$
- Lower cutoff frequency (high pass):
  - › 0 Hz in DC mode or 0.016 Hz/10 s in AC mode
  - › Switchable between AC and DC modes
  - › Filter type: First-order filter with 6 dB/octave
- High cutoff frequency (low pass):
  - › 1000 Hz/250 Hz
  - › Switchable for the resolutions 0.1  $\mu\text{V}$ /0.5  $\mu\text{V}$  per bit
  - › Fifth-order Butterworth filter with 30 dB/octave
- Measuring range:  $\pm 3.28 \text{ mV}/\pm 16.384 \text{ mV}/\pm 327.68 \text{ mV}$  (switchable)
  - › Typically 30 hours with one amplifier
  - › 15 hours with two amplifiers
- Resolution: 0.1  $\mu\text{V}$ /0.5  $\mu\text{V}$ /10.0  $\mu\text{V}$  per bit (switchable)
- Power supply: PowerPack (external rechargeable battery)
- Suitability for use in the scanner room
- Amplitude accuracy:  $\pm 2\%$
- Bit width of the A/D converter (EEG and AUX): 16 bit
- Sampling rate: 5 kHz per channel
- DC offset tolerance:  $\pm 300 \text{ mV}$
- Signal transmission: Optically coupled using duplex fiber optic cables
- Operating time between charges:
  - › Typically 30 hours with one amplifier
  - › 15 hours with two amplifiers
- Dimensions: approx. 68 mm x 160 mm x 187 mm
- Weight: approx. 1.1 kg
- Integrated impedance measurement
- Measurement includes ground electrode and reference electrode

## ■ Recorder

BrainVision Recorder is a multifunctional recording software designed to provide the amplifier with an extremely versatile and easy-to-use platform for recording setup and execution.

### Basic specification:

- Selecting the hardware filters on a channel by channel.
- The acquired data can be displayed in multiple ways.
- The channel montages (original, bipolar and average) can be switched on the fly.
- Acquisition parameters as well as the impedance check are automatically stored and can be accessed from within the analysis software at any time.
- A complete evoked potential analysis can be performed in real-time directly in BrainVision Recorder and the segmented/averaged data can be stored together with the raw data.
- Incoming data can be sent out to the network via the TCP/IP protocol using the Remote Data Access module to the BrainVision RecView software (or any homemade software) for real-time data analyses.
- BrainVision Recorder can be easily interfaced with other software products like E-Prime.

## ■ GSR (Galvanic Skin Response) sensor for fMRI

Skin conductance (SC) has for decades been one of the most employed measures in psychophysiological research. As a sensitive parameter for emotional and cognitive states, stress and pain, SC has also been widely used in psychiatric research.

Our MR amplifier development team devised an extremely compact but heavily shielded DC instrumentation amplifier capable of measuring conductance directly using 0.5 V constant voltage.

### Basic specification:

- Interfaces with the bipolar BrainAmp ExG MR via the ExG AUX box
- Records the GSR synchronously with the EEG

### Technical specification:

- Supply voltage:  $\pm 5$  V DC
- Power consumption:  $< 0.5$  mA
- Measuring principle: Constant voltage, 0.5 V
- Measuring range: 1 to 100  $\mu$ S
- Resolution: 0.2 nS
- Absolute error:  $< 2$   $\mu$ S
- Total electrode resistance: 10 k $\Omega$
- Dimensions: 22 x 30 x 45 mm
- Weight: 20 g



## ■ MR usable sensor for parallel respiratory measurement

Respiration may be a source of related artifacts. It can be linked to movement artifacts, physiological alterations, induced field inhomogeneity, or interference with the experimental paradigm.

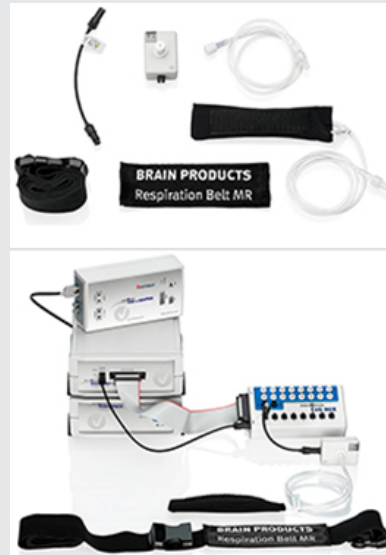
### Technical specification:

#### Respiration Belt MR

- Elastic belt with snap-in buckle: Length 1.50 m
- Pneumatic sensor - Test pressure: max. 100 mbar
- Weight: approx. 425 g
- Suitability for use in the scanner room

#### Transducer

- Supply voltage:  $\pm 5$  V
- Power consumption:  $< 1$  mA
- Output signal: max.  $\pm 4.8$  V at signal pin
- Output impedance:  $560 \Omega$
- Edge frequencies of transducer amplifier:
  - › Lower limit frequency (-3 dB) = 0.003 Hz
  - › Upper limit frequency (-3 dB) = 8 Hz



## ■ MR usable sensor to capture movements in 3 dimensions

Guarantees to combine the sensor with other recording modules and the ExG AUX input box to best meet the needs of your experimental design and comply with the particular conditions in scanner.

### Basic specification:

- Made up of the sensor and a preamplifier
- Two sensors with cables of different lengths are supplied as standard to ensure that the cables are routed in the best possible fashion

### Technical specification:

- Supply voltage:  $\pm 5$  V DC
- Range:  $\pm 2$  g
- Output: 1400 mV (neutral position)
- Sensitivity: 1450 mV/g  $\pm 10\%$
- Gain: 3.5
- Dimensions: 22 mm x 14 mm x 8 mm
- Weight: 8 g
- Cable length: 30/70 cm
- Connector: BINDER series 719 (5-pole male)
- Suitability for use in the scanner room



## ■ Contacts

Multimodal and functional imaging Laboratory Core Facility

[mafil.ceitec.cz](http://mafil.ceitec.cz)

**Core Facility Leader:** MICHAL MIKL

[michal.mikl@ceitec.cz](mailto:michal.mikl@ceitec.cz)

**Technical support:**

[elfyz.mafil@ceitec.muni.cz](mailto:elfyz.mafil@ceitec.muni.cz)

**Location:**

CEITEC MU Campus Bohunice, pavilion E35, Kamenice 5, 62500 Brno