IN THE FOCUS

New rTMS stimulation device PowerMAG research

Advanced solutions for online EEG and rTMS applications: A cooperation between MAG & More and Brain Products

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The ability to carry out TMS and EEG at the same time (online registration) offers a unique opportunity to investigate cortico-cortical networks. This combination is of massive significance in the scientific community across the globe (for registering functional reorganization patterns following a stroke or detecting changes to intracerebral connectivity with degenerative diseases).

We have therefore set ourselves the task of providing the best possible technical foundation for these kinds of scientific experiments. Using a combination of the BrainAmp DC or BrainAmp MR plus, the EasyCap TMS and the appropriate careful planning of the trial, the familiar TMS stimulus artifact can be reduced to 5 ms [1].

Further optimization (such as power-line noise and recharging artifacts) is, however, only possible in direct, close cooperation with a manufacturer of TMS equipment. The desire to also be able to correct the stimulus-induced artifacts in the EEG recording led to a fruitful collaboration between MAG & More and Brain Products.

One aspect of this unique full solution was the technical challenge of phase-synchronizing the TMS simulator and the EEG system, along the same lines as the established clock synchronization between the BrainAmp MR system and various MRI scanners. Along with stimulus timing that is precisely matched to the sample rate and provision of a constant interval between the stimuli by the stimulation hardware, a further prerequisite is that the TMS coil is securely attached and the test subject restrained.

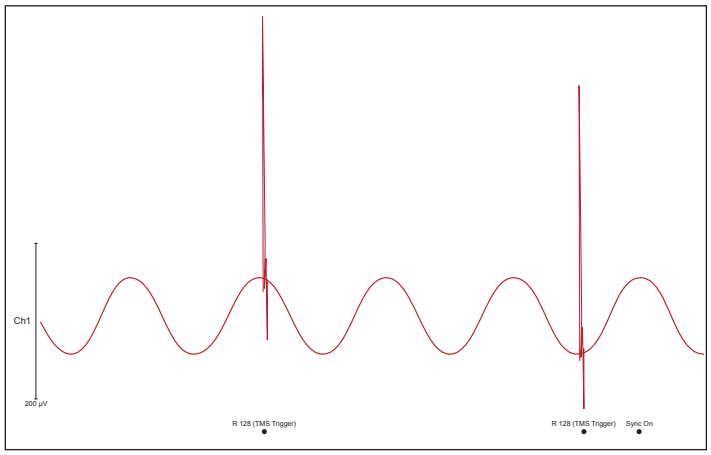
For demonstration purposes, we injected TMS pulses into a known signal (sine wave, 5 Hz, internal BrainAmp test signal) in order to illustrate the effectiveness of the TMS stimulus artifact correction that was now possible.

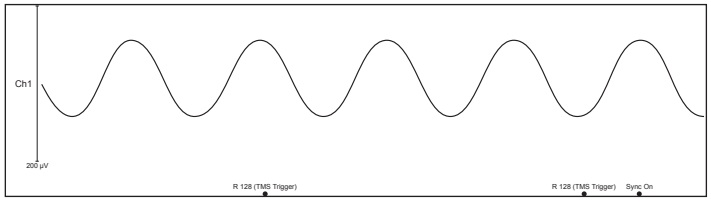
The red curve shows the sinusoidal signal with TMS artifacts and the black curve plots the adjusted signals.

It is already possible to correct artifacts using MR gradient correction and ICA. However, we are of the opinion that we have established a unique technical foundation that will provide the impetus for the development of many new correction techniques and scientific methods.

The PowerMAG *research* will be available in 30 Hz and 100 Hz variants. „Designed for Brain Products“, this rTMS range from MAG & More will be available exclusively from Brain Products and their distributors as of January 2010.

The PowerMAG *research* range offers special specifications for online TMS and EEG applications:





- Extremely reduced power-line noise on contact with the coil
- No recharging artifacts (e.g. with rTMS)
- Trigger output optimized for EEG
- Analog input for external protocol control (timing, intensity)
- Clock synchronization output for artifact correction

Hardware required: PowerMAG *research* (30 Hz or 100 Hz rTMS), BrainAmp DC/MR plus, SyncBox, EasyCap TMS

Reference

1. *Clin Neurophysiol. 2006 Aug; 117(8):1699-707. Transcranial magnetic stimulation and cortical evoked potentials: A TMS/EEG co-registration study. Bonato C, Miniussi C, Rossini PM. Neurofisiologia IRCCS Centro S. Giovanni di Dio Fatebenefratelli, Via Pilastroni 4, 25125 Brescia, Italy) Pattern Recognition, Wiley-Interscience; 1 Edition (March 27, 1992), Chapter 12*