

Signal

Sweep-based data acquisition & analysis system

Evoked response

Signal incorporates many features that make it ideal for the recording and analysis of evoked response data.

- Record and analyse motor, somatosensory, auditory and visual evoked potentials
- Overlay data from multiple sweeps and channels and configure multiple views of the same data file, even during sampling
- Use output pulses and built-in auxiliary device support to trigger and control current, voltage and magnetic stimulators while simultaneously recording and analysing responses
- Output fixed, random and pseudo-random pulse protocols
- Perform analysis on-line and off-line including waveform averaging, detection of waveform features and measurements of latencies, amplitudes and areas

Signal also has an import facility for reading data recorded by many alternative systems, meaning you can take advantages of this extremely versatile software to analyse existing data.

Applications

Motor evoked potentials Control magnetic stimulator parameters directly from Signal. Detect and plot response latency and peak amplitudes to XY trend plots automatically on-line or off-line.

Somatosensory evoked potentials Use digital outputs or generate analogue waveforms to trigger and control voltage and current stimulators.

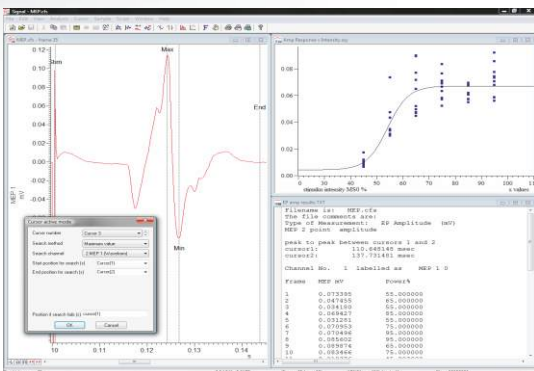
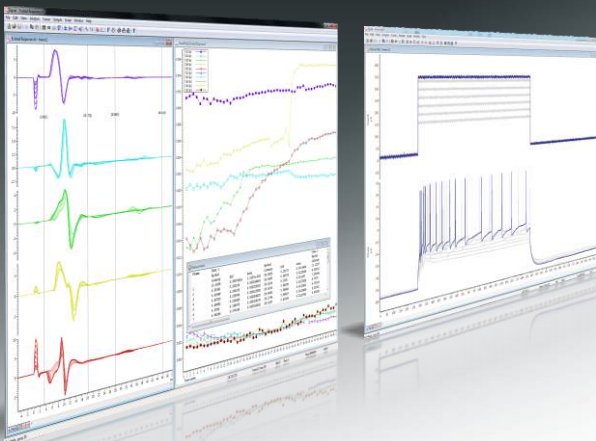
Auditory evoked potentials Generate tone pips and play out pre-recorded sounds as stimuli using the 1401 DAC outputs. Control the CED 3505 programmable attenuator using digital outputs and audiometers using the RS232 serial line via the script language.

Visual evoked potentials Digital outputs and serial line control can be used to interface with visual stimulus generators, including the ViSaGe and VSG range from Cambridge Research Systems, and experiment control programs such as E-Prime and Presentation to ensure accurate timing relative to sampling.

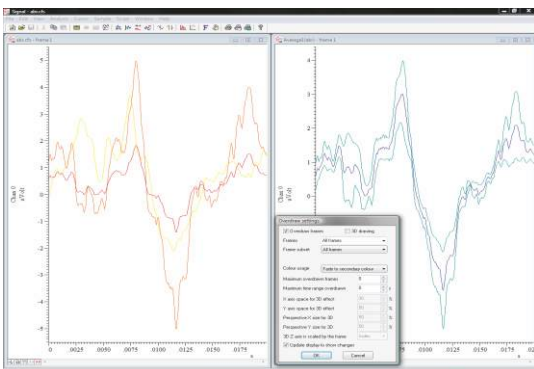
Stimulus generation

Signal can generate stimulus outputs on up to 8 analogue and 16 digital lines from a CED 1401 interface. A graphical pulse editor provides a user-friendly display for fast and easy creation of stimulus protocols. For more complex output and control requirements there is also a text editor which gives direct access to the sequencer instruction code.

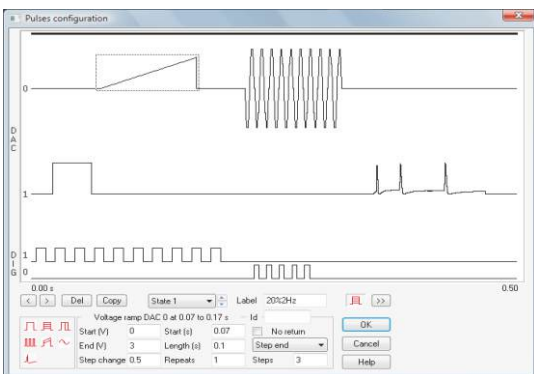
- Drag-and-drop pulses and analogue waveforms from a palette onto output tracks in the editor
- Modify pulse parameters including timings and amplitudes quickly and easily, even during sampling
- Create up to 256 sets of up to 500 pulses



Motor evoked potential analysis with trend plot of amplitude versus stimulus intensity



Auditory brainstem response recording using multiple stimulus states and fast triggers mode



Pulses configuration dialog

- Outputs can be fixed or change amplitude and duration on repeats
- Define pulse protocols for automated stimulus sequencing using multiple states and automatically record the stimulus used with each response
- Switch between stimulus protocols at the click of a button

Multiple sampling conditions

Signal includes a comprehensive multiple output states system that can be used to setup different sets of outputs. The order and repeat of each stimulus can be sequenced using a pre-defined protocol or executed semi-randomly or randomly. Each sweep of recorded data is marked to indicate the stimulus that was used and analysis such as waveform averaging and automated measurements can be applied to specific states or state combinations on-line and off-line.

TMS with Magstim control

Signal's built-in auxiliary states system provides direct control of Magstim transcranial magnetic stimulators during sampling, including adjusting stimulus amplitude and timing and checks on stimulator condition. All settings are stored with the corresponding data frame.

- Control Magstim 200, dual 200, BiStim and Rapid stimulators via serial line
- Set power output and inter-pulse timing settings for different stimulus protocols using multiple states
- Trigger stimulation using CED 1401 digital outputs for precise pulse timing relative to sampling
- Stimulation parameters for power level, pulse interval, secondary power level and pulse frequency are automatically saved to the data file

CED 1902 and Signal

The CED 1902 low-noise isolated pre-amplifier is a modular unit which is suitable for direct connection to the subject for research applications involving evoked response and TMS. Signal includes built-in control of the 1902 gain and filter settings and will automatically adjust scaling in response to changes.

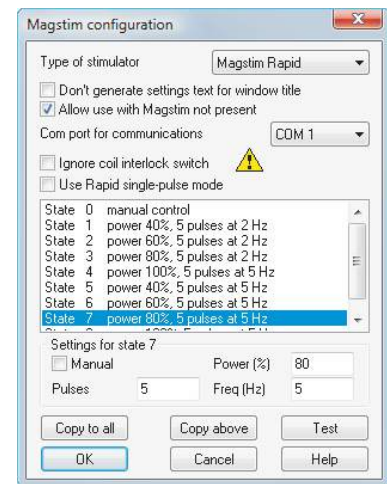
- Stimulus artefact clamp option designed to reduce artefacts that may cause saturation of the amplifier when using high intensity magnetic and electrical stimuli close to the recording site
- Selectable high and low pass digital filter settings
- Programmable gain

Control of current and voltage stimulators

Precisely timed TTL pulses delivered from the 1401 interface can trigger a wide range of constant current and constant voltage electrical stimulators. Constant current devices such as the DS4 and DS5 stimulators available from Digitimer will output a constant current stimulus proportional to an input analogue voltage waveform generated by the 1401.

CED 1401 hardware

Data acquisition and the use of the output sequencer for stimulus timing and control requires one of the family of 1401 intelligent laboratory interfaces



Configuration for controlling a Magstim Rapid



The CED 1902 isolated pre-amplifier



The Magstim BiStim2



The CED Micro1401 and Power1401

CED

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