CED
CAMBRIDGE ELECTRONIC DESIGN LIMITED

*e*NEWSLETTER

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CED turns 50!

This February, we are celebrating our 50th anniversary! Thank you to all our customers who have helped make this possible.

CED was established in Cambridge, England in 1970 by Dr. Michael Albutt and Dr. Peter Rice, both research students at the University of Cambridge. The company began focusing on engineering and life sciences applications for researchers, and although the engineering was challenging the life sciences became their passion.

CED originally started by operating out of Mike's front room, but soon outgrew the living space and began hopping across Cambridge; moving to St Andrews Street in 1973, to Regent Street in 1974, and to the (repurposed) Pelican inn in 1976! We finally settled in the Cambridge Science Park in 1979, and after growing the business there for 37 years we moved premises in 2016 and now reside next to the lovely Milton Country Park.

One of our first designs was a little outside electrophysiology; a balloon thermistor was developed to measure and predict the temperature inside hot air balloons, providing almost 25 seconds more time to react! Then during 1983, our 14th year of operations, the initial model of our data acquisition interface was released. Being the first product of that year, it was named the 1401. This remains the series namesake to this day, with our latest Micro1401-4 released just last year.

From all our staff, thank you for your continued support. Let's look forward to the next 50 years!

Training Days

Our next training day events are:

- 24/25th Feb, Paris, France
- 2nd Mar, London, UK
- 31st Mar, Seattle, WA, USA
- 1st Apr, Portland, OR, USA
- 2/3rd Apr, Los Angeles, CA, USA (to be confirmed)

Join us and learn how to make the best use of Spike2 and Signal to save hours of repetitive analysis. These sessions are free to attend and are suitable for both existing and prospective users of our data acquisition and analysis systems. If you'd like to register your place at an event, please get in touch.

If you are interested in hosting a training event in your local area, please get in touch: Marjorie@ced.co.uk.

Latest versions of Spike2 and Signal

Spike2	Released	Signal	Released
Version 10.01a	12/2019	Version 7.05	12/2019
Version 9.09a	11/2019	Version 6.05b	10/2019
Version 8.19a	11/2019	Version 5.12a	02/2018
Demo	12/2019	Demo	12/2019

Future meetings and events

PDN 2020
Cambridge,
UK
April 2nd – 3rd 2020

Experimental Biology 2020
San Diego, CA
USA
April 4th – 7th 2020

Canadian Neuroscience 2020
Montreal,
Canada
May 31st – Jun 3rd 2020

Bristol Brain Research 2020
Bristol,
UK
June 23rd 2020

UK Sensorimotor Conference
Birmingham,
UK
June 24th – 26th 2020

12th FENS Forum of Neuroscience
Glasgow,
UK
July 11th – 15th 2020

ISEK XXIII 2020
Nagoya,
Japan
July 11th – 14th 2020

Europhysiology 2020
Berlin,
Germany
September 11th – 13th 2020

Neuroscience 2020
Washington, DC,
USA
October 24th – 28th 2020

Script Spotlight

Idle routines are part of the ToolbarXXX() script functions in Spike2 and Signal. They are particularly useful to monitor changes or conditions, as well as for using off-line during analysis, for example when cursor positions are updated and new values need to be called.

You may consider the idle routine as an invisible button of the Toolbar; when a Toolbar containing the idle routine is active in a script, the idle function is repeatedly called whilst the script is waiting (idle) and checks if a given situation such as a new event has occurred, and if so branches to another function. The idle routine is only called if the script is not doing something else, for example if another function has been called by pressing another button on the toolbar.

To enable to idle routine we use the `ToolbarSet()` function. With the `item%` argument set to `0`, we can define the idle function `ToolbarSet(0, "", idle%);` here we have defined it simply as `idle%`:

```
Func idle%();
'Your test and branching code goes here
return 1;
end;
```

There are a couple of scripts readily available to help you get started with creating a toolbar with an idle function. The script `onskel.s2s` gives you a template to begin making your own on-line script, whereas the `ToolMake.s2s` Spike2 script and `ToolMake.sgs` Signal script included with your user data folder helps you build your own toolbar from scratch: usually C:\Users\Username\Documents\Spike2\Scripts.

How can I use digital filtering on-line?

With the release of update 10.01, the software team added the ability to digitally filter on-line. This can be achieved by applying one or more processes to sampled waveform data as it is acquired by the 1401 to either generate new channels or to replace the sampled data, or both. The sample processes released with 10.01 are: Infinite Impulse Response (IIR) filters, rectification, difference (slope), and down sample, with the potential for others to be added in the future.

These sample processes are not the same as existing Spike2 channel processes you may have used in the past; the sample processes are filters applied to raw data and used to create new disc-based channels, whereas channel processes are calculations which update the view. Here we will discuss how to add these sample processes to your sampling configurations.

Create a Derived channel

When filtering the data in real-time from a 1401 waveform channel to create a new channel, we refer to this new channel as a 'derived channel'. You create a derived channel interactively from the *Channels Tab* of the *Sampling configuration* dialog by dropping down the list next to the *New...* button and selecting *Derived*. This item is enabled when your sampling configuration contains at least one Waveform or RealWave channel sampled from a 1401. When selected, a new dialog opens (right).
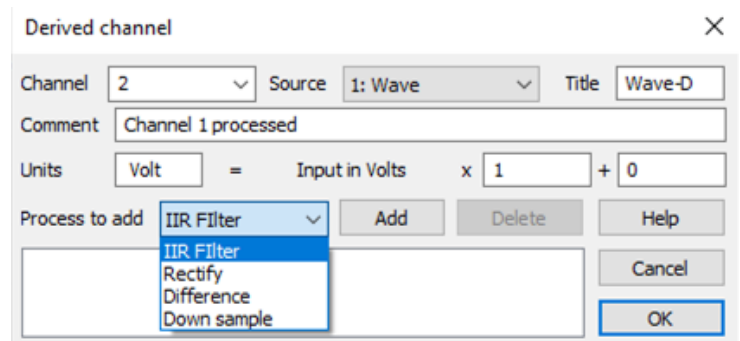
This dialog automatically selects the next available channel, but this can be altered to a different unused channel if preferred. The source waveform channel can then be selected.

The *Unit*, *Scale* and *Offset* fields are copied from the source channel each time the source channel changes.

Applying a Process

The area below the *Process to add* drop down list starts off empty and holds a list of the processes that have been attached to this channel. To add a process, select the desired type and then click the *Add* button.

IIR filter – When you add an IIR filter, this opens the Digital filter dialog in IIR mode where you can design the filter to apply. You can use Low pass, High pass, Band pass, Band stop and resonator IIR filters. The IIR processing is relatively time-consuming compared to the other processes and the time taken per point depends on the order of the filter; Band pass/stop filters take double the time of low and high pass filters.

Rectify – This replaces negative data values with equivalent positive values and leaves positive values unchanged.

Difference – Each data value is replaced by the difference of the current value with the previous value, then multiplies the result by the sampling rate. This is equivalent to the instantaneous slope of the signal. This will tend to be very noisy, so this will normally be followed by a Low pass filter to smooth the result.

Down sample – This process takes every *n*th sample from the data stream. You set the value for *n* in the *Down sample* dialog that opens when you *Add* this process or double-click the process in the list of added processes. This will usually be preceded by a Low pass filter to remove input frequencies that exceed half of the resulting sample rate. For example, if the source channel is rather noisy, with noise components up to 1 kHz, but we are only interested in signal frequencies of up to 30 Hz, we could sample it at 2.5 kHz, Low pass filter it to 30 Hz, then down sample by a factor of 25 to get an effective sample rate of 100 Hz.

If you wish to **delete an applied process**, simply select the process and then click the delete button. You can also edit processes by double-clicking them in your list of applied processes.

Replacing sampled data on Waveform or RealWave channels

Applying processes to sampled waveforms in real-time **will replace the sampled data**, this is performed similarly to creating a derived channel. When creating a waveform channel (or double-clicking the channel in your sampling configuration) simply click the *Process* button and it will take you to the *Real-time processes* dialog which works the same as above, except the channel and units will be greyed out as these are defined in your channel settings.

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Scripts: Spike2

Spike2 can import many foreign data formats. Individual files can be imported interactively via *Import* on the Spike2 *File* menu. However, this becomes tedious if you have many files to import. This script allows you to import all files of the same type in a specified folder in order to save you time, and has been included with your user data folder: C:\Users\Username\Documents\Spike2\Scripts.

When you run the script for the first time, you will be asked if you wish to create a hotkey (labelled BATCHIMP) on the script bar. Clicking this hotkey will automatically run the script the next time you wish to use it. The script will create a toolbar with 5 buttons: USER GUIDE | IMPORT | FORMAT | PREFERENCES | QUIT. The user guide will provide you detailed instructions on how to import file types which require some user interaction.

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 *How do I control my stimulator through Signal?*

Signal supports many types of **Transcranial Magnetic Stimulation (TMS)** devices, where a coil produces a magnetic pulse which can induce a response in nerve cells. Signal also supports **electrical current stimulators**: the CED 3304 and the Digitimer DS8R. **Up to ten stimulators can be added** in just one sample configuration, allowing you to mix and match different types. This simultaneous control of multiple stimulators affords you greater flexibility over the kinds of experiments you can perform.

Whilst there are common elements in setting up the different stimulator types, it's important to note that most will also have additional parameters to set. We have therefore put together a guide for the most common TMS devices as part of our TMS toolbox to help get you up and running.

To add your TMS device to Signal we need to **enable multiple frame states** in the *General* tab of the sampling configuration. With multiple frame states enabled, each stimulation output can be different from the previous in several ways, but really you can think of each state as a set of parameters that the 1401 can switch between to control external equipment. This allows different instructions to be sent to the TMS device to **change stimulus intensity, pulse interval, and number of pulses**.
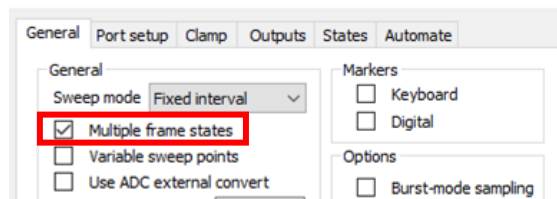
Within the States tab of the sampling configuration, you can select which **auxiliary states devices** you wish to use or remove using the *Auxiliary* devices button. The *Number of extra states* is defined in the corresponding box.
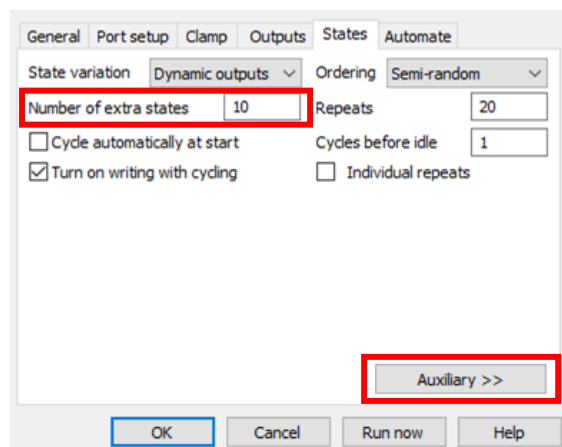
To adjust the settings before sampling, select your TMS device type in the Auxiliary menu of the sampling configurations States tab. A new *TMS configuration* dialog will appear. Use this to select the *Type of stimulator* and the *COM port* (or stimulator *Serial number* if using a DuoMAG or Neurosoft device).

The configuration dialogs of auxiliary states devices that are in use can be accessed during sampling using a pop-up menu in the main *Sample* menu or buttons in the *auxiliary states control bar*. When used online, settings for the individual states can be freely adjusted.

Scripts: Signal

FastMEPsr.sgs is an online script that greatly reduces the time for acquiring data for a stimulus response curve in a Transcranial Magnetic Stimulation procedure. Using traditional methods, acquiring a stimulus response curve can take up to 30 minutes, however this script can reduce that time to less than 5 minutes. Presently the script is written to work with the stimulators supported by Signal, namely those from Magstim, MagVenture, DuoMag, Mag&More, and Neurosoft. The script has been tested with the Magstim 200, BiStim, and Rapid[2] devices.

Knowledge of the participants' hotspot is necessary before beginning the script; we therefore recommend that you run a hot spotting procedure on the participant first.

There are two parts to the script. The first is to test the connection with the stimulator. The second is where data collected from the participant is recorded to a data file and plotted to an XY view, with the option of plotting a Boltzmann sigmoid curve after at least 10 data points have been recorded. The script allows the user to set a stimulus intensity range using maximum and minimum input fields in a dialog, from which a random intensity will be drawn from the range and used for stimulation.

In the second part of the script, the data file is presented on the left of the screen and the XY view for plotting the MEP amplitude (Y) and Stimulus Intensity (X) on the right.

A full discussion can be found in the associated paper to the script:
https://www.sciencedirect.com/science/article/pii/S1935861X18303176

This script has been produced in conjunction with Dr Michael Grey – UEA, M.Grey@UEA.ac.uk

Did you know…?

You can now use variable length gates for automatic data processing as of Spike2 version 10.0. This is in addition to the current fixed length gates. This type of data processing can be applied to creating a new result or XY view, for example if you were to perform a gated power spectrum of a selected channel for time sections of data. To provide another example, if a stimulator was active during recording that was 'gated' by a start and end event/marker, you could use the variable length gates to process only the time during which the stimulator was active (or even only the inactive time if you so wished).

Essentially, you choose an event, marker or marker-derived channel to define the gate start times, with the end of the gate determined by a second gate event, either on the same channel or optionally on a different channel. The search for a Gate end event begins immediately after the event that began the gate. The search for the following gate start event begins immediately after the event that ended the previous gate. The gate can be expanded beyond the start and end times using the Pre-gate offset and Post-gate offset fields. You can also narrow the gate by setting negative pre-gate and post-gate offset values. If two consecutive gate periods overlap, Spike2 amalgamates the two gate periods.

Recent Questions

How do I make a recording of my screen showing Spike2 data capture for a presentation?

The simplest way to record Spike2 data capture, and to make it easier on yourself editing the video later, is to replay the data offline. By this we mean complete the capture of the waveform data first, and then use the *Output Waveform* feature whilst capturing a recording of the screen.

Set up your Spike2 file as you wish to capture it and open *Output Waveform* feature in the *Analysis* menu of Spike2. You could output your waveform to your soundcard to hear the waveform being played and tick the *ReRun the file to match the waveform output* option to give the illusion of the data being captured in real time. Untick the *Cursor 0 tracks the waveform output* if desired too, then set up your screen recording software to capture. When ready, hit record and swap to Spike2 to hit play. Then you can easily edit out the little delays at the beginning and end of your captured video.

CED User forums

Try the CED Forums bulletin board for software and hardware support.

If you have any comments about the newsletter format and content, please get in touch: Marjorie@ced.co.uk.

To adjust your subscription preferences, please visit our website: www.ced.co.uk/upgrades/subscribeenews.

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