CED eNewsletter
Cambridge Electronic Design Limited

#77~ May 2013

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Future meetings and events

IUPS 2013
The International Convention Centre,
Birmingham, UK
July 22nd - 26th 2013

11th International Congress of the Polish Neuroscience Society
Hotel Novotel Poznan Centrum,
Poznan, Poland
September 15th - 17th 2013

Society for Neuroscience 43rd Annual Meeting
San Diego, CA
USA
November 9th – 13th 2013
Exhibit dates: November 10th – 13th 2013

Latest versions of Spike2 and Signal

Updates for Spike2 and Signal are available from the CED Downloads page, or by clicking on the links in the table below. Demonstration versions of the latest software are also available.

Spike2 downloads	Released	Signal downloads	Released
Spike2 version 7.11c	03/13	Signal version 5.08	11/12
Spike2 version 6.17	10/12	Signal version 4.10	10/12
Spike2 demo	03/13	Signal demo	06/12

<u>Scripts Spotlight</u>

Newsletter 75 demonstrated using the `SeqLib.s2s` script to calculate sequencer compatible values that could be written to the output sequence 'on-the-fly' during sampling. Now that we have sequencer compatible values, the next task is to transfer them to our output sequence. This is done with the `SampleSeqVar()` script command, which allows you to read and set variable values in the sequencer.

```
Func SampleSeqVar(svar%{, new%});
```

sVar%   The sequencer variable to set or read, in the range 1 to 256 (1-64 in the 1401plus).
new%   If present, the new variable value

A suitable example for Signal showing the use of `SampleSeqVar` can be found in the Signal script section, below.

Another example suitable for Spike2, `LinRampFreq.s2s`, can be downloaded from our website. This script creates linear ramps of increasing or decreasing pulse frequency on-line and allows the user to enter settings for ramp times, start times, turning point and end frequencies. Before running this script, ensure that the associated `LinRampFreq.pls` sequence file is loaded in the `Sequencer` tab of the sampling configuration. For testing purposes, set channel 1 in your sampling configuration to be an Event channel in which pulses can be recorded to help visualise the results. The pulses are set to be 10us long and are output from digital output 0 of your 1401.

Show me How!

Click here to view a video tutorial on removing mains noise in Spike2

Q.   I'm experiencing a lot of mains interference in my recordings. Is there any way to reduce this mains component using digital filters? I have tried to improve my shielding to minimise the noise interference in my recording rig, but this has had little effect so far on the mains noise that I am seeing.

A.   Electrophysiological recordings are often polluted by mains-related electrical interference despite one's best efforts to shield the preparation. This interference can change depending on the time of day and can come from varying sources, such as local electrical appliances, generators or even substations. We have even seen a scenario where interference was being generated by the day-to-day operations of a battleship in the vicinity!

Mains 'hum' is usually composed of multiple harmonics of the mains frequency, making it impossible to remove with simple high pass or notch filters. `HumRemoveExpress.s2s` is a Spike2 version 7 script that you can use offline to strip out much of the mains interference, making your data much more presentable and easier to analyse.

To use this script, your waveform sample rates should be at least 10x mains frequency and preferably 100x or more. You will also need an Event channel marking the onset of each mains cycle, which can be provided by the CED 4001-16 mains pulser unit.

The script works on the principle of reference noise subtraction. It generates an estimate of the mains–related noise on each channel using a waveform average triggered on the peaks of the mains cycle. It generates a clean signal by subtracting this average from each successive period of the mains cycle
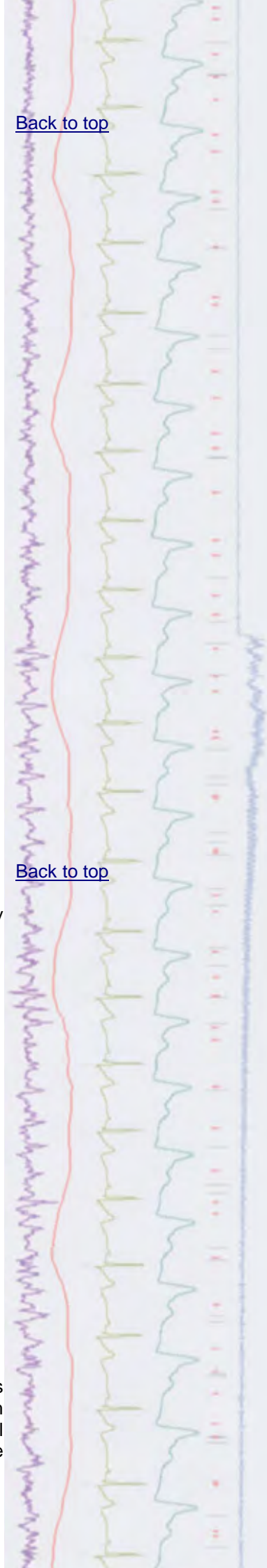
(20 ms in Europe, 16.66 ms in the USA). To work effectively, the interference must be relatively constant over periods of a few seconds.
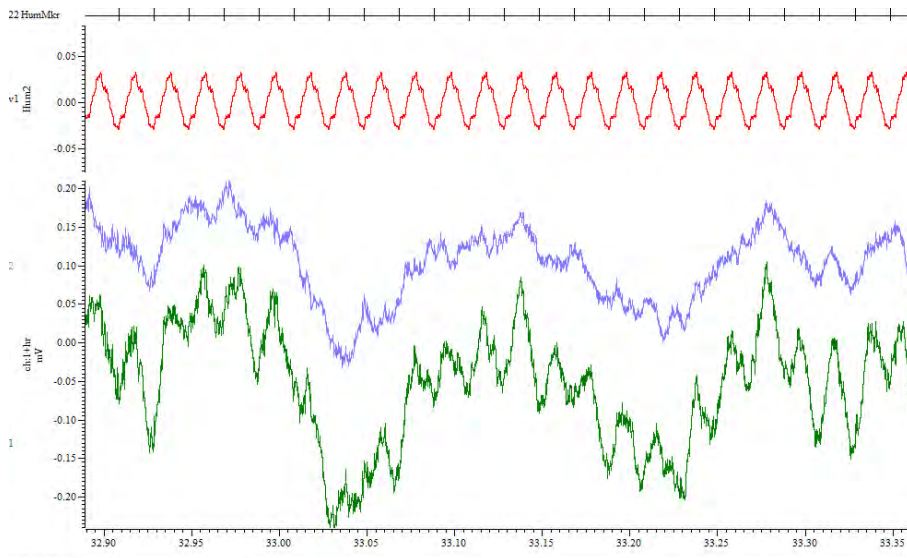
Output from the HumRemoveExpress script with the raw data at the bottom, cleaned data above it and the rejected hum signal and triggers at the top

The script is included in the Spike2 installation and can be found in your `Spike7\scripts` folder. Watch the accompanying [video tutorial](#) to see the script in action.

We also supply a companion script, `HumRemove.s2s` which can be used to attempt to remove mains hum from data where a hum marker event channel has not been recorded. This script can also be found in your `Spike7\scripts` folder, along with a user guide.

Scripts: Spike2   [Back to top](#)

Q.   I would like to extract certain features from a waveform channel, but the shapes I am interested in are not suitable for automatical templating with WaveMarks or marking with threshold crossings due to the data changing over time. I have marked the positions of the features of interest using events in a memory channel and would now like to extract all of the sections to a new channel, based on the position of these markers.

A.   The script, `ExtractSections.s2s`, will create a new memory channel containing sections of a waveform channel based around a selected event or marker channel. The script allows you to set the number of post and pre-trigger points to use for the waveform sections.
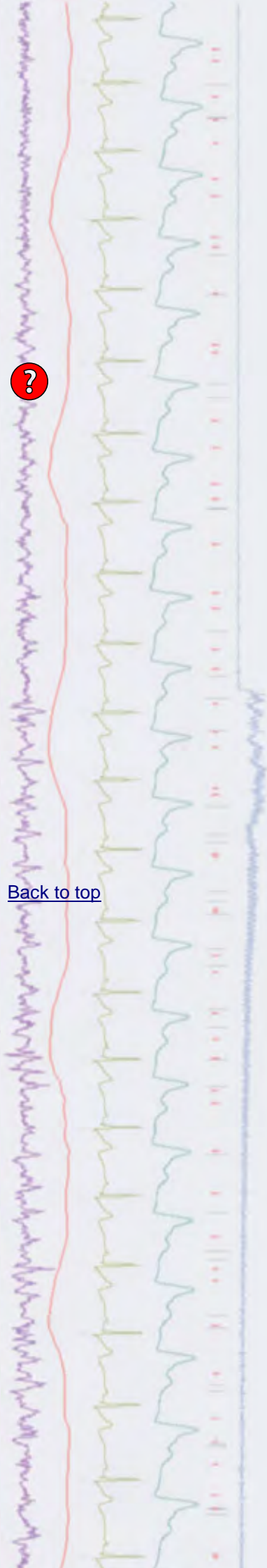
Signal

Q. I am using Signal to record intracellular action potentials. How can I automatically detect multiple action potentials in each frame of data?

A. Signal can search for and detect features in waveform data and step to digital markers using the built-in Active Cursor functions. Search methods include, but are not limited to:

- Peaks and troughs
- Threshold crossings, data within and data outside thresholds
- Slope measurements
- Percentage repolarisation

Up to ten cursors (0 – 9) are available in a frame and individual cursors can search any channel for features of interest. Cursor 0 acts as the iterator cursor so that, when it searches for and finds new features, all other active cursor positions are updated in response. For this reason Cursor 0 is nearly always used to find a common reference around which other features can be found by additional active cursors. Cursors can be created and Active modes set from within the Cursor menu.

Detecting Action Potentials
A common requirement is to be able to detect action potentials in a recording. In the example below, Cursor 0 is set up to search channel 1 for Peaks that have an amplitude change of 50mV. The amplitude value is a measure of the level that the waveform signal *falls* after a peak to be classified, which allows accurate detection of peaks on data with a baseline drift.

*Active cursor in peak find mode detecting action potentials*
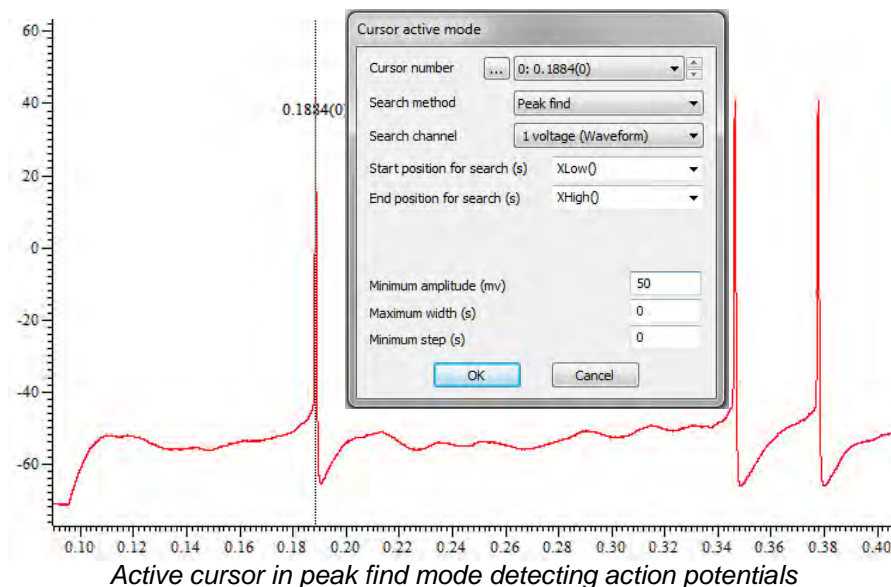
You can check the behaviour of active cursors by holding down `Ctrl+Shift` and using the left and right arrow cursor keys. This steps Cursor 0 between waveform features in the frame that match the search method parameters.

Finding additional features:
Now that Cursor 0 is set to find the peaks, we can set additional active cursors to find other features. In this example we'll set up Cursor 1 to find the afterhyperpolarization (AHP) of the action potential by using the Trough search method with an amplitude level of 10mV (For trough search methods, the

amplitude value is a measure of the level that the waveform *rises* after a trough). Cursor 1 is then set to search for the trough in the time range between `Cursor(0)` and `Cursor(0)+20` ms.
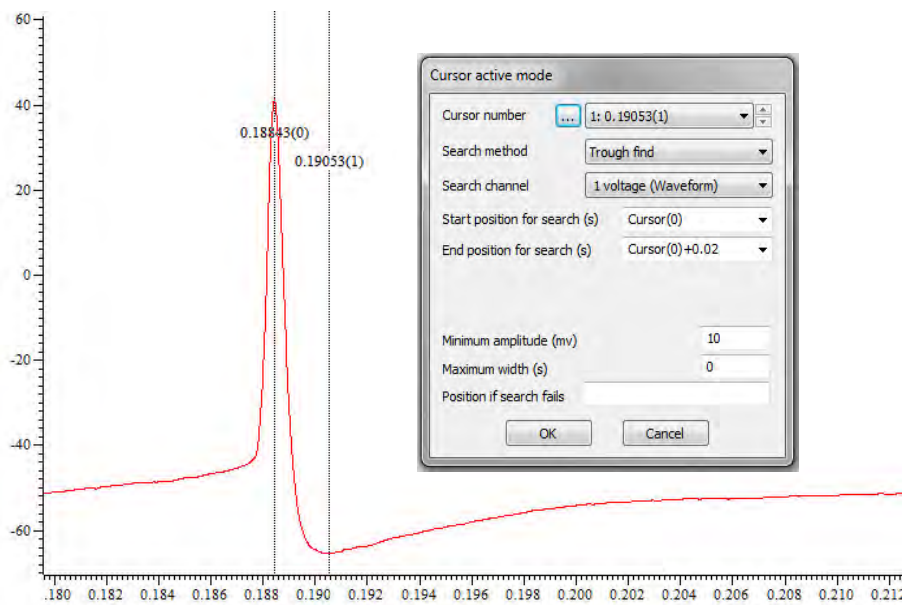
Multiple results from features in a frame can be plotted automatically to an XY view using the `Measurements...` function available from the `Analysis` menu `New XY view` option. For more information see the Signal on-line help or see our feature on taking measurements in the next eNewsletter.

Scripts: Signal

Q.   I am running a series of force contraction experiments and would like to generate a ramp target in Signal for the subject to follow, using the baseline activity of the subject as my starting point.

A.   The script, <u>TrackRamp.sgs</u> will generate a ramp shape for the subject to follow, which will use the current data from a nominated channel, as its baseline.

The script creates a toolbar from which you can define the ramp settings and open a `New file` for sampling. Starting and finishing sampling are also controlled from the script toolbar. The script creates a temporary output sequence file which is saved to a temporary directory, `TrackRampTemp`, on your C drive. These are both deleted when you use the `Quit` function in the script.
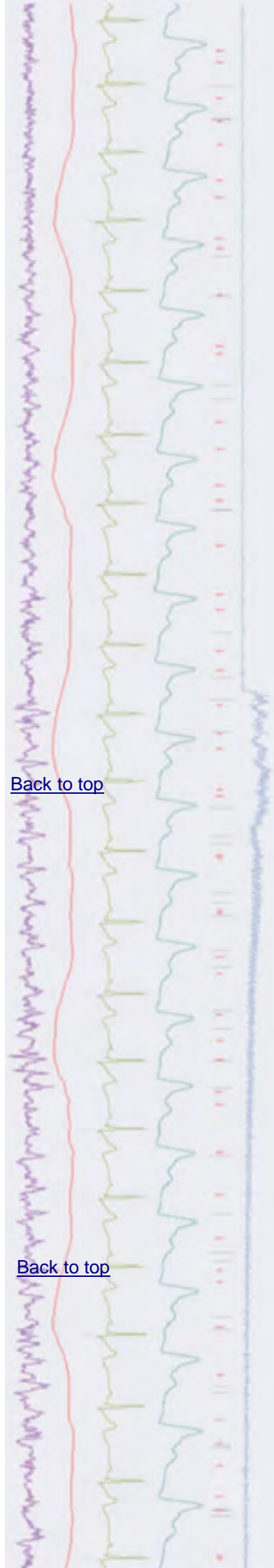
The script only supports Basic sweep mode due to the use of the sequence file. It will attempt to use the current sampling configuration to open a data file and warn you if it detects an error.

Did you know...?

The maximum single channel sampling rate of the Power1401-3 is 3 MHz, compared to 2 MHz for the Power1401 mk II.

**Recent Questions**

Q.   I'm using a footswitch to log events during a recording but I find that the switch is generating multiple markers each time it is used. Is there any way to remove these extra events so that I only get one each time the switch is activated?

A.   There is a `Debounce` field in the channel parameters dialog for Event and Digital Marker channels that will set the minimum acceptable interval (ms) between consecutive events so that events closer than this to the previous event are not saved to disk. This can be useful when, as in this case, switches have poor contacts which generate multiple switch closures in a short period of time.
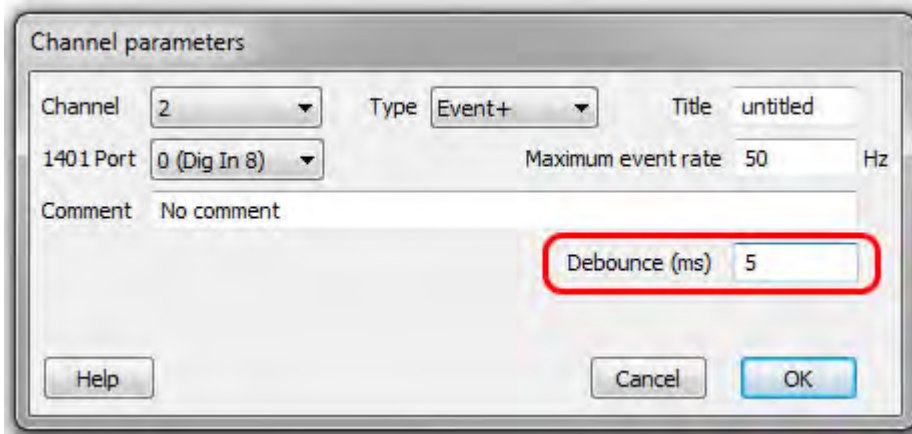
Debounce option for an Event+ channel

This debounce option is only available in Spike2 version 7 or later. For earlier versions of the software you can use a script, `debounce.s2s`, to remove multiple events.

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, or wish to unsubscribe from the mailing list for this newsletter, please notify sales@ced.co.uk.