CED eNews
The eNewsletter from Cambridge Electronic Design

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Signal version 3.07 released

The latest version of Signal is now available to download from our website by following the links below. This version now includes new support for voltage and patch clamp experiments. See the Signal feature in this newsletter for part 1 of our series on clamp sampling.

Local training sessions

In addition to our annual UK and US training days, we are also happy to offer local training sessions for Spike2 and Signal at universities and institutions. These smaller training sessions can be tailored towards particular requirements for research groups or departments. If you are interested in organizing a local training seminar for your group or department, please contact sales@ced.co.uk.

Latest versions of Spike2 and Signal

The latest 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	Signal downloads
Spike2 version 5.14	Signal version 3.07
Spike2 version 4.24	Signal version 2.16
Spike2 demo	Signal demo

A full list of the new features and changes in the latest software versions is available from the website.

See us at…

5th Polish Electrophysiology Forum
Lodz
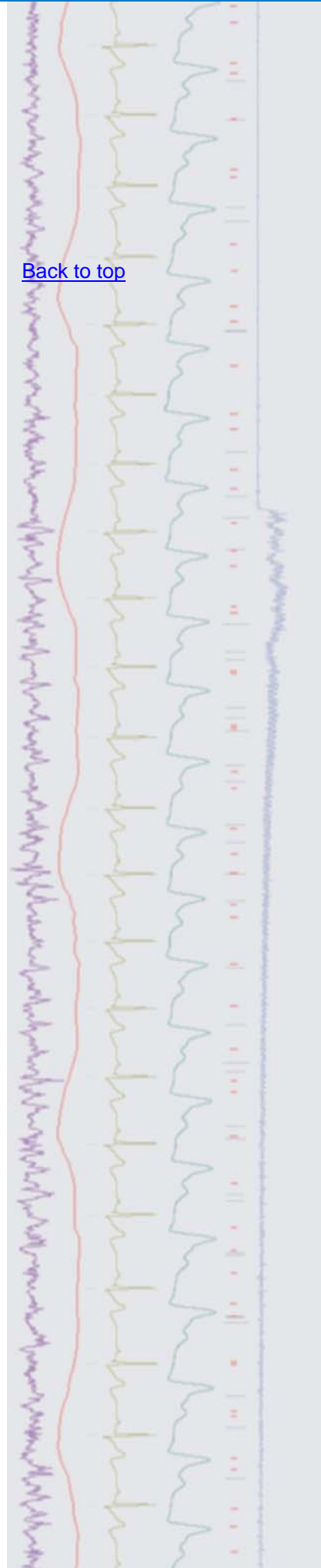Poland
June 7th - 9th

The Physiological Society AGM
University College London
July 5th - 7th

The
Physiological
Society

**5th Forum of European Neuroscience (FENS)**
Austria Centre
Vienna
July 8th - 12th

fens

S1-S2 heart pacing protocol

Q.   I am hoping to start recording cardiac action potentials using the S1-S2 pacing protocol as a stimulus and would like to use the 1401 to generate and control the pulse train. Is this possible using the output sequencer in Spike2?

A.   The Spike2 sequencer can be used to create a variety of stimulus protocols to use when sampling. The S1-S2 protocol is widely used as a pacing stimulus for recording cardiac action potentials, where the first stimulus (S1) is used to pace the heart at a fixed cycle length. The S2 stimulus is then applied at an initial interval after the S1 pulse. The time between the S1 and S2 stimulus is progressively reduced until the stimulus either a) fails to illicit a response; or b) generates a rapid atrial response. The object is usually to determine the shortest effective refractory period that still results in the generation of the cardiac action potential.
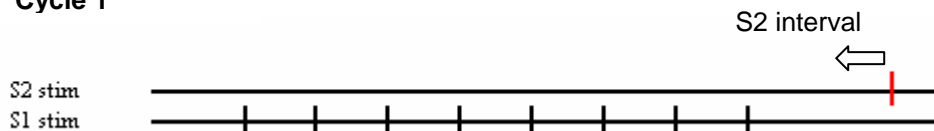
Basic S1-S2 protocol. The S2 interval reduces by a fixed amount

for each stimulus cycle

The attached script S1S2protocol.s2s generates a script toolbar which allows the user to open a new data file for sampling, set the parameters of the stimulation and apply and stop the stimulus when sampling. The attached sequence file S1S2protocol.pls must be loaded before running the script. The stimulus properties set in the script toolbar are copied to the sequencer when they are updated during sampling. Using a text sequence file gives greater flexibility and allows sequencer variables to be updated and modified from the script. For this example of implementing a basic S1-S2 protocol, the user can change the S1 cycle length, the initial interval between the S1-S2 stimulus and the reduction in S1-S2 time per cycle during the experiment. The sequencer generates the S1 pulses from digital output 0 and the S2 pulses from digital output 1 of the 1401.

Signal

Clamp sampling: part 1

Q.   I am using Signal for voltage clamp experiments and would like to know how to make best use of the new clamp support features.

A.   The latest version of Signal includes extra sampling support for whole-cell and single-channel clamping experiments. When Signal is run for the first time, it will give the option of including clamp support. The Edit preferences dialog can be used to enable or disable this option at any other time. The features enabled by the clamp option are the new clamp sampling support and the existing leak subtraction analysis and single-channel idealized trace functions. These features

have all been included in the clamp options so that non-clamping users can disable them when they are not needed.

Clamp setup

The following guidelines assume a basic sampling configuration that uses the first two available ADC ports of the 1401, with a one second sweep length and a sample rate of 10kHz. The attached configuration `ClampExample.sgc` is set up with the examples detailed below and can be used as a starting point for carrying out clamping experiments with the latest version of Signal.

With the clamping options selected, the sampling configuration has an additional Clamp tab where you can define up to two simultaneous clamp setups. This allows easy set-up of the channels recording the stimulus and response from the cell or patch and the DAC output used to control the stimulus for the selected experiment type. Once Signal has this information it can automatically scale the data and perform further clamp specific analysis. The State for resistance measurements can be used in Multiple states mode to nominate a particular State (set of pulse outputs) to monitor the membrane resistance on-line. In this simple example we are only going to specify a single set of outputs. We will set the State field to 0, which defaults to the current set of outputs for on-line measurements. How to use Multiple states for resistance measurements will be covered in more detail in the next part of our clamp sampling series.
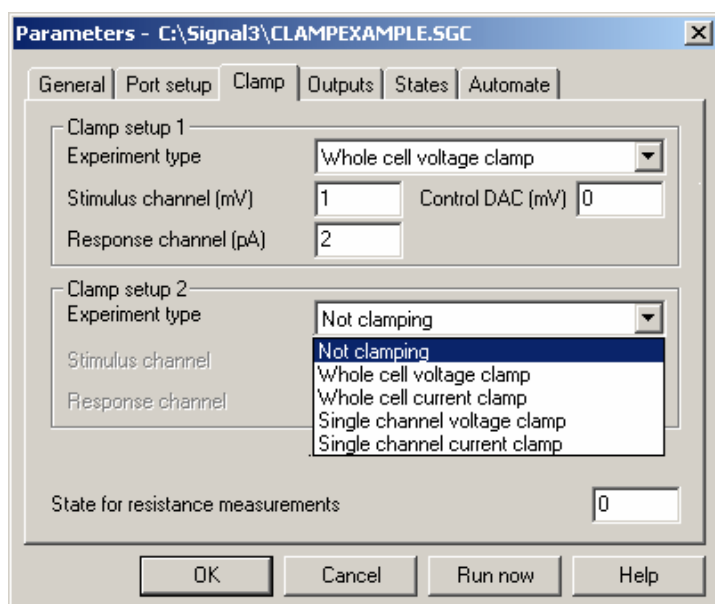
Example clamp setup

Channel setup and units

For voltage-clamp experiments the applied stimulus is voltage and the response is current and vice versa for current-clamp setups. The channels used to record the stimulus and response data must be set to use valid units in the Port setup tab of the sampling configuration. The units for a voltage channel must include the character 'V' (for example, mV) and the units for a current channel must include the character 'A' (or example, pA), so that on-line measurements give sensible values. The control DAC should also be set to match the units of the stimulus channel for the selected experiment type (see **Stimulus setup** below). Incorrect units for any aspect of the clamp setup will cause the text to be displayed in red and Signal will generate an error message when ready to sample.
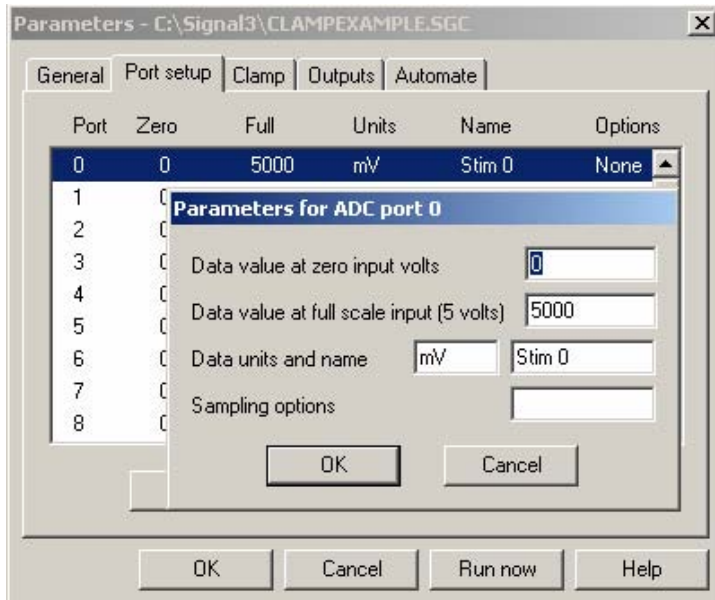
Port setup parameters for the stimulus channel

Stimulus setup

The units for the control DAC are set in the Outputs tab of the sampling configuration. The stimulus pulse is set using the graphical pulse configuration editor, which is available from the Configure pulses button. You can also access the pulse configuration during sampling to make adjustments and modifications on-line. Supported outputs for clamp experiments are constant or varying amplitude square pulses and square pulse trains. If more than one pulse is used for a given state you can define the one to use for resistance measurements (RM) by setting the pulse ID in the dialog, as below.
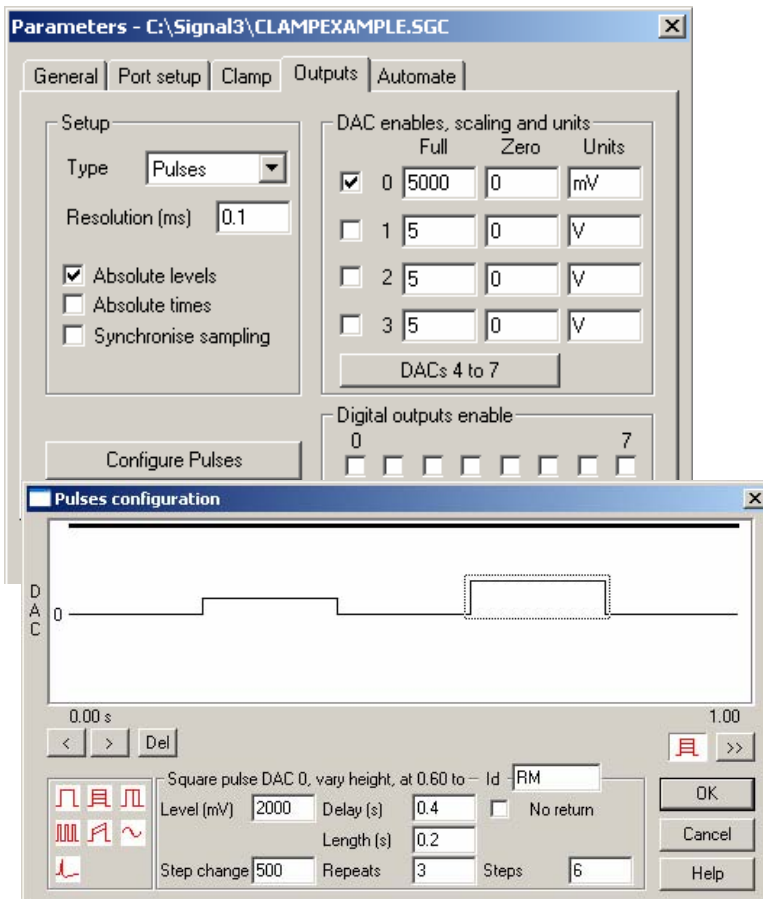
Outputs tab and pulse configuration with the second pulse specified for measurements

Ready to sample…

Following the setup above you should now be ready to sample. The sampling configuration is checked for the correct settings for clamp experiments when a new data file is opened. Signal will generate an error message to alert the user if any incompatibilities are found.

In the next eNewsletter - Part 2: Running a clamp experiment with on-line control and analysis.

Scripts: Spike2

Q. I have been making use of the Rerun feature in Spike2 for presentations, to show the data occurring in 'real-time'. It would be really useful if I could somehow get sound output of a data channel as well during a rerun. Is there any way to do this?

A. The attached script `Rerun with sound.s2s` can be used to rerun a data file and nominate a channel to be played out from the sound card during the replay. The script generates a toolbar from which the user can open data files, set the channel to play and run/stop the file.

Scripts: Signal

Q. I am recording from interneurones using Signal and would like get information about the spiking data. Is there a way to get the number and timing of intracellular spikes for each frame?

A. The attached script `ThreshCount.sgs` counts spikes in a Signal data file that exceed a user-set threshold. The number of spikes per frame and the time at which they occur within the frame is printed to the Log view

Did you know…?

We also manufacture amplifiers for life science research. The 1902 amplifier can be specified for general purpose transducer use or with medical-specification isolation suitable for EMG, ECG, EEG and evoked response measurements as well as many other research applications. 1902's are available as single, dual and quad-channel units, and multiple units can be connected together up to a maximum of 32 channels. They are controlled directly from Spike2, Signal or dedicated calibrate and control software via the host computers RS232 serial port, giving access to the gain and filter settings for each channel. The 1902 also has options for more specialised applications, including magnetic stimulus artefact clamps, skin conductance modules and input buffer options for multi-channel common-reference studies.

Recent questions

Q. I am analysing large files that take a long time to display when I open them in Spike2. Is there a way to stop them drawing all of the data in the file?

A. You can break out of long drawing or calculation operations in Spike2 using the `Ctrl+Break` keyboard shortcut. This is useful if you have inadvertently displayed or analysed a very large section of data. There is also an option in the General tab of the preferences dialog to ignore resource file X range settings to give a fast initial display by only showing the first second of data when a large file opens.

User Group

If you have any comments about the newsletter format and content, or wish to un-subscribe from the mailing list for this newsletter, please notify sales@ced.co.uk.