CED eNews

The eNewsletter from Cambridge Electronic Design

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Power1401-3 now shipping

The new Power1401-3 is a significant upgrade on the previous Power mkII model, with a new faster processor and more memory giving significant speed increases, notably for dynamic clamp using multiple models. The Power1401-3 uses advanced processor technology and expandable memory of up to 2GB to give you the power and flexibility required for the most demanding applications, all at the same cost as the Power1401 mkII.

1902 application guide

The *1902 application guide* is now available for download and contains comprehensive instructions for setting up and using CED1902 amplifiers with Spike2 and Signal, or as a standalone amplifier.

Future meetings and events

Society for Neuroscience 2012
Booth Number 441
Ernest N Morial Convention Center,
New Orleans, LA, USA
October 13th - 17th 2012

Biophysical Society 2013
Pennsylvania Convention Center,
Philadelphia, PA, USA
February 2nd - 6th 2013

Australian Neuroscience Society 2013
Melbourne Convention and Exhibition Centre,
Melbourne, Australia
February 3rd - 6th 2013

Local Training Sessions

In addition to our annual UK and US training days, we are also happy to offer on-site local training sessions for Spike2 and Signal. 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 us.

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 7.10c	09/12	Signal version 5.07a	09/12
Spike2 version 6.17	10/12	Signal version 4.10	10/12
Spike2 demo	07/12	Signal demo	06/12
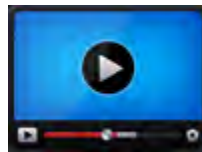
Show me How!

Click here to view a video tutorial on the script editor

Scripts Spotlight

Despite your best efforts when writing a script it is inevitable that, sooner or later (usually sooner), the script will refuse to work exactly in the way you expected or intended. Rather than admit to human error, we script writers attribute these small failures to "bugs". The act of diagnosing and removing these problems is therefore known as "debugging".

Luckily the script editor can access a Debug toolbar that has a number of built-in tools to help track down these anomalies in your code. The script will enter debug mode by the following routes:

- When it encounters a break point in the code. Break points are added by left-clicking in the farthest left hand margin of the script editor window.
- When it encounters the `Debug()` script command in the script itself.
- By pressing and holding the `Esc` key if your script is running or stuck in a loop

These first two methods are useful if you know whereabouts the bug is occurring (or likely to occur) in your script. The third method lets you break out of long running processes or stuck loops. You can also choose to automatically `Enter the debugger when a script has a runtime error` using the checkbox option in the `Script` tab of the `Edit preferences` dialog.

When your script enters the debugger, the debug toolbar will become enabled. This contains a range of functions to aid the elimination of bugs.
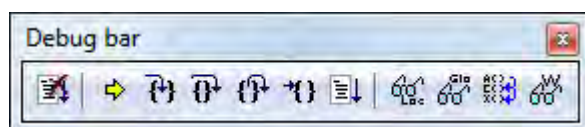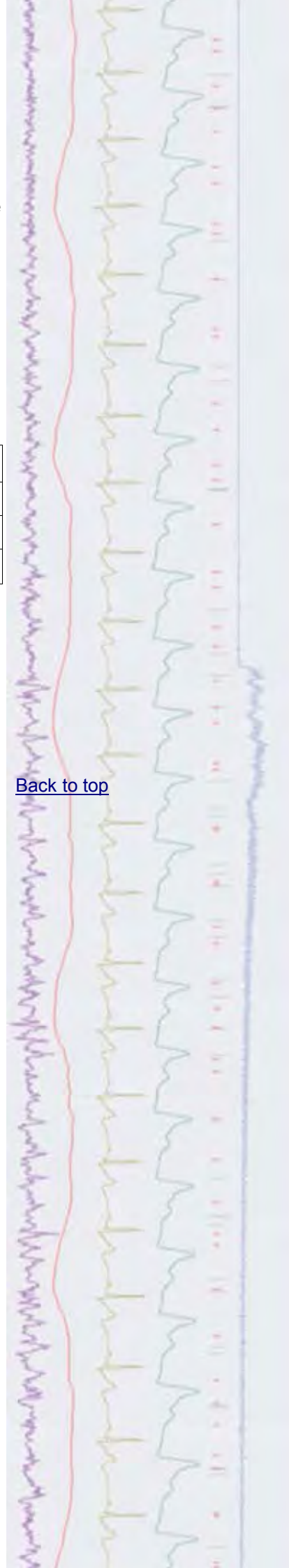
The first button in the toolbar will stop the script. The yellow arrow button displays the current script line.

The next group of buttons are used to step through the script. If the current script line statement includes a call to a function or procedure you can step into it or over it using the associated buttons.

Step into (left) and step over (right)

You can also step out of a procedure or function to the return statement.

Step out of procedure or function

The next button will run the script from the current line up to the start of the line where the text caret is placed.

Run to text caret

The final button in this section runs the script to the next break point or the end of the script if no break points are found.

Run to next break point or end of script

The final group of buttons in the debug toolbar are used to view local and global variable values and the 'call stack' list of user-defined functions that have been called on the way to the current line. The Watch window button will only display selected variables from the local and global variable windows, giving a convenient method of tracking variables of interest.
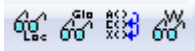
*From left: Local, global, call stack and Watch window buttons*

You can edit variable values for debugging purposes in the local, global and watch windows by double clicking on the variable.

Q.   I have found the recent articles and video tutorials on the use of the output sequencer very useful and am now setting up numerous stimulus protocols for my experiments. What I would like to do in the next stage of my study is to be able to change these output sequences during an experiment.

A.   If a text or graphical sequence file was enabled in the sampling configuration when sampling was started, it can be replaced with other text sequence files

at any time during sampling. When sampling starts, Spike2 reserves space in the 1401 memory for the current sequence and any table space that sequence needs. If you intend to replace the current sequence with ones that are larger or use more table data you first need to set Spike2 to reserve any additional required space in the 1401 using the Minimum Instruction and Table space fields in the Sequencer tab. For example, the settings below will reserve enough 1401 memory for up to 1000 sequencer instructions and a table with 20 elements.
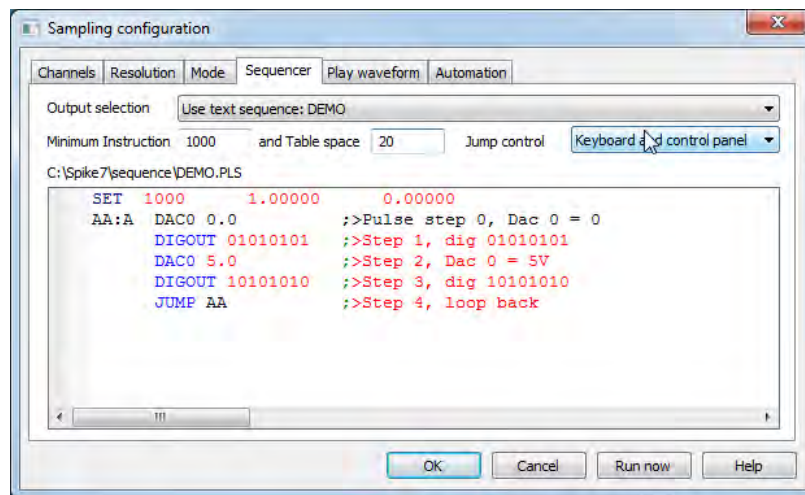
Minimum Instruction and Table space requirements set in the sequence tab

To load a new sequence file during sampling, select the `Change Output Sequence` command from the Sample menu, which will prompt you to open a text sequence file to load into the configuration

Scripts: Spike2

Q.   I am recording spike data based on a stimulus pulse and would like to get a count of spikes within certain time ranges from the stimulus. So a count of the spikes between 20-30ms, 30-90ms and 90-300ms after the stimulus pulse.

A.   The script `SpikeCountRanges.s2s` lets you set up to four time ranges, between 0 and 1000ms, from which to take spike counts based on a stimulus trigger. These counts are then plotted to an XY view and displayed alongside the data file.

Signal

Q.   Can I add my own models to the dynamic clamp system?

A.   The dynamic clamp system in Signal has been extended to accept user-defined tables of values in place of numerical parameters for selected models, allowing you to extend existing models and/or customise your own. The models that currently support user-defined values are as follows:
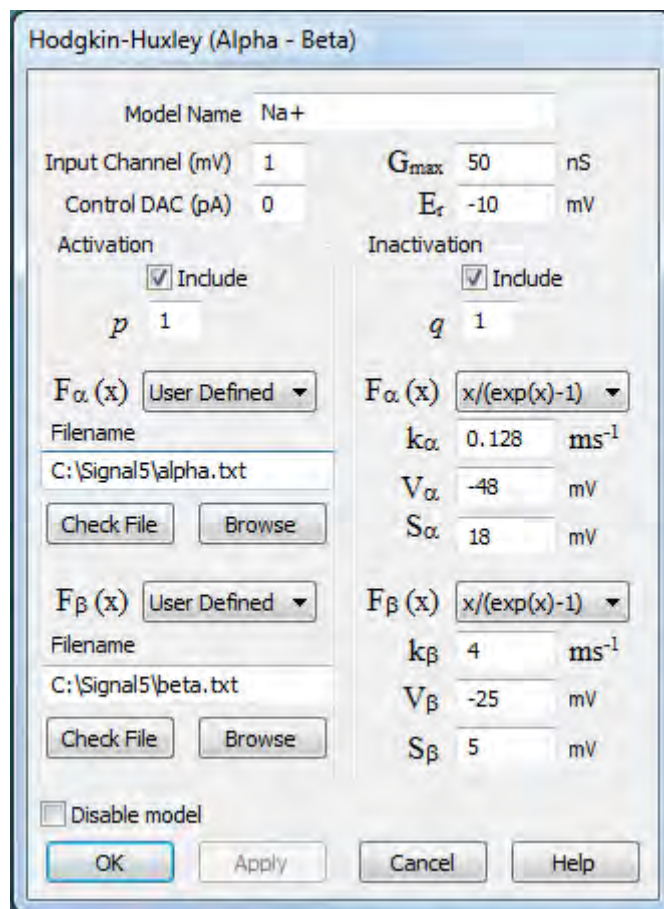
Hodgkin-Huxley Alpha/Beta
This model simulates the membrane current generated by a population of ion channels using a formulation based upon multiple rate equations. The User Defined option can be selected from the drop down lists to replace the

Right-click the script icon and save to disk

standard functions that are used to calculate the internal rate variables for the Activation and Inactivation stages of the model. Once User Defined is selected you can enter a filename or browse for a text file of values to use. An example script for creating tables of values, `GenAB.sgs`, is included in your `Signal5\scripts` folder.

Hodgkin-Huxley (Alpha - Beta)

Model Name: Na+

Input Channel (mV): 1 G_{max}: 50 nS
Control DAC (pA): 0 E_r: -10 mV

Activation   **Inactivation**
☑ Include   ☑ Include

p: 1 q: 1

$F_\alpha(x)$: User Defined ▼ $F_\alpha(x)$: x/(exp(x)-1) ▼
Filename k_α: 0.128 ms^{-1}
C:\Signal5\alpha.txt V_α: -48 mV
[Check File] [Browse] S_α: 18 mV

$F_\beta(x)$: User Defined ▼ $F_\beta(x)$: x/(exp(x)-1) ▼
Filename k_β: 4 ms^{-1}
C:\Signal5\beta.txt V_β: -25 mV
[Check File] [Browse] S_β: 5 mV

☐ Disable model

[OK] [Apply]   [Cancel] [Help]

HH Alpha/Beta model using user defined rate functions for activation

User defined synapse

Synapse models simulate a synapse between two cells. The user defined synapse model uses a lookup table of values in a text file to define the synapse current, allowing you to generate customised synapse current profiles that follow any required behaviour.

Leak

The Leak models provide a range of simpler behaviours where the simulated conductance does not have a time-dependent aspect. Select User defined from the Leak type drop-down menu to select a text file to use that defines the leak behaviour.

Noise - Ornstein-Uhlenbeck (Scaled)

This noise model uses a text file of values to scale the standard Ornstein-Uhlenbeck process according to the membrane potential. Select Scaled O-U from the Noise type drop-down list in the dialog to open a text file of suitable values.

Full details of the dynamic clamp features can be found in the on-line help.

Scripts: Signal

Q. I have a text file that contains a list of randomised state numbers generated by an external program. What I would like to do is import these into Signal to set the state order for an experiment.

A. The script, `ReadStateOrder.sgs`, will import a text file of numbers and use these to set the state ordering for sampling. The script generates a toolbar from which the user can select a text file to use before then clicking Sample to open a new data file. Signal will then execute the states in the order specified by the text file once sampling is started. This script requires Signal version 4 or later.

Did you know...?

When using an output sequence you can disable interactive control of sequence jumps to prevent accidental changes caused by a user key press or mouse click in the sequencer control toolbar. These control options can be set from the `Sequencer jumps controlled by` drop-down list in the Sequencer tab of the sampling configuration.

Recent Questions

Q. For an upcoming eye tracking experiment I'd like to display a background bitmap image on the data file. Can I do this directly in Spike2?

A. You can set a bitmap file as a background image for any channel in a data file, result file, memory view or XY plot in Spike2 and Signal from the View menu Channel Image command. This can be used to generate images for target tracking or activity studies.

The image can be set to fill the available channel background or a rectangle defined in X and Y axis units. The opacity of the image can also be adjusted using the slider in the dialog.

User group
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.