

Signal

Aquisição e análise de dados à base de regiões

Fixação dinâmica

A aplicação Signal é bem conhecida por seus extensos recursos de análise e gravação de patch e grampo de tensão. A partir da versão 5 do Signal, implementamos amplo suporte de grampo dinâmico para aumentar este programa flexível. Usado em conjunto com o CED Power1401-3A, -3, mk II ou o Micro-4 e seu amplificador de corrente existente, não é necessário hardware especial.

O Signal inclui um sistema de fixação dinâmica de alto desempenho totalmente integrado, facilmente configurável. Este recurso avançado torna a técnica prontamente disponível para pesquisadores que não têm acesso a hardware e software personalizados complexos, fornecendo um pacote projetado, mantido e com suporte profissional que pode ser usado por todos, a um custo baixo.

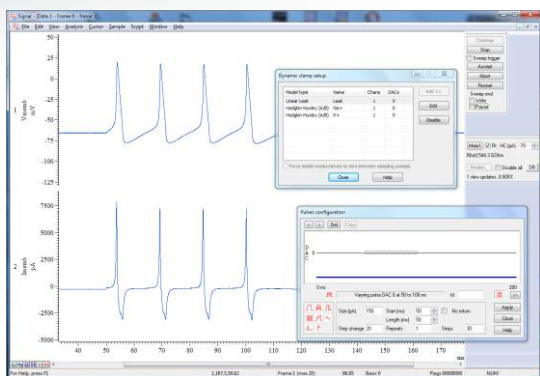
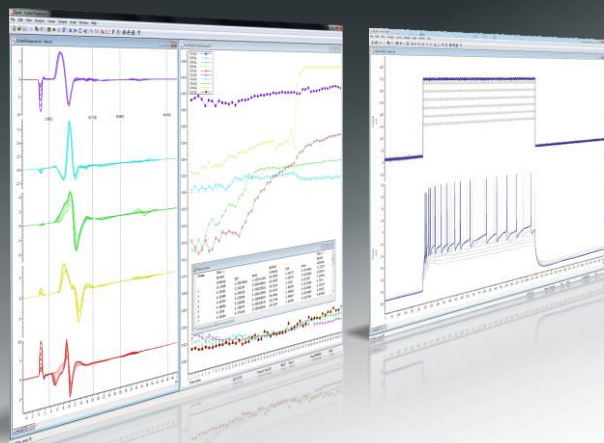
Na técnica de fixação dinâmica¹, um sistema de feedback tipicamente não linear fornece corrente a uma célula para representar as ações dos canais iônicos virtuais, permitindo que canais iônicos ou sinapses sejam simulados ou que as ações dos canais existentes sejam canceladas².

- Execute até 15 modelos para gerar saídas em até 8 DACs; vários modelos que conduzem um DAC são somados automaticamente
- Taxas de atualização rápidas: mais de 300kHz com um modelo Hodgkin/Huxley e 270kHz com dois modelos (consulte a tabela abaixo)
- Detecção de sobrecarga no hardware dá confiança em seus resultados
- Diálogos ergonômicos facilitam a visualização e edição dos parâmetros do modelo
- Modifique os parâmetros do modelo e aplique suas alterações durante a amostragem
- Alternar automaticamente entre vários estados de parâmetro durante a amostragem
- As saídas de pulso e forma de onda definidas pelo usuário podem ser somadas às saídas geradas pelo grampo dinâmico
- O sequenciador de saída pode habilitar e desabilitar modelos individuais dinamicamente durante uma única varredura de amostragem

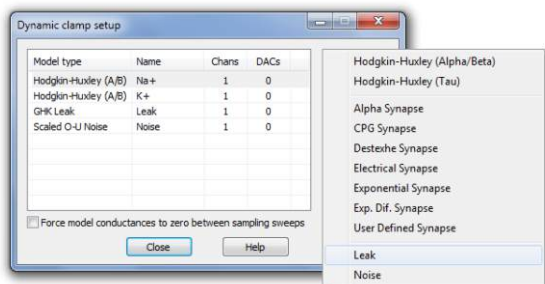
Model class	Type
Hodgkin-Huxley	Alpha/Beta *, Tau*
Synapse	Alpha, Central pattern generator, Destexhe, Electrical, Exponential, Exponential difference, User defined *
Leak	Linear, GHK, Boltzmann, User defined *
Noise	Ornstein-Uhlenbeck, Scaled Ornstein-Uhlenbeck *

H-H Models	x1	x2	x4	x8
Power1401-3	320 kHz	270 kHz	175 kHz	105 kHz
Power 1401 Mk II	100 kHz	85 kHz	60 kHz	45 kHz

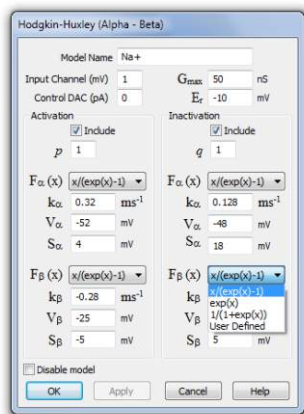
* These models can be customised or extended by replacing numerical parameters with user generated tables of values



Pinça dinâmica simulando potenciais de ação com acesso ao parâmetro do modelo durante a amostragem



Adding and selecting models



Setting parameters for a Hodgkin-Huxley model



The Power1401-3, as used for dynamic clamping

Currently available models and speeds

Embedded hardware-based dynamic clamp systems offer feedback that is fast and precisely timed, but these systems are often expensive and sometimes inflexible. PC-based systems, on the other hand, allow more complex feedback, but real-time performance can be poor³.

The CED Signal dynamic clamp system gives you the best of both worlds. All real-time aspects of the system are executed by the Power1401's fast embedded processor using pre-calculated lookup tables and optimised floating-point arithmetic, with the feedback calculations triggered by the ADC sampling for maximum stability. This software-based design is fast yet still provides great flexibility. The non-real-time aspects of the system are handled by the controlling PC to allow simplicity and ease of use. The result: a dynamic clamp system integrated into the standard Signal data acquisition software that greatly outperforms generally-available dynamic clamp systems.

It has been shown³ by simulations and experiment that the performance of dynamic clamp systems is strongly affected by the update rate and latency of updates. The very high-speed methods used by CED provide the superior update rates with low latencies that allow you to undertake the most demanding experiments. The mechanism incorporates a hardware based overflow detector so that you can be sure that the required update rates have been achieved and that your data is trustworthy.

¹ Sharp AA, O'Neil MB, Abbott LF, Marder E (1993) Dynamic Clamp: Computer-Generated Conductances in Real Neurons. *J Neurophysiol* 69: 992-995 †

² Prinz AA, Abbot LF and Marder E. The dynamic clamp comes of age. *Trends Neurosci.* 2004 Apr;27(4):218-24 †

³ Bettencourt JC, Lillis KP, Stupin LR and White JA. Effects of Imperfect Dynamic Clamp: Computational and Experimental results. *J Neurosci Methods.* 2008 April 30; 169(2):282-289 †

Voltage and patch-clamp features

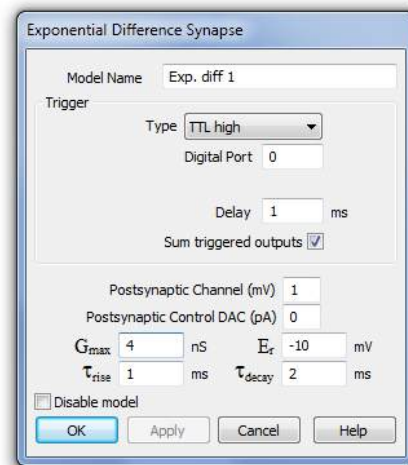
In addition to the integrated dynamic clamp features, Signal also provides support for standard clamping experiment methodologies:

Voltage and current clamp Generates all of the stimuli needed, including pre-recorded waveforms. Multiple sets of stimuli can be stored in one sampling configuration and selected manually or automatically sequenced. On-line measurement of seal and membrane resistance. Leak-subtraction and I/V plots online and offline. Curve fitting to waveform data and I/V plots.

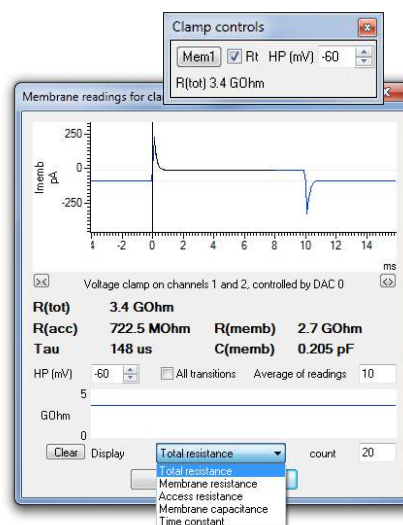
Single channel patch clamp Produces idealised current traces from patch data showing detected transition events either by thresholding or SCAN analysis. The idealised trace is editable by dragging open/closed times and amplitudes, splitting and combining events. Amplitude histograms and dwell time histograms can be produced.

System requirements

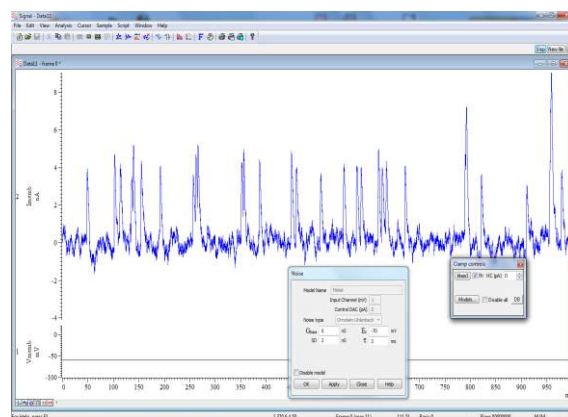
Signal Dynamic clamping requires a CED Power1401-3 or mk II laboratory interface and a PC with Windows XP, Windows Vista, Windows 7, Windows 8 or Intel Macintosh running Windows. Both 64-bit and 32-bit OS versions are supported. We recommend the computer has a minimum of 2GB of RAM.



Setting parameters for exponential difference synapse model



Análise de membrana durante a amostragem



Exponential difference synapse model with superimposed noise, triggered internally at randomised intervals

CED

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