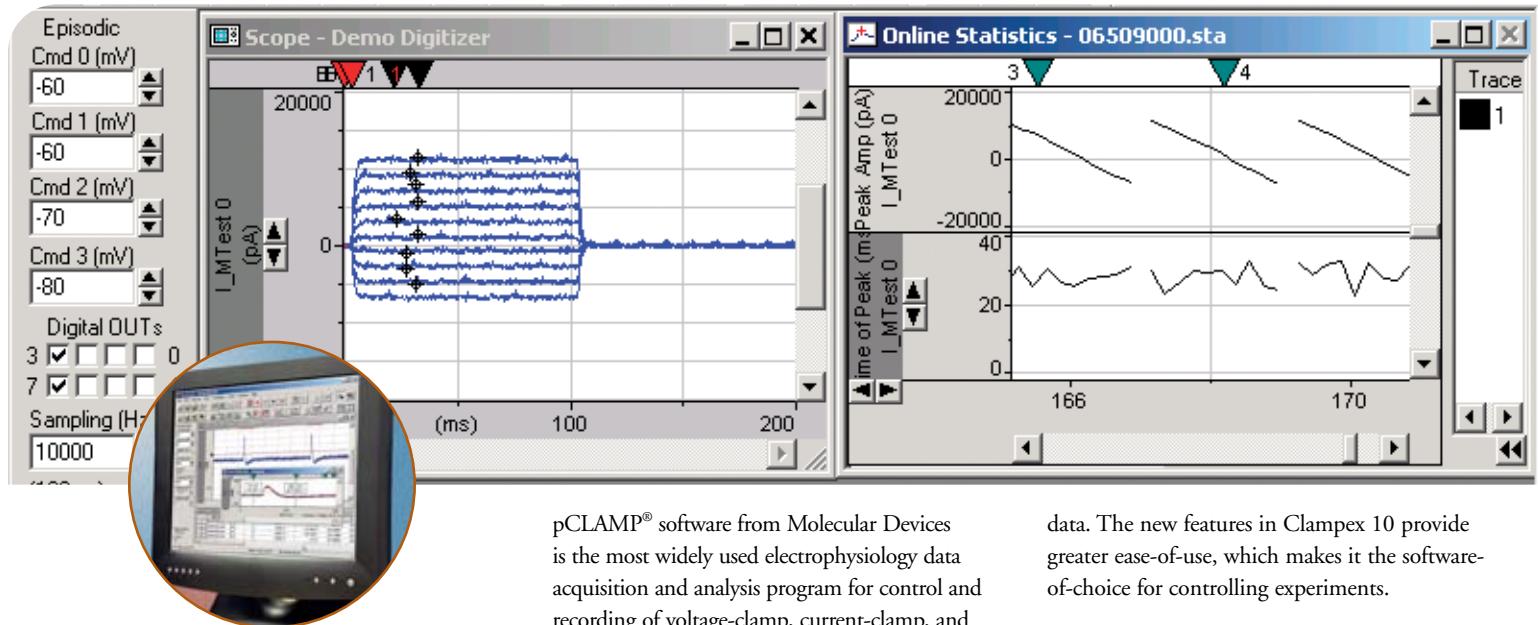


pCLAMP 10 software

pClamp10记录和分析软件

MORE DATA, MORE CONTROL, MORE CONVENIENCE



- COMPREHENSIVE ELECTROPHYSIOLOGY ACQUISITION & ANALYSIS SOFTWARE
- ONLINE MEMBRANE TEST/ ONLINE ANALYSIS
- MINIDIGI 2-CHANNEL DIGITIZER
- ANALYZES ALL TYPES OF ELECTROPHYSIOLOGY DATA

pCLAMP® software from Molecular Devices is the most widely used electrophysiology data acquisition and analysis program for control and recording of voltage-clamp, current-clamp, and patch-clamp experiments. The pCLAMP 10 suite of software consists of Clampex 10 for data acquisition, Clampfit 10 for data analysis, and AxoScope 10 for secondary background recording.

CLAMPEX 10, POWERFUL ELECTROPHYSIOLOGY DATA ACQUISITION PROGRAM

The focus of pCLAMP 10, the newest release, is to provide users with greater flexibility to control the acquisition of electrophysiology data. In addition to the already powerful set of Clampex protocol controls, new features include: support for four analog output waveforms with the new Digidata® 1440A digitizer, control of eight digital outputs per epoch during a sweep, and control of split-clock sampling per epoch during a sweep. The updated protocol editor in Clampex 10 displays sweep parameters in time and sampling intervals in frequency for easier protocol creation. The Membrane Test now calculates R_a and C_m per sweep during recordings and displays the results in a new resizable window incorporating the Seal Test. P/N Leak Subtraction now automatically saves both raw data and subtracted

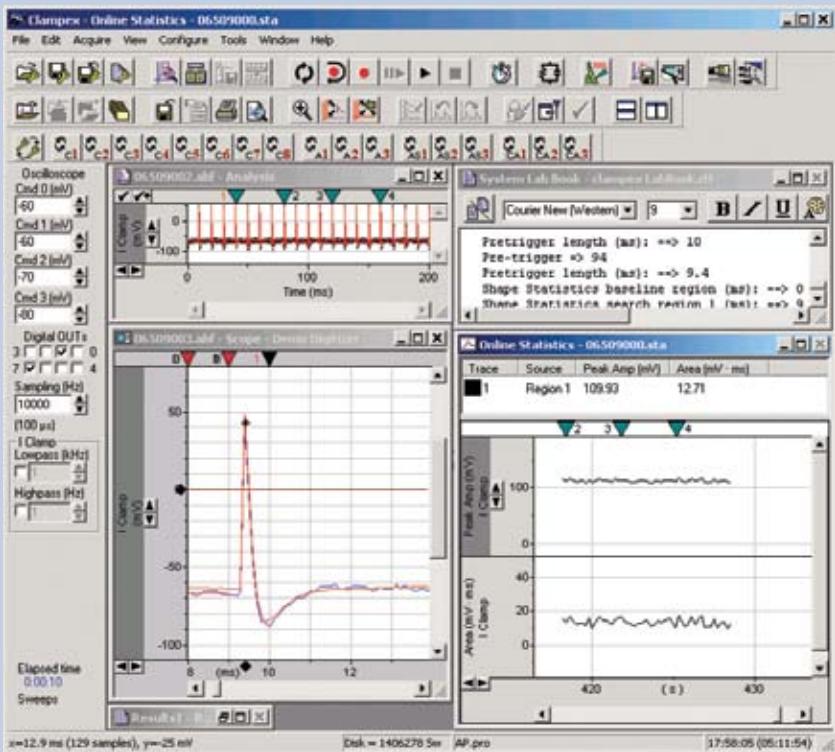
data. The new features in Clampex 10 provide greater ease-of-use, which makes it the software-of-choice for controlling experiments.

EPISTODIC AND CONTINUOUS RECORDING MODES

Clampex 10 is a superior program for stimulating cellular preparations in a sweep oriented “episodic” mode. Waveforms can be created from a variety of sources, such as the Clampex 10 protocol editor, pCLAMP ABF data files, and ASCII text files. Standard protocol patterns include steps, ramps, cosines, trains of pulses (biphasic), and sinusoidal or triangular patterns. Waveform stimulation utilizes a variety of timing and triggering aids, including Clampex 10 protocol controls and sequencing, hardware, software, and manual triggering options. Clampex 10 now supports eight digital output bits during sweeps and four simultaneous waveforms when used with the Digidata 1440A digitizer. Advanced “split-clock” capability has been added allowing users to shift the sampling rate on a per-epoch basis during sweeps, for example, for slowly changing conditioning or recovery phases of cell stimulation. For ease-of-use, all protocol durations are defined in terms of time and sampling rates in terms of frequencies.

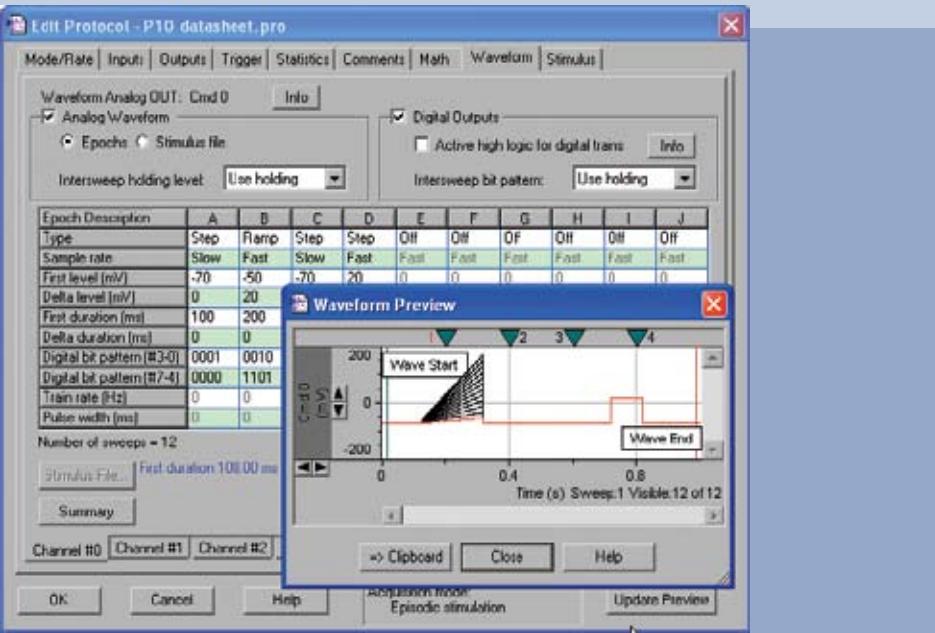
Clampex 10 recording and monitoring

acquisition windows



Clampex 10 has windows for online data, online graphs, recorded data, and cursor measurements.

waveform creation and preview



The spreadsheet-style waveform table also has a graphical display.

For continuous recording, four different modes are available. Gap-free recording is a simple continuous “chart-recorder” recording mode useful for monitoring single-channels, minis, and other spontaneous activity. Fixed- and Variable-Length Event Detection modes are suitable for recording spontaneous events of regular length or varying length that are separated by long periods of inactivity. The high-speed oscilloscope mode works like a storage oscilloscope to capture triggered fixed-length sweeps of data. By providing all of these recording modes, Clampex 10 provides the functionality necessary for a variety of simple and complex experimental protocols.

FILTERING AND CORRECTIONS TO THE DATA

Clampex 10 can be used to offset voltage level differences between connected instruments, correct liquid junction potential errors arising from ionic solutions, compensate passive leak currents with P/N leak subtraction, or reduce high-frequency noise spikes and slow baseline drift with highpass and lowpass filtering. Clampex 10 works to compensate for a wide variety of introduced noise sources. Amplifier gain and filter settings for Axoclamp 900A and MultiClamp 700B are software telegraphed so microelectrode amplifier settings are stored with the data. With Clampex 10, support for BNC-telegraphed amplifiers has been expanded to the latest amplifier models.

CELL MONITORING

The Membrane Test window in Clampex 10 has been redesigned to allow monitoring of the pipette resistance in the bath, formation of high-resistance seals between a cell and pipette, and to measure cell membrane capacitance (C_m), membrane resistance (R_m), and access resistance (R_a). During acquisition, Clampex 10 optionally runs the membrane test in the background, monitoring C_m and R_a during recording. This allows an entire experiment to be recorded into a single file, while simultaneously monitoring crucial cell parameters in real time.

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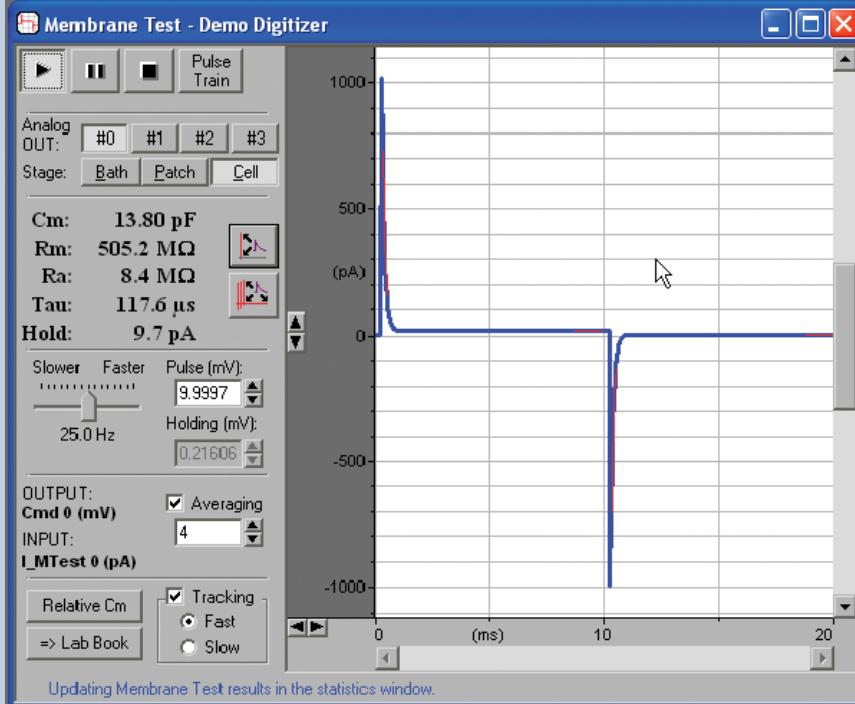
 flexible

 time saving

 labor saving

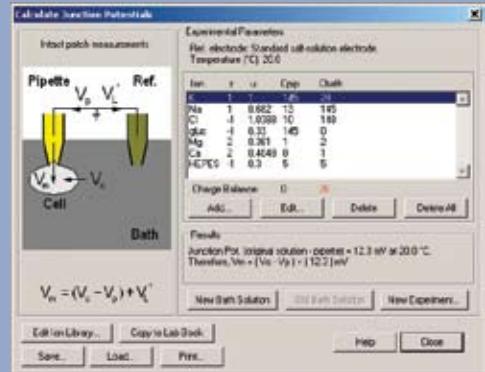
Clampex 10 analysis and tools

cell monitoring



The Clampex 10 Membrane Test handles all phases of patching a cell.

liquid junction potentials



The embedded liquid junction potential calculator has an editable ion library for pipette/bath offsets.

the MiniDigi digitizer



This unique 2-channel USB digitizer is run by the AxoScope 10 data acquisition software.

ONLINE ANALYSIS

To analyze data in real-time, Clampex 10 features online analysis. With online analysis, multiple regions can be simultaneously analyzed by an extensive set of peak-oriented measurements, such as peak amplitude, area, mean, and standard deviation. Measurement regions can be adjusted in real time for LTP experiments. Several measurements, such as half-width, rise and decay times, and rise and decay slopes are useful for cardiac analyses. Measurements are displayed in their own window and different trace colors identify each search region to simplify interpretation.

SEQUENCING KEYS

Sequencing keys control the setup and timing of operations, including loading protocols, recording data, setting analog and/or digital holding levels, running the Membrane Test, inserting comments into the Lab Book and data file, and linking to the next operation. By using Sequencing Keys, complex experiments can easily be automated and provide a powerful way to link the actions of an entire experiment.

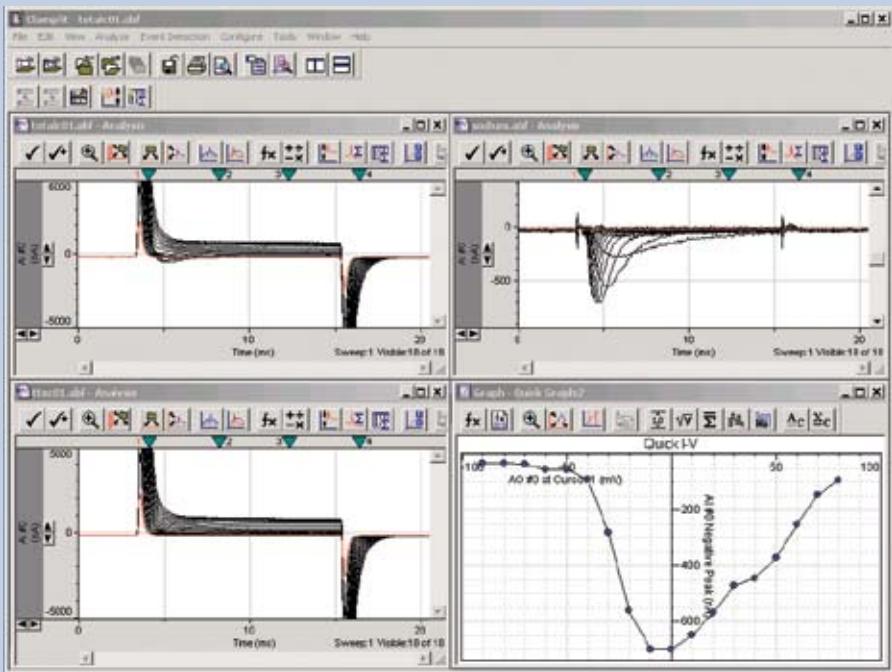
MINIDIGI DIGITAL CHART RECORDER

The MiniDigi digitizer provides two 1 kHz 16-bit analog inputs which run independently of Clampex acquisition. As a secondary background digitizer, the MiniDigi can act as a chart recorder to concurrently record between sweeps or record an entire experiment.

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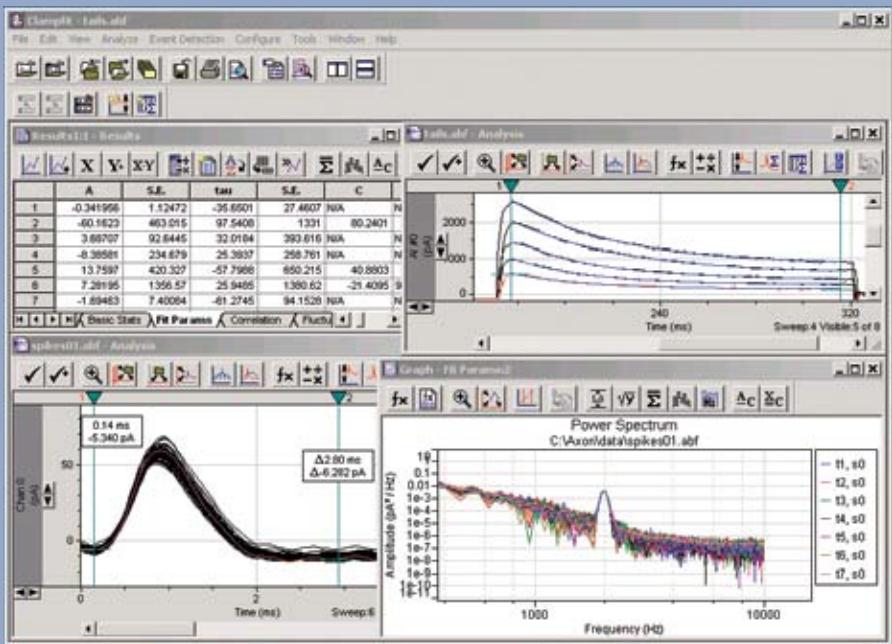
Clampfit 10 data preparation and analysis

file manipulations



TTX blocker is subtracted from raw sodium channel traces for a zero-crossing I-V plot.

fitting and FFT analysis



Fitting and power spectrum analysis handles all visible sweeps.

COMPREHENSIVE ELECTROPHYSIOLOGY DATA ANALYSIS PROGRAM

Clampfit 10 offers dedicated functions to quickly prepare data for analysis. In Clampfit 10, noise can be removed from signals using highpass, lowpass, and bandpass filters with Bessel, Butterworth, Chebyshev, Gaussian, or RC responses. Specialized notch and electrical interference filters can be used to remove specific noise frequencies and harmonics from recorded signals. Several different methods are available to adjust the baselines of recordings: constant values or averages can be subtracted from all points of the recording, linear drifting baselines can be adjusted by applying a slope correction, or, for unstable baselines, a manual correction using a poly-line can be applied. Additional data analysis functions are averaging, normalization, control subtraction, and peak alignment.

DATA ANALYSIS

Included with Clampfit 10 is a comprehensive palette of tools for analyzing and graphing electrophysiological data. For curve fitting, users can select from 37 pre-defined functions or define their own. Fits can be customized by selecting fitting methods and applying fitting seeds, models can be compared with different terms, and fits can be extrapolated to view curves, components, residuals, taus, etc. Specialized analysis tools include Fast Fourier Transform, Variance-Mean analysis, Perievent analysis, Burst analysis, and other statistical analyses. To display results and data, a range of graph types are available in the Graph windows. Graphs are dynamically linked to their Results window data so any manipulations made in the Results window updates the corresponding data in the Graph window.

Numerous peak statistics can be directly measured. Up to eight separate regions of interest, as well as a baseline region, enable the analysis of complex data. Online statistics can be recreated during offline review, eliminating the need to save separate statistics files during acquisition. A power spectrum (FFT) for noise analysis can be applied to individual, averaged, or segmented spectra, and produces a log-scaled graph of the results. Standard auto and cross-correlation analyses provide the means to compare data for patterns within or across populations. For synaptic modulation studies, the V-M analysis in Clampfit 10 provides a robust method for pre-/post-synaptic site identification.

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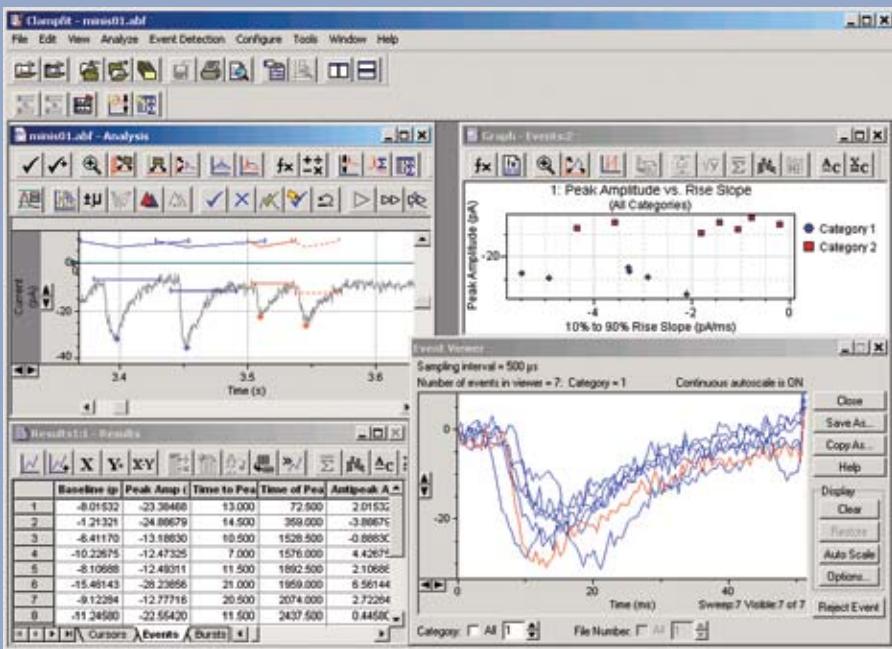
 flexible

 time saving

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Clampfit 10 analysis

minis analysis



A special environment links all views of the data during event detection.

EVENT DETECTION ANALYSIS

Clampfit 10 has extremely flexible Event Detection that analyzes spontaneous and evoked action potentials and post-synaptic data. Events are detected by either crossing a threshold or through a pattern-matching Template Search. Template Searches are designed for analyzing spontaneous events, such as miniature synaptic EPSPs and IPSPs. These events vary in amplitude but not shape, and thus are ideal for detection by the Clampfit 10 scalable shape-based algorithm. For added flexibility, multiple categories of events can be simultaneously detected and sorted for secondary analysis. The integrated environment of Clampfit 10 links the detected events in the data to the spreadsheet and graph windows to enable quick evaluation of the information within the context of the entire data set.

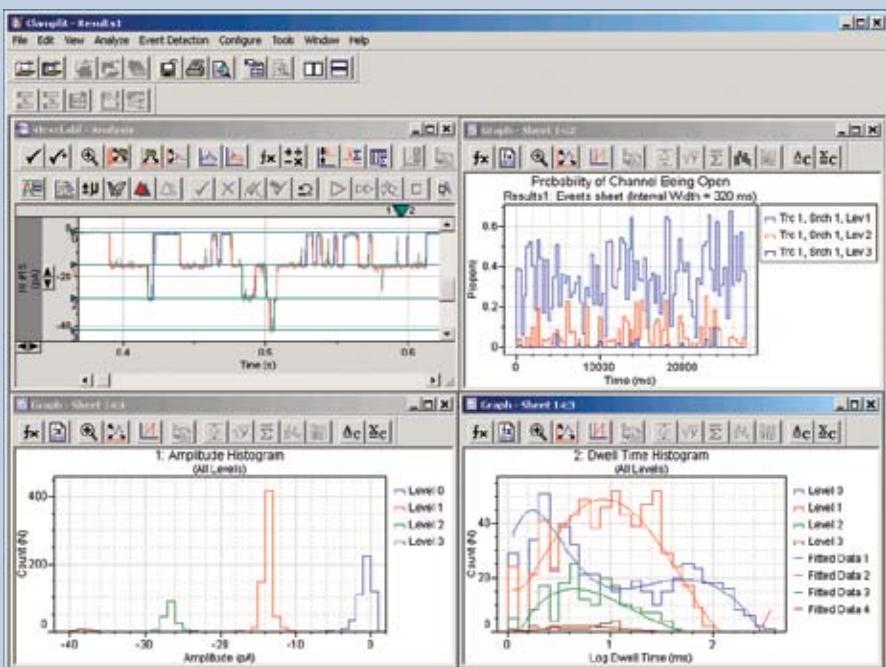
SINGLE-CHANNEL ANALYSIS

The Clampfit 10 single-channel analysis contains updated analyses and full processing of up to 1 million events on continuous and episodic data. Naturally expressed channels or artificial bilayers can be studied and open, closed, and sub-conductance levels can be detected up to eight levels in the data. An adjustment for baseline drift can be automatically applied, and an idealized record of the channel activity created. Amplitude and dwell-time histogram plots, including log and cumulative plots, can be created. Clampfit 10 also has specialized analyses, such as P(open), Burst Analysis, Latency Analysis, for evoked responses, and Nonstationary Fluctuation Analysis to estimate channel conductance.

SPREADSHEET ANALYSIS

Primary analysis results populate a spreadsheet where secondary analyses can be performed. These results can be analyzed within Clampfit or exported to Microsoft Excel® for further analysis. The secondary analyses available within Clampfit are analysis of variance, F-test, Chi-squared, Kolmogorov-Smirnov, rank correlations, and Student's t-Test. Graphing secondary data can be as easy as selecting a data column and clicking on the Create Graph Button. Available graphing options include line, scatter and various histogram plots (e.g., normalized, frequency, log [square root] and cumulative).

single-channel analysis



Single-channel graphs shown pasted into a layout window.

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SYSTEM REQUIREMENTS

Operating system: US Windows® XP Pro SP2 or 2000 SP4

CPU: 1.2 GHz Pentium (2.4 GHz recommended)

Drives: 500 MB HD space DVD/CD-ROM

Display: 1024 x 768 resolution

Ports: USB 1 (for security key)
USB 1.1 (for MiniDigi 1)
USB 2.0 (for Digidata 1440A)

Slots: PCI (for Digidata 1322A)

BUNDLED HARDWARE*

Digitizer type: MiniDigi 1

Channels: 2

Channel type: Analog input

Input range: ± 10 V

Resolution: 16 bits

Sampling rates: 1 Hz– 1 kHz

Filter types: Analog, min/max

Control software: AxoScope 10

Communication: USB 1.1

* Not supplied with upgrades from pCLAMP 9.

SUPPORTED HARDWARE**

Digidata 1440A: 16-channel digitizer

Digidata 1322A: 16-channel digitizer

MiniDigi 1: 2-channel digitizer

CyberAmp® 380: Signal-conditioning amplifier

Axoclamp 900A: Sharp electrode amplifier

Axopatch 200B: Microelectrode amplifier

MultiClamp 700B: Microelectrode amplifier

Most BNC-telegraphed amplifiers also supported.

** Supports all previous versions in a model line.

ORDERING INFORMATION

pCLAMP 10 Data Acquisition and Analysis Software

Part Number: pCLAMP 10 Standard

→ pCLAMP 10 CD

→ MiniDigi 1 digitizer*

→ USB 1.1 cable*

→ USB 1.0 security key

→ User guide (printed)

* Not supplied with upgrades from pCLAMP 9.

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