COMBINATION OF ANY TWO IPA OR DOUBLE IPA DEVICES ENABLES UP TO FOUR HEADSTAGE CHANNELS FOR AS MANY AS 16 SIGNALS

FULLY INTEGRATED PATCH CLAMP AMPLIFIER AND DATA ACQUISITION SYSTEM ENSURES QUICK AND EASY SETUP

OPTIMIZED FOR WHOLE-CELL PATCH CLAMP RECORDINGS IN TISSUE SLICES, ADHERENT OR DISSOCIATED CELLS

FULL COMPUTER CONTROL PROVIDES AUTOMATED COMPENSATION OF ELECTRODE AND WHOLE-CELL CAPACITANCE

VOLTAGE AND TRUE CURRENT CLAMP CAPABILITY FOR COMPLETE CHARACTERIZATION OF CELLS' ELECTRICAL ACTIVITY

BUNDLED SUTTERPATCH® SOFTWARE EXCELS IN COMPREHENSIVE DATA MANAGEMENT, INTUITIVE NAVIGATION, AND STREAMLINED DATA ANALYSIS

LINE FREQUENCY REDUCTION IN SUTTERPATCH

IPA® AND DOUBLE IPA® INTEGRATED PATCH AMPLIFIERS WITH DATA ACQUISITION SYSTEM

The **IPA®** family of Integrated Patch Amplifiers enables efficient, low-noise whole-cell recordings. The **IPA** system, available with either a single headstage (**IPA**) or dual headstages (**Double IPA®**), combine state-of-the-art amplifier technology with fully integrated D/A and A/D conversion and a high-speed USB interface. Acquisition, data management, and streamlined analysis are performed using the bundled **SutterPatch®** Data Acquisition and Analysis Software, built on the foundation of Igor Pro (WaveMetrics, Inc.).

External Inputs & Outputs
External signals, such as environmental parameters or stimulus information, can be recorded using 4 auxiliary analog input channels. The **IPA** systems also support the control of peripheral hardware, such as wavelength or solution switchers, with 2 analog and 8 digital (TTL) output channels. Alternatively to the standard breakout cable, the available Patch Panel provides a tidy way of connecting auxiliary signals on the front of your rack.

SutterPatch Software
The **IPA** system, in combination with **SutterPatch** software, has been engineered to automatically capture and store all amplifier settings, stimulus information and external experiment parameters and associate them in time with the raw data traces. This includes all amplifier and acquisition settings, as well as timing and progress of the experiment. Fully integrated computer control of the amplifier stages means that the acquisition software is aware of the internal state of the amplifier and digitizer at all times and can track any changes that may occur. This is independent of whether a change is triggered automatically or initiated by the user.

Tracking of Other External Data
In addition to status changes in connected hardware that are automatically tracked, the experimenter can manually trigger tags to document events like stimulus application in instruments not connected to the **IPA** system.

Information about environmental parameters and a more detailed specification of sample properties can be recorded and stored with the raw data. A total of over 600 metadata attributes are supported. Examples include: animal species, strain, genotype, date/time when a cell sample was prepared, recording solutions, pipette resistance, hardware properties, and detailed information about stimuli applied.

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SUTTER INSTRUMENT®

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Data Visualization and Analysis

SutterPatch® software has been designed to simplify the navigation and analysis of complex datasets. The scope window supports multiple view modes in both two-dimensional and an innovative three-dimensional display. The 3D view is particularly useful during assay development. Built on top of the latest version of the proven Igor Pro platform, the **SutterPatch** program combines native Igor Pro functionality with a wealth of features that are tailored to electrophysiology applications. Both the newcomer and the experienced user of patch clamp programs will feel comfortable using **SutterPatch** software.

Application modules provide focused functionality for particular applications.

- Event Detection Module: A deconvolution algorithm that excels at detecting miniature synaptic events even on a noisy background.
- Action Potential Analysis Module: Phase plane plot, timing and waveform statistics.
- Camera Module: An easy way to document the identity and condition of the recorded cell.

Common Applications: IPA / DOUBLE IPA

- Tissue slice recordings
- Cultured-cell experiments
- Cell line studies from adherent or dispersed cells
- *In vivo* patch clamp
- Network studies
- Optogenetics

Optional IPA Patch Panel

The **IPA**® and **Double IPA**® Amplifiers come standard with an "octopus" breakout cable for auxiliary inputs and outputs, and digital outputs. The optional **IPA** Patch Panel, machined from ½ inch thick billet aluminum stock like the **IPA** faceplate, brings the auxiliary I/O connections to the front of the rack in a tidy 2U rack mount panel with BNC connectors. The **IPA** Patch Panel includes a 2.5 ft (76 cm) connector cable and replaces the standard cable that ships with the **IPA** system.
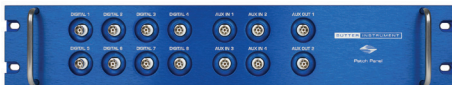
IPA-PCH Patch Panel for tidy, convenient connection of peripherals at the front of the rack

The **IPA®** and **Double IPA®** Integrated Patch Clamp Amplifiers are computer-controlled single- or dual-headstage amplifiers optimized for whole-cell recording applications.

Amplifier

- Voltage clamp and true current clamp modes with smart switching between modes to avoid current artifacts
- Open-Circuit (RMS) noise of 1.4 pA in a 0.1–10 kHz bandwidth
- 500 MΩ headstage feedback resistor provides a maximal range of ±20 nA
- Fast pipette capacitance compensation and whole-cell compensation
    - Fast compensation up to 25 pF
    - Whole-cell compensation: Cm from 1–100 pF; R$_s$ from 1–100 MΩ
- Onboard automatic compensation routines
- Series resistance prediction and correction (0–100 MΩ)
- Four-pole Bessel low-pass filter (cutoff = 0.5–20 kHz)
- Output gain: 0.5–25 mV/pA (voltage clamp); 10–500 mV/mV (current clamp)
- Holding potential ±1000 mV
- Current clamp bridge compensation and capacitance neutralization
- Slow holding potential tracking compensates for drift during current clamp recordings

Data Acquisition

- Embedded data acquisition system eliminates the need for an external data acquisition board and facilitates setup
- Single high-speed USB connection controls data acquisition and amplifier settings
- Up to 6 or 8 input channels (0.1–50 kHz sampling rate per channel)
- Up to 400 kHz aggregate sampling rate (1–10 kHz sampling rate per channel)
- Multi-amplifier mode: A combination of any two IPA or Double IPA amplifiers can be connected, providing up to 16 input channels
- Complex command waveforms
- Auxiliary input / output for control of other instrumentation
    - 4 analog input channels (±10 V)
    - 2 analog output channels (±10 V)
    - 8 digital output channels (TTL)
- Data acquisition can be initiated by an onboard microsecond clock or external (TTL) trigger

SutterPatch *Software*

- Built on the foundation of Igor Pro (WaveMetrics, Inc.)
- Paradigms and Routines provide complete experimental control
- Waveform Editor for easy creation of even the most complex stimulus patterns or user-defined templates
- Associated metadata stores all relevant information regarding your experiment
- Comprehensive data analysis routines and publication-quality graphics
- Rapid-response online line-frequency reduction
- Runs on Windows or Macintosh OS
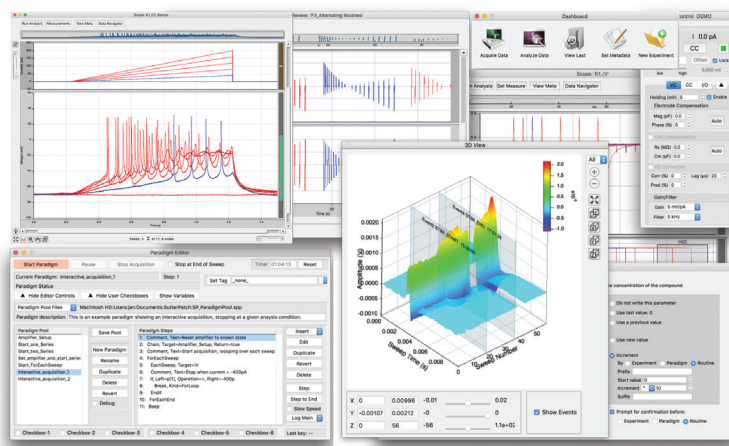
Screen shot of SutterPatch software