

IonFlux™ System

High Throughput Automated Patch Clamp with Plate Reader Simplicity

Optimized for throughput, flexibility, and superior performance

Plate reader simplicity: Fluxion's proprietary microfluidic flow control technology eliminates the need for pipetting and washing; it's all handled automatically within the reader. The design ensures reliability and consistency.

Ligand-gated channel capability: Compound application takes less than 100ms. Multiple compounds or concentrations can be applied in rapid succession to the same group of cells. Ideal for assaying ligand-gated channels.

Continuous recording: The IonFlux reader continuously records from the whole plate during all phases of the protocol. Cells are continuously clamped.

Highest throughput: Available with 64 multiplexed amplifiers, the system can deliver 1,000 data points per hour.

Cost-effective: Optimized design significantly reduces the cost per data point and initial system cost.

Compact: The IonFlux system can sit on a benchtop, making it ideal for the typical lab environment. The system is designed to integrate with existing liquid handlers for fully automated, unattended operation. The IonFlux system integrates easily into high throughput screening workflows.

The IonFlux System delivers a high throughput electrophysiology solution for ligand-gated and voltage-gated ion channels with “plate reader” simplicity. The system's unique microfluidic well plate format eliminates pipetting steps, allows continuous recording of cell ensembles, and rapidly delivers compounds.

The IonFlux System delivers outstanding patch clamp performance in a complete, easy-to-use system. Designed for higher throughput screening, the system uses parallel-cell ensemble recording to improve reliability and minimize variability. Workflow is greatly simplified: once IonFlux plates are filled with cells and compounds - by any standard liquid handling system - the plates are loaded automatically into the IonFlux reader. The system's unique microfluidic design automates all aspects of the compound application and recording protocol. No additional pipetting or washing steps are required. Voltage clamping occurs continuously throughout the entire experiment. This optimized design offers significant advantages in throughput and speed of compound application.

Better System, Better Workflow

The IonFlux system is a benchtop instrument which provides up to 64 ion channel recordings in parallel. The system consists of 1) a “reader” for running the voltage protocol and managing fluid flow, 2) software for experiment set-up, control, and analysis, and 3) IonFlux microfluidic plates for cell and compound handling. The use of a simple reader format, active fluidics, and 64 integrated amplifiers provides throughput capability of 1,000 data points per hour.

IonFlux plates combine the ease of use of an SBS-standard well plate with the benefits of integrated fluidics. Plates are filled in the same way as traditional well plates. However, the plate bottom has been replaced by a microfluidic network. Cell introduction, seal formation, and rapid compound addition and exchange (<100 ms) are all accomplished using a pneumatic interface that seals automatically to the IonFlux plate inside the reader. Since the interface also includes the electrodes, fluid control and recording occur simultaneously; there is no need for a test-add-test discontinuous workflow.



1. The IonFlux reader has been designed for ease of use, reliability, and workflow simplicity – just like a traditional plate reader.
2. IonFlux plates look and handle exactly like standard well plates. They can be filled by standard liquid handling systems.
3. In place of a solid bottom, the IonFlux plate has a microfluidic network connecting wells. The IonFlux reader includes an interface that seals to the wells and controls cell introduction, trapping, seal formation, and compound introduction via software control.

IonFlux Product Specifications

IonFlux Reader

Amplifiers: Integrated 16 or 64 channel amplifiers, sampling rate adjustable to 20 kHz; includes capacitance, leak, and series resistance compensation

Dimensions: App. 20" (50 cm) X 20" (50 cm) X 10" (25 cm)

Temperature control: ambient to 40 °C

Integrated plate/liquid handler: available

IonFlux Plate

Plate formats: SBS-standard 96 and 384 well

Recording format: Parallel-cell ensemble recording, 20 cells per group

Patch zones per experiment: 2 patch zones in same experimental region

Compounds: 8 unique compounds or concentrations per experiment

Experiments per plate: 96-well plate: 8 experiments per plate, each w/ 2 traps, 8 compounds
384-well plate: 32 experiments per plate, each w/ 2 traps, 8 compounds

IonFlux Software

Operating modules: Protocol editor, run table manager, assay development mode, recording visualization, analysis, and data export

Operating system: Windows XP, Vista

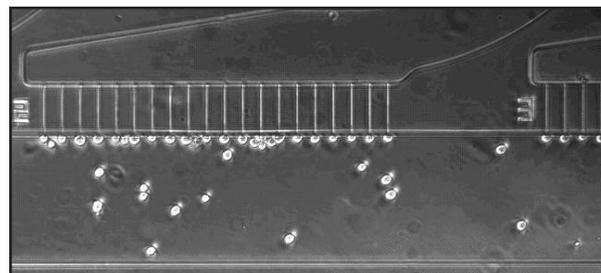
Performance

Throughput: 96-well plate: 250 data points per hour
384-well plate: 1000 data points per hour

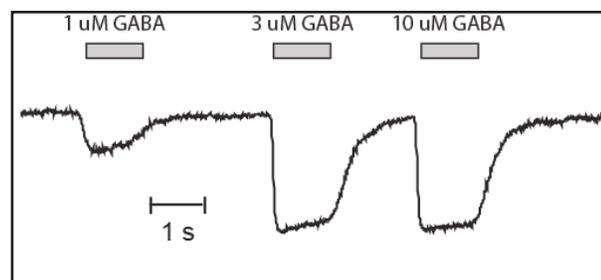
Compound application time: <100 ms

Unique Ion Channel Screening Capabilities

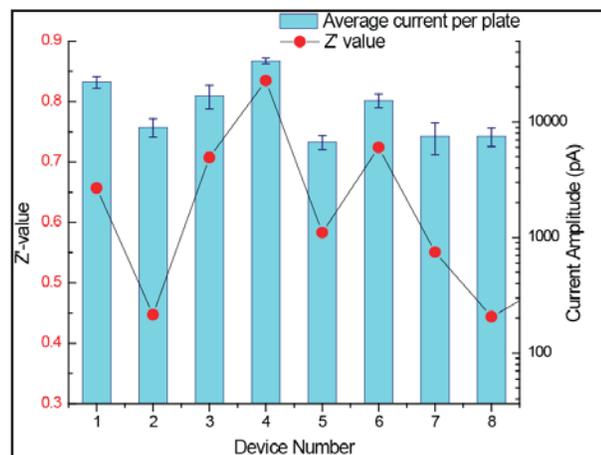
Ensemble trapping region. The IonFlux plate records from a 20-cell ensemble in parallel, providing the best combination of consistency, success rate, and recording fidelity. Active fluidic control is utilized to introduce cells, move them to the trapping area, and position the cells for optimal trapping. Trapping channels have a height and width of approximately 1.5 μm .



Rapid compound exchange. Continuous recording from an ensemble of CHO cells expressing GABA-A receptors during successive application of increasing GABA concentrations is shown. This data illustrates the ability to exchange compounds rapidly for a cell ensemble with continuous recording.



Robust assay consistency. IonFlux data showing the magnitude of the stimulus response (10 μM GABA application) for 128 cell ensembles across 8 plates, and comparison to a negative control (ECS). Z' values (control vs. 10 μM GABA) across the 8 plates shown averaged $Z' = 0.58 \pm 0.15$.



Automation and scalability.

An integrated automation solution utilizing Tecan's Freedom Evo robotic platform and IonFlux electrophysiology readers is available. Up to 4 readers can be integrated with the same robotic workstation for superior throughput.

