

# Cerebus™ System

The Cerebus™ system is a highly-configurable and easy-to-use multichannel data acquisition system for animal neurophysiology experiments. The Cerebus™ neural signal processor captures, processes and analyzes action potentials (spikes), field potentials and other physiological signals in relation to experiment state events™ in real-time.

**Neural Signal Processor** Real-time processing for up to 128 electrodes, 16 auxiliary analog channels, and individual TTL or strobed word experiment events (multiple systems can be synchronized for higher channel counts)

**128-Channel Front-End Amplifier** Amplifies, filters and digitizes neural signals before converting to a single multiplexed optical output



## Applications

The Cerebus™ System is configurable for in vivo (bird, rodent, feline, monkey) and in vitro (cell culture, brain slice) preparations to assist in the study of:

- » Sensory perception
- » Motor control
- » Attention, cognition, and decision making
- » Learning and memory
- » Drug and toxin effects
- » Epilepsy
- » Parkinson's disease
- » Neuroprosthetics
- » Brain-machine interfaces
- » Neurostimulation therapies

## Key Features

### Hardware

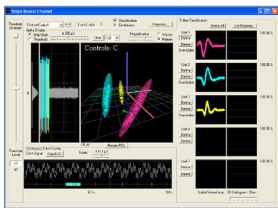
- » Ultra-compact design
- » Fiber-optic link for noise immunity
- » 8, 16, 32, 64, 96, 128 and 256 channel configurations
- » High-resolution signal recording (30 kHz at 16 bits)
- » Compatible with low- and high-impedance electrodes
- » Electrode impedance and crosstalk measurement
- » Flexible I/O options for synchronizing with behavior, stimulus and video systems
- » Parallel multi-PC control and operation

### Software

- » Per-channel user-defined digital filters
- » Up to 3 signal streams per channel
- » Real-time 2D/3D spike sorting (including tetrodes)
- » 2-channel oscilloscope (time and frequency modes)
- » User-defined analog outputs
- » Digital noise (line and magnetic) cancellation
- » Interface to NeuroExplorer, Spike2, MATLAB, C/C++, and other 3rd-party software
- » SDKs for MATLAB and C++ (offline and online)
- » Offline spike sorter

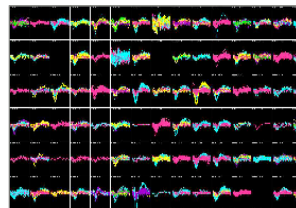
## The Cerebus™ GUI software

Provides a user-friendly interface to configure the signal processing and visualize the processed data as it is being acquired. The system's powerful and flexible digital architecture allows the user to perform a variety of online functions simultaneously from digital filtering and adaptive 3D spike sorting to data streaming and storage.



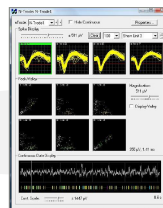
### 3D PCA

Quickly isolate units in 3D PCA space



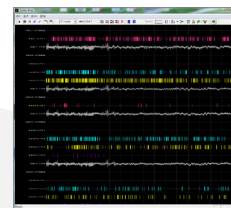
### Multichannel Display

See individual action potentials (units) on every channel



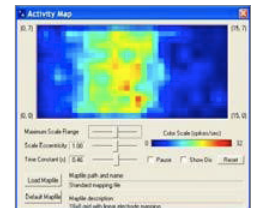
### N-trode (for a tetrode)

Online feature vs. feature plots for tetrode sorting



### Raster

Scrolling view of spikes, field potentials and event data



### Activity Map

Geometric display of spike firing rates across channels

# Cerebus™ System

## Specifications

### Cerebus™ Front-End Amplifier/Digitizer

<b>Number of inputs</b>	32 to 128 electrodes in banks of 32
<b>Differential configuration</b>	Each input amplified with respect to the common reference in each bank
<b>AC input range</b>	± 8.191 mV
<b>AC input conversion</b>	16-bit resolution at .25µV/bit
<b>Common mode rejection input range</b>	± 3.0V between inputs and ground
<b>Common mode rejection</b>	> 100 dB at 50/60 Hz
<b>High pass filter</b>	1 <sup>st</sup> -order 0.3 Hz (full-bandwidth mode)
<b>Low pass filter</b>	3 <sup>rd</sup> -order Butterworth 7.5 kHz
<b>Input referred noise</b>	< 3.0 µVrms (14 µVp-p) at full bandwidth
<b>Input impedance</b>	> 10 <sup>12</sup> Ω    3 pF
<b>Input bias/leakage</b>	± 5 pA typical, ± 20 pA max
<b>Channel crosstalk</b>	< 1 LSB for all combinations
<b>Maximum input voltage</b>	± 5.0 V between inputs and ground
<b>Input connection</b>	34-pin 2 mm male header for each bank
<b>Ground connection</b>	4.4 mm banana jack / binding post
<b>Output connection</b>	MTRJ digital fiber optic port
<b>Headstage power output</b>	± 5.0 V, up to 150 mA for powering optional headstages
<b>Power supply</b>	Five-channel external power supply with sequencing, 120 VAC/60 Hz or 220 VAC/50 Hz input
<b>Dimensions</b>	110 mm (H) x 42 mm (W) x 186 mm (L)
<b>Weight</b>	600 g

### Neural Signal Processor with Experiment I/O

<b>Digital signal processing</b>	Adaptive noise cancellation and 4 <sup>th</sup> -order hi/and/lo pass digital filtering. Separate digital filters for simultaneous field potential and spike processing for up to 144 channels
<b>Front-end input</b>	MTRJ digital fiber optic port
<b>Experiment analog inputs</b>	Sixteen ±5.0V, 16-bit analog inputs for experiment or neural signals (BNC)
<b>Experiment analog outputs</b>	Four ± 5.0V, 16-bit analog outputs (BNC) Two line-level audio outputs (BNC + 3.5 mm)
<b>Experiment TTL and strobed-word inputs</b>	One 16-bit input port (DB-37) with individual or strobed-word event detection
<b>Experiment digital outputs</b>	Four single-bit digital outputs (BNC), Synchronization TTL output (BNC)
<b>Experiment serial I/O</b>	RS 232 port (DB-9), 115 kbps
<b>PC interface</b>	1 Gbit Ethernet
<b>Power supply</b>	3-pin PC power connector (110-240 VAC, 50-60 Hz)
<b>Dimensions</b>	88 mm (H) x 325 mm (W) x 425 mm (L)
<b>Weight</b>	6.8 kg
<b>Mounting options</b>	Table-top rubber feet or 2U slot in 19-inch instrument rack

**Computer requirements (not included with system)** Minimum requirements: 2 GHz Intel® Core™2 Duo or equivalent AMD® processor, one available PCI slot, 250 GB hard drive, 4 GB RAM, dual-screen monitor with Windows XP (32-bit) or Windows 7 (32- or 64-bit)

## System

### Complete Cerebus™ System

- 128-channel data acquisition system
- 96-channel data acquisition system
- 64-channel data acquisition system
- 32-channel data acquisition system
- 16-channel data acquisition system
- 8-channel data acquisition system

### Complete Cerebus™ System

- Front-End Amplifier/Digitizer
  - One fiber-optic cable (10 m)
  - Four CHA-32 adapter boards
  - Four 40-pin ribbon cables (20 cm)
  - User guide with connection diagrams
  - One 128-channel neural signal simulator

### Upgrade Boards

- 32-channel front-end amplification board

### Neural Signal Processor

- One gigabit ethernet card
- One gigabit ethernet cable
- One power cable
- User guide with connection diagrams
- User interface and control software for Windows XP/Windows 7

