

The Cerebus system is a highly-configurable, easy-to-use multichannel data acquisition system for animal neurophysiology experiments. The Cerebus Front-End Amplifier and 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.

## 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
- » Neuroprosthetics
- » Brain-machine interfaces
- » Neurostimulation therapies

- 1 **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)

- 2 **128-Channel Front-End Amplifier**  
– Amplifies, filters, digitizes neural signals before converting to a single, multiplexed optical output



## Key Features

### Hardware

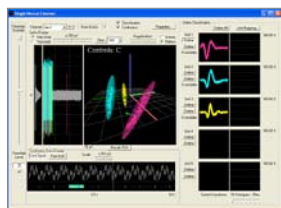
- » Ultra-compact design
- » Fiber-optic link for reduced system noise
- » 8-, 16-, 32-, 64-, 96-, 128- and 256-channel recording (16 bit)
- » Continuous recording of spikes and field potentials (30 kHz)
- » Compatible with low and high-impedance electrodes (individual metal microelectrodes, microelectrode and microwire arrays, planar silicon probe, ECoG grids, and surface EEG/EMG/EKG electrodes)
- » Flexible I/O options for synchronizing with behavior, stimulus, and video systems

### Software

- » Per-channel selection of digital filter/sampling rate
- » Adaptive spike detection, 3D spike sorting
- » Electrode impedance/crosstalk measurements
- » Digital noise (line, magnetic) cancellation
- » Interface to NeuroExplorer, Spike2, MATLAB, C/C++, and other 3rd-party software
- » Parallel, multi-PC control and operation
- » Remote control of data acquisition and storage

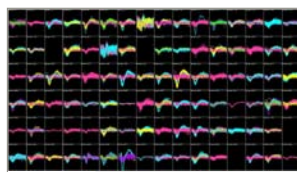
## The Cerebus GUI software

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



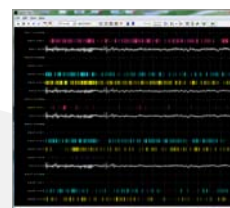
### Multichannel Display

See individual action potentials (units) on every channel



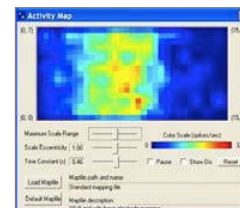
### N-trode (for a tetrode)

Online feature vs. feature plots for tetrode sorting



### Raster

Scrolling view of spikes, filed potentials and event data



### Activity map

Geometric display of spike firing rates across channels

## Specifications

### CEREBUS™ Front-End Amplifier/Digitizer

Number of Inputs	32 to 128 electrodes in banks of 32
Differential Configuration	Each input amplified with respect to the common reference in each bank
AC Input Range	+/- 32 mV
AC Input Conversion	16-bit (14-bit linearity) at 1.0 µV/bit
Common Mode Rejection Input Range	+/- 3.0 V between inputs and ground
Common Mode Rejection	>90 dB at 50/60 Hz
High Pass Filter	1 <sup>st</sup> -order 0.3 Hz (full-bandwidth mode)
Low Pass Filter	3 <sup>rd</sup> -order Butterworth 7.5 kHz
Input Referred Noise	< 3.0 µVrms (14 µVp-p) at full bandwidth
Input Impedance	>10 <sup>12</sup> Ohms    3 pF
Input Bias/Leakage	+/- 5 pA typical, +/- 20 pA max
Channel Crosstalk	<1 LSB for all combinations
Maximum Input Voltage	+/- 5.0 V between inputs and ground
Input Connection	34-pin 2 mm male header for each bank
Ground Connection	4.4 mm banana jack / binding post
Output Connection	MTRJ digital fiber optic port
Headstage Power Output	+/- 5.0 V, up to 150 mA for powering optional headstages
Power Supply	Five-channel external power supply with sequencing, 120 VAC/60 Hz or 220 VAC/50 Hz input
Dimensions	110 mm (H) x 42 mm (W) x 186 mm (L)
Weight	600 g

### Neural Signal Processor with Experiment I/O

Digital Signal Processing	Adaptive noise cancellation and 6 <sup>th</sup> -order hi/band/lo pass digital filtering; Separate digital filters for simultaneous field potential and spike processing for up to 144 channels
Front-End Input	MTRJ digital fiber optic port
Experiment Analog Inputs	Sixteen +/- 5.0 V, 16-bit analog inputs for experiment or neural signals (BNC)
Experiment Analog Outputs	Four +/- 5.0 V, 16-bit analog outputs (BNC) Two line-level audio outputs (BNC + 3.5 mm)
Experiment TTL and Strobed-Word Inputs	One 16-bit input port (DB-37) with individual or strobed-word event detection
Experiment Digital Outputs	Four single-bit digital outputs (BNC), Synchronization TTL output (BNC)
Experiment Serial I/O	RS 232 port (DB-9), 115 kbps
PC Interface	1 Gbit ethernet
Power Supply	3-pin PC power connector (110-240 VAC, 50-60 Hz)
Dimensions	88 mm (H) x 432 mm (W) x 490 mm (L)
Weight	6.8 kg
Mounting Options	Table-top rubber feet or 2 U slot in 19-inch instrument rack

**Computer Requirements (not included with system)** Minimum requirements: 2 GHz Pentium or AMD processor; one available PCI slot; 60 GB hard drive; 512 MB RAM; dual-screen monitor and Windows XP, Windows 2000, Windows Vista operating system

## System

### Complete CEREBUS™ System

PN 4550: 128-Channel Data Acquisition System  
 PN 4551: 96-Channel Data Acquisition System  
 PN 4552: 64-Channel Data Acquisition System  
 PN 4553: 32-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

PN 4094: 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/Vista

