Pinnacle offers **BIOPOTENTIAL RECORDING SYSTEMS** for sleep, seizure and general behavioral paradigms in freely moving mice and rats. Our EEG/EMG systems use headmounted amplification to produce exceptionally clean waveforms, even during animal movement. We offer wireless & tethered preconfigured three-channel systems. A flexible four-channel tethered system is available which includes the capability to incorporate simultaneous accelerometer, optogenetics or sensor measurements.

**WIRELESS SYSTEM FOR MICE & RATS**

Pinnacle’s turn-key **WIRELESS EEG/EMG SYSTEMS** can record up to three biopotentials simultaneously and present data in real time for review. This lightweight, head-mounted Bluetooth® device enables animals to move freely. It is ideal for behavioral paradigms and group housed research. The same hardware can be used for mice and rats.

**COMMON USES**

- **Sleep Studies**
- **Seizure Research**
- **Depth Electrodes**
- **Cortical Recordings**
- **Local Field Potential**
- **Cognitive Studies**

**8274 WIRELESS SYSTEM SPECIFICATIONS**

<table>
<thead>
<tr>
<th></th>
<th>SL</th>
<th>SE3</th>
<th>SE3 (EI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong># Channels</strong></td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong># bits</strong></td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td><strong>System Configuration</strong></td>
<td>EEG 0.5 Hz; EMG 10 Hz</td>
<td>EEG 1.0 Hz</td>
<td>EEG 1.0 Hz</td>
</tr>
<tr>
<td><strong>High Pass Filter</strong></td>
<td>+/- 480 uV</td>
<td>+/- 480 uV</td>
<td>+/- 960 uV</td>
</tr>
<tr>
<td><strong>Input Range</strong></td>
<td>2600 V/V</td>
<td>2600 V/V</td>
<td>1300 V/V</td>
</tr>
<tr>
<td><strong>Total Gain</strong></td>
<td>0.23 uV</td>
<td>0.23 uV</td>
<td>0.47 uV</td>
</tr>
</tbody>
</table>
| **Sample Rate** | 256 - Battery Life 6 + days; 512 - Battery Life 4 + days; 1024 - Battery Life 2 + days

**8274 WIRELESS SYSTEM WEIGHT & SIZE**

<table>
<thead>
<tr>
<th></th>
<th>Mice</th>
<th>Rats</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Weight</strong></td>
<td>3.8 g</td>
<td>6.8 g</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>Mice</td>
<td>17.1 x 16.2 x 11.0 mm</td>
</tr>
</tbody>
</table>

*Bluetooth interference may affect battery lifetime. For longer studies the removable battery can be easily replaced.

**Includes electronics, battery and enclosure."
TETHERED SYSTEM

HOW OUR PREAMPLIFIERS WORK

Pinnacle’s preamplifiers provide differential amplification (x10 or x100) between electrodes. Our standard three and four-channel preamplifiers have two referential channels and one or two differential channels. Fully referential and fully differential versions are also available.

Example: A 2 EEG/1 EMG preamplifier configured for seizure studies in mice has a gain of x100 on all channels, 1.0 Hz high-pass filters on the EEG channels, and 10 Hz high-pass filters on the EMG channel.
TETHERED SYSTEM

A data conditioning and acquisition system (DCAS) performs secondary amplification and filtering before sending data to Pinnacle's Sirenia® Acquisition software for collection via a USB connection.

### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specifications</th>
<th>3-Channel</th>
<th>4-Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustable Sampling Rates</td>
<td>200 - 2,000 Hz</td>
<td>200 - 20,000 Hz</td>
</tr>
<tr>
<td>Software Configurable Low-Pass Filters</td>
<td>10 Hz - 1 kHz</td>
<td>21 Hz - 15 kHz</td>
</tr>
<tr>
<td>ADC Resolution</td>
<td>14 bits</td>
<td>16 bits</td>
</tr>
<tr>
<td>TTL Input/Outputs and Analog Outputs</td>
<td>1 TTL Input/Output and 3 Analog Outputs</td>
<td>4 TTL Input/Outputs and 4 Analog Outputs</td>
</tr>
</tbody>
</table>

### COMMUTATORS

A low-torque commutator, which is mounted above the cage, allows for unencumbered freedom of movement.

**Rotational Torque:** $< 2 \times 10^4$ N-m

### PREAMPLIFIERS

Signals are amplified and filtered at the animal's head using our preamplifiers. This ensures the delivery of clean, artifact-free data. The cable from the commutator connects to the seven-inch cable of the preamplifier. Six insulated wires are banded together to create this lightweight cable. The mouse preamplifier connects to a headmount via a friction fit.

**High-Pass Filters:**
- 0.5 Hz EEG, 10 Hz EMG for sleep
- 1.0 Hz EEG, 10 Hz EMG for seizure

**Gain:**
- x100 for sleep
- x10 or x100 for seizure

### MOUSE HEADMOUNTS

Prefabricated headmounts reduce surgery time, allow for reproducible electrode placement and provide ready-to-insert EMG leads. Six- or eight-pin headmounts support flexible electrode placement for customizable cortical or depth recordings.

Seizure event from a C57 mouse model captured using Pinnacle's three-channel EEG/EMG system.

**Data courtesy of Drs. Phillip Haydon and Jerome Clasadonte, Tufts University School of Medicine, Department of Neuroscience**
SLEEP DEPRIVATION
Gently restrict sleep in rodents based on real-time EEG/EMG thresholds or programmed schedules without human intervention.

SYNCHRONIZED VIDEO
Integrated video recording provides a platform for synchronizing EEG and EMG changes with observable behavioral states. Video can be added to any new or existing hardware system. Captured video is displayed live on screen as it is streamed from the animal and is synchronized with other recorded data in playback mode.

SENSORS *
The addition of sensors enables the correlation of EEG/EMG activity with neurophysiological changes in freely moving mice and rats.

OPTOGENETICS *
LED fiber probes allow for localized stimulation of neurons in specific brain regions with precise timing and illumination control while simultaneously monitoring EEG/EMG.

USE WITH YOUR EXISTING AMPLIFIER *
Analog adapters allow researchers to use their existing amplification/acquisition systems with Pinnacle’s preamplifiers and headmounts.

*Tethered Systems Only

“The clarity of the data rivals anything I have ever seen. Quite simply, this is the best system for EEG and sleep recording on the market today.”
— Dr. Fred Turek
CEO, NuNetix, Inc.

ADVANCED ANALYSIS SOFTWARE

SIRENIA® SEIZURE PRO
Quickly identify, analyze and log user-defined seizure events in a given time period. Tools include spectral power, heat maps, line length, amplitude and seizure duration. Custom reports and graphs.

SIRENIA® SLEEP PRO
Reduce scoring and analysis time with semiautomated tools such as cluster scoring, threshold scoring, hypnograms and spectral plots. Quickly compare scores, perform bout and sleep analyses and customize high-quality charts and graphs.

SIRENIA® FEEDBACK PRO
Create rule sets using baseline data, thresholds and power analysis to initiate stimuli in real-time for a variety of sleep, seizure, optogenetics and other studies.

SIRENIA® X-Y TRACKING
Track real-time or pre-recorded locomotor behavior. Includes quadrant and user-defined zone analysis, speed plots, movement trajectories, heat maps and overlay capabilities.