EPOCH SYSTEMS

Wireless EEG Dual-Channel Systems
- EPOCH-MSE-SYS Mouse EEG System
- EPOCH-RAT-SYS Rat EEG System
- EPOCH-PUP-EEG-S Pup EEG System

EEG Sensors
- EPOCH-T2 EEG Sensor (2 mo)
- EPOCH-T6 EEG Sensor (6 mo)
- EPOCH-PUP-EEG-SEN Pup EEG Sensor
- EPOCH-REUSE-SEN Reusable EEG Sensor

Sensor Activator for EEG or ECG
- EPOCH-ACTI Epoch Sensor Activation Utility

Differential Sensor
- EPOCH-P-DIF-SEN Pup Sensor
- EPOCH-M-DIF-SEN Mouse Sensor
- EPOCH-R-DIF-SEN Rat Sensor

Wireless ECG Single-Channel Systems
- EPOCH-M-ECG-SYS Mouse ECG System
- EPOCH-R-ECG-SYS Rat ECG System

ECG Sensors
- EPOCH-M-ECG-SEN Mouse ECG Sensor
- EPOCH-R-ECG-SEN Rat ECG Sensor

Click to use the Epoch System Builder Wizard or to view an Epoch System Diagram with MP Hardware

These long-term wireless biopotential systems for mice and rats collect two channels of EEG System or a single channel ECG System. To record, the animal's cage is simply placed on top of the receiver tray with the implanted animal inside of the cage. EEG or ECG data from the sensor is telemetered to the receiving tray and then sent to the data acquisition system.

Complete EEG system includes a receiver tray, two 2-channel implantable EEG sensor transmitters, and interface cables (2 x CBL102, 2 x CBL122) to collect data from a mouse or rat housed in an industry standard home cage. The Epoch EEG Transmitter amplifies and transmits two channels of high-fidelity EEG data. Epoch Systems use capacitive coupling, not radio frequency. Sensor transmitters operate at 6 kHz ± 2 kHz where the transmitter emissions are localized to the footprint of the receiver. The power of the transmitter is 620 microwatts. Implants are small enough to be implanted into mice as young as P21. The receiver tray has BNC connections that easily connect to a BIOPAC MP160/MP150 data acquisition system (via the HLT100C or UIM100C) or third-party devices capable of accepting signals within the ±5 V range.

Complete ECG system includes a receiver tray, two single-channel implantable ECG sensor transmitters, and interface cables (1 x CBL102, 1 x CBL122) to collect data from a mouse or rat housed in an industry standard home cage. The Epoch ECG Transmitter amplifies and transmits one channel of high-fidelity ECG data. Implants are small enough to be implanted into mice as young as P21. The receiver tray has BNC connections that easily connect to a BIOPAC MP160/MP150 data acquisition system (via the HLT100C or UIM100C) or third-party devices capable of accepting signals within the ±5 V range.

Sensors are shipped with the default transmitter Gain setting; other Gain settings are available if requested before order is placed. AcqKnowledge software includes the scale settings for each transmitter Gain option.

### Neural Implant Options

<table>
<thead>
<tr>
<th>Typical Use</th>
<th>Gain</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEG, ECoG, LFP</td>
<td>2000x</td>
<td>±1.0 mV range, 1.0 mVpp in = 2 V out</td>
</tr>
<tr>
<td>Status-Epilepticus</td>
<td>800x</td>
<td>±2.5 mV range, 2.5 mVpp in = 2 V out</td>
</tr>
<tr>
<td>ECG</td>
<td>2000x</td>
<td>±1.0 mV range, 1.0 mVpp in = 2 V out</td>
</tr>
</tbody>
</table>
When used with an MP Research System, use the power of AcqKnowledge software’s automation and scoring tools to identify seizures, predefine and control recording protocols, or set triggers based on external events (dosing, light changes, etc.). After recording, use automated EEG or ECG analysis routines to quickly score multiple channels of data simultaneously. Derive frequency bands, complete a Frequency analysis, look at Alpha RMS, etc., all with guided automated routines.

For more options, add SleepSign (SSA100W) for complete sleep data analysis or use Camera Systems (CAMSYS4 or 8) to monitor and record protocols and animal behavior. Recorded video will be time synchronized to the physiological signals in AcqKnowledge for easy investigation of key areas of interest.

**Implantable EEG Sensors**

Sensors require an EPOCH-MSE-SYS, EPOCH-RAT-SYS or EPOCH-PUP-EEG-S to operate. Battery options can each be used for rat, mouse or pup if footprint and weight dimensions suit the animal; mouse should typically be larger than P21. Teflon insulated platinum electrode wires are shipped at 10 cm and can be truncated to desired length.

- **EPOCH-T2** Two-channel transmitter with 2 month battery life
- **EPOCH-T6** Two-channel transmitter with 6 month battery life
- **EPOCH-PUP-EEG-SEN** Two-channel transmitter with 2 week battery life

**Reusable EEG Sensor – EPOCH-REUSE-SEN**

This two-channel reusable sensor can be used multiple times in multiple animals—easily activate/deactivate with the EPOCH-ACTI Sensor Activation Utility.

- **Bandwidth:** 0.1-200 Hz
- **Battery life:** 2 months
- **Footprint:** 8 mm x 13 mm  
  **Height:** 18 mm  
  **Weight:** 4.0 g  
  **Volume:** 1.34 cc
- **Interface:** Includes Plastics1 MSS33 style 3-electrode system (not suture style)

**EPOCH-ACTI Epoch Sensor Activation Utility**

This is an activation and test utility for Epoch EEG and ECG sensors. The sensors are always shipped from the factory deactivated. The utility is required to start the battery when ready to use the sensor.

*Note* The Activator was updated in April 2017 to include an ON/OFF switch for reusable transmitters. If you purchased the ORIGINAL and want to use Reusable Transmitters, contact BIOPAC to discuss options.
Differential Transmitters – EPOCH-P-DIF-SEN, EPOCH-M-DIF-SEN, EPOCH-R-DIF-SEN

Epoch differential transmitters enable wireless recording of two different biopotentials with their own reference. Record long-term EEG+EEG, EEG+ECG, EEG+EMG, or ECG+EMG.

Transmitters amplify biopotentials and wirelessly transmit data to a receiver tray placed under each animal cage for continuous wireless recording of rats, mice, or pups. There is no crosswalk between cages, unlike other types of implantable transmitters that use RF.

Transmitters ship deactivated—activate with EPOCH-ACTI when ready to start recording.

Choose transmitter size/battery life: 2-week (P10), 2-month, or 6-month.

<table>
<thead>
<tr>
<th>Differential Reference</th>
<th>Signal Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Ch EEG +</td>
<td>0.1-100 Hz</td>
</tr>
<tr>
<td>1-Ch EEG</td>
<td>0.1-100 Hz</td>
</tr>
<tr>
<td>1-Ch EEG +</td>
<td>0.1-100 Hz</td>
</tr>
<tr>
<td>1-Ch ECG</td>
<td>0.1-200 Hz</td>
</tr>
<tr>
<td>1-Ch EEG +</td>
<td>0.1-100 Hz</td>
</tr>
<tr>
<td>1-Ch EMG</td>
<td>0.1-200 Hz</td>
</tr>
<tr>
<td>1-Ch ECG +</td>
<td>0.1-200 Hz</td>
</tr>
<tr>
<td>1-Ch EMG</td>
<td>0.1-200 Hz</td>
</tr>
</tbody>
</table>

common reference electrode layout

Example 2-Ch
Ch 1 = A - C
Ch 2 = B - C
looking up at the bottom of the transmitter

differential reference electrode layout

Example 2-Ch
Ch 1 = A - B
Ch 2 = C - D
looking up at the bottom of the transmitter
EEG and ECG Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>2 week</th>
<th>2 month</th>
<th>6 month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implant Weight</td>
<td>0.5 g</td>
<td>2.3 g</td>
<td>4 g</td>
</tr>
<tr>
<td>Sensor Footprint</td>
<td>4 mm x 6 mm</td>
<td>8 mm x 9 mm</td>
<td>8 mm x 12 mm</td>
</tr>
<tr>
<td>Volume</td>
<td>0.192 cubic cm</td>
<td>0.756 cubic cm</td>
<td>1.344 cubic cm</td>
</tr>
<tr>
<td>Electrode Wire Length</td>
<td>Default 10 cm</td>
<td>(truncate to desired length; custom longer lengths available upon request)</td>
<td></td>
</tr>
<tr>
<td>Electrode Wire Material</td>
<td>Teflon insulated platinum material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implant Material</td>
<td>Medical Grade Epoxy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System Gain Options</td>
<td>2000x – (±1.0 mV range, 1.0 mV in = 2 V out) - EEG and ECG</td>
<td>800x – (±2.5 mV range, 2.5 mV in = 2 V out) - EEG version only</td>
<td></td>
</tr>
<tr>
<td>Bandwidth</td>
<td>EEG: 0.1 – 100 Hz per channel, ECG: 0.1 – 200 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input</td>
<td>5 MΩ impedance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>30 – 45°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Tray Dimensions</td>
<td>Pup: 188 mm x 188 mm x 160 mm (7.4” x 7.4” x 6.3”)</td>
<td>Mouse: 345 mm x 210 mm x 21 mm (13.6” x 8.25” x 1”)</td>
<td>Rat: 429 mm x 216 mm x 21 mm (16.9” x 8.5” x 1”)</td>
</tr>
<tr>
<td>Receiver Tray Power</td>
<td>16 VDC, 500 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Animal Size</td>
<td>1 kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Output</td>
<td>4 V peak-to-peak</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Epoch System FAQs

1. Are EEG and ECG receiver trays interchangeable?
   No, receiver trays are not interchangeable (signal optimization requires hardware and firmware changes). EEG system receivers work with EEG sensors only, and ECG system receivers work with ECG sensors only.

2. Does the 2-channel EEG transmitter have the same battery life as the previous single channel system?
   Yes, the 2-channel system has a 2 or 6 month battery life, similar to what was previously available for the 1-channel system. (2 weeks for pup system.)

3. How many electrodes does the 2-channel transmitter use?
   The 2-channel device has three electrodes - one ground/reference electrode, and the two recording electrodes. The recording electrodes are measured with respect to the ground/reference electrode.

4. Is it possible to implant one or two electrodes in deep brain structures for recording LFPs? Can you explain the procedure for that case?
   Yes, we have several users that attach the implant to their stereotactic frame and insert the electrode(s) in the hippocampus, and then glue the implant in place. A surgery manual that demonstrates implanting the Epoch transmitter in deep brain structures is available. See the Support tab on the EPOCH EEG System page.

5. Is one receiver tray required per transmitter/subject?
   Yes. It is not possible to use one receiver tray with multiple animals in a single cage. The rat and mouse size implants and trays are also completely interoperable. For example, if a customer wants to buy a rat size tray for a large mouse setup, this is not a problem. Each tray provides an analog output between ±4 volts.
6. *Is the battery life determined from the time a transmitter is activated?*

   Yes, the battery life starts when the transmitter is activated. An EPOCH-ACTI activator unit is required because the transmitters are always shipped in an off state. An activated transmitter cannot be deactivated and reactivated at a later time. The transmitter must be activated within 6 months of shipment to ensure the full 2-month or 6-month active battery-life.

7. *Does each transmitter provide a maximum of two EEG, ECoG, or LFP signals?*

   Yes. It is possible to change the gain of the transmitter on a custom basis without degrading recording time. This gain setting can be chosen on the order form provided to customers.

8. *Are consultants available to provide surgical training to new Epoch customers when needed?*

   Yes, surgical training can be provided by staff that are well trained in the procedures by contacting BIOPAC.

9. *Is it possible to have adjacent cages or should there be a minimum distance between cages, in order to prevent crosstalk?*

   The receiver trays can be placed adjacent to each other without picking up any crosstalk.

10. *Is it possible to reuse the implants?*

    The implants are technically reusable, though not recommended. Typically, a user explants the transmitter, trims the leads, soaks the entire transmitter in acetone, rinses with H₂O, and lets it air dry.

11. *I have a special treatment chamber. Is it compatible with the Epoch system?*

    Yes, as long as the animal is positioned over a receiver within 1” it will detect the transmitter. However, we recommend using the Faraday enclosure at all times. Outer dimensions of the mouse Faraday enclosure are 14.25” x 12.5” x 12.5”. (L x W x H) and rat Faraday cage are 20.25” x 14.5” x 14.5”. For information about custom Faraday enclosures, contact BIOPAC.

12. *Will my data acquisition system work with the Epoch?*

    In general, yes. The output of the Epoch receiver is +/-4 V max. Most DAQs can handle this type of input, though BIOPAC recommends checking the manufacturer specifications first. BIOPAC can provide guidance as well. The Epoch receiver uses standard BNC-style connectors and an adapter may be necessary for certain DAQ systems.

13. *What type of amplifier do I need?*

    The Epoch system does not need an amplifier between the Epoch receiver and your data acquisition system.

14. *Is the Epoch system compatible with other wireless systems?*

    In general, no. However, if you have a wireless system that uses a separate data acquisition unit, it may be possible to use the Epoch system with that unit.

15. *I need to video my animals during the recordings. Is this possible?*

    Yes. Contact BIOPAC for information about setting up a Faraday enclosure for recording video at the desired angle.

16. *Can the Epoch system record ECG?*

    ECG recording functionality is now supported with the single-channel ECG System.
17. Where and how is the ECG transmitter implanted?
For transmitter implant surgical guides, see the Support tab on the EPOCH ECG System page. Manuals are available for adult rat, adult mouse and rat pup post-natal 18. See page 8 of the Epoch User Manual to view an ECG transmitter placement diagram.

18. Can the Epoch system be used with neonatal pups similar to the previous 1-channel system?
Receiver trays and transmitters for use with neonatal rodents as small as P6 pups are available by contacting BIOPAC.

19. Can the Epoch system be used with other devices, such as a drug infusion cannula?
Yes. The only constraint is that the transmitter must be exposed to work properly.