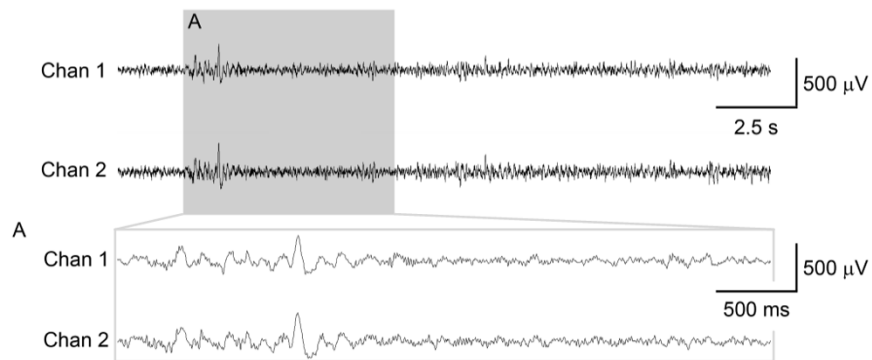
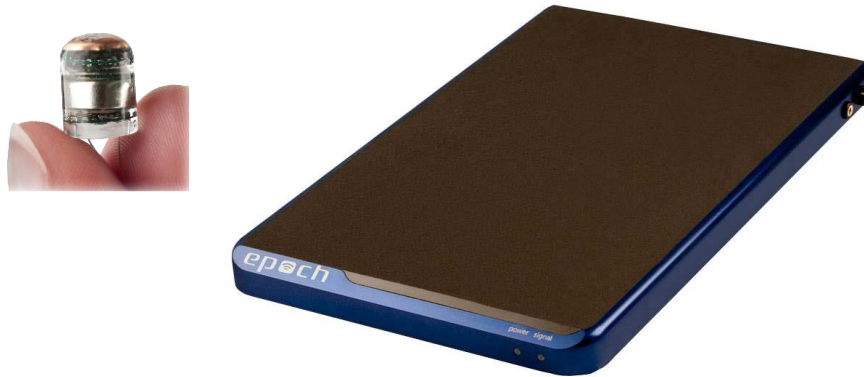


Epoch™ User Manual

Epoch™ Wireless EEG System
For Life Science Research Applications



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System Overview

How to Use This Manual

This manual provides an overview of the Epoch wireless dual-channel *in vivo* recording system for small animal research and how to set up the system in AcqKnowledge software. The specifications and diagrams that are provided in this manual are to assist users in understanding the capabilities of the Epoch system. This document is not intended as a service manual. Only authorized BIOPAC employees and representatives are qualified to repair any component of the system. All rights of the warranty for said component are voided if any other party modifies any component without the written consent of BIOPAC.

The Epoch Wireless System

The Epoch wireless system is comprised of three components that can be used for the acquisition of biopotential signals from naturally or freely-behaving, small animals:

- The wireless sensor, which is affixed to the head of the animal, Figure 1.
- The wireless receiver base, Figure 2.
- The Faraday shield used to reduce the amount of noise interference from the ambient environment if present, shown in Figure 15. (Page 14)



Figure 1. Epoch wireless sensor
(Dual-channel EEG sensor shown)



Figure 2. Epoch wireless receiver tray

Dual-Channel EEG Sensor Implant

The dual-channel EEG wireless sensor implant, Figure 1, contains a small amplifier, sensor, and a battery encapsulated in medical-grade epoxy. Each electrode is made of Platinum-Iridium (Pt90/Ir10) material insulated with Teflon, with a 0.127 mm diameter (0.005 in.). Two of these leads are for acquiring independent biopotentials with the third lead being the common reference electrode. Spacing for these leads are detailed on the following page. The sensor is shipped deactivated, and is available with a two-month battery life (2 mo) commonly used for mouse studies, or a six-month battery life (6 mo) commonly used for adult rat studies only. A sensor activator must be used to activate sensors on-site.

The output gain of the sensor is set at 2000x during production (± 1.0 mV range), but can be set to the following gains depending on your needs: 800x (Status-Epilepticus in adult animals) or 2000x (EEG, ECoG, LFP). A sensor activator and tester must be used to activate sensors on-site.

Dual-Channel Differential Sensor Implant

Epoch Differential Sensors resemble Dual-Channel EEG Sensor Implants but additionally enable wireless recording of two different biopotentials with their own reference. Record long-term EEG+EEG, EEG+ECG, EEG+EMG, or ECG+EMG. Sensors 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 sensors that use RF. Sensors ship deactivated—activate with EPOCH-ACTI when ready to start recording.

Technical details of the Dual-Channel EEG and Dual-Channel Differential sensors are as follows:

Channels:	2
Reference:	Dual-Channel EEG: Common Dual-Channel Differential: Differential
Electrodes:	Dual-Channel EEG: 3 Dual-Channel Differential: 4
Footprint:	8 mm x 9 mm (2 mo), 8 mm x 12 mm (6 mo)
Weight:	2.3 g (2 mo), 4.0 g (6 mo)
Volume:	0.76 cm ³ (2 mo), 1.35 cm ³ (6 mo)
System Gain Options:	800x -- (± 2.5 mV range, 2.5 mV in = 2 V out) 2000x -- (± 1.0 mV range, 1.0 mV in = 2 V out) 4000x -- (0.5 mV range, 500 μ V in = 2 V out)
Bandwidth:	0.1 – 100 Hz per channel
Input Referred Noise:	< 7.0 μ V rms

EEG Sensor Electrode Spacing

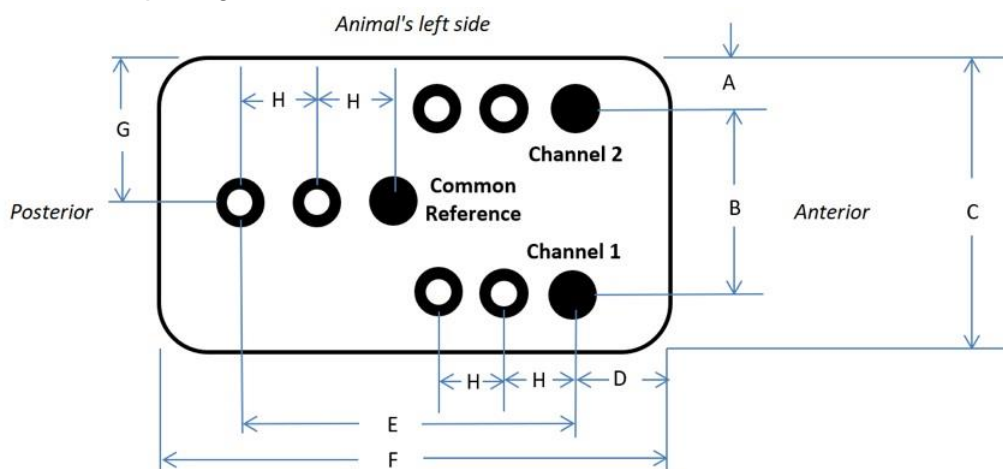


Figure 3. Dual-channel EEG sensor electrode spacing schematic looking **down** at animal's head. The electrodes go **through** the page.

Differential Sensor Electrode Spacing

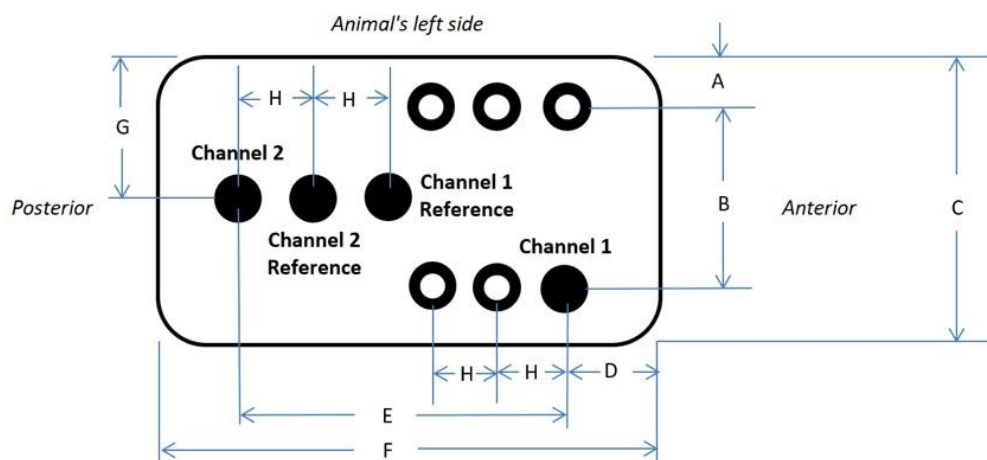


Figure 4. Dual-channel Differential sensor electrode spacing schematic looking **down** at animal's head. The electrodes go **through** the page.

Standard Dimensions (Common and Differential Sensors):

A – 1.8 mm (2 mo) or 2.2 mm (6 mo)

B – 5 mm

C – 8.5 mm (2 mo) or 9.3 mm (6 mo)

D – 2 mm (2 mo) or 3.5 mm (6 mo)

E – 6.5 mm

F – 9.5 mm (2 mo) or 12.4 mm (6 mo)

G – 4.3 mm (2 mo) or 4.7 mm (6 mo)

H – 1.5 mm

Note Custom sensor configurations may be ordered by contacting BIOPAC.

Reusable Sensor

The dual-channel reusable wireless sensor implant contains a small amplifier, sensor, and a battery encapsulated in medical-grade epoxy with the Plastics1 MS-335 connector system.

Two of these leads are used for acquiring independent biopotentials with the third, central lead, being the common reference electrode. No ground electrode is used in the Epoch system.

The Epoch reusable sensor must be used with corresponding Plastics1 MS-333, 3-channel electrode pedestals. We recommend MS333/3-A/SPC, however, any MS333-compatible pedestal will work with the Epoch reusable wireless sensor. Only the MS-333 electrode pedestal is implanted in the animal.

Note that it is very important to remove as much insulation from around the common electrode as possible.

The sensor is only available with a two-month battery life (2 mo) commonly used for adult mouse and rat studies. The output gain of the sensor is typically set at 2000x during production (± 1.0 mV range) for EEG or ECG signals, but can be set to the following gains depending on customer needs: 800x (Status-Epilepticus in adult animals, EMG), 400x (EMG). A Sensor Activator and Tester must be used to activate sensors on-site. The reusable sensor can be deactivated at any time using the Sensor Activator and Tester.



Figure 5. Epoch Reusable Sensor with MS-333/3A Electrode Pedestal



Figure 6. Epoch Reusable Sensor on Carrier Board

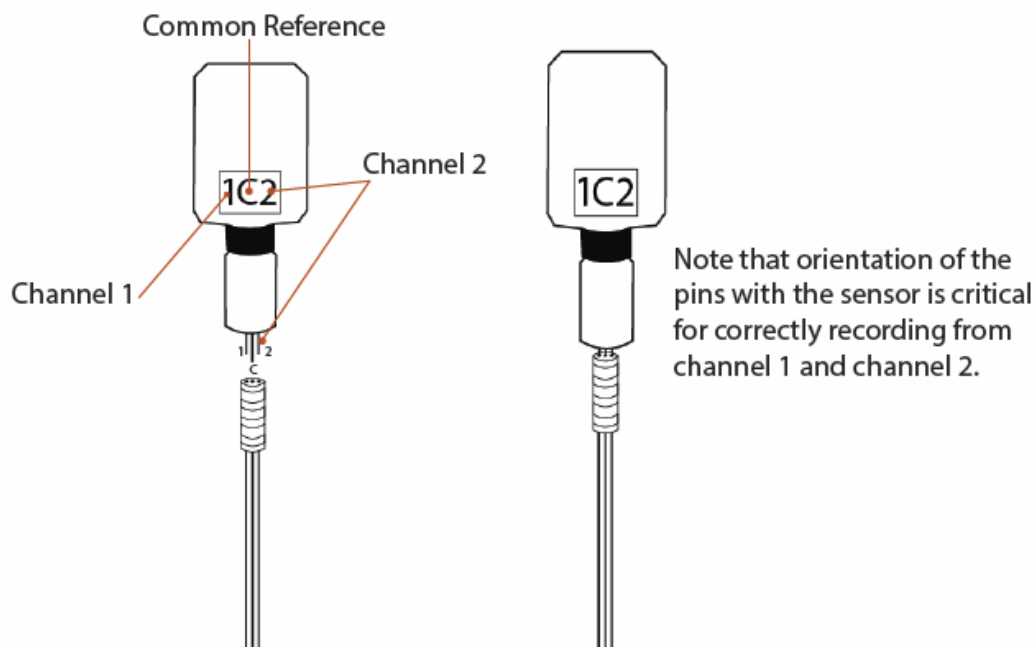


Figure 7. Epoch Reusable Sensor and Electrode Pedestal

Sensor channels are (left to right) channel 1, common, and channel 2 pins and shown with corresponding MS-333/3-A electrodes. Please note that trimming may be required to implant the pedestal.

Technical specifications of Epoch Reusable 2-month Sensor:

Channels:	2
Reference:	Common
Electrodes:	3 (pins, MS-335 connector)
	Dual-Channel Differential: 4
Weight:	2.53 g (sensor only)
Volume:	0.76 cm ³ (2 mo),
System Gain Options:	400x (±5.0 mV range, 5.0 mV in = 2 V out)
	800x -- (±2.5 mV range, 2.5 mV in = 2 V out)
	2000x -- (±1.0 mV range, 1.0 mV in = 2 V out)
	4000x – (0.5 mV range, 500 µV in = 2 V out)
Bandwidth:	0.1 – 100 Hz per channel
Input Referred Noise:	< 7.0 µV rms

Four Channel and Six Channel EEG Sensors

The four-channel and six-channel EEG wireless sensor implants contain a small amplifier, sensor, and a battery encapsulated in medical-grade epoxy.

Each electrode is made of Platinum-Iridium (Pt90/Ir10) material insulated with Teflon, with a 0.127 mm diameter (0.005 in). The leads (four or six) are used for acquiring independent biopotentials with an additional lead being the common reference electrode. No ground electrode is used in the Epoch system.

Spacing for these leads is detailed below. The four-channel sensor is available with a two-week battery (2 wk) commonly used for pup studies, two-month battery life (2 mo) commonly used for adult mouse and rat studies, or a six-month battery life (6 mo) commonly used for adult rat studies only.

The six-channel sensor is available with a two-month (2 mo) or six-month (6-mo) battery life.

The output gain of the sensor is set at 2000x during production (± 1.0 mV range), but can be set to the following gains depending on customer needs: 800x (Status-Epilepticus in adult animals), 2000x (EEG, ECoG, LFP), or 4000x (Pup EEG). A Sensor Activator and Tester must be used to activate sensors on-site.

Technical details of the Four-Channel and Six-Channel sensors are as follows:

Channels:	4 or 6
Reference:	Common
Electrodes:	5 or 7
Weight:	0.5 g (2-wk), 2.3 g (2 mo), 4.0 g (6 mo)
Volume:	0.76 cm ³ (2 mo), 1.35 cm ³ (6 mo)
System Gain Options:	800x -- (± 2.5 mV range, 2.5 mV in = 2 V out) 2000x -- (± 1.0 mV range, 1.0 mV in = 2 V out) 4000x (four-channel only) – (0.5 mV range, 500 μ V in = 2 V out)
Bandwidth:	0.1 – 60 Hz per channel
Input Referred Noise:	< 7.0 μ V rms

Four-Channel 2-Week Electrode Spacing

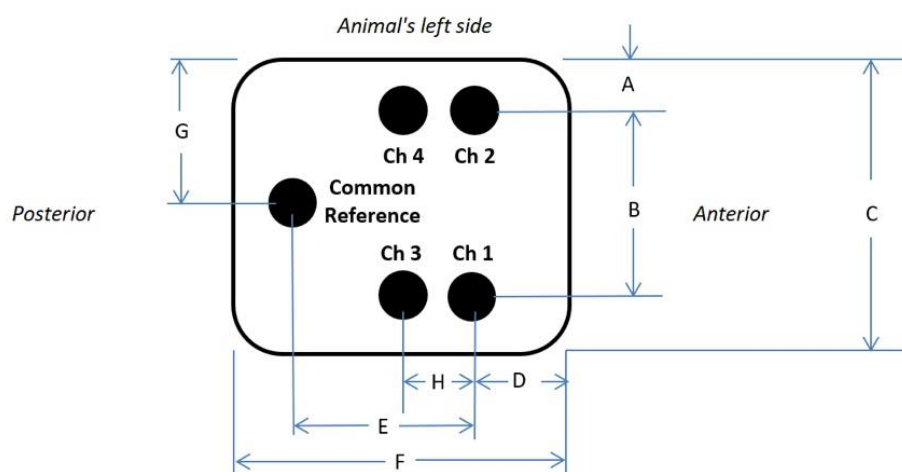


Figure 8. Four-Channel 2-Week sensor electrode spacing schematic looking **down** at animal's head. The electrodes go **through** the page.

Standard Dimensions (Four-Channel 2-Week sensor only):

- A – 1 mm
- B – 2 mm
- C – 4 mm
- D – 1.8 mm
- E – 2.5 mm
- F – 6 mm
- G – 2 mm
- H – 1.5 mm

Four-Channel 2-Month and 6-Month Electrode Spacing

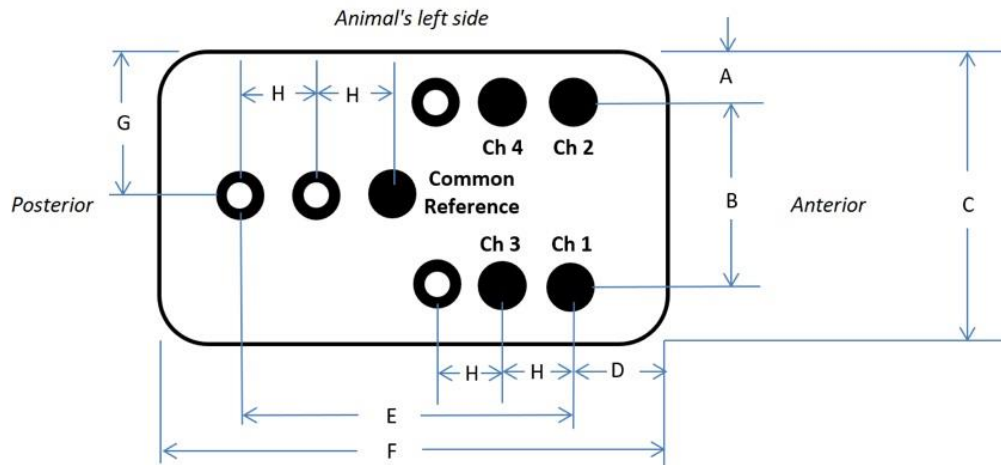


Figure 9. Four-Channel 2-Month or 6-Month sensor electrode spacing schematic looking **down** at animal's head. The electrodes go **through** the page.

Six-Channel 2-Month and 6-Month Electrode Spacing

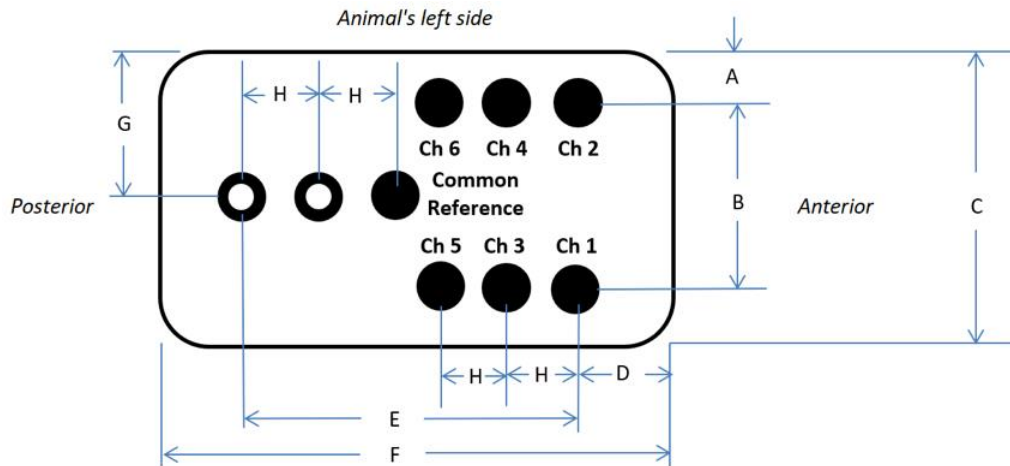


Figure 10. Six-Channel 2-Month or 6-Month sensor electrode spacing schematic looking **down** at animal's head. The electrodes go **through** the page.

Standard Dimensions (Four-Channel and Six-Channel 2-Month and Six-Month sensors):

A – 1.8 mm (2 mo) or 2.2 mm (6 mo)

B – 5 mm

C – 8.5 mm (2 mo) or 9.3 mm (6 mo)

D – 2 mm (2 mo) or 3.5 mm (6 mo)

E – 6.5 mm

F – 9.5 mm (2 mo) or 12.4 mm (6 mo)

G – 4.3 mm (2 mo) or 4.7 mm (6 mo)

H – 1.5 mm

Single-Channel ECG Sensor Implant

The single-channel ECG wireless sensor implant contains a small amplifier, sensor and a battery encapsulated in medical-grade epoxy. Each electrode is 7-strand braided stainless steel with Teflon insulation. Each strand is 50 μm in diameter. Making the bare electrode 152 μm in diameter (229 μm diameter insulated). There are two electrode leads on the ECG sensor, and the routing of these leads in the animal is shown in Figure 11. Spacing for these leads on the sensor is detailed below. The sensor is shipped deactivated, and is available with a two-month battery life (2 mo) commonly used for mouse studies, or a six-month battery life (6 mo) commonly used for rat studies. The output gain of the sensor is set at 2000x during production (± 1.0 mV range). A sensor activator must be used to activate sensors on-site. The technical details of the sensors are as follows:

Footprint:	8 mm x 9 mm (2 mo), 8 mm x 12 mm (6 mo)
Weight:	2.3 g (2 mo), 4.0 g (6 mo)
Volume:	0.76 cm ³ (2 mo), 1.35 cm ³ (6 mo)
System Gain Options:	2000x -- (± 1.0 mV range, 1.0 mV in = 2 V out)
Bandwidth:	0.1 – 200 Hz per channel
Input Referred Noise:	< 8.0 μV rms at 100 Hz (11 μV rms at 200 Hz)

ECG Sensor Electrode Spacing

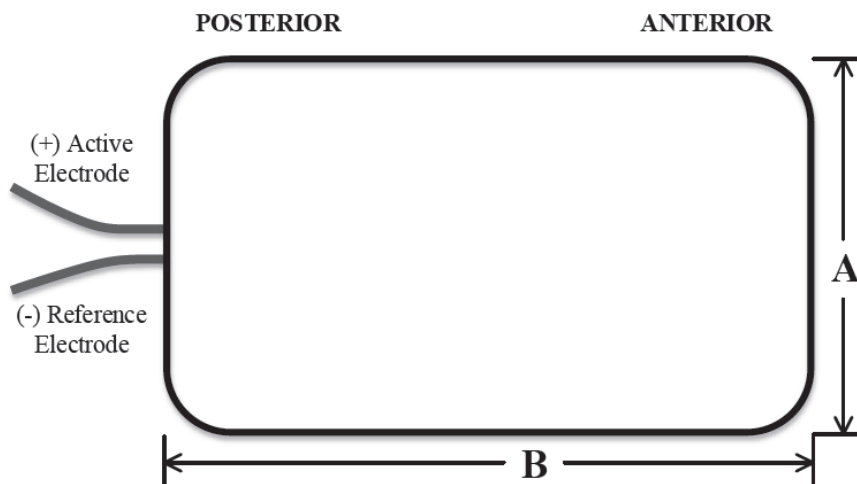


Figure 11. Single-channel ECG sensor electrode spacing schematic looking **down** at animal's head. The electrodes exit the bottom of the sensor towards the animal's neck and back.

Sensor Activator and Tester

Standard sensors are shipped deactivated for both EEG and ECG systems. BIOPAC offers a Sensor Activator and Tester device, shown in Figure 12 on right. This device is required in order to activate sensors prior to use, and to test an entire Epoch system before sensor implantation, through the receiver tray and a newly activated sensor.

To activate a sensor:

1. Flip the “Transmitter” switch at the bottom of the Sensor/Activator/Tester to the “ON” position.
2. Insert the sensor PCB so that the sensor sits above the Epoch symbol, as shown in Figure 13 on lower right.
3. Press the “POWER” button until the power light in the top left corner turns green. **NOTE:** Power signal will automatically time out at 2.5 minutes. If this occurs, repeat Step 3 to activate or test signal of sensor.
4. Press the “ACTIVATE” button until the check mark in the top right corner turns green.

At this point the sensor will be active.

Note The sensor must be activated within 6 months of shipment to ensure the full 2-month or 6-month active battery-life.

The Activator was updated in April 2017 to include an ON/OFF switch for reusable sensors. If you purchased the ORIGINAL and want to use Reusable Sensors, contact BIOPAC .



Figure 12. Dual channel sensor activator and tester

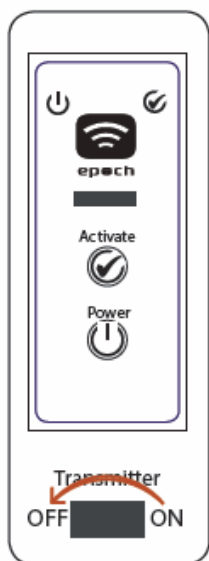


Figure 13. Activation of dual channel sensor shipped in off state

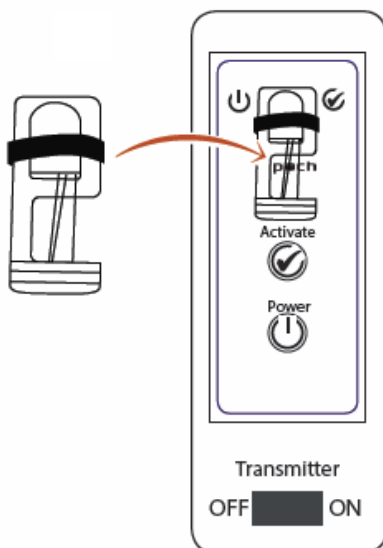


Figure 14. Proper placement of Sensor in Activator/Tester shown on left

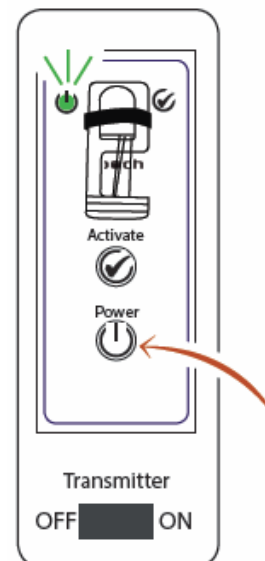
Deactivating a Sensor



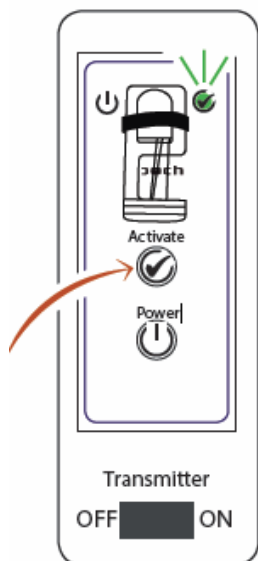
1. Flip the “Transmitter switch” at the bottom of the Sensor Activator to the “OFF” position.



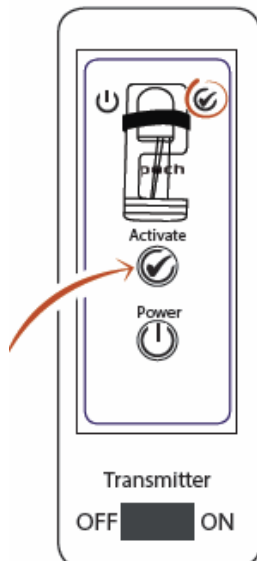
2. Insert the sensor circuit board so that the sensor sits above the Epoch symbol.



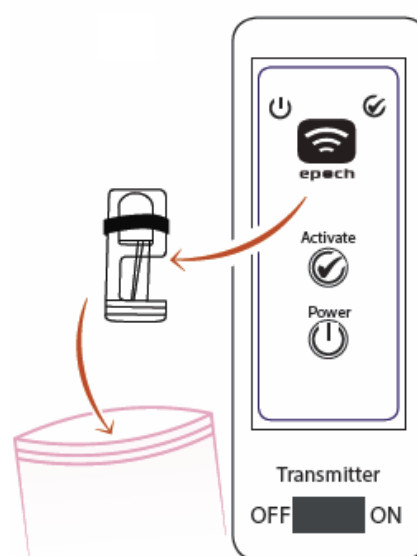
3. Press the POWER button until the power light in the top left corner turns green



4. Make certain the check mark in the upper right hand corner is illuminated green. If it is *not* illuminated and the power is on (Step 3) and the sensor is properly placed (Step 2), *the sensor is already turned off.*



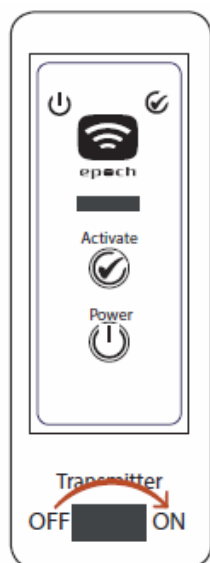
5. Press the ACTIVATE button until the check mark in the top right corner is no longer glowing green.



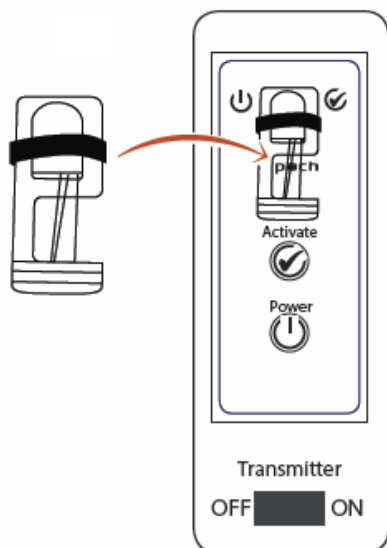
6. Remove the sensor from the Sensor Activator and Tester and place it back in its pink anti-static bag.

To Test a Sensor

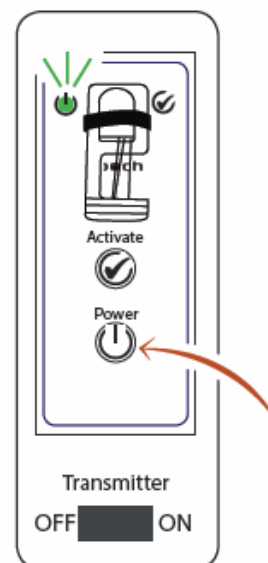
For sensor testing purposes, the Sensor Activator and Tester device delivers a 54-Hz, ± 0.5 -mV signal via channel 1 of the sensor, and a 27-Hz, ± 0.5 -mV signal via channel 2 (or channels 2-6, depending on the number of channels for a particular sensor). This test signal will last for 2.5 minutes every time the Sensor Activator and Tester power is turned on.



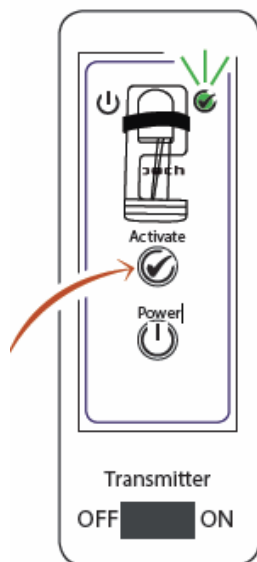
1. Flip the “Transmitter switch at the bottom of the Sensor Activator to the “ON” position.



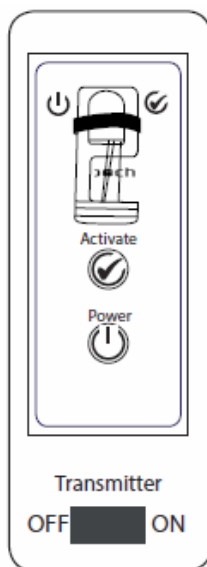
2. Insert the sensor circuit board so that the sensor sits above the Epoch symbol.



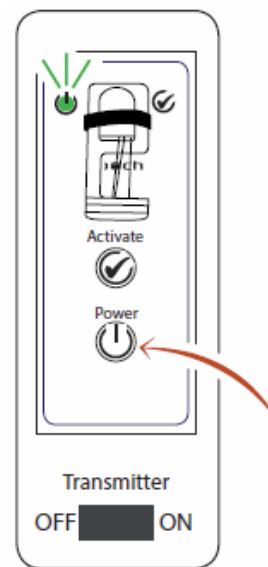
3. Press the POWER button until the power light in the top left corner turns green.



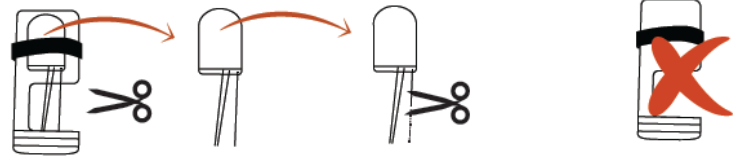
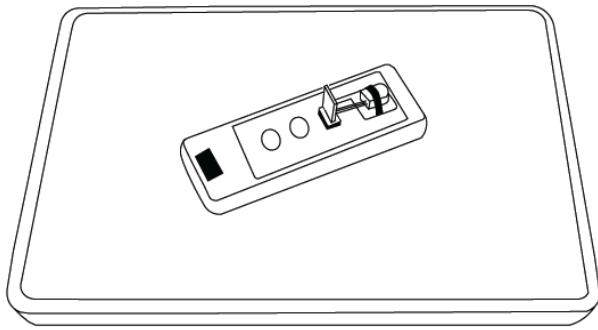
4. Press the ACTIVATE button until the check mark in the top right corner turns green.



5. Set the sensor still docked in the Sensor Activator/Tester aside for three (3) minutes to allow the electronics in the sensor to equilibrate.



6. Press the POWER button until the power light in the top left corner turns green.



7. Place the activated sensor docked in the Sensor Activator/Tester on top of the Epoch Receiver inside the Faraday Cage.

8. After system testing and before implantation, carefully snip the electrode wires free from the circuit board to a desired electrode length. The sensor circuit board can then be discarded.

9. Place the activated sensor docked in the Sensor Activator and Tester on top of the Epoch receiver **inside the Faraday cage**

Turn on your data acquisition system. You should see one sine wave at 54-Hz, ± 0.5 -mV signal via Channel 1 of the sensor and a second sine wave at 27-Hz, ± 0.5 -mV signal via Channel 2 (or channels 2-6, depending on the number of channels for a particular sensor).

Note: this test signal will last for 2.5 minutes every time the Sensor Activator and Tester power is turned on.

Note: The sensor must be activated within 6 months of shipment (2 wk) or 12 months of shipment (2 mo & 6 mo) to ensure the full 2-week, 2-month, or 6-month active battery-life, respectively.

Receiver Tray

The wireless receiver tray, as shown in Figure 2 and Figure 15, contains a large internal receiver antenna and electronics for reproducing the acquired biopotential signals. The receiver tray is similar for both the EEG and ECG system, and is available in two sizes for use with most standard mouse housings and most standard rat housings, as shown in Figure 15 below. Contact BIOPAC if you require custom receiver tray dimensions.

- Pup Receiver Dimensions: 185 mm x 178 mm x 127 mm (7.3" x 7.0" x 5.5")
- Mouse Receiver Dimensions: 345 mm x 210 mm x 21 mm (13.6" x 8.25" x 1.0")
- Rat Receiver Dimensions: 429 mm x 216 mm x 21 mm (16.9" x 8.5" x 1.0")



Figure 15. Mouse and rat Epoch receiver trays. Inset shows common mouse housing on receiver tray.

There are two small LED indicators on the front of the receiver tray, one for power status and one for signal transmission status. The power indicator will illuminate green when the power plug is connected to the receiver. The signal transmission indicator will illuminate green when an activated sensor is within range of the receiver. On the back of the receiver tray are the power plug connector and two BNC connectors, one for each channel of acquired analog data, as shown in Figure 16 below. The maximum output of each Channel is ± 4 V and can be acquired by standard ± 5 V analog data acquisition systems.



Figure 16. Back of receiver tray showing power plug and BNC output terminals

The receiver tray has two accessory connectors and a power connector located on the side as shown in Figure 17 below.

- **Antenna Extension:** The 3.5 mm audio-type port is an antenna extension used to connect the receiver to a metal feeding trough via an alligator clip. This connection is helpful to prevent the wireless signal from being grounded when an animal climbs onto the metal feeding trough.
- **Faraday Shield Connection:** The banana-plug port (GND) is used to connect the included Faraday shield accessory to ground via an alligator clip. The Faraday shield is recommended in any environment that may contain electrical noise interference. A Faraday shield around a mouse housing is shown in Figure 18 below. The Faraday shield must be assembled, and detailed instructions are provided in Appendix B. The Faraday shield is available in three sizes that can encompass standard pup, mouse, or rat housings. Custom Faraday shields may be created by contacting BIOPAC.
- **Power Connection:** Power is supplied to the Epoch receiver using the power adapter included with the Epoch system. Epoch requires 9 VDC, 8 W through a 3.5 mm jack.

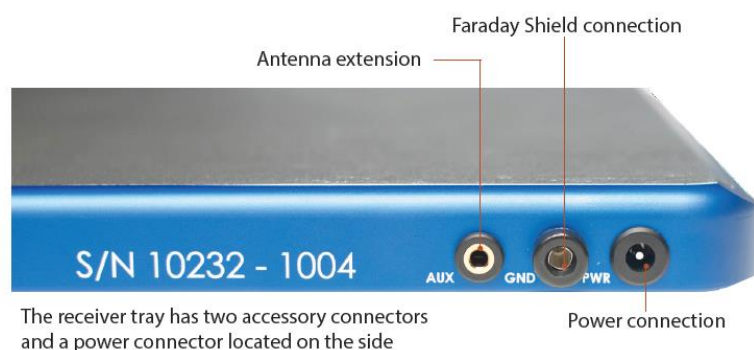


Figure 17. Antenna extension, Faraday shield, Power connection



Figure 18. Epoch mouse wireless system with Faraday shield

- Pup housing shield: 203 mm x 254 mm x 254 mm (8.0" x 10.0" x 10.0")
- Mouse housing shield: 356 mm x 305 mm x 305 mm (14.25" x 12.5" x 12.5")
- Rat housing shield: 508 mm x 365 mm x 365 mm (20.25" x 14.5" x 14.5")

Experimental Setup Requirements

There are a few requirements necessary to ensure reliable transmission between the animal's sensor and the receiver tray:

- **Signal Range.** The sensor needs to remain vertically within 6 in. of the receiver board. If an animal were to climb out of this range, the signal reliability may be compromised. Note that connecting the metal feeding trough to the receiver base eliminates this issue for most animal housing systems.
- **Electrical Noise Interference.** In the event that the room contains high environmental noise (e.g., RF interference, power strips, fluorescent lights, other 50/60 Hz noise sources, etc.), it is recommended to use the supplied Faraday shield around the receiver tray and animal housing shown in Figure 18. If the signal transmission indicator is illuminated when no sensor is present, the environmental noise is too strong and the shielded housing is necessary.
- **Housing Compatibility.** Each receiver tray can accommodate a number of different animal housing systems such as commercially-available rodent housing. The limitations on the housing size are that 1) the housing must fit within the shielding (see shielding specifications for sizing on previous page) and 2) the animal must have at least one foot within the footprint of the Epoch receiver at all times. BIOPAC recommends using the smallest housing that is suitable for the species according to your institutional guidelines. It is also recommended that the housing be centered on the receiver.

Surgical Implantation of the Sensor

Surgical manuals can be provided by contacting BIOPAC. Manuals are available for the following animal implants:

- Adult mouse
- Adult rat
- Rat pup - post-natal day 18.

For ECG sensors, the surgical procedures are similar to EEG except for placement of the electrodes, which should be done following the diagram below.

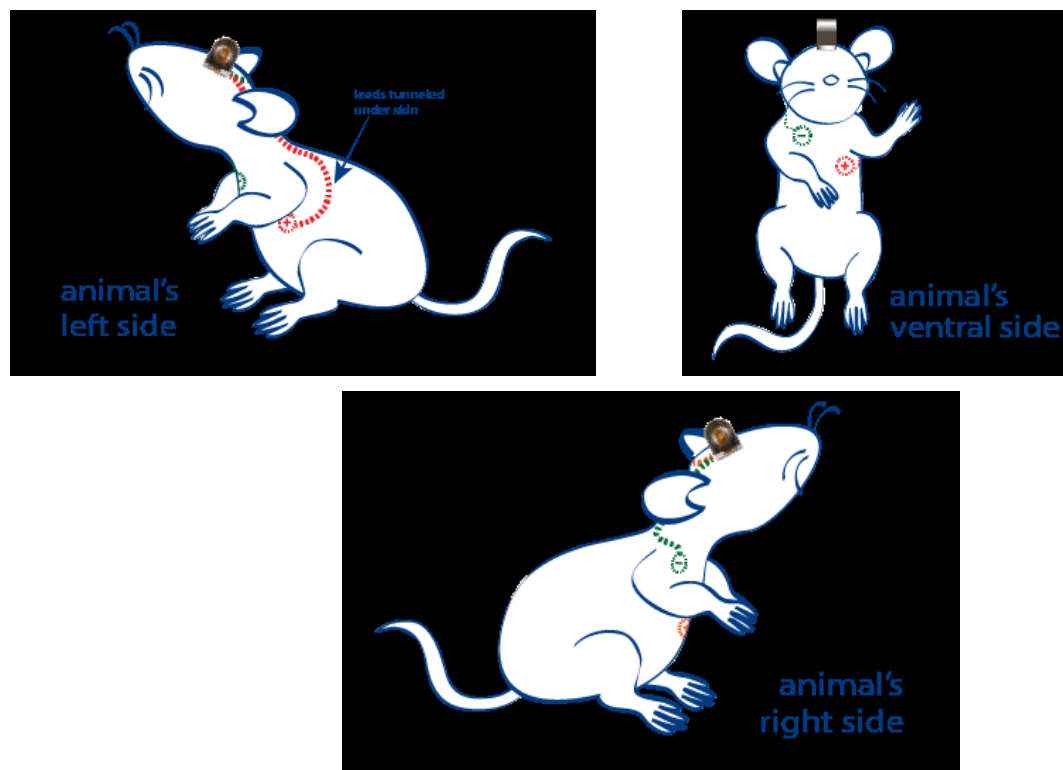


Figure 19: Wiring diagram for single-channel ECG sensor

Experimental Setup Requirements

There are a few requirements necessary to ensure reliable transmission between the animal's sensor and the receiver tray:

SIGNAL RANGE: The sensor needs to remain vertically within 6 inches of the receiver tray. If an animal were to climb out of this range, the signal reliability may be compromised. Note that connecting the metal feeding trough to the receiver tray through the 3.5 mm stereo jack "Antenna extension" eliminates this issue for most animal housing systems.

ELECTRICAL NOISE INTERFERENCE: In the event that the room contains high environmental noise (e.g., RF interference, power strips, fluorescent lights, other 50/60 Hz noise sources, etc.) it is recommended to use the supplied Faraday Shield around the receiver tray and animal housing. If the signal transmission indicator is illuminated when no sensor is present, the environmental noise is too strong and the shielded housing is necessary.

HOUSING COMPATIBILITY: Each receiver tray can accommodate a number of different animal housing systems, such as commercially-available rodent housing. The limitations on the housing size are that 1) the housing must fit within the Faraday Shield (see shielding specifications for sizing on page 15) and 2) the animal must have at least one foot within the footprint of the Epoch receiver tray at all times. BIOPAC recommends using the smallest housing that is suitable for the species according to your institutional guidelines. It is also recommended that the housing be centered on the receiver.

Setting Up the Epoch System with the BIOPAC Hardware

1. Connect the receiver tray antenna extension (3.5 mm cable) and Faraday shield ground (banana plug) as shown on page 15.
2. Connect the BIOPAC Modules. (AMI100D/HLT100C for MP160 or UIM100C for MP150)

MP160 Hardware:

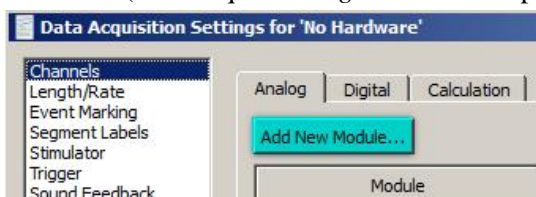
- Snap the AMI100D/HLT100C Module onto the right side of the MP160.
- Connect the two CBL102 BNC interface cables from the Epoch receiver tray's BNC output terminals to two CBL122 adapters.
- Connect the RJ11 end of the CBL122 adapter to the appropriate channel inputs on the HLT100C Module.

MP150 Hardware:

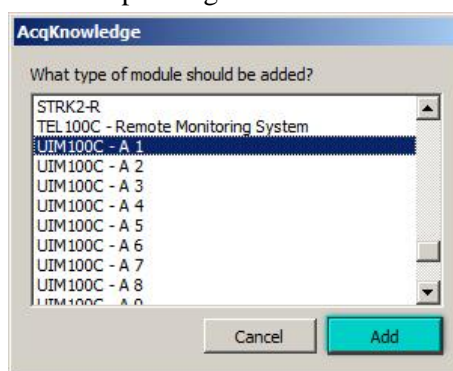
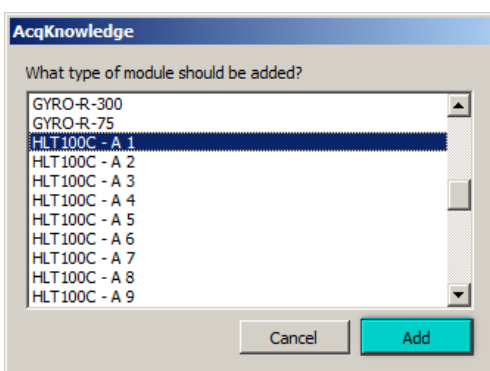
- Snap the UIM100C Module onto the right side of the MP150.
- Connect the two CBL102 BNC interface cables from the Epoch receiver tray's BNC output terminals to the appropriate channel inputs on the UIM100C Module.

Epoch Module Setup in AcqKnowledge Software

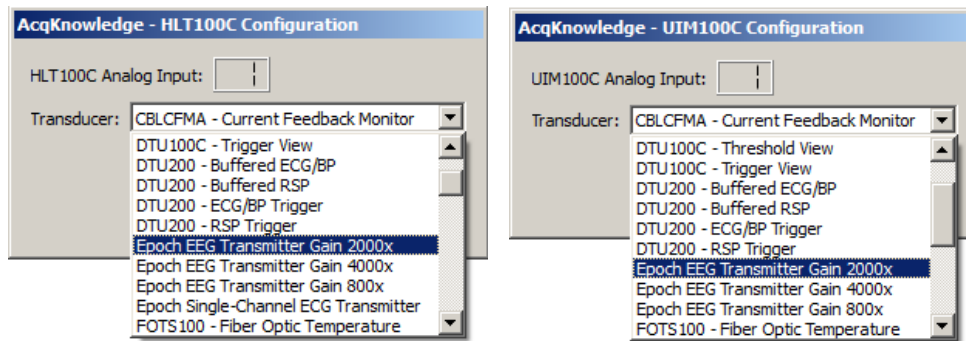
1. In AcqKnowledge, select "MP160/150 > Set Up Data Acquisition > Channels" and choose "Add New Module." (The AcqKnowledge Module setup is also presented by default at application launch.)



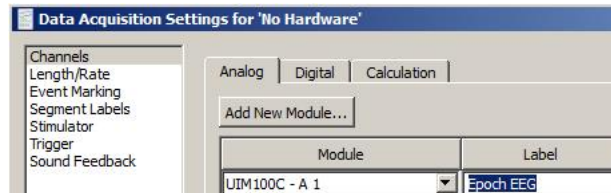
2. Select the BIOPAC Module (AMI100D/HLT100C for MP160 or UIM100C for MP150) as follows:
 - **MP160:** Select the AMI100D/HLT100C module corresponding to the desired channel and click "Add."
 - **MP150:** Select the UIM100C module corresponding to the desired channel and click "Add."



3. From the "Transducer" menu, select the desired Epoch sensor as follows:
 - **MP160:** Select the Epoch Sensor (and desired gain) from the AMI100D/HLT100C Configuration list and click "OK." (Lower left figure)
 - **MP150:** Select the Epoch Sensor (and desired gain) from the UIM100C Configuration list and click "OK." (Lower right figure)

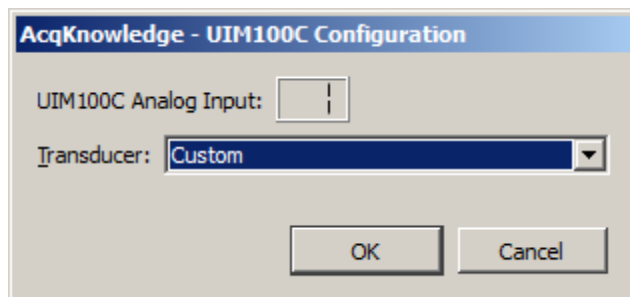


4. Enter a channel label for the new configuration and click “Close.”

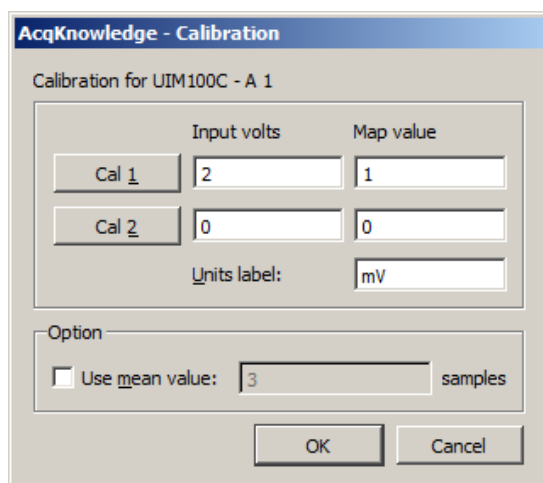


NOTE: In AcqKnowledge versions 4.4.2 and earlier, the Epoch Single-Channel ECG Sensor option is not supported in Module Setup. However, these settings can be configured manually via the following steps:

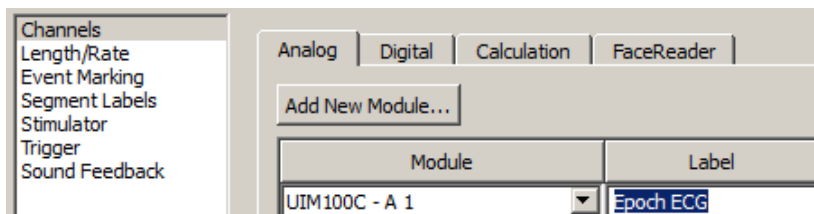
1. Select the UIM100C Module as shown in steps 1 and 2 on the previous page. Be sure to select an unoccupied channel number for the module (i.e., A2, A3, A4, etc.)
2. Choose “Custom” from the configuration list and click OK. This opens a Calibration scaling dialog.



3. In the Calibration scaling dialog, change the default Cal1 and Cal values to those shown in the figure below (Also, change the default “Units label:” from Volts to mV.) Click OK.



4. Enter “Epoch ECG” as the channel label and click “Close.”



For more details on AcqKnowledge software, including the EEG Specialized Analysis routines see the [AcqKnowledge Software Guide](#).

Appendix A: Troubleshooting Guide

This appendix provides helpful hints and solutions for troubleshooting the Epoch wireless system. This appendix addresses issues that may not be consistent across all customers. Consistent, replicable problems will be addressed by BIOPAC engineers. This appendix will be updated with problems found by customers and solutions determined by BIOPAC. All solutions have been tested as much as possible by BIOPAC.

Table 1. Epoch wireless system troubleshooting solutions:

Error	Solution
The signal status indicator is illuminated even when there is no sensor in range.	This occurs when there is too much electrical interference in the environment. BIOPAC recommends the use of the provided Faraday shield that can be grounded to the Epoch receiver GND port. It can also be helpful to use the Epoch system on racks that can be grounded.
Signal appears to be extremely noisy and/or floating.	This can occur if the ground electrode on the sensor is not making a low-impedance connection with the surrounding tissue, or if the electrode becomes encased in glue during implantation fixation. The solution is to recheck the electrode placement and possibly the electrode tip as well.
The signal looks noisy directly after implantation.	The surgical implant procedure often results in acute trauma that can cause degradation of the signal. BIOPAC recommends waiting 24 hours post-implantation before recording signals.

Appendix B: Faraday Shield Assembly

The Epoch wireless telemetry system includes a Faraday shield that can reduce the amount of noise interference from the ambient environment. This Faraday shield is designed to be placed around the receiver tray and the animal housing. The Faraday shield must be assembled by the end user because it is shipped with the Epoch system in a compact unassembled form to reduce the size of the shipment. The assembled Faraday shield will look similar to those shown in Figure 20 below.



Figure 20. Assembled Faraday shield (Rat size on left / Mouse size on right)

List of Components

The Faraday shield kit, as shown in Figure 21 below, contains the following components:

Item:	Quantity:	Description:
1	20	M4 x 8 mm oval-head screws
2	5	8" long tapped-hole L-brackets
3	3	Long panels – 2 side, 1 top - 14" x 12" for mouse, 20" x 14" for rat (L x W)
4	1	Back panel – 10" x 12" for mouse, 14" x 12" for rat (L x W)

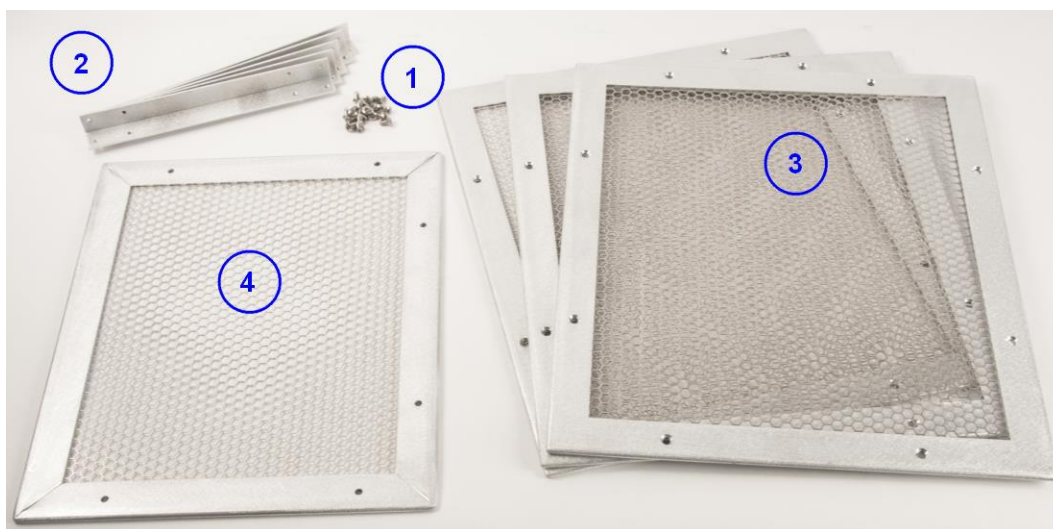


Figure 21. Unassembled Faraday shield components

Step 1

Take one of the long panels and attach two L-brackets to the long sides as shown in Figure 22 below, using the outer tapped hole on one end of the L-bracket and the inner tapped hole on the other end of the L-bracket. Note: either set of holes on the L-bracket may be used.



Figure 22. Step 1 – Top assembled using one long panel and two L-brackets

Step 2

Using the two remaining long panels, attach one panel to each of the open faces of the L-brackets placed in Step 1 above. At the completion of Step 2, the Faraday shield should look like Figure 23 below.



Figure 23. Step 2 – Top and sides assembled

Step 3

Attach the three remaining L-brackets to the smaller back panel as shown in Figure 24 below. For the top L-bracket, use one outer tapped hole and one inner tapped hole, similar to Step 1. For the two side L-brackets, be sure to use the outer tapped hole on the side of the L-bracket closest to the top L-bracket, as shown in Figure 24.

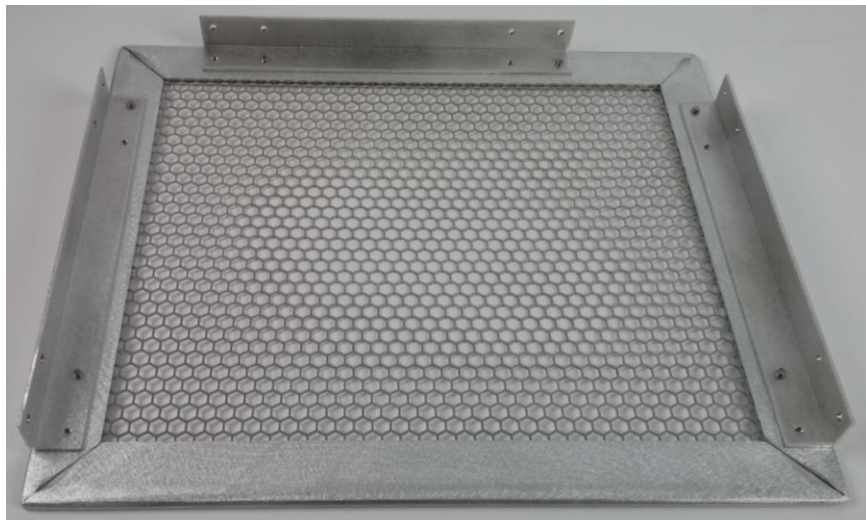


Figure 24. Step 3 - Back panel with attached L-brackets

Step 4

Complete the Faraday shield assembly by attaching the back panel to either end of the three long panels. When complete, the Faraday shield should look like Figure 25 below. Connect the assembled Faraday shield to the receiver tray using the banana plug to alligator clip cable included with the Epoch system.



Figure 25. Completed Faraday shield assembly

Intended Use

BIOPAC Systems, Inc., instruments, components, and accessories are designed for educational- and research-oriented life science applications and investigations. BIOPAC Systems, Inc. does not condone the use of its instruments for clinical medical applications. Instruments, components, and accessories provided by BIOPAC Systems, Inc., are not intended for the diagnosis, cure, mitigation, treatment, or prevention of disease.

Warranty

BIOPAC Systems, Inc. warrants to the original end purchaser that

- the Epoch™ hardware shall be free from material defects in material and workmanship for a period of one (1) year from the original date of purchase (the "Hardware Warranty Period")
- the software shall be free from material defects or errors for a period of one (1) year from the original date of purchase (the "Software warranty period").

If the product is determined to be materially defective during the Warranty Period, your sole remedy and BIOPAC's sole and exclusive liability shall be limited to the repair or replacement of this product with a new or refurbished product at BIOPAC's or its licensed distributor's option. For purpose of this Limited Hardware Warranty and Liability, "refurbished" means a product that has been returned to its original specifications. Visit WWW.BIOPAC.COM for instructions on how to deliver the product to an authorized service facility.

This warranty shall not apply if this product

- a) is used with products that are not compatible with this product
- b) is modified, or tampered with
- c) is damaged by acts of God, misuse, abuse, negligence, accident, wear and tear, unreasonable use, or by other causes unrelated to defective materials or workmanship
- d) has had the serial number altered, defaced or removed
- e) has, in the reasonable opinion of BIOPAC or its licensed distributors, been opened, altered, or defaced.

This warranty shall also be voidable by BIOPAC or its licensed distributors

If (1) BIOPAC reasonably believes that the Epoch™ system has been used in a manner that would violate the terms and conditions of a separate end user license agreement for system software; or (2) the product is used with products not sold or licensed by BIOPAC. You assume all risks and liabilities associated with use of third-party products.

This warranty is provided to you in lieu of all other express or implied warranties including warranties of merchantability and fitness for a particular purpose for the Epoch™ system, which are disclaimed hereunder. However, if such warranties are required as a matter of law, then they are limited in duration to the warranty period.

Our sole and exclusive recourse in the event of any dissatisfaction with or damage arising from the use of the Epoch™ system and BIOPAC's maximum liability shall be limited to repair or replacement of the Epoch™ system. Except as expressly stated above, BIOPAC excludes all liability for any loss of data, loss of profit, or any other loss or damage suffered by you or any third party, whether such damages are direct, indirect, consequential, special, or incidental and however arising under any theory of law, as a result of using your Epoch™ system. Some countries, states or provinces do not allow limitation on how long an implied warranty lasts and some countries, states and provinces do not allow the exclusion or limitations of consequential or incidental damages, so the limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from country to country, state to state or province to province. This warranty is in all countries where BIOPAC has an office or a licensed distributor. The warranty offered by BIOPAC Systems, Inc. on your Epoch™ hardware is the same whether or not you register your product.

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