Advancements in Rodent Surgical Monitoring: Q&A Session Submissions

Pulse Oximetry

Can you talk a bit quickly about your pulse oximetry module, and how it integrates with the rest of the system?

The Pulse Oximeter clip connects into the Pulse Oximeter Module via a standardized cable to allow easy switching between a number of clips. The Pulse Oximeter Module itself plugs into the heated surgical platform's embedded USB ports on the underside of the chassis. The Display Unit can display a Plethysmogram waveform and SpO2% numeric values alongside the other parameters you have selected in Settings.

Pulse Oximeter Module with Clip & USB connection

What is the best place / method to position the SpO2 probe on mice?

There are two clips available for mice: one for the foot and one for the thigh—

If using the foot clip, attention to the temperature of the mouse is especially important, as any hypothermia-related vasoconstriction will decrease perfusion in the distal portions of the extremities first.

If using the thigh clip, it is necessary to remove the hair from the thigh from BOTH sides to reduce diffraction and absorption of the light by the fur.

In both cases, the right leg is the suggested leg to use, as it is the ECG reference leg and not directly involved in measurement of Leads I, II, or III.

Does the placement of the pulse oximeter interfere with surgical interventions in the abdominal region?

Since the clips are designed to be connected to either the thigh or the foot of the subjects, their placement should not interfere with abdominal surgeries.

Multi-Pad

Is it possible to connect more than one pad?

You can connect multiple MouseMonitor™ S units to a large data acquisition system using the Analog Output Module. This is your best option to easily collect and consolidate data from numerous surgeries at once and increase both your surgical consistency and your throughput.

The Display Unit serves as a Control Unit for the Heated Surgical Platform; therefore, both need to connect to each other in a 1:1 ratio to work properly. Because of the length of the cable that connects the two and the compact nature of the system, it is very easy to position numerous Display Units in an arrangement that is convenient for you.

Output

Is the data output compatible with any operating system (e.g. Windows)?

The MouseMonitor™ S setup includes a Java applet for conversion of recordings into .csv or .txt formats, which will work with any program utilizing those formats, such as LabChart (ADI), LabScribe (iWorx) and iox (Emka). Further, CSV files can be opened with other analysis software such as Excel and Matlab.

Is there any data analysis software associated with the package, or is it compatible with something?

Currently, there is no data analysis software included; however, converting the recordings to .csv or .txt files with the included Java applet affords the data you've recorded a high level of compatibility with a variety of data analysis systems, including LabChart (ADI), LabScribe (iWorx) and iox (Emka). Further, CSV files can be opened with other analysis software such as Excel and Matlab.

Can you adapt the MouseMonitor™ S for use with Scisense PV loop system to capture ECG along with your PV traces?

Yes, using the Analog Output Module, you can directly feed ECG waveforms into the data acquisition system handling the Scisense PV loop system. This allows access to simultaneous ECG and PV traces and a more in-depth understanding of cardiac behavior.

Regulations

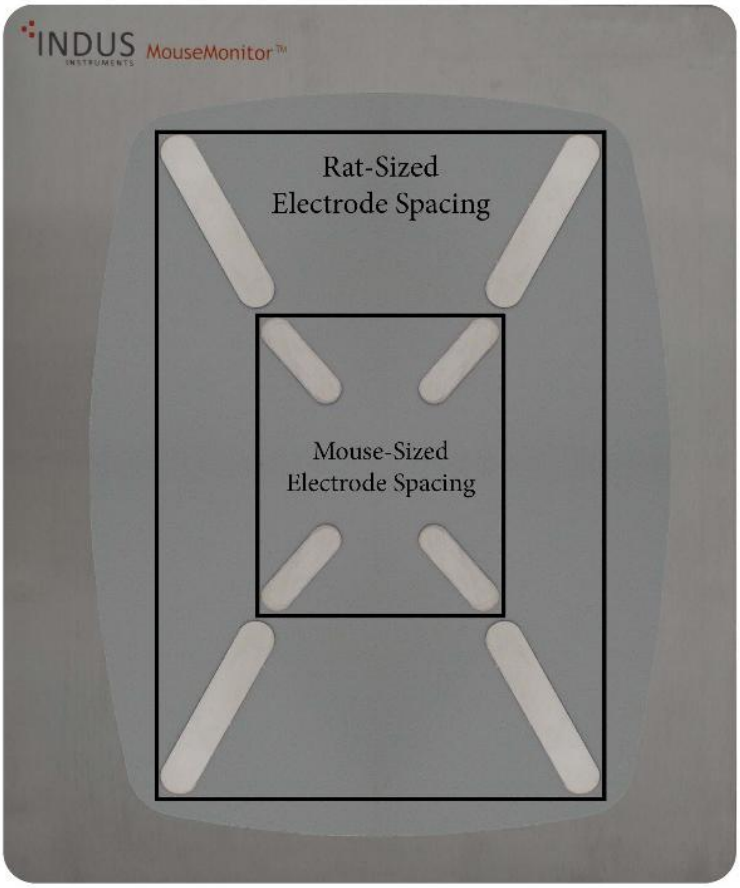
Can this system be used in pre-clinical GLP studies? Some considerations for GLP studies are if the data or acquisition files can be manipulated after it is acquired, if the software is validated, and if there an available audit trail.

Data files stored in our proprietary file version are not able to be manipulated; however, once the files are converted into .csv or .txt formats, they are open for manipulation. For pre-clinical GLP studies, having an Analog Output Module feed the data directly into a validated data acquisition system would be the best option. This would allow you to collect high-resolution waveforms from up to eight channels per MouseMonitor™ S simultaneously.

Other Models

I do not work with mice. Will this system work on other rodents?

Yes! We have heard from researchers who use the MouseMonitor™ S on rats, naked mole rats, bats, and more. Having two sets of electrodes with different spacing allows users flexibility in their desired models.



Heated Surgical Platform Top View

Is the system suitable for guinea pigs?

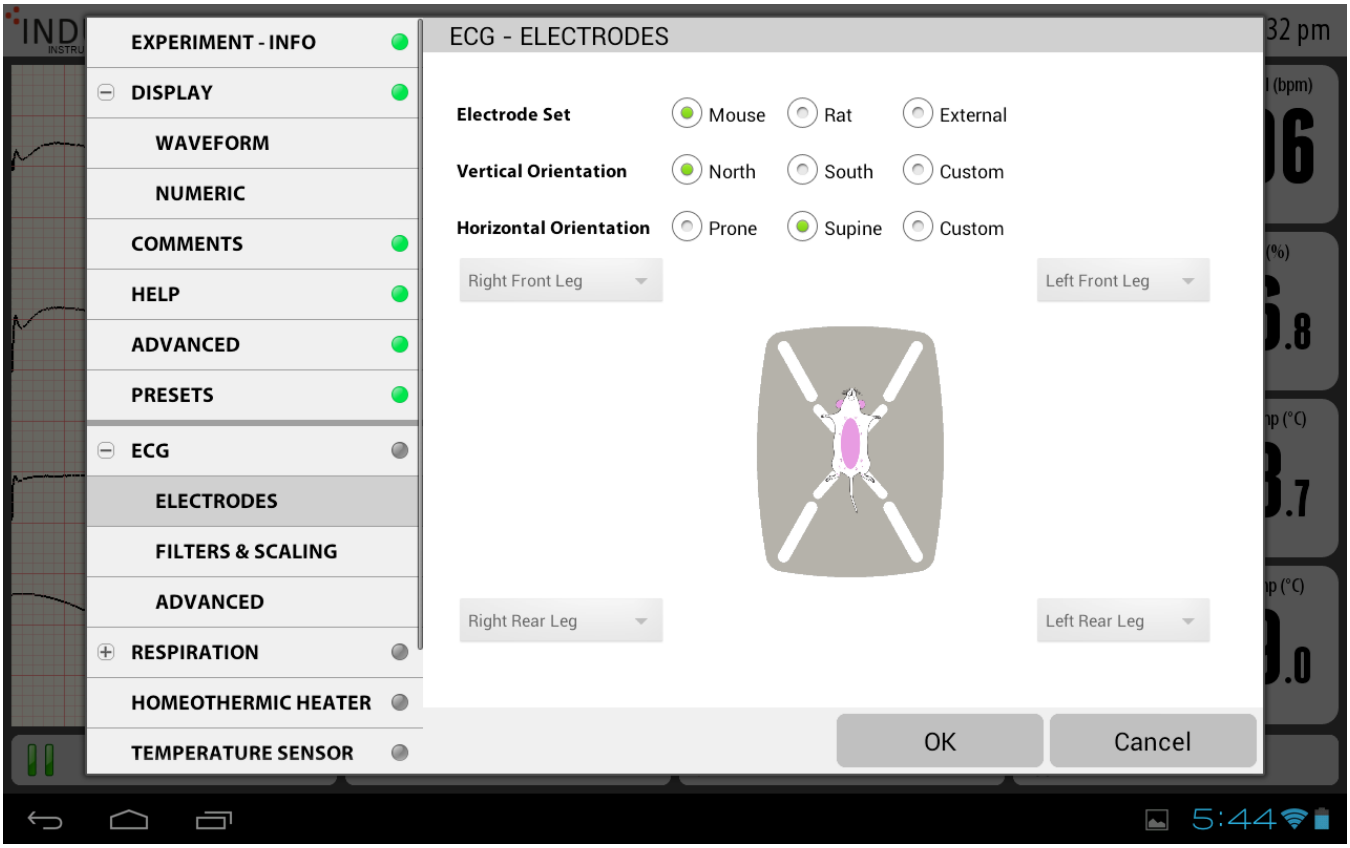
The spacing of the embedded electrodes is likely too tight to allow for non-invasive monitoring of fully-grown guinea pigs. This is one reason we include input ports through standard 1.5mm safety DIN jacks (one set of external leads included, as well) to enable surgery on larger animals.

Heated Surgical Platform side view with DIN jacks

Position

If you change the body position of the mouse, how can you do the monitoring?

The MouseMonitor™ S hardware incorporates switches that can be easily toggled in the configuration software to represent how your animal is oriented in relation to the pad electrodes: North/South, Prone/Supine, and Mouse/Rat size. The current positioning is also shown in a graphic on the electrode settings screen, for easy identification.



Screen Capture of Electrode Switching Menu

Does the animal have to lie flat on the stage? In our mouse and rat MI we rotate animals 45 degree to the stage.

To use the non-invasive electrodes on the top of the surgical platform, the animal's paws would have to be touching the electrodes. In an arrangement such as you describe, you would need to use the included needle electrodes (or non-invasive disc electrodes if you choose) and select "external leads" in settings.

Alternately, I have seen situations in which the Heated Surgical Platform is set on the lab table at an angle. This does not seem to cause any issue as long as the animal is securely taped to the board.

Noise

How sensitive is the ECG signal to external noise? Is it easy to filter out those disturbances?

Due to the amount of electronic devices in use in a laboratory setting, noise is an important issue. The MouseMonitor™ S has been engineered with this specifically in mind. A number of unique aspects of its hardware and software ensure the effects of noise on our ECG waveforms are eliminated or are minimal. Filtering is also very easy to apply, helping you eliminate any remaining noise that does get through.

Vevo

Does this apparatus provide better ECG data with the Vevo 2100, compared to visual sonic surgical ECG table?

The board for the Vevo 2100 (which we also produce) is designed with less of a focus on electrophysiological signals than the MouseMonitor™ S is. Because of this, and the newer design of the MouseMonitor™ S, the ECG signals (full six-lead ECG available) from the MouseMonitor™ S are of a higher resolution than the signal (ECG Lead II) from the Vevo platforms.

Anesthetic

Which anesthetic are you using during acquisition?

Vaporized isoflurane is the most common method of anesthesia, but injectable anesthetics have been used in surgical procedures with the MouseMonitor™ S as well.

Heating

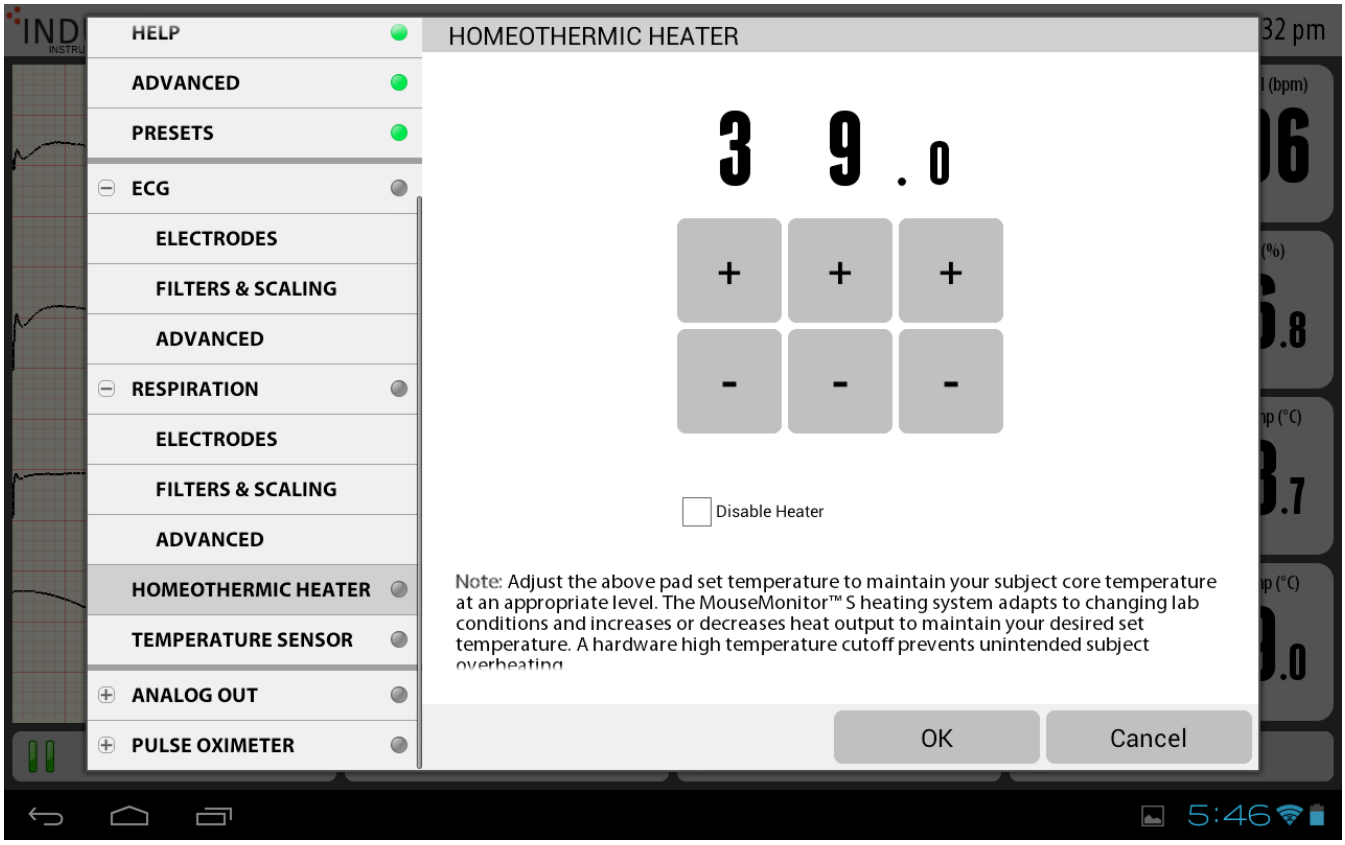
Some bigger animals (fat rats, guinea pigs) require a lot of heat from the stage to maintain core temperature. These animals normally require a pad to prevent overheating or burn. If a pad is used, will the signal be lost?

The short answer is that if the animal's paws are not in contact with the electrode pads, then the related signals will be lost. In this case, you would want to either use the breakout electrode ports and needle electrodes (minimally invasive) or disc electrodes (non-invasive). We include one set of stainless steel needle electrodes with each system to allow maximum flexibility with the system.

Is the heated pad servo-controlled?

Yes, the MouseMonitor™ S uses a feedback control loop that modulates the heat output based on a temperature sensor incorporated into the surgical platform. For safety reasons, the heat output is not controlled off of the rectal temperature probe.

A note on heating: The temperature is adjusted in a range between 27° and 42°C using the Display Unit's touch screen. An included hardware cutoff will not allow the temperature to rise above 45°C for the safety of the animal. For procedures that fare better with the subject mildly hypothermic, there is also a switch that disables heating of the pad.



Screen Capture of Heating Menu

Cost

What is the cost of the system?

The MouseMonitor™ S is a comprehensive surgical monitoring and heating solution designed to be used again and again in your lab. We are proud to offer the MouseMonitor™ S at a fraction of the price of what it would take to cobble together other systems for a less-integrated solution. For specific pricing of the MouseMonitor™ S and optional modules and accessories, please send us an email at sales@indusinstruments.com. Alternately, feel free to call 281-286-1130 to get your questions answered and learn more.

Cleaning

What about transfer of pathogens from one mouse to the next via the table or the electrodes or the pulse oximeter?

The Heated Surgical Platform's stainless steel surface, non-reactive powder coating, and the Pulse Oximeter clip can be disinfected with research-grade ethanol. We will be releasing a list of other compatible cleaners soon.

More Web Content

It would be great to look at a live demo.

We couldn't agree more! Seeing the MouseMonitor™ S in use is one of the best ways to truly understand how it can benefit your research. This webinar is the first in a line of videos and informational presentations we intend to produce and post online so you can learn more about the MouseMonitor™ series.