SomnoSuite®

Low Flow Anesthesia System for Mice and Rats

Owner's Manual

Kent Scientific
CORPORATION
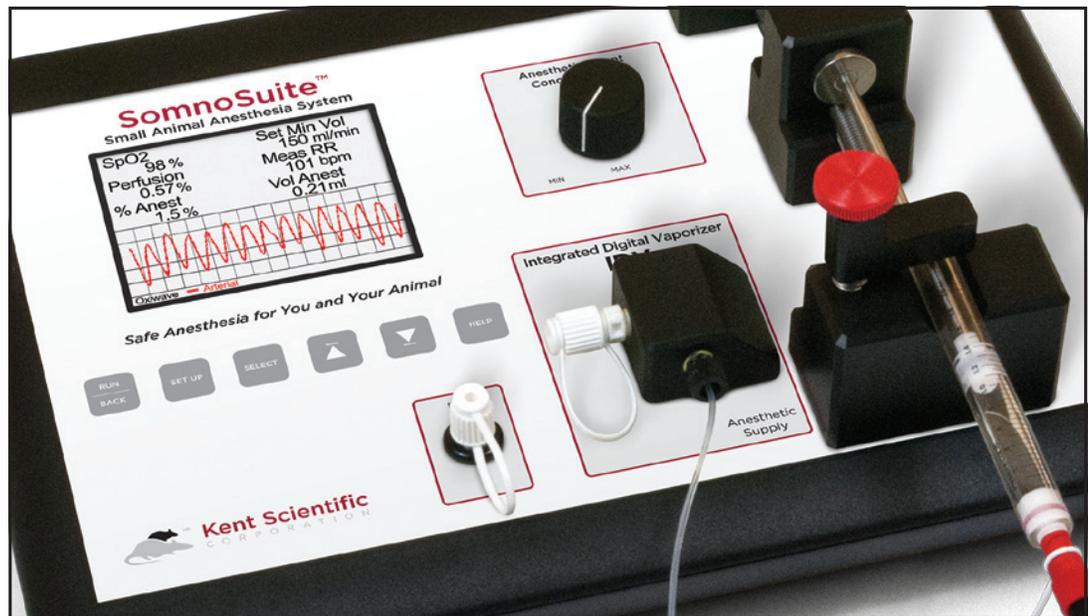
SomnoSuite

Anesthesia System

Owner's Manual

Table of Contents

This product is not designed, intended or authorized for use in human applications.

Part 1: SomnoSuite User's Guide

SomnoSuite® is an anesthesia machine for use with small animals. As a digital vaporizer, it provides a constant-flow stream of gas. **SomnoSuite is not designed, intended or authorized for use in human applications.** Two optional SomnoSuite modules provide additional features:

- **MouseVent®**

  Provides artificial ventilation to deeply anesthetized animals or assists spontaneous breathing in lightly anesthetized animals. Once you provide the animal's weight, the MouseVent uses allometric formulas to automatically determine and use the correct tidal volume and respiration rate for normal artificial ventilation. A wide variety of settings allows you to decide precisely how the Ventilator will work for special procedures. A Constant Flow state, which functions exactly like the Vaporizer configuration, is included.

  To learn more, go to **kentscientific.com** or contact Kent Scientific about adding modules to your existing SomnoSuite.

- **MouseSTAT®**

  Measures and tracks oxygen saturation (SpO2), heart rate, perfusion and respiration rate; **with Optional Respiratory Rate Parameter (ORRP)**, it also measures and tracks respiration rate.

SomnoSuite Included Equipment

- **Either** with Integrated Digital Vaporizer (IDV) alone if you do not purchase the MouseVent SomnoSuite Controller
  or with IDV plus MouseVent Module if you do purchase the MouseVent.
  Note: Upgrades after purchase to add either MouseVent or MouseSTAT will require you to return your Controller to Kent Scientific for appropriate modifications.

- power supply

- mini USB cable

- charcoal filter

- Somno-Fill syringe filling adapter for isoflurane
  Please contact Customer Service if you are using sevoflurane.

- SomnoSuite Tubing Accessory Kit: includes anesthesia circuit and MouseVent Accessory Kit

- Mouse paw pulse oximeter sensor plus sensor adapter (with MouseSTAT only)

- Available for purchase:
  - mouse or rat induction chamber
  - mouse or rat nosecone
  - 2mL, 5mL or 10mL syringe for use with rats or other larger animals
    Order codes: SOMNO-5ML, SOMNO-10ML
  - paw sensor for rats or other larger animals (MouseSTAT only)

    Order code: MSTAT-Sensor-RAT

The SomnoSuite Parameters

SomnoSuite uses a variety of Parameters which appear in menus, displays, charts, etc. The modules you have installed and the flow type you use govern which Parameters are available to you, and thus which Parameters appear in your menus.

Parameters	
SomnoSuite	
%Anest	Target percent of anesthetic in gas delivered to the animal (user-selectable with **Anesthetic Agent Concentration** knob)
VolLeft	Instantaneous volume of anesthetic remaining in syringe
MinVol	Measured volume of air delivered to the animal per minute (= flow rate with no MouseVent)◆
InstPres	Measured pressure of delivered air◆
SetMVol	Target Minute Volume (= volume of air delivered to the animal per minute, user-selectable with a default of 100mL/min) ◆◆
MouseVent Adds	
PeakPres	Highest measured pressure in a cycle
TidalVol	Measured volume of air delivered to the animal per breath
MinVol	Measured volume of air delivered to the animal per minute (= tidal volume X respiration rate)◆
RR	Animal's rate of breathing (automatically calculated from animal's weight or user-selectable)
TargPres	Target Inspiration Pressure used when **Priority** is set to **Pressure** (user-selectable with a default of 15cmH2O)
PEEP	Peak end expiratory pressure (user-selectable with a default of 0cmH2O)
InstPres	Instantaneous pressure reflecting the airway pressure of the animal◆
MouseSTAT Adds	
HeartRate	Measured heart rate
SpO2	Measured blood oxygen saturation
Perfusion	Measured blood flow at the sensor site
MeasRR	Measured respiration rate (with ORRP only)

◆ Unless you have a MouseVent module with Ventilator mode turned on, **InstPres** and **MinVol** will remain approximately constant.

◆◆ Does not appear if you have a MouseVent module and set it to use the Ventilator.

System Components

1. Anesthetic Delivery Line
2. Syringe Holding Clamp
3. Syringe Holding Block
4. Syringe Pusher Block
5. Anesthetic Agent Concentration Knob
6. Inspiratory (INSP) Port
7. Vapor Block
8. Expiratory (EXP) Port
9. Display
10. Control Buttons

Rear Panel Layout

COMPRESSED GAS INLET
(5 -10 psi max.)

POWER

ON / OFF

EXHAUST

FACTORY USE

REMOTE

AUX

USB

AIR INLET

SomnoSuite Setup Diagram

F/Air Canister

Compressed Gas Supply

Exhaust

Room Air Supply

SomnoSuite
Small Animal Anesthesia System

Safe Anesthesia for You and Your Animal

Kent Scientific

Integrated Digital Vaporizer

Anesthetic Supply

Expiratory Line — —Inspiratory Line

Choose 1 of 3 connections below

Constant Flow Options

Ventilator Set-Up

EXP   INSP

Face Mask or Nose Cone

EXP   INSP

Induction Chamber

EXP   INSP

Breathing tube

Intubated Animal

Controlling SomnoSuite

The SomnoSuite Buttons

You communicate with the SomnoSuite Controller through the buttons on the front panel. There are six buttons whose function depends on where you are when you press them:

RUN/BACK	**Home Screen**	To Run Screen
	Setup mode	Back one menu level
		To Run Screen from **Main Menu**
	Run Mode	Air flow on and off
SET UP	**Home screen**	To **Main Menu**
	Setup mode	To next menu choice
	Run mode	Turn off alarms, display **Main Menu**
SELECT	**Setup mode**	Display sub-menu, if any, associated with currently highlighted menu choice
△ ▽	**Setup mode**	Move up or down through setting choices
	Run mode	Move between **Chart**, **History** and **Parameters** displays
	Help Screens	Page forward or back for multi-page help
HELP	**Home Screen**	General Help on and off
	Setup mode	Context-sensitive Help on and off
	General Help	Back one level

Menu Tips

The menus displayed on the Controller screen allow you to configure the SomnoSuite to meet your needs. Here are a few general facts about how the menus work:

- As you use the **SET UP** button to cycle through menu choices, the current menu item becomes highlighted in red.

- If the highlighted menu choice permits a direct action, such as setting a value range or clearing the History, you will see instructions for that action on the right.

- If the highlighted menu choice leads to a sub-menu, you will see instructions to press **SELECT** for the new menu.

- Pressing the **RUN/BACK** button at any point within a menu goes back one menu level.

Getting Started

Three steps are required to prepare your SomnoSuite for use:

Step 1: Set up the hardware (instructions below).

Step 2: Configure the SomnoSuite using the menus. See *Part 2: SomnoSuite Configuration Guide*.

Step 3: Connect the animal to the SomnoSuite. See page 9.

When you have completed the three steps, you will be ready for Run mode, which is the way you will use the SomnoSuite to perform its tasks. You can always return to the Menus from Run mode to change your configuration parameters.

See *Frequently Asked Question and Troubleshooting* on page 17 for more information that may be helpful.

Step 1: Set Up the Hardware

Be sure to include the steps for each of the modules you have purchased.

For all modules

1. Plug one end of the Power Adapter into the **Power** port on the rear of the Controller.

2. Plug the other end into a standard wall outlet.

3. Remove the **Air Inlet**, **Exhaust** and **Compressed Gas Inlet** caps from the rear of the Controller.

4. Attach the charcoal filter from the SomnoSuite Accessory Kit to the Controller **Exhaust** port.

5. If you are using compressed gas, select the Compressed Gas tubing from the Accessory Kit. Then:
   i. Set the regulator to 5-10 psi or use a pressure reducer.
   ii. Attach the green fitting, or the appropriate fitting for your specific regulator, to the regulator.
   iii. Connect the white luer fitting to the **Compressed Gas** inlet on the rear of the Controller.

6. Place a syringe in the Holding Block:
   i. Use the red thumbscrew to loosen the Holding Block clamp.

Important
Step 3, connecting the animal, should be the last step in your setup. Be sure to make all the settings and adjustments you can before you connect the animal.

Note about Connections
For a reliable connection at a Controller socket—AUX or Remote—you must push the plug firmly until it is seated against the silver metal of the socket.

Power is directly above the black collared Exhaust port.

Home Screen
If you have the MouseVent module, the Home Screen displays some important information about the setup for the Ventilator along with the animal weight you have selected. You can also change the animal weight at this screen. See page 38 for more information about animal weight.

ii. Place a VICI Pressure-Lok syringe into the notch. Use only VICI Pressure-Lok syringes, sold through Kent Scientific, to ensure accurate anesthesia delivery.

iii. Tighten the thumbscrew so that the syringe is held securely in the block.

iv. Push the plunger all the way into the syringe.
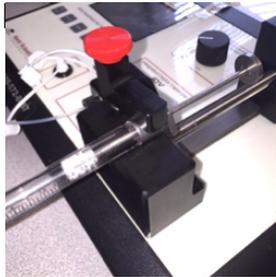
Correct   Incorrect

7. Set the syringe Empty position:
   i. Press **SETUP** to highlight **Set Empty**, then press and hold ∇ to move the Pusher Block *just* into contact with the syringe plunger.

   ii. If you accidentally go too far, press $\triangle$ to back up to a location before the **Empty** position, and then press ∇ to approach it again.

   iii. When you have the right location, press **SELECT** to set the **Empty** position. To confirm, the screen will display **Location Saved**.

8. Fill the syringe:
   i. Press **RUN/BACK** once to return to the **Anesthesia** menu. (**Main > Anesthesia**)

   ii. Press **SETUP** to highlight **Remove**, then press **SELECT** to move the Pusher Block to the full position for your syringe. The Pusher Block will travel slightly past the syringe's full position to allow for easier mounting of the full syringe.

   iii. Remove the syringe from the Syringe Holding Block and fill the syringe with anesthetic. If you are using the Somno-Fill accessory, please refer to the instructions that accompany it.

Vapor Block Heating
The SomnoSuite heated Vapor Block warms to provide consistent vaporization conditions regardless of any temperature changes in the environment.

Somno-Fill
The Somno-Fill accessory for isoflurane is included with every SomnoSuite. If you plan to use sevoflurane, please contact Customer Service.

↵ !

Anesthetic will travel through the tube very quickly so press ∇ for short periods of time only.

The Syringe Holding Block
The horizontal arm of the syringe clamp is reversible. Larger diameters require the arm to be at the top of the clamping screw. Smaller syringe diameters require it to be toward the bottom. See page 21 for more information and for directions to reverse the clamp.

↵ !

Take care not to push too far to avoid damaging the syringe

iv.   Remove the cap from the Anesthetic Delivery Tube.

v.   Screw the red fitting onto the syringe tip.

9. Prime the syringe:
   i.   Place the syringe into Syringe Holding Block and secure the syringe.

   ii.   Ensure that the on/off valve of the syringe is open by confirming that the green button is pressed against the syringe barrel.

   iii. Press **SETUP** to highlight **Prime Tube**, then briefly press ∇ to prime the Anesthetic Delivery Tube. Once liquid has reached into the black fitting on the vapor block, the tube is fully primed.

10. Set the Anesthetic Concentration knob to **MIN**.

11. Connect the animal circuit:
   - To deliver anesthetic via induction chamber or nose cone, attach the induction chamber or nosecone assembly to the **INSP** and **EXP** ports on the front of the Controller.

   - To deliver anesthetic via the optional MouseVent instead, see *For MouseVent* below.

For MouseVent
1. Select the **INSP** and **EXP** tubing from the MouseVent Accessory Kit.

2. Connect the tubing to the **INSP** and **EXP** ports on the Controller front (Fig 1). Each piece of tubing should be the same length and should be about 0.5m long.

For MouseSTAT
1. Plug the pulse oximeter sensor into the MouseSTAT adapter cable.

2. Plug the sensor adapter cable into the Controller AUX socket.

3. Ensure that the red light is visible in the sensor.

CAUTION!
For animal safety!
*Do not prime the tube if the circuit is already filled with anesthetic. Priming is intended for use **only** when you are using a new syringe and no anesthetic is present in the circuit. Priming the tube while anesthetic is already present in the circuit can cause too much anesthetic to be pushed into the line resulting in an overdose to the animal.*

Anesthetic Concentration
The range set by the Anesthetic Agent Concentration knob for isoflurane is 0 to 5%. For sevoflurane it is 0 to 8%.

↵

Refer to the SomnoSuite Setup Diagram on page 4 for connecting the Induction Chamber, Nosecone Assembly or Ventilation Tubing.

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Step 2: Configure SomnoSuite

Turn the Controller on using the switch on back. When the Home Screen appears on the Controller, you will see: **Press RUN/BACK or SET UP**. Press **SET UP** to display the **Main Menu** and configure your PhysioSuite features.

Detailed directions for all the Menu choices begin on page 33. You can also press HELP on your Controller for context-sensitive help at any time.

First Time Setup

Configuring the SomnoSuite consists of selecting the settings that are appropriate for your needs using a system of Menus. You can return to those Menus at any time to change your settings. During initial set-up of your SomnoSuite hardware, you will find that some steps involve a combination of hardware connections and Menu choices that perform actions rather than make settings. *Quick Start and Quick Tips* on page 12 can help you see how these processes combine to get your SomnoSuite up and running the first time.

Step 3: Connect the Animal

You can connect the animal in several different ways and many researchers have their own procedures. If you are using the MouseVent Ventilator, be sure to connect the endotracheal tube to a T fitting as close to the animal as possible to minimize physiological dead space.

Some instructions in this section differ depending upon the air delivery mode you are using:

Constant Flow

With or without the MouseVent option, SomnoSuite is able to deliver air in Constant Flow mode. This is useful for providing anesthetic to an animal in an induction chamber or on a nose cone.

Ventilator

With MouseVent, SomnoSuite is also able to deliver air in Ventilator mode and you can switch between Air Modes as needed. For constant pressure ventilation, the MouseVent Ventilator delivers enough inspiratory gases to attain the desired

More detailed information about the SomnoSuite buttons and using the SomnoSuite menus begins on page 5.

Tubing Size
Both branches of the expiratory tubing should be about the same length and each about 0.5 meters long. The expiratory tubing diameter should be large enough to decrease any resistance to the expiratory airflow. Since the animal completely controls expiration, higher expiratory airway resistance makes exhalation more difficult. If the animal fails to exhale completely, it can rebreathe the same air, causing a buildup of CO_2 in the lower airways.

pressure. The overall volume of gases delivered is dependent on tubing dead space and animal tidal volume. In other words, the inspiratory volume delivered is dynamic to maintain the desired inspiratory airway pressure. MouseVent automatically delivers the tidal volume required to produce this pressure.

For all modules (Constant Flow)
1. Position animal as needed for your selected animal circuit.
2. Press **RUN/BACK** until you reach **Main Menu > Air Mode**.
3. Turn air flow on at the appropriate minute volume for your circuit. **Main > Air Mode** and **> Minute Vol**.
4. Adjust any settings as needed while the system is in Setup mode.

For MouseVent only

To use Constant Flow:
1. Select **Constant Flow** at **Main > Air Mode**.
2. Follow the directions under *For all modules* above.
Important: Do not use Constant Flow Air Mode when the animal is intubated to avoid over-pressurizing the lungs.

To use the Ventilator:
1. Select **Ventilator** at **Main > Air Mode**.
2. Turn the MouseVent on and enter the animal's weight.
3. Intubate the animal with the appropriate endotracheal tube or cannula.
4. Slide the endotracheal tube onto the trunk section of the endotracheal tube adapter.
5. Adjust any settings as needed while the system is in Setup mode.
6. When you are finished, press **RUN/BACK** to begin running the Ventilator.
Important: Use Ventilator mode **only** while the animal is intubated. Using Ventilator mode with a standard nose cone can cause a build-up of expired air and reduce available oxygen to the animal.

For MouseSTAT
Apply the pulse oximeter sensor to the most convenient appendage of your small animal. See page 63 and following for important information about sensors.

Important
Calibrating Dead Space
Before you connect the animal, calibrate the dead space. First, go to Main > Air Supply and choose the source of air for your animal. Then, go to Main > Actions > Calib Ddspc. Seal the end of the endotracheal tube with your finger or an air tight cap and press SELECT twice. The MouseVent will pressurize the respiratory tubing circuit and calculate the dead space. The dead space value will be subtracted from the total volume to give an accurate Tidal Volume value.

Be sure to calibrate the dead space again any time you change the tubing setup.

Ports
If you are not connecting any tubing, such as tubing for compressed gas or scavenging canisters, to the ports on the back of the SomnoSuite, the ports should be uncapped and open while you are using SomnoSuite.

When SomnoSuite is Not is Use

When you finish using the SomnoSuite, you may choose either to leave the syringe in place or to remove it.

To remove the syringe:

1. Turn the Controller off.

2. Remove the syringe from the Syringe Holding Block.

3. With the Anesthetic Delivery Tube connected to the syringe, pull back on the plunger to remove any remaining anesthetic from the delivery tube.

4. Remove the red Anesthetic Delivery Tube Fitting from the syringe.

5. Cap the red delivery tube port.

6. Return the anesthetic to its storage container.

7. Place the syringe back in its storage box.

The SomnoSuite saves your settings when you power off.

For more practical tips and information about setting up and using the SomnoSuite, please see the Quick Start and Quick Tips for each of the SomnoSuite modules beginning on page 12, and the FAQ and Troubleshooting section on beginning on page 17.

Quick Start and Quick Tips

The process of getting your SomnoSuite up and running varies with the modules you have installed. These guides can help you understand how to integrate the various steps required to get started using your SomnoSuite. Be sure to check the steps for all modules you have installed.

Quick Start and Quick Tips: SomnoSuite

1. **Turn the Controller on and wait for the Home Screen to appear.**

2. **Ensure that the anesthesia circuit is empty of any anesthetic from previous use.**

3. **At Main > Anesthesia, disable anesthesia temporarily.**

4. **At Main > Anesthesia> Setup > Type Anest, press △ or ▽ to choose an anesthetic.**

5. **At Main > Anesthesia> Setup > Syr Size, choose a syringe size.**

6. **Place a syringe into the Syringe Holding Block.**
    i. Loosen the Holding Block clamp with red thumbscrew.
    ii. Place a VICI Pressure-Lok syringe into the notch.
    iii. Tighten the thumbscrew to hold the syringe securely.
    iv. Push the plunger all the way into the syringe.

7. **Set the syringe Empty position.**
    i. At **Main > Anesthesia > Set Empty**, hold ▽ to move the Pusher Block *just* into contact with the syringe plunger.
    ii. **Moved too far?** Press △ to back up to a location before the **Empty** position, then press ▽ to approach it again.
    iii. When the location is right, press **SELECT** to set the **Empty** position.

8. **Fill the syringe with anesthetic.**
    i. At **Main > Anesthesia**, press **SETUP** to highlight **Remove.**
    ii. Press **SELECT** to move the Pusher Block to slightly past the full position for your syringe. This allows easier mounting of the full syringe.
    iii. Remove the syringe from the Holding Block and fill it.
    iv. **Using the Somno-Fill accessory?** Refer to the instructions that accompany it.
    v. Remove the cap from the Anesthetic Delivery Tube.
    vi. Screw the red fitting onto the syringe tip.

Quick Start and Quick Tips: SomnoSuite continued

9. **Prime the syringe.**
   i.   Place the syringe into Syringe Holding Block and secure the syringe.
   ii. Ensure that the on/off valve of the syringe is open by confirming that the green button is pressed against the syringe barrel.
   iii. Press **SETUP** to highlight **Prime Tube**, then briefly press ▽ to prime the Anesthetic Delivery Tube. Once liquid reaches into the black fitting on the vapor block, the tube is fully primed.

10. **At Main > Air Supply, press △ or ▽ to choose an Air Supply source.**

11. **For:**
    Compressed Gas: Turn regulator to 5-10psi or use pressure reducer. Connect to Compressed Gas port.
    Room Air: Remove cap from Air Inlet port.

12. **Using the MouseVent Ventilator?**
    Yes: See Quick Start and Tips for MouseVent, before continuing.
    No: At **Main > Air Mode**, choose **Constant Flow**.
             At **Main > Minute Vol**, choose a flow rate.

13. **Attach the Induction Chamber, Nosecone Assembly or Ventilation tubing:**
    Connect the white fitting to the **INSP** port and the black to the **EXP** port.

14. **Turn on the air flow:**
    i.   Press **RUN/BACK** to enter Run Mode.
    ii. Press **RUN/BACK** again to begin air flow.

15. **Set the Anesthetic Agent Concentration knob to MIN temporarily.**

16. **At Main > Anesthesia, enable anesthetic flow.**

17. **Adjust the Anesthetic Agent Concentration as desired.**
    The percentage you are setting is displayed on the Run Screen.

Quick Start and Quick Tips: MouseVent

With power supplied to the PhysioSuite, wait for the Home Screen to appear.

1. **Press △ or ▽ to set animal body weight.**
   PhysioSuite calculates and sets tidal volume, respiration rate and minute volume.

2. **At Main > Air Mode, choose Ventilator.**

3. **Make Ventilator and other settings as needed.**
   Press **SET UP** to reach the **Main Menu**.

4. **Connect the INS and EXP tubing to the front of the Ventilator and connect the endotracheal tube adapter.**

5. **Calibrate the dead space if this is a new or changed tubing configuration.**
   i. At **Main > Actions**, choose **Calib Deadsp**.
   ii. Connect the endotracheal tube and seal the end with your finger.
   iii. Press **SELECT** to calibrate.

7. **Begin ventilating.**
   - Press **RUN/BACK** until you reach the Run screen, then press **RUN/BACK** again to start the Ventilator.
   - Even if you return to Setup mode to change settings, the Ventilator continues to run. To stop it, press **RUN/BACK** <u>at the Run screen</u>.

Quick Start and Quick Tips: MouseSTAT

1. **Connect the MouseSTAT.**
   i. Connect the MouseSTAT interface to the back of the PhysioSuite, ensuring that the interface cable is fully seated in the DIN plug.

   ii. Connect the MouseSTAT sensor to the MouseSTAT interface cable, ensuring that a steady red light is visible in the sensor.

2. **Make MouseSTAT settings.**
   At **Main > MouseSTAT**, press $\triangle$ or $\triangledown$ to choose the minimum heart rate for your animal. Mouse (240), Rat (140) or Custom (40 to 600).

3. **Place the MouseSTAT sensor.**
   i. Place the sensor over the animal's hind paw.

   ii. Center the red light over the paw pad.

Running SomnoSuite

Pressing **RUN/BACK** from the **Main Menu** goes to the Run Screen, which displays real-time information about your SomnoSuite.

The Run Screen

The Run Screen is your window into the operations of SomnoSuite and the state of some of its settings. You can almost completely configure the displays of the Run Screen.

Parts of the Run Screen

The Run Screen is divided into three basic areas:

- **The top half** of the Run Screen contains a Parameter display, showing the values of up to six Parameters.

- **The bottom half** of the Run Screen contains the Charts, Parameters and History displays. You can cycle through the displays by pressing △ and ▽. The possible displays are Chart #1 , Chart #2, a second Parameter display and History.

- **The very bottom line** of the Run Screen contains informative messages. Error messages appear on the left. On the right, **RUNNING** or **STOPPED** appears indicating the run state of SomnoSuite. Change from **RUNNING** to **STOPPED** and back again by pressing **RUN/BACK** at the Run Screen.

Running and Stopped

The meaning of RUNNING varies for each module:

SomnoSuite alone
SomnoSuite runs when Air Flow is turned on. See **Main > Air On/Off**. With air flow off, the Run Screen status reads **STOPPED**. Press **RUN/BACK** again to restart it.

With MouseSTAT
MouseSTAT measures and tracks its associated Parameters any time power is on, independent of **RUNNING** or **STOPPED** status displayed at the Run Screen.

With MouseVent
RUNNING means the Ventilator function is on. Press **RUN/BACK** at the Run Screen to turn the Ventilator on or off.

Run Screen
*You can choose which Parameters to display and their exact locations at **Main > Config > Parameters**. Your installed modules determine the default selection.*

*You can hide one or more of these displays, choose what to plot in **Chart #1** and **Chart #2**, and configure the Parameter display. See **Main > Config** for details. You can also choose what you'd like to see in the History display or hide **History** by choosing **Omit** for all Parameters. See **Main > History**.*

Changing Settings in Run Mode
If you change settings that affect either the Vaporizer or Ventilator while it is running, you may notice that the Vaporizer or Ventilator enters a brief adaptation period to accommodate the new settings.

While the MouseVent Ventilator is running,
do not:
- *perform any tests or calibrations*
- *reload any defaults*
- *access the **Send new**, **Send all** or **Erase** choices of the **History Menu***

Any of these actions could stop the Ventilator.

Frequently Asked Questions and Troubleshooting

Setup

Calibration

Settings

Connections

Troubleshooting

Setup

1. **How do I connect the SomnoSuite to my oxygen source?**

To use compressed gas such as oxygen, you must connect the source of the gas to the compressed gas inlet on the back of the SomnoSuite.

The SomnoSuite can handle a maximum compressed gas flow of 10 psi, equivalent to 0.7 Bar. If your oxygen source cannot regulate the pressure down to 10 psi, you will need to purchase the SomnoSuite Pre-Set Pressure Reducer, which is capable of bringing up to 100 psi down to 10 psi. Conversion Reference: 1 psi = 0.068 Bar. Order code: AC-7305

2. **Is there a way to speed up the downward movement of the pusher block when setting the empty position?**

   Yes. After you place the syringe into the Syringe Holding Block, go to **Main > Anesthesia > Prime Tube** and press ▽. Once you get close enough to the **Empty** position, return to **Anest Setup > Set Empty** and press ▽ to move the syringe pusher block gradually to the actual empty position.

3. **How can I be sure my syringe is mounted properly on the Syringe Holding Block?**

   It is important to make sure that your syringe is mounted properly and that the syringe holding clamp is in the correct position:
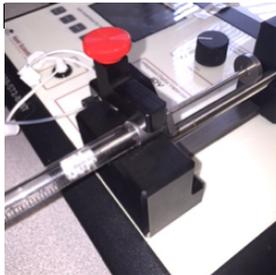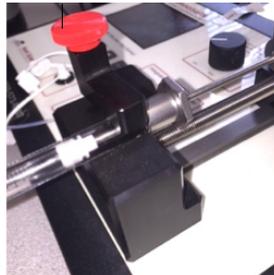
   Correct   Incorrect

   Depending upon your syringe size, you may need to reverse the position of the syringe holding clamp. Large syringe diameters require the horizontal arm to be at the top of the clamping screw. Small syringe diameters require the horizontal arm to be toward the bottom of the clamping screw.

   2mL position   5mL and 10mL position

   To reverse the position of the clamp, remove the thumb screw, reverse the bracket, and place the assembly back in position on the unit. You can place the spring either above or below the bracket as you prefer.

Calibration

4. **What are the calibration requirements for the SomnoSuite?**

   SomnoSuite does not require annual calibration as traditional systems do since its anesthesia delivery technology differs from that of traditional anesthesia vaporizer systems.

   Traditional anesthetic vaporizers rely on passive vaporization and moving mechanical mechanisms to control the vaporization of the anesthetic. The physical nature of these mechanisms means that annual calibration is required to maintain accurate delivery of the anesthetic agent.

The SomnoSuite provides vaporization and control of anesthetic using solid-state electronics, hardware and software. The SomnoSuite also uses an active vaporization system which precisely controls the delivery of anesthetic agent. Electronic sensors monitor vaporization, gas flow and anesthesia delivery. Computer algorithms rather than mechanical components control these parameters. Unlike traditional systems, SomnoSuite is designed to stop operating if a sensor reports a problem. The sensors feature no moving parts and are designed to remain stable over time.

If you have any questions or would like to speak with one of our product specialists about your facility's calibration requirements, please call toll-free 888-572-8887 or 860-626-1172.

Settings

5. **What are the recommended values for minute volume and % isoflurane?**

The best flow rate for an animal depends upon many factors and different values are best for induction and for maintenance. You might want to start with a constant minute volume equal to 150% of resting minute volume for your animal. You can then adjust this value based on your results and how your animal responds.

This table shows settings for a 30 gram mouse using a 0.5L induction chamber. Adjust these settings to accommodate the weight of your animal and the size of your induction chamber.

	Light Anesthesia in mL/min using a nose cone	Deep Anesthesia in mL/min using a nose cone	Induction in mL/min
Minute Volume	100 – 150	100 – 150	250-350
% Isoflurane	1.0 – 1.5	1.5 – 2.0	2.0-2.5

Important! Monitor your animal closely during induction and while delivering anesthetic via nose cone. Adjust the delivery of the anesthetic based on observation of the animal and monitoring of its vital signs.

Connections

6. **How do I connect my PhysioSuite MouseVent Ventilator to my SomnoSuite?**

1. In the MouseVent Accessory Kit locate the Vaporizer Connection Assembly with Bypass. Connect this component to the back of the PhysioSuite.

   - Attach the white luer-lock connector to the Air Inlet.

   - Attach the black luer-lock connector to the Exhaust Port.

2. On the Vaporizer Connection Assembly, locate two T-Connectors with barb fittings.

   - Attach the open side of the black T-fitting to the scavenging canister.

   - Attach the open side of the white T-fitting to the SomnoSuite.

3. In the SomnoSuite Accessory Kit, locate a package of tubing called Vaporizer Connection Assembly.

   - Attach the tube with the white luer-lock connector to the **INSP** port on the SomnoSuite.

- Attach the other end to the open port on the white barb fitting on the Vaporizer Connection Assembly w/ Bypass on the back of the PhysioSuite.

4. Set the MouseVent to the appropriate settings and note the Minute Volume.

5. Set the SomnoSuite to **Constant Flow** mode and Set the **Minute Vol** of the SomnoSuite so that it is at least 10% higher than the Minute Volume on the MouseVent, but no less than 50mL/min.

See also Question 7, *How do I connect my SomnoSuite to another ventilator?*
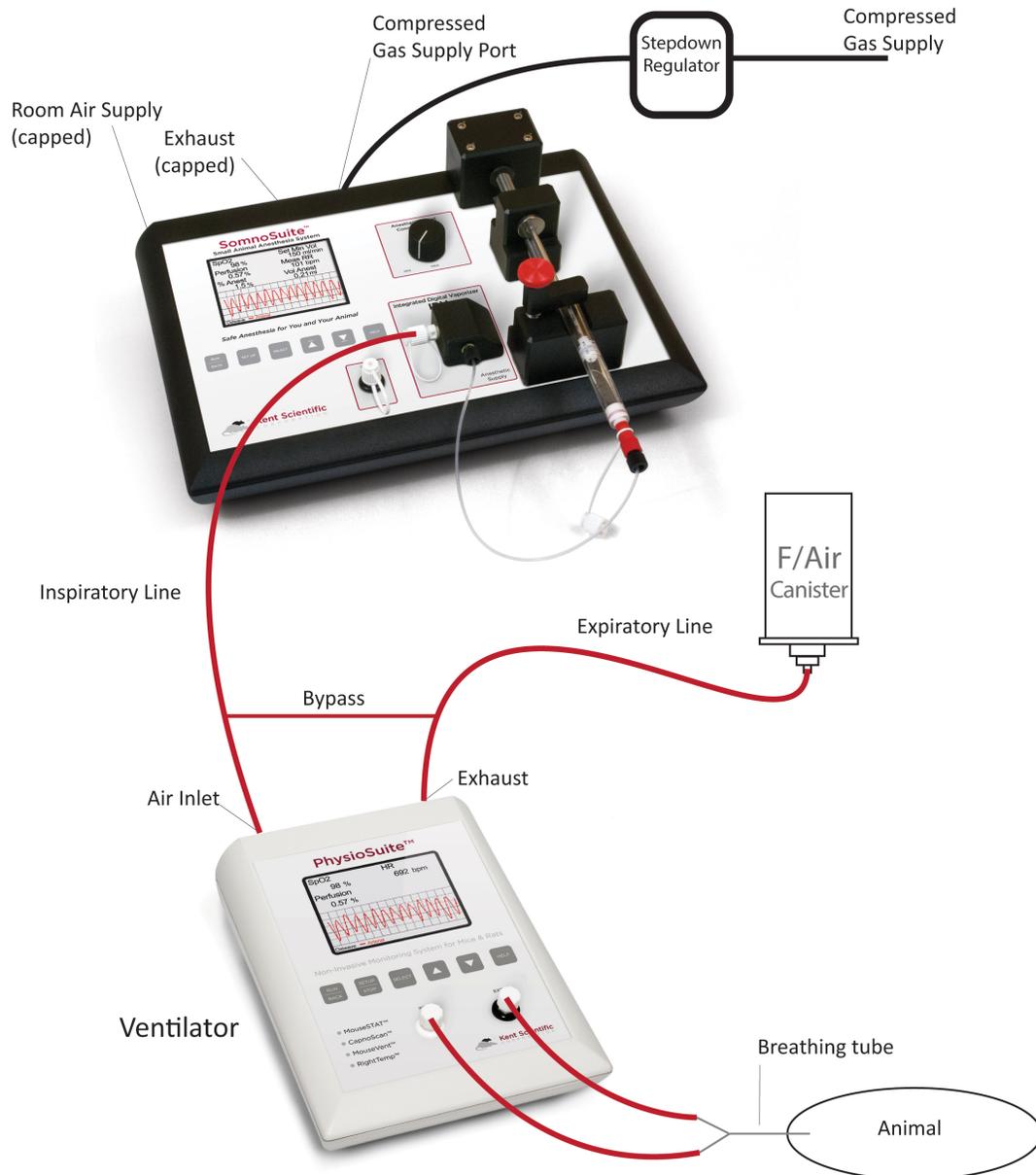
7. **How do I connect my SomnoSuite to another ventilator?**

There are two options for making this connection. For either option, please see the diagram on the next page:

Option 1: Conventional method
1. Attach the **INSP** port of your SomnoSuite to the air inlet of your ventilator.

2. At **Main > Air Mode**, select **Constant Flow**.

3. At **Main > Minute Vol**, set the SomnoSuite minute volume to 1.25 times the minute volume of your ventilator.

4. At **Main > Air On/Off,** select **On**.

5. Turn on your ventilator.

6. In this mode SomnoSuite will provide a constant gas flow to the ventilator based upon the draw rate of the ventilator.

Option 2: For better anesthetic conservation
1. If you are artificially ventilating an animal with room air, you do not need to connect the by-pass tubing to the charcoal canister.

2. Attach the **INSP** port of your SomnoSuite to the air inlet of your ventilator.

3. At **Main > Air Supply**, select **Compressed Gas**.

4. Remove the cap from the **Compressed Gas** Inlet on the rear of the unit and ensure the port remains open to atmospheric pressure.

5. At **Main > Minute Vol**, set the SomnoSuite minute volume to either 1.25 times the minute volume of your ventilator or to the maximum of 500mL/min. Since the flow rate detected is lower than the actual setting, the control valve in the SomnoSuite will open completely and allow free air passage to the ventilator.

   As air is drawn through the SomnoSuite vaporizer by the external ventilator, the electronic air flow sensor in the SomnoSuite measures the airflow. The anesthetic delivery rate is automatically adjusted to deliver the proper concentration of the measured air flow. No excess gas or anesthetic is required.
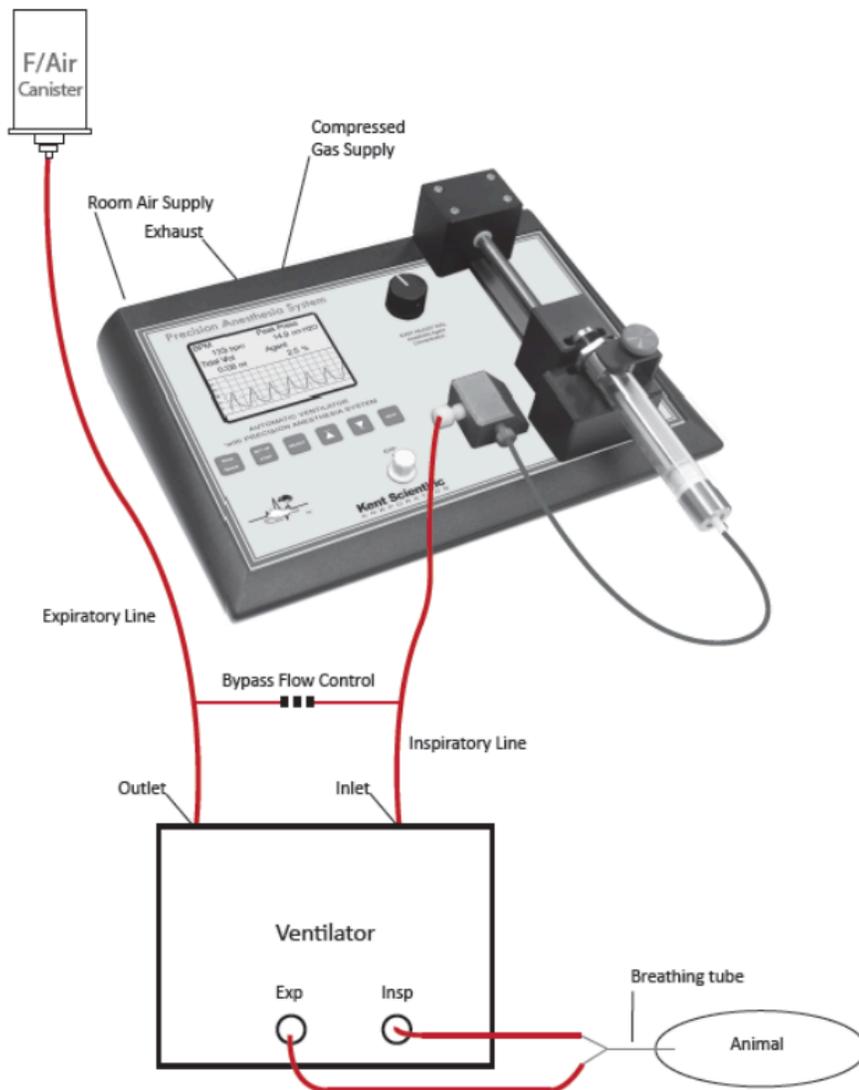
Scavenging

8. **Are there special considerations if I use an in-house (piped-in) vacuum?**

Yes. It is likely that you will have to use a vacuum break between the exhaust tubes and the vacuum to prevent too much negative pressure on the exhaust side. The vacuum break relieves pressure on the exhaust line and ensures proper operation of the SomnoSuite.

SomnoSuite can be used without hooking it up to your in-house vacuum. Simply attach the included charcoal canister and tubing to the exhaust port in the back of the SomnoSuite Controller. Replace the charcoal canister as required.

Troubleshooting

9. **The Minute Volume display shows 0mL/min or the Injector is not moving. What can I do?**

If you reset the SomnoSuite to the Factory Defaults and reconfigure the system, you will be able to report your findings to a clinical support person at Kent Scientific for further help.

Please follow these steps:

1. Go to **Main > Actions > Defaults**.

2. Close all caps.

3. Configure SomnoSuite as you did previously. For more information, see *Part 2: SomnoSuite Configuration Guide*. The basic steps to reconfigure are:

   a. Press **SETUP** for the **Main Menu**.

   b. At **Main > Anesthesia > Enable**, if the screen reads **"SELECT to Enable,"** press **SELECT** to enable anesthesia.

   c. At **Main > Anesthesia > Setup > Type Anest**, press △ or ▽ to select your anesthetic.

   d. At **Main > Anesthesia > Setup > Syr Size**, press △ or ▽ to select a size.

   e. Set the empty position of the syringe:

      i. Loosen the clamp using the red thumb screw.

      ii. Place the syringe in the notch.

      iii. Tighten the red thumb screw so that the syringe is held securely in the block. Note the correct position of the syringe:

Correct   Incorrect
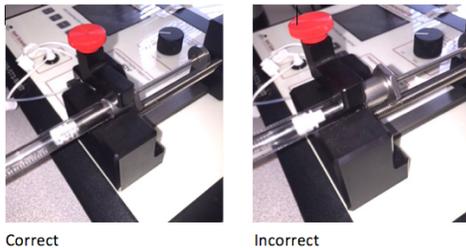
      iv. At **Main > Anesthesia > Setup > Set Empty**, press and hold ▽ to move the pusher block and syringe plunger until you reach the empty position of the syringe. Leave about 0.1 to 0.2mm space between the end of the syringe and the plunger.

      v. Press **SELECT** to set the **Empty** position.

      vi. At **Main > Anesthesia > Remove**, press **SELECT**. This will move the pusher block back to the full position of your syringe. At this point, you would normally fill your syringe with anesthetic, but do not do that. You will use air as to troubleshoot your system.

      vii. Draw the syringe plunger back to a full position and place the syringe into the Syringe Holding Block as you normally would.

      viii. At **Main > Anesthesia > Prime Tube**, briefly press ▽ until the pusher block makes contact with the syringe plunger.

4. Open the air **inlet** & **INSP** ports by removing the caps.

5. At **Main > Air Mode**, choose **Constant Flow.**

6. At **Main > Air Source**, choose **Internal Pump**.

7. At **Main > Minute Vol**, choose **500mL/min**.

8. Confirm that your **syringe contains no anesthetic**. For this test, you will simulate delivery of anesthetic using air only.

9. At **Main > Anesthesia > Enable**, enable anesthetic delivery.

10. Turn the Anesthetic Agent Concentration knob all the way to the right (5% isoflurane, 8% sevoflurane).

Checkpoint 1: At this point, please make a note of:
- the average Minute volume you see on the screen

- whether or not the syringe block is moving

    Note: If the syringe block is not moving, make sure you have enabled anesthesia at **Main > Anesthesia > Enable**. Note: If anesthesia is enabled, there will be no other menu choices under **Enable** in the left column of the screen. Only **Enable** will appear.

If compressed gas is available, please proceed to step 9. Otherwise, report your findings to the clinical support person assigned to your account.

11. Press **RUN/BACK** to stop the SomnoSuite.

12. Turn the Anesthetic Agent Concentration knob all the way to the left (0%).

13. Close the air inlet cap.

14. Open the compressed gas port on the back of the controller.

15. Attach 5 to 10psi of oxygen to the compressed gas inlet.

16. At **Main > Air Supply**, choose **Compressed Gas**.

17. At **Main > Minute Vol**, set the flow rate to **500mL/min**.

18. Turn the Anesthetic Agent Concentration knob all the way to the right (5% isoflurane, 8% sevoflurane).

Checkpoint 2: At this point, please make a note of:
- the average Minute volume you see on the screen

- whether or not the syringe block is moving (see Note at *Checkpoint 1* above)

Thank you for following this troubleshooting procedure. Please report your findings to the clinical support person assigned to your account. It may also be helpful to send images or video of the SomnoSuite and of your entire anesthesia setup.

10. **The syringe pusher block is stuck at the top of the Controller. What can I do?**

You may have positioned the pusher block too far up on its track, causing it to bind against the top block. This can happen if you set the **Empty** position too high and then used the **Remove** function. To fix this:

1. Turn the lead screw clockwise by hand until it unbinds.

2. If that is too difficult or the screw simply will not move, at **Main > Anesthesia > Prime Tube**, press ∇ briefly until the pusher block releases from the top of the unit.

If you are still unable to release the block try performing steps 1 and 2 at the same time.

To prevent this from happening in the future, please make sure your syringe is positioned correctly in the syringe holder block.

11. **I am having trouble with my MouseSTAT. What can I do?**

This chart shows common problems you might experience with the MouseVent. If none of the suggested solutions solve your problem, please contact Kent Scientific for assistance.

Problem	Possible Cause	Solutions
Flickering light or no red light in sensor	Sensor not fully connected	• Ensure that all connections are tight, especially at the back of the PhysioSuite
	Sensor or interface cable has damaged wire	• Test each cable independently and replace the damaged cable
No red line on Oxiwave chart	Internal hardware issue	• Contact Kent Scientific
Inconsistent readings or no readings	Incorrect sensor placement	• Reposition sensor on animal's paw
	Poor animal circulation	• Investigate type and dose of anesthetic and other drugs; reduce if possible • Increase body temperature of animal to encourage circulation

12. **I am having trouble with my MouseVent. What can I do?**

This chart shows common problems you might experience with the MouseVent. If none of the suggested solutions solve your problem, please contact Kent Scientific for assistance.

Problem	Possible Cause	Solutions
Pressure fluctuations	Back pressure in inlet or exhaust lines	• Ensure that bypass is connected properly • Turn flow rate down to about 0.5L/min • Examine tubing set up for valves or other areas that create pressure backup • Shorten exhaust tubing
High tidal volume or tidal volume increasing over time	Leak in animal circuit	• Ensure animal is intubated properly with correct size endotracheal tube • Ensure endotracheal tube is tightly connected to its adapter
Low tidal volume or tidal volume decreasing over time	Back pressure in exhaust line	• Ensure that bypass is connected properly • Examine tubing set up for valves or other areas that create pressure backup • Shorten exhaust tubing
Gasping animal	Animal not anesthetized properly	• Examine anesthetic concentration • Examine line from vaporizer to ventilator for leaks • Ensure Y clips direct flow to ventilator only • Examine vaporizer for anesthetic level and functionality
	Animal rebreathing	• Calibrate dead space • Correct tubing length • Ensure endotracheal tube is connected directly to its adapter to minimize dead space

Managing Data

SomnoSuite supports a robust and customizable set of data collection, storage and upload features:

- History –stores the most recent roughly 1000 records from your PhysioSuite runs. This data can be sent to a PC through the USB port. See **Main > History**.

- Upload –uploads real-time data to your computer through the USB port. See **Main > Config > Upload**.

All data from your SomnoSuite is in the form of comma separated values. In some cases, it includes headings, units, ranges and other extra data.

You can collect and monitor this data using a serial over-USB connection and the Free Serial Port Terminal program under Windows® Vista® or Windows® 7 or 8. Once the data is on your computer, you can use a variety of programs there to examine the data.

To upload SomnoSuite data successfully, you must upload and install:
- *The latest FTDI driver*
- *Free Serial Port Terminal.exe*

FTDI Driver Installation Guide

Download and install the FTDI driver to enable your computer's USB port to communicate with your PhysioSuite:

1. In a browser, navigate to **http://www.ftdichip.com/Drivers/VCP.htm**.

2. Find the latest **Currently Supported VCP Drivers** table. Click the link that says **setup executable**.

3. When the prompt appears, click **Save File**.
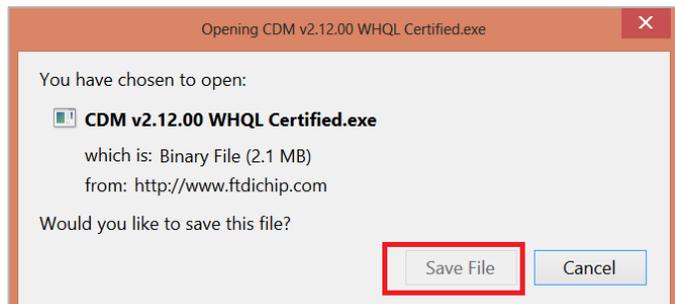
4. When the download is complete, locate the saved file on your computer and open it.
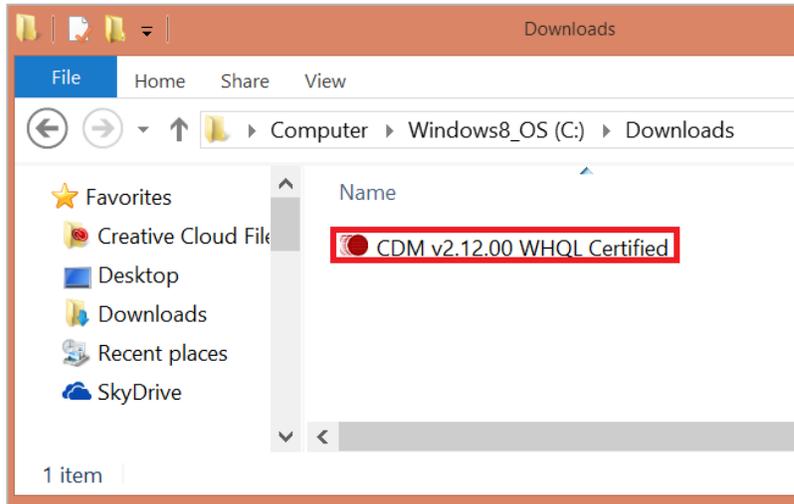
5. Click **Extract** to extract the driver installer and launch the installation program.
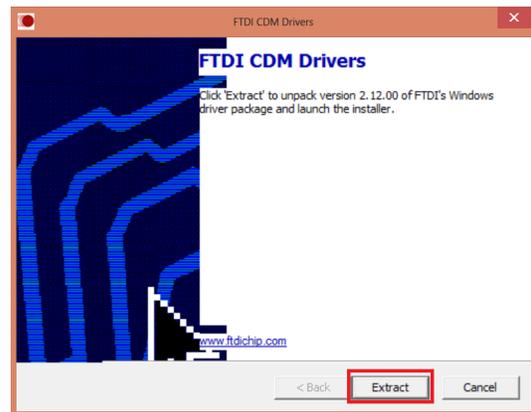
6. When the extraction is finished, the computer will launch the **Device Driver Installation Wizard**. Click **Next** to begin installation of the PhysioSuite communication drivers.
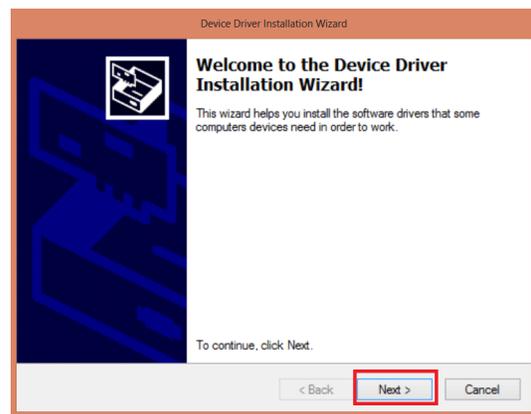
7. Accept the License Agreement and click **Next**.
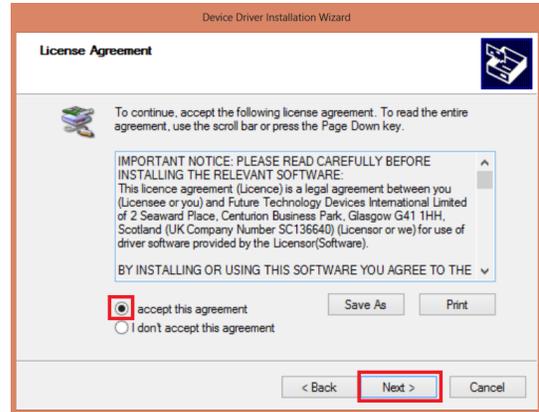
8. When the driver installation is complete, click **Finish** to close the driver installation program. You have now finished installing the FTDI-Chip drivers.
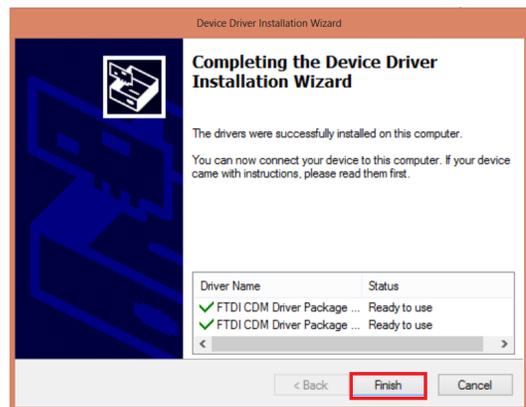
9. Turn your SomnoSuite on and connect it to your PC using the USB to Mini-USB cable included with your system.

10. Open **Control Panel** and from there, open **Device Manager**.
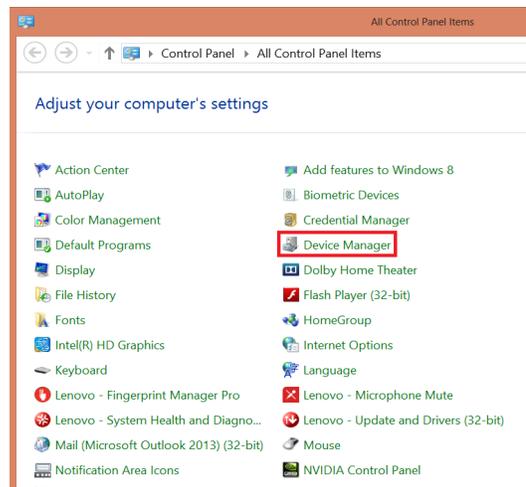
11. In **Device Manager**, open the **Ports (COM & LPT)** tab. If your device is installed properly, it will show up as a USB Serial Port. **COM9** in the image below is an example of a port number. Your port number may be different.
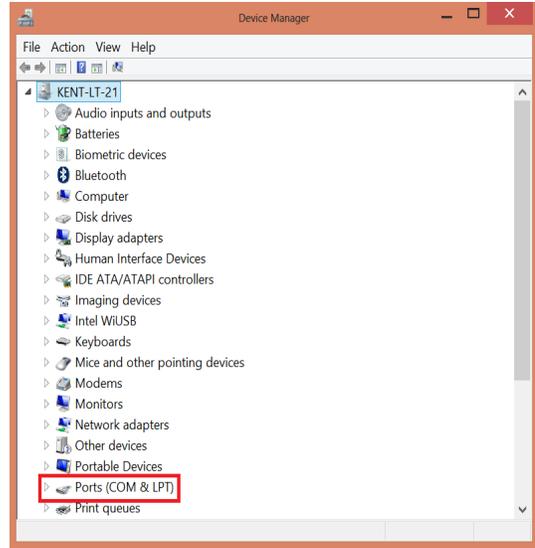
Terminal Emulator Setup Guide

These directions are for use with Free Serial Port Terminal.exe, a program that allows your computer to receive data from your SomnoSuite. Please note that some features, such as the location of menus or settings, may vary from those presented in this guide, depending upon your operating system and your data collection program.

> **Free Serial Port Terminal is a freeware third-party program and is not developed or supported by Kent Scientific Corporation. It is provided as is. Kent Scientific is not responsible for loss of data or time, or for damage to property, due to misuse of this program or caused by any bugs in this software or conflicts caused by the use of this software.**

Before you begin:

- Confirm that the FTDI VCP drivers are installed on your system. SomnoSuite will not be able to upload data properly if this driver is not installed. See *FTDI Driver Install Guide* on page 27 for directions.

- Connect your SomnoSuite to your computer using the included USB to Mini-USB cable.

- Download and Install Free Serial Port Terminal using this URL: http://www.softpedia.com/get/System/System-Miscellaneous/Free-Serial-Port-Terminal.shtml. *Please note that this freeware, third-party program was not developed by and is not supported by Kent Scientific.*

Setup

1. At the Windows **Control Panel**, open **Device Manager**. Locate the **Ports (COM & LPT)** selection.
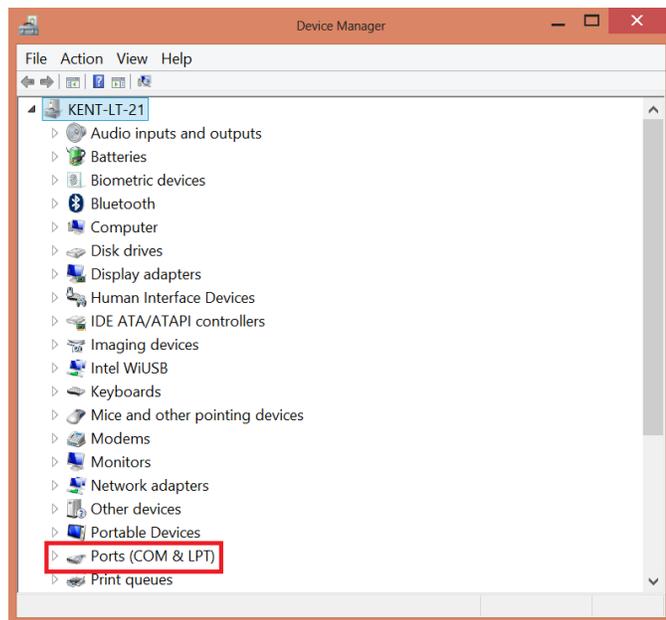
2. Open the **Ports (COM & LPT)** menu. Note the COM port number of this SomnoSuite, shown as **USB Serial Port (COM##)**.
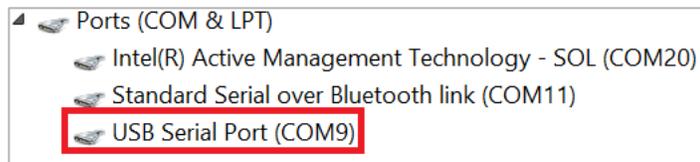
3. Locate the icon for Free Serial Port Terminal and open the program.

4. Open the **COM Port** drop down menu and select the COM Port of the device. In the Settings drop down menu, select **COM Port Settings**. The number you see after **COM** will not necessarily be **9**.
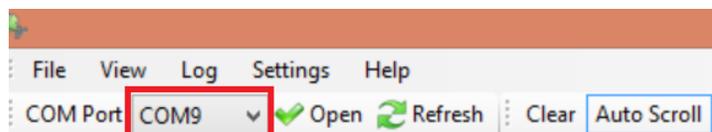
5. Set the COM port settings to:
   Bits per second: 115200
   Data Bits: 8
   Parity: None
   Stop bits: 1
   Flow Control: DTR: green **RTS**: green
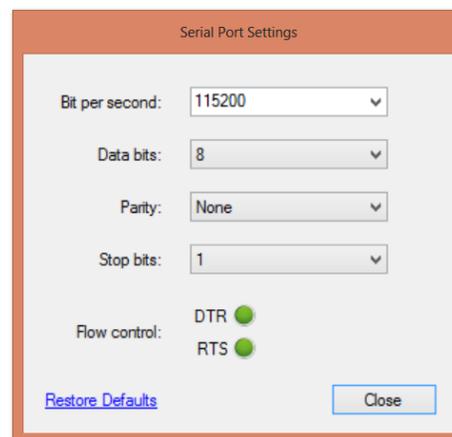
6. Press the **Open** button on the Toolbar to open the COM port and begin communication between your PhysioSuite and computer. Be sure you have enabled data upload in the SomnoSuite firmware to receive readings in the terminal emulator.
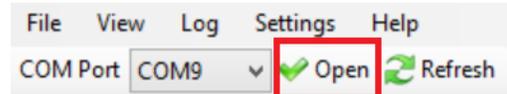
Logging Data

The Terminal emulator will not save data to disk unless you enable Data Logging. Data Logging allows you to record experimental data for later analysis in programs such as R, Excel and Matlab.

 To begin logging data:
1. Select **Start Logging** from the **Log Menu**.

2. In the resulting **Save As** dialog box, type your desired file name in the **File name** field.

3. In the **Save as Type** field, select **Text file (*.txt)** from the drop down menu.

4. Click **Save**.

The data stream is now be saved for later use.

Unable to upload data?

If you are not able to upload data, please check that:

• You have enabled **Upload** through your SomnoSuite menus.

• You have selected one or more Parameters to be uploaded.

• Your SomnoSuite is in Run Mode if your settings require that. See **Main > Upload**.

• Your SomnoSuite has successfully been assigned to a COM port. To verify this, open **Device Manager**.

• You have entered the correct COM port settings.

Part 2: SomnoSuite Configuration Guide

The Main Menu

Any time you press **SET UP** at the Home Screen, the **Main Menu** appears on the left side of the display. The **Air On/Off** choice will be highlighted.

Press **SET UP** to move through the choices of the **Main Menu**. For each choice, on-screen instructions tell you either to press **SELECT** for another menu or to use the $\triangle$ and ∇ buttons to make a setting.

Pressing **RUN/BACK** moves back a level in the menu structure. Pressing **RUN/BACK** at the **Main Menu** puts the SomnoSuite into Run mode.

At the Main Menu, choices vary depending upon modules installed:

- **Air Mode** appears only if you have the MouseVent module.

- **Minute Vol** appears only if you have no MouseVent module or are running the MouseVent with **Air Mode** set to **Constant Flow**.

- **MouseVent** appears only if you are running the MouseVent module with **Air Mode** set to **Ventilator**.

Main > Air On/Off

Control air flow

Turn the air flow **ON** or **OFF**. Press **SELECT** to choose.

If you choose **OFF**, the Ventilator or Vaporizer immediately turns off. Pressing **RUN/BACK** will cause the system to enter Run mode and all the associated displays to appear. However, you will have to press **RUN/BACK** again if you want the Ventilator or Vaporizer to turn on.

If you choose **ON**, the Ventilator or Vaporizer immediately begins to run and will continue running even if the system is in Setup mode. This allows you to make changes in your system settings while maintaining an air flow to the animal. With this setting, at the Run Screen, you can use the RUN/BACK button to pause the Ventilator. SomnoSuite will then beep to remind you it is paused.

Main Menu
Air On/Off
Anesthesia
Air Supply
Air Mode
Minute Vol
MouseVent
MouseSTAT
Actions
History
Alarms
Config

Main > Anesthesia

Go to Anesthesia Menu

The Anesthesia menu lets you set up how and if you will use anesthetic along with the air flow to the animal. It contains four choices:

Main > Anesthesia > Enable

Deliver anesthesia

Choose whether or not anesthetic will be included along with the air delivered to the animal. Press **SELECT** to choose. Choices: **Enable, Disable**. Default: **Disable**.

When you are asked to confirm, press **SELECT** again for yes or **SET UP** for no. Before you select **Enable**, be sure your anesthetic setup is complete, the syringe is loaded and the anesthesia tubing is filled and primed.

Main > Anesthesia > Remove

Remove syringe

Move the pusher block away to allow you to replace a syringe. Begin by removing the empty syringe. Then press **SELECT** to move the pusher block a sufficient distance to allow you to place the newly filled syringe. The block will stop slightly more than 6cm back from the empty position you have set with **Main > Anesthesia > Setup > Set Empty**. If you want to stop or restart the block while it is reversing, press **SELECT**.

Please see **animal safety caution** in sidebar.

Main > Anesthesia > Prime Tube

Move block to prime tube

Move the pusher block back into position after placing a newly filled syringe. Press ∇ to adjust the position of the block until you have filled the anesthetic connecting tubing with anesthetic.

Please see **animal safety caution** in sidebar.

Main > Anesthesia > Setup

Go to Anest Setup menu

The **Anest Setup Menu** allows you to set parameters for the anesthetic delivery system. It contains four choices:

Set type of anesthetic

Choose the type of anesthetic you will use in the syringe. Choices: **Isoflurane, Sevoflurane**. Default: **Isoflurane.**

If you plan to use sevoflurane, please contact Kent Scientific to ensure that you have the most up-to-date firmware.

Your **Type Anest** choice sets the scaling of the SomnoSuite Controller's **Anesthetic Agent Concentration** knob, which is used to select the percentage of anesthetic you want to use. The **MIN** value (knob all the way to the left) is 0%. The **MAX** value (knob all the way to the right) is 5% for isoflurane and 8% for sevoflurane.

Select syringe size

Choose the size of the syringe you will be using. Choices: **2mL, 5mL, 10mL**. Default: **2mL**.

See page 61, *Choosing Syringe Size*, for a discussion and tables to help you select the size syringe that will provide anesthesia for the length of time you want to use it.

To ensure continuous operation of the pump and constant flow of anesthetic, choose a syringe that will last for your specific procedure, but no longer than 3 to 6 hours. If your procedure is longer than that, fill a second syringe and quickly switch syringes when the first syringe is 95% empty.

Built in alarms sound when your syringe is 90% empty (1 beep), 95% empty (2 beeps) and completely empty (5 beeps). These cannot be turned off.

See **Main > Alarms** on page 50 to set an alarm that will alert you when the syringe reaches any volume you select.

Set empty for syringe

Identify the position at which the pusher block will stop and treat the syringe as empty. With an empty syringe in place, press △ or ▽ to move the block to the empty position for

Syringe Size

The SomnoSuite is designed to use specific gas-tight analytical syringes in 2mL, 5mL and 10mL sizes.

CAUTION!
For animal safety!

*Do not prime the tube if the circuit is already filled with anesthetic. Priming is intended for use **only** when you are using a new syringe and no anesthetic is present in the circuit. Priming the tube while anesthetic is already present in the circuit can cause too much anesthetic to be pushed into the line resulting in an overdose to the animal.*

the syringe. When you have the plunger in the correct location, press **SELECT**. The pusher block will now automatically detect this position as empty and stop moving.

Built in alarms sound when your syringe is 90% (1 beep), 95% (2 beeps) and 100% (5 beeps) empty. These cannot be tuned off. You can also set an alarm to warn you when the syringe reaches any volume you select. See **Main > Alarms** on page 50**.**

Main > Anesthesia > Setup > Auto Rev

Enable automatic reverse

Enable the pusher block to reverse automatically when the syringe is empty. Choices: **YES**, **NO**. Default: **YES**.

Auto reverse automatically returns the pusher block to the full position when the syringe becomes empty. If you choose **NO**, an empty syringe simply causes the block to stop.

You can press **SELECT** to stop the auto-reversing midway if you would like to use a partially filled syringe.

When the pusher block stops, either when auto-reversing is complete or because you have pressed **SELECT**, you can use $\triangle$ and $\triangledown$ to adjust the block's position. This lets you make small adjustments to assist in repositioning the syringe.

When you have positioned your syringe, press **RUN/BACK** to enable anesthesia. This also disables use of $\triangle$ and $\triangledown$ to move the pusher block.

Main > Air Supply

Select air supply

Choose the source of the air supply for your animal. Choices:

- **Internal Pump** — Set the source of air to be the SomnoSuite pump.
- **Compressed Gas** — Set the source of air or gas to be an external supply.

Default: **Internal Pump**

Main > Air Mode

Select air mode
Choose the way the air is delivered to your animal. Choices:
- **Ventilator** — Use the Ventilator mode to generate breaths. This is the default.
- **Constant Flow** — Use the Vaporizer mode for a constant flow of gas to the animal.

Default**: Ventilator**

Air Mode appears only if the MouseVent module is installed.

Air Mode and Air Supply
If you set Air Mode to Constant flow:
- For animals over 500g, set **Air Supply** to **Compressed Gas** only.
- For animals of 500g or less, set **Air Supply** to either **Internal Pump** or **Compressed Gas**.

Main > Minute Vol

Set target flow rate
Choose the gas flow rate for SomnoSuite to use. This menu choice appears only if you:
- have no MouseVent module
- are using the MouseVent with **Air Mode** set to **Constant Flow**

Choices: 10mL/min to 500mL/min in 1mL/min increments for **Air Supply** set to **Internal Pump**, and 10 mL/min to 800mL/min for **Air Supply** set to **Compressed Gas**. These settings allow you to use flow rates that are much lower than traditional vaporizers support.
Default: **100mL/min**.

Vaporizer vs Ventilator
*Vaporizer mode (**Air Mode = Constant Flow**) produces a constant flow stream of air or gas through an induction chamber or mask. Ventilator mode (**Air Mode = Ventilator**), which requires the MouseVent module, operates as a full-featured Ventilator using the MouseVent functions. A Constant Flow operation is a settable MouseVent option.*

Minute Vol
*If you have set **Minute Vol** to a value greater than 500mL/min using **Internal Pump**, and you then switch to **Compressed Gas**, **Minute Vol** will reset automatically to 500mL/min.*

Main > MouseVent

Go to MouseVent Menu

The **MouseVent Menu** allows you to specify the operating conditions for the MouseVent Ventilator. The number of menu choices varies with the setting you make under **Priority**:

- **Targ Press** — (inspiration pressure priority, default setting) only **TargPres** appears below **Priority** in the **MouseVent Menu**
- **Tidal Vol** — (tidal volume priority) **Tidal Vol**, **Init Press**, **Max Press** and **Min Press** appear instead

Main > MouseVent > Body Wgt

Set body weight

Choose the animal body weight that will be used to set a typical **RR** and **Tidal Vol** for that weight. Choices: 3 to 500g. Default: **30g**.

As you change the weight for your animal, the default **Tidal Volume**, **RR** and **Minute Volume** for that weight are shown on the screen. If you want to use values other than these default values, you must reset them *after* you set **Body Wgt:**

- To reset **RR**, choose **RR** from the **MouseVent Menu**.

- To reset **Tidal Vol** (and thus **Minute Vol**), choose **Tidal Vol** at **MouseVent > Priority** and then set the target **Tidal Vol**. See **Priority** below.

Each time you set a new body weight, the defaults for that weight will appear, and those values will replace any settings you may have made for them.

You can also change body weight at the Home Screen when you have the MouseVent module. Setting the weight in either place overrides any setting you have previously made. Note that the Home Screen also displays the current settings for several important ventilator parameters.

Main > MouseVent > RR

Set ventilation rate

Choose a target ventilation rate in breaths per minute. Choices: 20 to 350bpm. Default: **133bpm** for an animal of the default weight, which is 30g.

Main > MouseVent > Priority

Set ventilator priority

Choose which Parameter will be given priority as the MouseVent regulates artificial ventilation. You can choose to ventilate to a target tidal volume, **TidalVol**, or a target inspiration pressure, **TargPres**. The recommended setting and default is **TargPres**.

Your choice at this screen, which depends upon the requirements of your procedure, will add the selection(s) you need to the **MouseVent Menu,** allowing you to set your target criteria. For more about constant-volume ventilation and constant-pressure ventilation, see pages 57 and following.

Main > MouseVent > TargPres

Set target insp pressure

Choose a target inspiration pressure that the MouseVent will try to maintain from breath to breath. Choices: 2 to 30cmH2O. Default: **15cmH2O**.

This choice appears only if you have chosen Inspiration **TargPres** under **Priority**.

Main > MouseVent > Tidal Vol

Set target tidal volume

Choose a target tidal volume that the MouseVent will try to maintain from breath to breath. Choices: 0.01 to 5.00mL. Default: depends upon the body weight you have selected.

This choice appears only if you have chosen **Tidal Vol** under **Priority**.

Main > MouseVent > Init Press

The Set init insp pressure screen

Choose an initial inspiration pressure that the MouseVent will use on its first cycle after you press **RUN/BACK**. Choices: 2 to 30cmH2O. Default: **15cmH2O**.

This choice appears only if you have chosen **Tidal Vol** under **Priority**.

Main > MouseVent > **Max Press**

Set maximum insp press

Choose the maximum inspiration pressure that the MouseVent should use in trying to reach your target tidal volume. Choices: from the value you have set for **Init Press** to 30cmH2O. Default: **20cmH2O**.

This choice appears only if you have chosen **Tidal Vol** under **Priority**.

Main > MouseVent > **Min Press**

Set minimum insp press

Choose a minimum inspiration pressure that the MouseVent should use in trying to reach your target tidal volume. Choices: 2cmH2O to the **Init Press** value you have set. Default: **5cmH2O**.

This choice appears only if you have chosen **Tidal Vol** under **Priority**.

Main > MouseVent > **PEEP**

Set peak end exp press

Choose a **PEEP**—Peak End Expiratory Pressure—to be used to prevent lung collapse in your animal. Choices: 0 to 9cmH2O. Default: **0cmH2O**. For more about PEEP, see page 57 and following.

Main > MouseVent > **Advanced**

Go to Advanced Menu

The **Advanced Menu** allows you to customize certain specialized parameters of the MouseVent. It contains seven choices:

Main > MouseVent > Advanced > **Run/Stop**

Set Ventilator stat on power-up

Choose whether or not the Ventilator will run when you turn the power on. If you choose not to have the Ventilator run on start-up, you will have to press **RUN/BACK** after power-up to start it. Choices: **Running, Stopped**. Default: **Stopped**.

Stopping the Ventilator

Even in Setup mode, the Ventilator continues to run in the background. To stop it, press **RUN/BACK** until you reach the Run screen. Press it one more time to stop the Ventilator. The lack of valve or pump sound will confirm that it is stopped.

Max Press and Min Press
*For animal safety, the allowed range of pressures is bracketed by the values you specify with **Max Press** and **Min Press**. If the MouseVent reaches **Max Press** before delivering your target tidal volume, it will stop inspiration at **Max Press** to avoid over-pressuring the animal's lungs. If it reaches **Min Press** before delivering your target tidal volume, it will deliver **Min Press** to make sure the animal is at least minimally ventilated. IMPORTANT: If this occurs, check your settings and tubing connections.*

Advanced Menu
Run/Stop
I/E Ratio
Sigh
Assist
Triggers
Insp Pause
Sync Out

Main > MouseVent > Advanced > I/E Ratio

Set ratio of insp to exp parts of cycle

Choose the ratio between the inspiratory and expiratory phases of a breath cycle. Choices: **1/1, 1/1.5, 1/2, 1/3, 1/4**, and **1/5**. Default: **1/2**.

Note that you are setting the ratio between the inspiratory and expiratory phases of a MouseVent breath cycle, not between the inspiratory phase and the entire breath cycle. That means a ratio of **1/2** yields an expiratory phase that is twice as long as the inspiratory. If you wanted the inspiratory cycle to be half of an entire cycle, you would choose an **I/E Ratio** of **1/1**.

Main > MouseVent > Advanced > Sigh

The **Sigh Menu** lets you enable Sigh breaths and configure the details of those breaths. The **Sigh Menu** has three choices:

Main > MouseVent > Advanced > Sigh > Enable

Enable Sigh breaths

Enable or disable Sigh breaths. Choices: **YES, NO**. Default: **NO**.

Main > MouseVent > Advanced > Sigh > Sigh Press

Set target pressure for Sigh breaths

Set the target pressure for Sigh breaths. Choices: from either **TargPres** for Pressure Priority or **Init Press** for Volume Priority to 30cmH2O. Default: **20cmH2O**.

Main > MouseVent > Advanced > Sigh > Interval

Set number of breaths before a Sigh breath

Specify the number of regular breaths between **Sigh** breaths. Choices: 10 to 100. Default: **25 (Sigh** every 26th breath).

Main > MouseVent > Advanced > Assist

Go to Assist Menu

The **Assist Menu** allows you to enable assisted ventilation and configure the way in which it will be implemented. The **Assist Menu** has six possible choices:

Main > MouseVent > Advanced > Assist > Enable

Enable assisted ventilation

Enable or disable assisted ventilation. Choices: **YES, NO**. Default: **NO**.

Sigh Menu
Enable
Sigh Press
Interval

See page 60 for more about Sigh breaths.

Assist Menu
Enable
Backup Trg
Button Trg
Remote Trg
Breath Trg
-Trig Press

Tip: If you have enabled assisted breaths and have not chosen any other trigger, the backup trigger will be the only trigger for an assisted breath.

Set time for backup trigger

Set the timed backup trigger, which acts as a backup to any other triggers you have set for assisted ventilation. Unless you turn the backup trigger off, the MouseVent will wait up to your specified number of cycle periods after the end of a cycle and if no other trigger occurs in that time, deliver an assisted breath. Choices: **Off**, a number of cycles between 0.25 and 4.00. Default: **Off**.

Enable SELECT button as trigger

Enable **SELECT** as a trigger for an assisted breath. If you choose to enable it, pressing **SELECT** at any time in Run mode will cause an assisted breath to be delivered. Choices: **YES**, **NO**. Default: **NO**.

Enable remote signal as trigger

Enable the triggering of an assisted breath by an external signal you supply. If **Remote Trg** is enabled, a drop from HI signal to LO on pin 5 of the Remote connector will act as the trigger. Choices: **YES**, **NO**. Default: **NO**.

Enable attempted breath as trigger

Enable the attempted breath trigger, which is the triggering of an assisted breath by the animal's attempt to breathe. Choices: **YES**, **NO**. Default: **NO**.

Set pressure drop for breath trigger

Select the required drop in pressure that
The MouseVent must detect before it triggers an assisted breath. Choices: -2.0 to -0.2cmH2O. Default: **-0.5cmH2O**.

This menu choice appears only if you have enabled the attempted breath trigger at **Assist > Breath Trg**.

Remote Triggering
*You can apply an external signal at the **REMOTE** connector of the MouseVent and use this signal to trigger and/or control sigh breaths, assisted breathing and breathing pauses. Grounding pin 5 of the **REMOTE** port causes a drop from high to low and acts as a trigger. For continuous actions, such as maintaining **Hold at Expiratory** (see page 43) the action remains as long as the drop to low is held.*

*You will need a custom cable for the **REMOTE** connector if you want to use the Remote Trigger feature. Contact Kent Scientific for more information.*

Breath Trigger
*If you enable the breath trigger, you must set a value for **Trig Press**.*

Go to Triggers menu

The **Triggers Menu** lets you choose the effect of the **SELECT** button and of the external signal if you are not already using them for assisted breathing. The **Triggers Menu** has three possible choices:

Set action of SELECT btn and external trigger

Choose the effect of the **SELECT** button and of the external signal in Run mode. The screen will indicate which triggers are still available for use. Function choices are:

- **Hold at expiratory** — causes a pause at the expiratory phase until the setting you make under **Duration** is satisfied. Choosing **Hold at expiratory** adds the **Duration** choice to the menu.

- **Hold at inspiratory** — causes a pause at the inspiratory phase until the settings you make under **Duration** and **Pressure** are satisfied. Choosing **Hold at inspiratory** adds the **Duration** and **Pressure** choices to the menu.

- **Insert Sigh breath** — causes the next breath after the trigger to be a **Sigh** breath.

- **None** — assigns no function to the available triggers. Default: **None**.

Set length of triggered pause

Choose how long a triggered pause will remain in effect. Choices: a number of seconds between 1 and 30, **Until released**. Default: **Until released**. **Until released** maintains the pause until you release the **SELECT** button or the signal on pin 5 of the **Remote** connector drops to low.

Set target hold pressure

Choose whether or not the MouseVent is to actively maintain a constant pressure during a triggered pause in the inspiratory cycle, and if so, what that pressure should be. Choices: a pressure from 2cmH2O to 30cmH2O, **Not Actively Held**. Default: **Not Actively Held**.

Triggers Menu
Effect
-Duration
-Pressure

There may be no choices, one choice, or two choices under Effect depending on the setting you make there.

The pair of Triggers—the SELECT button and the external signal— will both be assigned the same function if they are both available for assignment. If you have already used the SELECT button, the external signal or both for assisted breathing, the used trigger(s) will be marked as not available for selection here.

About Hold at Inspiratory
During a triggered pause in the inspiratory phase, the gas used to maintain the pressure is not included in the measured tidal volume for that breath.

Set insp pause as % inspiration interval

Set the length of the inspiratory pause at the end of an active inspiration. You are choosing the length of the pause as a percentage of the time from the opening of the **INSP** valve to the opening of the **EXP** valve. Note that larger **Insp Pause** values cause more rapid pressure changes in the lungs, with the lungs being held for longer periods at either **TargPress** or the tidal volume. Choices: 5% to 50%. Default: **10%**.

Select SyncOut signal

Choose the type of analog signals to send to external equipment. Choices are:

- **Sqr wave** — Send a high signal at the beginning of each inspiration, dropping to low at the beginning of each exhalation.

- **Inv sqr wave** — Send a low signal at the beginning of each inspiration, going up to high at the beginning of each exhalation.

- **Insp pulse** — Send a pulse at the beginning of each inspiration.

- **Insp pause pulse** — Send a pulse at the beginning of the plateau phase of the each breath.

- **Exp pulse** — Send a pulse at the beginning of each expiration.

- **Not enabled** — Do not send a signal.

Default: **Not Enabled**.

The signal is sent from the same **Remote** port used by the analog output feature. See page 55. As a result, turning on any of the **Sync Out** signals will disable analog output as long as **Sync Out** remains set to anything but **Not enabled**.

Signal Type
*The pulsed signal sent for **Exp pulse**, **Insp pause pulse** and **Insp pulse** is a 1ms low-high-low signal.*

Important
*Please contact Kent Scientific for the required cable if you want to use the **Sync Out** feature.*

Main > **MouseSTAT**

Set minimum allowed HR

Choose a minimum heart rate for the MouseSTAT module to recognize. This allows you to filter out any small movements or respiration artifacts the animal might produce.

Select a minimum heart rate that is higher than the animal's maximum respiration rate. Choices: **Mouse** (240), **Rat** (140) and **Custom**, which can range from 40 to 600. All heart rates are in beats per minute. Default: **Mouse**.

Main > **Actions**

Go to Actions Menu

The **Actions Menu** allows you to perform several "housekeeping" functions for your SomnoSuite. It contains up to five choices if you have the MouseVent module, but only one choice—**Defaults**—if you are using the Vaporizer configuration.

Main > Actions > **Purge**

Purge valves

Clear any accumulations from the MouseVent valves using high-pressure air flow.

1. Remove the animal from the Ventilator.
2. Using the tubing from your MouseVent Accessory Kit, connect the **INSP** and **EXP** ports.
3. Press **SELECT**.

After you press **SELECT** the first time, you will be asked **Are you sure?** Press **SELECT** again for yes or **SET UP** for no.

Main > Actions > **Leak test**

Test plumbing for leaks

Check for MouseVent system leaks.

1. Remove the animal from the Ventilator.
2. Firmly seal the end of the endotracheal tubing with your finger or a cap to test the external tubing. For an internal leak test, connect the **INSP** and **EXP** ports with a short length of tubing and fittings from the Accessory Kit.
3. Press **SELECT**.
4. You will be asked **Are you sure?** Press **SELECT** again for **Yes** or **SET UP** for **No**.

---

*If you do not have the MouseSTAT Pulse Oximeter, the screen will read **Module not installed** and you will not be able to set a heart rate.*

If you do have the MouseSTAT module, be sure to plug the sensor into the Controller for the functions to work properly.

To use the Pulse Oximeter feature, you must first apply the oximeter sensor to a convenient appendage of your small animal. Read about sensors on page 63.

Tip: For best results, use the hind paw for SpO2 measurements.

Actions Menu
Purge
Leak Test
Calib Ddspc
Calib Vol
Defaults

Leak Test
*The ventilator tubing will be pressurized to 20cmH2O with the **EXP** valve closed. The **INSP** valve will then be closed and the pressure in the tubing will be measured after two seconds has passed. You will see a display of the pressure changes. The tubing pressure drops must be 2cmH2O or less to pass the test.*

Main > Actions > Calib Ddspc

Calibrate tube dead space

Calibrate the volume of all the tubing connected to the
MouseVent Ventilator—the dead space.

1. Ensure that all tubing is set up exactly as you plan to use it
   to ventilate your animal.
2. Remove the animal from the Ventilator.
3. Firmly seal the end of the endotracheal tubing with your
   finger or a cap, ensuring that there is no leakage.
4. Remove the caps from the **Air Inlet** and **Exhaust** ports.
5. Press **SELECT**.
6. You will be asked **Are you sure?** Press **SELECT** again for yes or
   SET UP for no.

Be sure to perform this calibration every time you modify your
setup in a way that changes the kind or amount of tubing you are
using.

Note: If you use only a small amount of tubing or large tidal
volumes, you can ignore this procedure.

Main > Actions > Calib Vol

Calibrate tidal volume

Calibrate the volume registration components of the MouseVent.

1. Remove the animal from the Ventilator.
2. Draw 3mL of air into the 3mL Volume Calibration syringe.
3. Connect the syringe to the luer T.
4. Connect one end of the luer T to the **EXP** port and one end
   to the extension tubing.
5. Connect the extension tubing to the **INSP** port.
6. Press **SELECT**. You will be asked **Are you sure?** Press **SELECT**
   again for **Yes** or **SET UP** for **No**.
7. Wait for the beep and inject the 3mL of air.
8. Press **RUN/BACK**.

This process is different from calibrating the tubing, which
corrects the tidal volume actually delivered to the animal.

Main > Actions > Defaults

Restore factory defaults

Restore all the factory default settings for the SomnoSuite
Controller. Press **SELECT**. You will be asked **Are you sure?** Press
SELECT again for yes or **SET UP** for no.

Calib Ddspc
*During the test, try not to flex the
tubing, or move it or the syringe,
to avoid creating pressure
fluctuations.*

*When the calibration is done, the
measured tube volume will be
displayed. You do not need to
know this volume to use the
MouseVent, but a value that looks
significantly off could indicate a
leak in the MouseVent.*

Calib Vol
*The volume registration
components have been calibrated
at the factory. It is unlikely that
you will need to perform this
calibration unless you are
experiencing difficulties and a
support representative at Kent
Scientific has suggested you do so.*

*During the test, try not to flex the
tubing or move it or the syringe to
avoid creating pressure
fluctuations.*

Defaults
*Restoring factory defaults resets
the SomnoSuite with the factory
defaults for settings across the
entire unit.*

Main > History

Go to the History Menu

The **History Menu** allows you to configure the display of SomnoSuite historical data, and to view the data while you are in Menu mode in addition to viewing it in Run mode.

The History consists of stored data records from your SomnoSuite runs. The most recent 1000 records are stored in memory and are not erased when the power is turned off.

You can view the History in three ways:

- **In Menu mode**
  Use the **View** choice of the **History Menu >** (see below).

- **In Run mode**
  Press △ and ▽ to scroll through the various runtime displays on the bottom of the screen until you reach the History.

- **On your computer**
  Upload the History to your computer with **History > SendAll** or **History > SendNew**.

The History Menu contains nine choices:

Main > History > Enable

Save to History storage

Enable the storage of your History data. Choices: **YES**, **NO**. Default: **NO**.

Main > History > Group ID

Set Group ID

Specify an optional six-character identifier to be stored with each record. If you do not choose one, the area reserved for displaying the identifier will be blank. Use △ and ▽ to cycle through the choices for each of the six places in the identifier.

Choices: letters from A to Z, numerals from 0 to 9, underline (_) and blank. Press **SELECT** after each choice to move to the next field in the identifier. Press **SET UP** when you finish.

History Menu
Enable
Group ID
View
SendNew
SendAll
Header
Params
Timing
EraseAll

Main > History > View

View History data

View the History on the screen. When you select this, the Menu will be cleared from the screen and the History data will appear. Use △ and ▽ to page vertically and **SELECT** to page horizontally, necessary only if you have more than three parameters in a record. Press **SET UP** to return to the menu.

When you view the History in Menu mode, you see more information than you would on the Run screen. The first column displays a unique identifier (**RecID**) for each record. This identifier is an automatic record counter and is cumulative until you reset it with the EraseAll menu choice.

Directly under **RecID** is the time between record uploads. You will also see the **Group ID** you have specified. A period (.) in front of the **Group ID** indicates it is consecutive with the previous record. An exclamation point (!) indicates there are intervening records that are not displayed. This means there was a power off or an interruption in saving **(Enable** was set to **No)** between records.

Main > History > SendNew

Send new History data

Send all History records since your last History upload to your computer as ASCII records. You will be asked **Are you sure?** before the upload begins. Press **SELECT** for yes and **SET UP** for no.

When the upload is finished, all uploaded records will be marked as no longer new and you will see **Upload complete**.

Note: This action temporarily turns off any regular data upload to your computer. See page 54. When you return to Run mode, your ordinary upload will resume.

Main > History > SendAll

Send all History data

Send all History records to your computer as ASCII records. This choice works exactly as **SendNew** above does, except for the fact that all records are uploaded.

To Send History Data
Your Controller must be connected to a computer for SendNew or SendAll to work. No warning or message is displayed if there is no connection.

Main > History > Header

Include header info

Choose whether or not to send a two-line header with each data upload. The first line of the Header contains the Parameter name of each data column. The second line contains the units for each column, except for column 1, which contains the time interval between records. Choices: **YES**, **NO**. Default: **NO**.

Main > History > Params

Go to Parameters Menu

The **Parameters Menu** lets you select which Parameters will be stored and displayed in the History. The modules installed determine which Parameters appear in your **Parameters Menu.**

Press **SET UP** to highlight the Parameter whose display you would like to configure and then use △ and ▽ to choose a column for that Parameter. You may select up to ten columns. Your SomnoSuite configuration determines the default settings.

Main > History > Timing

Choose update rate

Select the update rate for History data. Any time you set or reset the timing, your existing History data will be erased. Choices: once a second to once every 5 hours. Default: **5sec**.

Main > History > EraseAll

Erase all History data

Clear all History data from memory and reset **RecID** to 0. You will be asked **Are you sure?** Press **SELECT** for yes and **SET UP** for no.

Parameters Menu
% Anest
VolLeft
PeakPres
TidalVol
MinVol
RR
TargPres
PEEP
Pressure
SetMVol
SpO2
HeartRate
Perfusion
MeasRR

CAUTION!
When you change your Parameter selection (Params) or Timing, all History data will be erased! RecID will be reset to 0 as well.

About History Parameters
Keep in mind that the Run mode History display contains only the first five columns you specify. If you would like to format your data so that you have space—a blank column—between your columns, you can choose not to assign a parameter to the columns you want to leave blank.

Main> Alarms

Go to the Alarms Menu

The **Alarms Menu** allows you configure how, when and if to use the SomnoSuite alarms. It contains five choices:

Main > Alarms > Alarm #1

Go to Alarm #1 Menu

The **Alarm #1 Menu** lets you choose the circumstance under which **Alarm #1**, a single-beep alarm, will sound. It contains five choices:

Main > Alarms > Alarm #1 > Parameter

Set Param to trip alarm

Choose which Parameter you would like to activate **Alarm #1**. The available Parameters depend upon the modules you have installed. See page 2. The **Omit** choice disables the alarm.

Main > Alarms > Alarm #1 > Type

Choose type of trigger

Choose between sounding **Alarm #1** when your measured value is greater than a threshold value or less than a threshold value. Default: **is > trigger value**.

Main > Alarms > Alarm #1 > Value

Set trigger value

Choose the threshold value of the Parameter that will activate **Alarm #1**.

Allowed Value Ranges	
Parameter	**Min to Max**
%Anest	0 to 10%
VolLeft	0 to 10mL
PeakPres	0 to 40cmH20
TidalVol	0 to 6mL
MinVol	0 to 1000mL/min
RR	0 to 350bpm
TargPres	0 to 30cmH2O
PEEP	0 to 9cmH2O
InstPres	0 to 40cmH2O
SetMVol	0 to 1000mL/min
SpO2	0 to 100%
HeartRate	0 to 900bpm
Perfusion	0 to 16%
MeasRR	20 to 350bpm

Alarms Menu
Alarm #1
Alarm #2
Alarm #3
Alarm #4
Sys Alarm

Alarm #1 Menu
Parameter
Type
Value
Delay
Repeat

Alarms Details
Alarms function only in Run mode. Alarm conditions are tested once per second, so an event that lasts under one second could be missed.

Set delay before trigger

Choose how long the measured value must meet your alarm trigger value before **Alarm #1** sounds. Choices: 0sec to 8hr. Default: **0sec**.

Set behavior of beeper

Choose how long **Alarm #1** will sound. Choices:

- **Forever** — continues sounding until a reset
- **While triggered** — continues sounding until the trigger condition is no longer met
- **Once per minute** — sounds once every minute until the trigger condition is no longer met, although if the condition recurs, the alarm can sound more often
- **Once per reset** — sounds once and not again until a reset

Default: **While triggered**

Go to Alarm #n

These menus work the same way as **Alarm #1**. The number in the name of an alarm indicates the number of beeps in its beep pattern.

If more than one alarm sounds, the beep patterns adjust. For one alarm, the beep spacing is 2 seconds. When two or more alarms sound at the same time, the spacing decreases to 1 second and each alarm sounds in its turn.

Enable System Alarm

The System Alarm is a 5-beep alarm. Choices: **YES**, **NO**. Default: **NO**.

A message on the bottom of the Run screen shows the cause:

- **Cannot supply sufficient air**
- **Open to atmosphere**
- **Delivery tube blocked**
- **Exhaust tube blocked**
- **Anesthesia delivery stalled** (not due to empty syringe)
- **Pump communication failed** (internal communications failure)

Reset an Alarm

You can reset and alarm in one of two ways:

- *Pressing **SET UP** in Run mode turns off any alarms and resets all alarms to their initial states.*
- *A momentary press of the **RUN/BACK** button performs a silencing reset. The effect of a silencing reset depends on the **Repeat** setting of an alarm.*
  - *For **While triggered** and **Forever**, it prevents retriggering of the alarm for 60 seconds.*
  - *For **Once per minute**, it resets the one-minute timer.*
  - *For **Once per reset**, it rearms the alarm.*

Multiple Alarms

*Multiple alarms sounding change the beep patterns. For example, if both **Alarm #1** and **Alarm #3** are triggered, the pattern will be 1 beep, pause, 3 beeps, pause, repeat. Not only does the spacing between the alarm patterns decrease, but the beeps themselves occur closer together , causing a clearly noticeable change in their sounds.*

Main > Config

Go to Config Menu

The **Config Menu** allows you set up data export for use by other programs and to configure the display of data on the SomnoSuite Controller screen.

Some **Config Menu** choices lead to other menus that list Parameters. The Parameters that appear depend upon the modules you have installed. See page 2**.**

The **Config Menu** contains seven choices:

Main > Config > Parameters

Go to Parameters Menu

The **Parameters Menu** lets you configure the display of your current Parameters on the SomnoSuite Controller's Run screen. Some or all of the Parameters shown in the sidebar appear in your **Parameters Menu** depending upon your SomnoSuite configuration.

Press **SET UP** to highlight a Parameter, then use $\triangle$ and ∇ to specify a location on the screen for that Parameter to be displayed. Default: varies with modules installed.

The screen locations look like this:

1-top	2-top
3-top	4-top
5-top	6-top
1-bottom	2-bottom
3-bottom	4-bottom
5-bottom	6-bottom

You may choose up to twelve Parameters to display. Font size is adjusted to take advantage of the available space on the screen.

The highest-numbered location you choose for each half of the screen (for example, **3-top** is higher than **2-top**) determines the number of rows that appear on that half of the screen.

Main > Config > Chart #1

Go to Chart #1

The **Chart #1 Menu** lets you configure the first of two available Charts that can be displayed on the lower half of the Run screen while your experiment is running.

The Chart #1 Menu contains up to three choices:

Main > Config > Chart #1 > Type

Choose chart type

Choose the data to be displayed as Chart #1. Choices:

1. **{name}** – named Parameter(s) against time

2. **Oxiwave** – real-time infrared signal to help determine signal quality, for MouseSTAT only

3. **Composed** – one or more Parameters of your choosing against time; see **Compose** below

4. **Omit** – Omit Chart #1

Default: varies with modules installed.

Main > Config > Chart #1 > Compose

Go to Compose Menu

Select your own combination of Parameters for your Chart:

1. Choose **Composed** under **Type**. This will cause the **Compose** choice to appear in the menu.

2. Highlight the **Compose** choice and press **SELECT** to go to the **Compose Menu**.

3. Highlight a Parameter and use △ and ▽ to choose whether or not to include that Parameter on your Chart. You may choose up to three Parameters. The available Parameters depend upon the modules installed.

Main > Config > Chart #1 > Timing

Choose update rate

Select an update rate for your data. Choices: 10ms to 10min. End of cycle (MouseVent only). Timing is not adjustable for **Oxiwave**, **InstPres** or **InstCO2**.

Choose the Parameter data range for the Chart using the **Range Menu**.

Chart Menu
Type
Compose
Timing

*The **Compose** choice will not appear in the **Chart Menu** unless you first choose **Composed** under **Chart Type**.*

Charts
*The **Chart #1** and the **Chart #2** choices of the **Config** Menu cause same **Chart** Menu to be displayed. The only difference is which of the two charts you will be setting up.*

Compose Menu
%Anest
VolLeft
PeakPres
TidalVol
MinVol
RR
TargPres
PEEP
Pressure
SetMVol
SpO2
HeartRate
Perfusion
MeasRR
Timing

Main > Config > Chart #2

Go to Chart #2 Menu

This menu works the same way as the **Chart #1** choice.

Main > Config > Startup

Choose startup display

Configure the Startup display, which appears on the lower half of the Run screen. This setting determines the initial display only. While you are in Run mode, you can scroll to other displays with △ and ▽. Choices: **Chart #1**, **Chart #2**, **History**, **Parameters**, **No Display**. Default: **Chart #1**.

Main > Config > Upload

Go to Upload Menu

The **Upload Menu** lets you configure the sending of real-time data to your computer through the USB port. Note that any time you choose to upload History data to your computer, this data Upload will be suspended temporarily, and will resume only when you return to Run mode.

The Upload Menu contains four choices:

Main > Config > Upload > Enable

Enable upload

Enable the upload of real-time SomnoSuite data. Choices: **YES**, **NO**. Default: **NO**.

Main > Config > Upload > Header

Include header info

Choose to send a two-line header with each data upload. The first line of the header contains the Parameter name of each data column. The second line contains the units for each column, except for column 1, which contains the time interval between records. Choices: **YES**, **NO**. Default: **NO**.

Main > Config > Upload > Params

Go to Parameters Menu

The **Parameters Menu** lets you select which Parameters will be uploaded. The modules installed determine which Parameters appear in your **Parameters Menu.** Press **SET UP** to highlight a Parameter and then use △ and ▽ to choose **YES** or **NO**. You may choose up to 20 Parameters. The upload order will match

Upload Menu
Enable
Header
Params
Timing

To Stop an Upload

Go to **Upload > Enable** and choose **NO**. This will stop any upload in progress.

Parameters Menu
%Anest
VolLeft
PeakPres
TidalVol
MinVol
RR
TargPres
PEEP
Pressure
SetMVol
SpO2
HeartRate
Perfusion
MeasRR

their order in the menu. If you send only one Parameter, each value will be on a single line. If you send multiple Parameters, each set of values will be on a single line with the individual values separated by spaces.

Choose upload rate

Choose how often data is to be uploaded. Choices: 10ms (20ms for the MouseVent) and 10min, **End of cycle** (MouseVent only, once per breath. Default: **1sec**.

Notes about Uploads

The USB port is configured as a virtual COM port on the computer. Use Windows® Device Manager or a similar facility on your computer to locate the particular COM port that is assigned to the Controller. The COM port settings are 115200 baud, 8 data bits, 1 stop bit, no parity, no flow control. SomnoSuite uses the FTDI USB interface driver, which you can download at **www.ftdichip.com/Drivers/VCP.htm.** Please see page 27 for information about downloading terminal emulator software.

Go to Analog Menu

The **Analog Menu** lets you choose which data to output through the **Remote** port on the back of the Controller. Please contact Kent Scientific for the optional recorder cable if you would like to use this feature.

Press **SET UP** to highlight the Parameter you would like to configure and then use $\triangle$ and ∇ to choose **YES** or **NO**. Your configuration and usage of the SomnoSuite will determine which Parameters appear in your menu.

You may choose only one Parameter for analog output, so setting one to **YES** automatically sets the others to **NO**.

The data update rate is the same as that used for the Chart display. The voltage output goes from 0V to approximately 4.095V. The endpoints of the data range you choose at the **Range Menu** will correspond to these two voltages.

Timing: End of Cycle

*If you choose **End of cycle** and the Ventilator is not running, there will be no end of cycle and thus no upload.*

Analog Menu
%Anest
VolLeft
PeakPres
TidalVol
MinVol
RR
TargPres
PEEP
Pressure
SetMVol
SpO2
HeartRate
Perfusion
MeasRR

*One D/A signal is available through the Controller's **REMOTE** port. You can use this for analog recording of a signal from the Controller—a strip chart, for example.*

Analog and Sync Out

*Enabling **Sync Out** at **Main > MouseVent >Advanced** will override any setting you make here. To re-enable regular Analog output, you must disable **Sync Out**.*

Go to Range Menu

The **Range Menu** lets you set the range of data values that will be used to scale the Charts and the analog output.

Press **SET UP** to highlight the Parameter you would like to configure and then use $\triangle$ and ∇ to make your settings. The installed modules determine which Parameters appear in your menu. Some parameters have fixed ranges, shown on the chart below as one **1** range.

Parameter Ranges		
Parameter	**# of Ranges**	**Min to Max**
%Anest	1	0 to 8%
VolLeft	2	0 to 10mL
PeakPres	1	0 to 30cmH20
TidalVol	2	0 to 4mL
MinVol	4	0 to 1000mL/min
RR	2	0 to 350bpm
TargPres	1	0 to 30cmH2O
PEEP	1	0 to 10cmH2O
Pressure	1	0 to 30cmH20
SetMVol	4	0 to 800mL/min
SpO2	2	25 to 100%
HeartRate	4	0 to 900bpm
Perfusion	2	0 to 16%
MeasRR	3	20 to 350bpm

For Charts

When you graph more than one Parameter on the same Chart, the Chart is numerically meaningful only if the Range is the same for each Parameter. If you choose two or more different ranges, each Parameter will be scaled to fit the full width of the Chart and there will be no labels. This kind of Chart can be useful if you are interested in a visual indication of trends for your Parameters but are not concerned about the actual numerical values in the Chart.

For Analog Output

The range you specify for each Parameter scales the output by assigning the low end of your range to 0 volts and the high end of your range to 4.095 volts.

Range Menu
%Anest
VolLeft
PeakPres
TidalVol
MinVol
RR
TargPres
PEEP
Pressure
SetMVol
SpO2
HeartRate
Perfusion
MeasRR

Setting a Range
*When you set a **Range** for a given Parameter, the setting remains in force for the Parameter regardless of where you use it. In other words, only one **Range** of values is used at a time for a Parameter, and it will be used for **Charts** and for **Analog Output**.*

Part 3: Theory of Operation

This section provides some useful information about the practical application of the SomnoSuite and its modules.

MouseVent and Artificial Ventilation in Small Animals

There are two methods for controlling artificial ventilation: pressure controlled and volume controlled. Your specific application will determine which type of ventilation priority is best suited for your research.

Pressure Controlled Ventilation

Pressure controlled ventilation delivers inspiratory gases at the onset of the inspiration portion of the ventilation cycle. Gas delivery continues until the inspiratory pressure reaches the desired threshold. The pressure in the airways and lungs is then maintained during the inspiratory pause until the end of the inspiration portion of the cycle; there is no gas flow during this portion of the cycle. With pressure controlled ventilation, the delivered volume is dynamic, with the Ventilator delivering the appropriate tidal volume to attain the desired airway pressure. This means that the Ventilator delivers enough air to the tubing and animal's lungs to attain a desired pressure and then stops until the next inspiration portion of the respiratory cycle. It will report the tidal volume delivered. (For constant-pressure ventilation, select **TargPres** (target pressure) at the **Priority** menu, then use $\triangle$ and $\triangledown$ to choose a target inspiration pressure for the MouseVent to maintain from breath to breath.)

Generally, the pressure is set between 10 and 15 cmH2O for all animals with closed chest procedures. For open chest procedures, you should activate the **PEEP** feature to provide a back pressure preventing lung collapse at the end of exhaling.

NOTE: It is possible for restriction of the animal's airway to occur. Observe the animal's breathing pattern. If the Ventilator reaches pressure without a noticeable expansion of the animal's chest, it is likely that the animal is not getting an adequate inspiratory volume.

Volume Controlled Ventilation

Volume controlled ventilation delivers a constant inspiratory volume and allows the inspiratory pressure to vary dynamically with the tidal volume of the animal. Traditional volume controlled ventilation delivers inspiratory gases for the entire inspiratory period of the respiratory cycle. The tidal volume of the animal plus the connecting tubing determines the final airway pressure. Care is required to avoid over-pressurizing the lungs with an excessive volume of gas.

The Respiratory Cycle

In the expiratory portion of the respiratory cycle, gases in the lungs are released through the expiratory tubing. The lungs should be at atmospheric pressure by the end of that portion of the cycle. During certain procedures, such as an open chest, Peak End Expiratory Pressure (**PEEP**) is required to prevent the lungs from collapsing since the intra-pleural pressure which normally keeps the lungs from collapsing has been removed.

The inspiratory portion is typically one third of the respiratory cycle and the expiratory portion two thirds. The relative lengths of the portions can be adjusted to meet your research needs.

When you choose **Tidal Volume** priority, the MouseVent functions like a volume ventilator, reporting the airway pressure generated to deliver the desired inspiratory volume. For animal safety, a minimum pressure setting ensures maintenance of a minimum airway pressure regardless of the volume delivered, ventilating the animal at a minimal level. A maximum pressure setting protects the animal from overventilation by ensuring that, regardless of the inspiratory volume, the airway pressure remains below the maximum pressure setting. You can set the **Min Press** and **Max Press** (minimum and maximum pressures) or you can use the default values of 5cmH20 and 20cmH20.

Normal Respiratory Rate

The allometric formula for Resting Respiration Rate is:

$$53.5 \times (\text{Body Weight in kg})^{-0.26}$$

Artificial Ventilation in Open-Chested Animals

The space between the inside of the chest cavity, diaphragm, and the outside of the lungs is covered by the pleura and is called the intra-pleural space. The difference between the negative intra-pleural pressure and atmospheric pressure keeps the lungs from collapsing. Opening the chest causes the intra-pleural pressure to become equal to the atmospheric pressure, which in turn can cause a collapse of the lungs. Because there is no restriction on the expiratory cycle of the MouseVent to the exhaust port on the rear of the Ventilator, all the air can escape from the lungs and the lungs can collapse. To prevent a collapsed lung, a **PEEP** (Peak End Expiratory Pressure) is used.

Even with the **PEEP** activated, inflating collapsed lungs can initially take significant pressure. Using a sigh breath set to a pressure higher than the Target Pressure may help. Be sure to have the **PEEP** activated <u>before</u> opening the chest cavity to avoid lung collapse.

Artificial Ventilation in Closed-Chested Animals

The animal must be sufficiently anesthetized to completely inhibit normal breathing. If you would like the animal to breathe on its own, the **Assist** feature of the Ventilator must be active. See page 41 for additional details. If the animal fails to breathe adequately on its own with the **Assist Breath Trg** feature activated, you must set the Backup Trigger (**Backup Trg**) in the **Assist** mode or deactivate the **Assist** and use controlled artificial ventilation.

About Anesthesia and Anesthetics

Anesthesia is the controllable and reversible loss of consciousness induced by chemical intoxication of the central nervous system. The goal of anesthetic administration is to prevent the perception of painful stimuli without undue depression of physiological functions. Characteristic features of the anesthetic state include lowered sensitivity to outside stimuli (including pain), relaxation, and diminished motor response.

In general, the safest anesthetics are inhalants used with the proper delivery and scavenging systems. Isoflurane and sevoflurane are two of the most commonly used inhalant anesthetics due to their rapid onset and offset with minimal side effects.

Isoflurane	Forane, 1-chloro-2,2,2-trifluoroethyldifluoromethyl ether	Halogenated ether that is a clear, colorless, volatile liquid at standard temperature and pressure. It has a mild, ether-like odor and a molecular weight of 184.5.
Sevoflurane	2,2,2-trifluoro-1-(trifluoromethyl) ethyl ether	Halogenated fully fluorinated methyl isopropyl ether that is sweet smelling and non-flammable. It has a molecular weight of 200.

Both isoflurane and sevoflurane require a precision vaporizer for delivery to the animal. An induction chamber can be used for mice or rats. Anesthetic concentrations from the vaporizer are typically limited to 5 percent. Since isoflurane and sevoflurane are very rapid-acting inhalant anesthetic, death can result if the animal is not observed closely or if the concentration is too high.

One advantage of these agents is that they are not metabolized and therefore have little or no toxic effect. Another is that they are relatively insoluble in blood, and therefore "blown-off" quickly, providing a quick recovery. Although very similar to one another, isoflurane and sevoflurane have slightly different effects and mechanisms of action, yet the anesthetic result is nearly identical.

For safety, waste gas scavenging systems are required when using isoflurane or sevoflurane. Precision vaporizers provide precise, controlled levels of anesthesia administration to the patient, offering a margin of safety for the animal. Using gas anesthetics at full concentration quickly results in overdosing the animal and can kill very quickly. Precision vaporizers are part of an anesthesia machine and serve to mix inspiratory gases, such as air or oxygen, with the anesthetic in a precisely-controlled concentration. Animal researchers who routinely incorporate surgery or the use of anesthetics in their animal experiments should consider purchasing an anesthesia machine. The SomnoSuite is a precision vaporizer and artificial ventilator for small animals such as mice and small rats. For other animals or applications, Kent Scientific offers a selection of single- and multiple-channel traditional anesthesia systems.

Glossary of Terms

Target Pressure (TargPres): The airway pressure to be attained by the end of the inspiratory portion of the ventilation despite changing respiratory mechanics or ventilatory muscle activity.

Tidal Volume (TidalVol): The volume of gas either inhaled or exhaled during a breath.

Initial Inspiratory Pressure (TargPres): The initial inspiratory pressure used as a starting point to deliver the first breath when searching for the set tidal volume with ventilation priority set to tidal volume.

Maximum Inspiratory Pressure (Max Press): The maximum inspiratory pressure allowed during tidal volume priority ventilation. This safety setting prevents over-ventilation of the animal since inspiratory gas delivery stops at Max Press even if the Tidal Vol has not been attained. Default is 20cmH20.

Minimum Inspiratory Pressure (Min Press): The minimum inspiratory pressure that must be reached regardless of the inspiratory tidal volume delivered. This safety setting ensures a minimal ventilation level for the animal. Default is 5cmH20.

Positive End Expiratory Pressure (PEEP): A minimum positive airway pressure that is maintained at the end of the expiration during pulmonary ventilation to prevent the lungs and alveoli from collapsing completely between breaths. Primarily used with open chested applications, this setting mimics the negative intra pleural pressure of closed chested animals.

Minute Volume (MinVol): The total volume delivered per minute calculated by multiplying the tidal volume by the respiratory rate.

Sigh Breath (Main > MouseVent > Advanced > Sigh): The introduction of a typically larger than normal tidal volume that inflates the animal's lungs to a larger volume, replicating the natural sigh. This allows the lungs to expand and open any collapsed alveoli, redistributing pulmonary surfactant and preventing microatelectasis.

Inspiratory Pause: The interval from the end of inspiratory flow to the start of expiratory flow.

Assisted Ventilation (Main > MouseVent > Advanced > Assist): A breath for which a ventilator generates all or part of the inspiratory flow. The MouseVent is capable of generating an assisted breath based on any of these triggering events:

- you press the **SELECT** button (**Button Trg**) to initiate one ventilation cycle
- time between cycles reaches a user-selectable point (**Backup Trg**)
- an external digital signal is received (**Remote Trg**)
- the animal attempts to breathe (**Breath Trg**)

Cycle: One complete breath—inspiration and expiration.

End Expiratory Pressure: The pressure at the end of the expiratory phase measured relative to atmospheric pressure.

Expiratory Pause (Hold at expiratory): The interval from the end of expiratory flow to the start of inspiratory flow.

Choosing Syringe Size

To ensure continuous operation of the pump and constant flow of anesthetic, you will need to choose a syringe that will last for your specific procedure, but no longer than 3 to 6 hours.

If your procedure is longer than 6 hours, you can fill a second syringe and quickly switch syringes when the first syringe is 95% empty. See **Main > Alarms** on page 50 to set an alarm that will alert you when the syringe is almost empty.

Three charts are provided below to help you choose a syringe size. Simply follow these steps:

- Calculate the Minute Volume (flow rate) based on your animal's weight. Note that an animal free breathing with a face mask will require a higher flow rate than this Minute Volume.

> **Minute Volume = 331.7 × W$^{0.75}$**
> **W** = animal weight in kg
> **Minute Volume** is in mL/min

- Select your anesthetic concentration.

- Read how long each of three syringe sizes will last in hours and select the syringe size that works best for you.

Number of hours a 2ml syringe of Isoflurane will last in Constant Flow mode

Concentration

Flow Rate	1%	1.5%	2%	2.5%	3%	3.5%	4%	4.5%	5%
50	13.3	8.9	6.7	5.3	4.4	3.8	3.3	3.0	2.7
100	6.7	4.4	3.3	2.7	2.2	1.9	1.6	1.5	1.3
150	4.4	3.0	2.2	1.7	1.5	1.3	1.1	0.9	0.8
200	3.3	2.2	1.6	1.3	1.1	1.0	0.8	0.7	0.6
250	2.7	1.7	1.3	1.0	0.9	0.8	0.6	0.6	0.5
300	2.2	1.4	1.1	0.8	0.7	0.6	0.5	0.5	0.4
350	1.9	1.2	0.9	0.7	0.6	0.5	0.4	0.4	0.3
400	1.6	1.1	0.8	0.6	0.5	0.5	0.4	0.3	0.3
450	1.4	0.9	0.7	0.5	0.4	0.4	0.3	0.3	0.2
500	1.3	0.8	0.6	0.4	0.4	0.3	0.3	0.2	0.2
550	1.2	0.8	0.6	0.4	0.4	0.3	0.3	0.2	0.2
600	1.1	0.7	0.5	0.4	0.3	0.3	0.2	0.2	0.2
650	1.0	0.7	0.5	0.4	0.3	0.2	0.2	0.2	0.2
700	0.9	0.6	0.4	0.3	0.3	0.2	0.2	0.2	0.2
750	0.8	0.5	0.4	0.3	0.2	0.2	0.2	0.1	0.1
800	0.8	0.5	0.4	0.3	0.2	0.2	0.2	0.1	0.1

Number of hours a 5ml syringe of Isoflurane will last in Constant Flow mode

Concentration

Flow Rate	1%	1.5%	2%	2.5%	3%	3.5%	4%	4.5%	5%
50	33.3	22.2	16.6	13.3	11.1	9.5	8.3	7.4	6.6
100	16.6	11.1	8.3	6.6	5.5	4.8	4.2	3.7	3.3
150	11.1	7.4	5.5	4.4	3.7	3.2	2.8	2.5	2.2
200	8.3	5.5	4.2	3.3	2.8	2.4	2.1	1.8	1.6
250	6.6	4.4	3.3	2.7	2.2	1.9	1.6	1.4	1.3
300	5.5	3.7	2.8	2.2	1.8	1.5	1.4	1.2	1.1
350	4.8	3.2	2.4	1.9	1.5	1.3	1.1	1.0	1.0
400	4.2	2.8	2.1	1.6	1.4	1.1	1.0	0.9	0.8
450	3.7	2.5	1.9	1.4	1.2	1.0	0.9	0.8	0.7
500	3.3	2.2	1.6	1.3	1.1	0.9	0.8	0.7	0.6
550	3.0	2.0	1.5	1.2	1.0	0.8	0.7	0.6	0.6
600	2.7	1.8	1.4	1.1	0.9	0.7	0.6	0.6	0.5
650	2.5	1.7	1.2	1.0	0.8	0.7	0.6	0.5	0.5
700	2.3	1.5	1.1	0.9	0.8	0.7	0.6	0.5	0.4
750	2.2	1.4	1.1	0.8	0.7	0.6	0.5	0.4	0.4
800	2.0	1.3	1.0	0.8	0.7	0.6	0.5	0.4	0.4

Number of hours a 10ml syringe of Isoflurane will last in Constant Flow mode

Concentration

Flow Rate	1%	1.5%	2%	2.5%	3%	3.5%	4%	4.5%	5%
50	66.6	44.4	33.3	26.6	22.2	19.0	16.6	14.8	13.3
100	33.3	22.2	16.6	13.3	11.1	9.5	8.3	7.4	6.6
150	22.2	14.8	11.1	8.8	7.4	6.3	5.5	4.9	4.4
200	16.6	11.1	8.3	6.6	5.5	4.7	4.1	3.7	3.3
250	13.3	8.8	6.6	5.3	4.4	3.8	3.3	3.0	2.7
300	11.1	7.4	5.5	4.4	3.7	3.2	2.8	2.5	2.2
350	9.5	6.3	4.7	3.8	3.2	2.7	2.4	2.1	1.9
400	8.3	5.5	4.1	3.3	2.8	2.4	2.1	1.9	1.7
450	7.4	4.9	3.7	3.0	2.5	2.1	1.9	1.6	1.5
500	6.6	4.4	3.3	2.7	2.2	1.9	1.7	1.5	1.3
550	6.0	4.0	3.0	2.4	2.0	1.7	1.5	1.3	1.2
600	5.5	3.7	2.7	2.2	1.8	1.5	1.4	1.2	1.1
650	5.1	3.4	2.5	2.0	1.7	1.4	1.2	1.1	1.0
700	4.7	3.1	2.3	1.8	1.5	1.3	1.1	1.0	0.9
750	4.4	2.9	2.2	1.7	1.4	1.2	1.1	0.9	0.8
800	4.1	2.7	2.0	1.6	1.3	1.1	1.0	0.9	0.8

MouseSTAT and Pulse Oximetry

A pulse oximeter measures how much oxygen is carried in the blood. Oxygen saturation and pulse rate are determined by passing two wavelengths of low intensity light, one red and one infrared, through the body tissue to a photodetector. The signal strength of each light source depends on the color and thickness of the body tissue, sensor placement, and the absorption of the arterial and venous blood in the body tissue.

Oximetry processes the signals, separating out the time-invariant parameters (arterial volume and SpO2) to identify the pulses and calculate the oxygen saturation. Simple calculations for oxygen saturation can be performed because blood saturated with oxygen predictably absorbs less red light than oxygen-depleted blood.

Since measurements of SpO2 depend on a pulsating vascular bed, any condition that restricts blood flow, such as the use of spring-loaded Y-clip sensors, may make accurate SpO2 and pulse rate readings impossible.[1]

Perfusion Index

Perfusion Index (PI) is a numeric value indicating the strength of the plethysmographic signal at the sensor site. The greater the number, the greater the level of blood flow is at the sensor site. The highest perfusion index value indicates the optimal site for sensor placement. Each perfusion index value is unique to the sensor site.

MouseSTAT Sensors

The MouseSTAT Pulse Oximeter module includes one pulse oximeter sensor with each Controller. There are two styles of MouseSTAT Sensor: clip and annular:

- **The clip sensor** is used on the paw and is designed to make contact with the skin without affecting circulation. The clip hinge is not spring loaded, thus reducing the possibility of ischemia at the sensor site, and detects signals equally well on the front or rear paw. Clip sensors are available for both mice and rats.

- **The annular sensor** is used for pups and allows for accurate measurements without making full contact with the skin. MouseSTAT sensors are available in four sizes: 5mm, 9mm and 13mm. The size refers to the internal diameter of the hole in the center of the sensor. The MouseSTAT annular sensor does not require contact with the skin to obtain accurate measurements and is used as a whole-body sensor in neonatal rodents.

Sensor Placement

For best results, position the sensor in an area where there the pigment is lightest, such as the palm (metacarpal or metatarsal) region of the paw.

Paw: Clip Sensor

We recommend the MouseSTAT clip sensor for pulse oximetry measurements on the metacarpal or

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[1] Wright, B., Hellyer, P.W., Respiratory Monitoring During Anesthesia: Pulse Oximetry and Capnography. The Compendium. 1996;18:10

metatarsal section of the paw of adult rodents. The hind paw is optimal because less movement associated with breathing occurs there compared to the front paw.

Whole Body (Neonatal Rodents): Annular Sensor

We recommend the annular sensor in neonatal rodents for pulse oximetry measurements around the body. Lay a portion of the pup's body through the sensor. Full skin contact is not required for measurements with the annular sensor.

Tail: Considerations Regarding Placement

We do not recommend the MouseSTAT annular sensor for pulse oximetry measurements on the tail. Significant research over the years has shown the tail of a rat or mouse to be a specialized organ under control of the CNS for the thermoregulatory control of body temperature. Warming of the subject to the point of eliciting a thermoregulatory response is required to increase blood flow through the tail and assure the most accurate SpO2 readings. Experiments of Lemons and Wu[2] have shown that:

- perfusion in the tail tip is more than tenfold higher than that in the tail base
- perfusion in the middle region of the tail increases eightfold during warming compared to threefold to fourfold in the base and tip.

Our experience shows that pulse oximetry sensors placed simultaneously on a limb and the tail of non-warmed subjects such as rat pups and mice produce significant differences in signal quality. The limb, which is a smaller appendage, shows a significant pulse signal quite usable for SpO2 detection, but the signal from the base tail is almost devoid of pulses and shows mainly a strong respiration artifact.

Ear: Y-Clip Sensor

We recommend the MouseSTAT Y-clip sensor for pulse oximetry measurements on the ear of larger animals. Place the Y-clip sensor on the portion of the ear that provides the greatest amount of skin surface-area contact with the Y-clip sensor. Generally, ear placement is suitable for larger animals such as rabbits, cats, dogs, etc.

Tongue: Y-Clip Sensor

We recommend the MouseSTAT Y-clip sensor for pulse oximetry measurements on the tongue. Place the Y-clip sensor on the portion of the tongue that provides the greatest amount of skin surface-area contact with the Y-clip sensor. Generally, lingual placement is suitable for larger animals such as rabbits, cats, dogs, etc.

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[2] Wu Y, Jiji LM, Lemons DE, Weinbaum S., Department of Mechanical Engineering, City College of the City University of New York, New York, USA. A non-uniform three-dimensional perfusion model of rat tail heat transfer. Phys Med Biol. 1995 May;40(5):789-806.

Part 4: General Information

Thank you for purchasing a SomnoSuite. We truly appreciate your business. We strongly advise that you read and study this Owner's Manual to appreciate fully all the features, benefits, and capabilities of the SomnoSuite.

Contact Information

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Toll-Free: 888-5RATTUS (888-572-8887)
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Fax: 860-626-1179
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Disclaimer

Kent Scientific Corporation makes no representations or warranties, expressed, statutory or implied, regarding the fitness or merchantability of the components of this system for any particular purpose. Further, Kent Scientific Corporation is not liable for any damages, including but not limited to, lost profits, lost savings, or other incidental or consequential damages arising from ownership or use of these products, or for any delay in the performance of its obligations under the warranty due to causes beyond its control. In no case shall Kent Scientific Corporation's financial obligation extend beyond the cost of or replacement of the Kent product in question. Kent Scientific Corporation also reserves the right to make any improvements or modifications to these products described in this manual at any time, without notice of these changes. All brand and product names used in this manual are the trademarks of their respective owners.

This product is not designed, intended or authorized for use in human applications.

Product Warranty

The SomnoSuite has a one (1) year warranty including all parts and labor charges. This warranty does not cover damage by any cause including, but not limited to, any malfunction, defect or failure caused by or resulting from unauthorized service or parts, improper maintenance, operation contrary to furnished instructions, shipping or transit accidents, modifications or repair by the user, harsh environments, misuse, neglect, abuse, accident, incorrect line voltage, fire, flood, other natural disasters, or normal wear and tear. Changes or modifications not approved by Kent Scientific Corporation could void the warranty. The foregoing is in lieu of all other expressed warranties. Kent Scientific Corporation does not assume or authorize any party to assume for it any other obligation or liability.

Satisfaction Guarantee

Should you experience difficulty with the SomnoSuite, our Technical Support Group will assist you in trouble-shooting and determining if the product needs to be returned to our facility. We will issue you a Return Manufacturer Authorization (RMA) number before the product is shipped back for repair. It is at the discretion of the manufacturer to replace or repair a defective part or product. Please call Customer Service at 888-572-8887 to obtain a Return Manufacturer Authorization number. Shipments without a RMA number will not be accepted. Please note that after our 30-day return policy period ends, we will be happy to assist you with your application, but cannot issue any credit or refund for a returned SomnoSuite.

Prior to shipment, please clean and decontaminate the product of any chemical, biological, or isotopic contamination. Please include a completed Product Return Form with the shipment. The form can be found on page 68 of this Owner's Manual. For additional copies, call Kent Scientific Customer Service at 888-572-8887.

Cleaning Instructions

Do not use any alcohol (except as indicated) or abrasive detergents.

Controller

Always position the Controller away from areas of potential contamination. Should the unit become soiled, gently spot clean with a damp wipe or towel. Never use liquids directly on the Controller.

MouseSTAT Pulse Oximeter Sensor

Gently wipe the Sensor clean.

Specifications

Controller

Voltage	12 V, 2.5A
Connection	x1 mini USB, x1 power, x1 6-pin DIN, x1 8-pin DIN (x1 5-pin DIN for factory use only)
Dimensions	29cm (11.41in) x 20cm (7.87in) x 7.6cm (2.97in)
Weight	1.7kg; 1.9kg if MouseVent included

Power Supply

Input	100 to 240 V, 50 to 60 Hz, 1.0 A
Output	12 V, 2.5 A

MouseVent

Control Modes	Volume controlled, pressure controlled
I:E Ratio	1:1 to 1:5
PEEP	Built-in
Respiratory Assist	Automatic or Manual
Sigh Pressure	2cmH2O to 30 cmH2O
Sigh Breath	Automatic or Manual
Respiratory Rate Range	20bpm to 350bpm
Max Inspiratory Flow	1.5 SLPM
Weight Range	3 to 500gm

MouseSTAT

Heart Rate	Up to 900bpm
Resolution	1%
SpO2 Range	70% to 100%
Alarms	5, programmable
Data Export	Yes
SpO2 Sensors	Mouse: Soft Touch paw sensor Rat: Soft Touch paw sensor

Trademarks

SomnoSuite, MouseVent and MouseSTAT are registered trademarks of Kent Scientific Corporation.

MatLab is a registered trademark of MathWorks.

Windows and Excel are registered trademarks of Microsoft Corporation in the United States and other countries.

⇨Product Return Form - Complete Steps 1 through 4

Kent Scientific
C O R P O R A T I O N

860.626.1172 / **toll-free: 888.572.8887** / fax: 860.626.1179
1116 Litchfield Street, Torrington, CT 06790 / www.kentscientific.com

①

Product Name: _____ Serial #: _____ RMA#: _____
                                                                        (in subject line of email)
Product Name: _____ Serial #: _____
Product Name: _____ Serial #: _____

②

Prior to returning equipment that may be contaminated with biohazardous materials, potentially biohazardous materials, or radioactivity; the user must first decontaminate the equipment being returned. The decontamination procedure will include the following, as appropriate:

RETURNS WILL NOT BE ACCEPTED WITHOUT THIS INFORMATION

Place an "X" next to the appropriate box

☐ This equipment has not been used in an area which would result in any biohazard or radioactive exposure.

☐ This equipment was appropriately decontaminated* from any biohazardous materials with:_____
⇨ _____
*Example: Autoclave, 10% bleach, Ethylene Oxide, formalin, etc. (Please note that it is the user's responsibility to confirm that the method of decontamination used is appropriate). Instruments must be decontaminated externally and internally, if needed.

☐ This equipment was appropriately decontaminated and tested for radioactivity by:_____
*Example: Wipe test with results (^{3}H, ^{14}C, α-emitters), Geiger counts, etc.

③

If you are expecting a return or replacement shipped to you, please indicate the shipping address:

Institution: _____
Department: _____
Address Line 1: _____
Address Line 2: _____
City: _____ State: _____ Zip: _____
Country: _____ Telephone: _____ ☐

④

Name: (print) _____ Telephone: _____
Signature: _____ Date: _____

Return Product To:	Kent Scientific Corporation 1116 Litchfield Street Torrington, CT 06790 USA Attn: Returns/RMA #	Returns using a Kent Scientific account should be sent "standard ground" service only. Written permission is required to use any service other than standard ground. Unless prior written authorization is obtained, the sender will be responsible for additional costs associated with the shipment if it is not sent by standard ground.

BEFORE SHIPPING THE PRODUCT: Fax or Email the completed form to 860-626-1179, sales@kentscientific.com

Kent Scientific
CORPORATION

1116 Litchfield Street
Torrington, CT 06790
www.kentscientific.com

Tel: 860-626-1172
Toll-free: 888-572-8887
sales@kentscientific.com