

# MouseOx<sup>®</sup> 3.0/2.0 Small Animal Vital Signs Monitor

# User's Manual



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# Introduction

MouseOx 2.0 and 3.0 are Windows<sup>®</sup> compatible software that provide configuration, monitoring, data acquisition and playback tools for use with STARR Life Science's MouseOx Plus products and accessories.

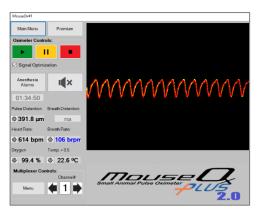
# **Standard Features**

- Continuous noninvasive monitoring of vital signs:
  - Oxygen Saturation
  - o Heart Rate
  - Pulse Distention
  - o Breath Rate
  - o Breath Distention
  - o Temperature
- Configurable alarms for each parameter
- Specialized anesthesia monitoring alarms
- Cardiac PhotoPlethysmoGram (PPG) waveform (300 Hz)
  - Display and analog signal output (IR)
- Switch between multiple subjects and monitor summary data using the MouseOx Multiplexer
- Stream parameters to 3<sup>rd</sup>-party data acquisition systems using the Starr Link output module

Premium Features (In addition to Standard Features)

- High speed data acquisition/recording (.tdms format)
  - Continuous "streaming" parametric data (15 Hz)
  - Continuous discrete data sampling (Snapshot) user specified
  - Cardiac PhotoPlethysmogram Recording (300 Hz)
- Realtime display of all parameters
- Playback/Review of primary recorded data file
- Export all or parts of data files to ".tdms" or ".csv" formats for use with 3<sup>rd</sup>-party analysis software

Mouse	eOx#1					
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Sig	anal Optimizatio	n 🗹 BR				~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
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	01:32:51					Start Necording
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### **Conscious Software Module**

Optional add-on that provides enhanced motion artifact rejection that maximizes the amount of valid data acquired in the presence of movement associated with conscious subjects. Accurate measurement of SpO2 using Pulse-Oximetry depends on the light path length remaining constant over the time period of each individual heartbeat. Excess anatomical movement can alter the path length and cause error. The Conscious/Awake algorithm anticipates motion artifact allowing it to be more selective thus minimizing data lost during anatomical movement. Motion Sensitivity can be adjusted to best match experimental conditions. This software module is required for monitoring awake subjects.

To purchase additional Software License Keys, contact Starr Life Sciences

# **System Requirements**

# Minimum Computer Requirements for 2.0

Processor - Pentium<sup>®</sup>-class processor, 1 GHz or higher; Intel i3 or better

Operating System - Windows® 8.1, 10 & 11

- Currently backward compatible with Windows XP, Vista and 7
  - Subject to change without notice
- MouseOx can run on Apple<sup>®</sup> computers with the use of **PC emulation software**

#### **Computer Ports**

- MouseOx 1X USB 2.0/3.0
- Multiplexer 1X USB 2.0/3.0
- Starr Link 1X USB 2.0/3.0
- Recommended Powered USB hub for multiple accessories

**RAM -** Minimum 4 GB RAM, 8GB or higher recommended

Hard Drive Space - 5 MB for software installation (does not include data files)

Minimum Screen Resolution - 1024 by 768 pixels

# Additional Computer Recommendations for 3.0

MouseOx 3.0 software is essentially 6 versions of MouseOx 2.0 running simultaneously on a computer. This software has a larger computer processing requirement. All screen sizing and adjustments should be made before monitoring is started.

Processor - Pentium<sup>®</sup>-class processor, 1 GHz or higher; Intel i5 or better

#### **Computer Ports**

- All MouseOx systems must be connected to the computer through a powered USB hub
- One optional Starr Link 1X USB 2.0/3.0

RAM - Minimum 16GB or higher recommended

# MouseOx Electrical Requirements

### **\*\*\*ONLY USE POWER SUPPLIES PROVIDED BY STARR LIFE SCIENCES\*\*\***

### Device Operating Voltage - 12 VAC

#### **Operating Wall Voltage:**

- 100/120 VAC @ 50-60 Hz
- 230/240 VAC @ 50-60 Hz

#### **Operating Current:**

- 200 mA MouseOx® Plus
- 200 mA Multiplexer™

#### **USB Current Source Requirement:**

- 85 mA MouseOx® Plus
- 40 mA Multiplexer™
- 180 mA STARR-Link™

#### **Recommended:**

- Plug all equipment into an Uninterruptible Power Supply (UPS)
- Operate laptop computers with power supply attached
- Attach MouseOx and accessories to powered USB hub

# **Software Installation**

# Download 2.0

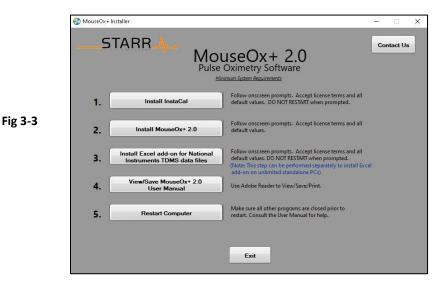
- Download software from <a href="https://www.starrlifesciences.com/resource/mouseox-software-download/">https://www.starrlifesciences.com/resource/mouseox-software-download/</a>

   Installation media available upon request (CD ROM, USB Drive)
- Select link to MouseOx 2.0 (Fig 3-1)
- Click "Save File" (Fig 3-2) File is saved to default Windows<sup>®</sup> download location on your computer

MouseOx and MouseOx Plus Sof	tware	Fig 3-1	Opening MouseOx-Installer.exe	Fig3- 2
<b>Step 1</b> : Click on appropriate link t transferred to multiple computers	to download installer.(Program can be saved to a )	USB drive and	You have chosen to open:  MouseOx-Installer.exe	Tigo 2
MouseOx Plus Rev 3.0 (Simultaneous product key an up to 6 MouseOx plus systems required)	This installer installs both MouseOx 3.0 and Mo MouseOx 3.0 is for use of multiple MouseOx Plu simultaneous operation. A simultaneous produ order to access 3.0 software. (Second Generatio SLS-MP-xxxxx)	us systems used in ct key is required in	which is: exe File (115 MB) from: https://www.starrlifescience.or Would you like to save this file?	Save File Car
MouseOx Plus Rev 2.0 (9) Ingle MouseOx plus system required)	This installer installs the MouseOx 2.0 software modernized version of MouseOx 1.6. MouseOx playback feature for post data collection analys MouseOx, Serial # SLS-MP-xxxxx)	2.0 contains a		
MouseOx Plus Rev 1.6 (Single MouseOx plus system required)	This installer installs the MouseOx Plus 1.6 soft has improved resolution and more awake anim abilities. (Second Generation MouseOx, Serial #	al features and		
MouseOx Revision 6.3.13 (Single Original MouseOx Legacy system required)	This installer installs the Original MouseOx Leg- installer was designed for Windows XP. To run t versions of Windows a newer version of InstaCa Miscellaneous Software section bellow. (First Ge Serial # SLS-MO-xxxxx)	this software on newer al is required. See		

• Run/Double Click "mouseox-plus-v2.exe" from download location – Figure 3-3 should appear

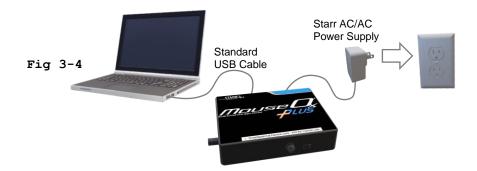
### Perform steps 1-5 and follow the on-screen instructions



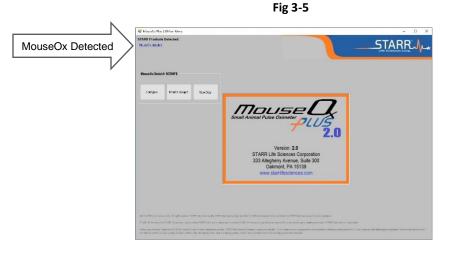
# Activate Software

# After computer restarts:

- 1) Connect MouseOx controller to PC using included USB cable
  - a) Wait a few seconds to allow Windows to recognize MouseOx

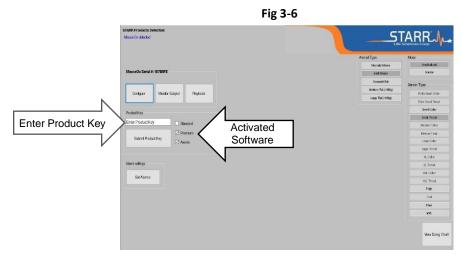


- 2) Start MouseOx 2.0 software: Windows <u>Start</u> button  $\rightarrow$  <u>Starr Life Sciences</u> $\rightarrow$  <u>MOX2.0</u>
  - a) The MouseOx Plus Main Menu should appear. (Figure 3-5)



- b) "MouseOx Detected" should appear in the upper left corner of the screen
  - i) If "MouseOx not detected" is displayed see Appendix A Troubleshooting, Section 3

3) Click <u>Configure</u> - Figure 3-6 should appear



- a) Enter your Software License Key (from Starr Life Sciences)
- b) Click <u>Submit Product Key</u>
  - i) Checks should appear next to activated software modules

# Download 3.0/2.0

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Note: The Mouse Ox 3.0 software installer will also include the latest 2.0 software. The 2.0 software is just automatically downloaded. This allows the user to use the simultaneous product with 2.0 software if a single subject id desired to be analized.

- Download software from <u>https://www.starrlifesciences.com/resource/mouseox-software-download/</u>
  - Installation media available upon request (CD ROM, USB Drive)
- Select link to MouseOx 3.0 (Fig 3-7)
- Click "Save File" (Fig 3-8) File is saved to default Windows<sup>®</sup> download location on your computer

#### MOUSEOX SOFTWARE DOWNLOAD

#### MouseOx and MouseOx Plus Software

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Fig 3-7
```

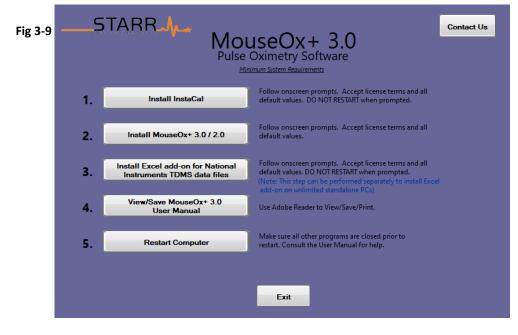
Step 1 : Click on appropriate link to download Installer.(Program can be saved to a USB drive and transferred to multiple computers)

$\subset$	» MouseOx Plus Rev 3.0 (Simultaneous product key an up to 6 MouseOx plus systems required)	This installer installs both MouseOx 3.0 and MouseOx 2.0 software. MouseOx 3.0 is for use of multiple MouseOx Plus systems used in simultaneous operation. A simultaneous product key is required in order to access 3.0 software. (Second Generation MouseOx, Serial # SLS-MP-xxxxx)
	MouseOx Plus Rev 2.0 (Single MouseOx plus system required)	This installer installs the MouseOx 2.0 software. This software is a modernized version of MouseOx 1.6. MouseOx 2.0 contains a playback feature for post data collection analysis. (Second Generation MouseOx, Serial # SLS-MP-xxxxx)
	MouseOx Plus Rev 1.6 (Single MouseOx plus system required)	This installer installs the MouseOx Plus 1.6 software. This software has improved resolution and more awake animal features and abilities. (Second Generation MouseOx, Serial # SLS-MP-xxxxx)
	MouseOx Revision 6.3.13 (Single Original MouseOx Legacy system required)	This installer installs the Original MouseOx Legacy software. This installer was designed for Windows XP. To run this software on newer versions of Windows a newer version of InstaCal is required. See Miscellaneous Software section bellow. (First Generation MouseOx, Serial # SLS-MO-xxxx)



• Run/Double Click "mouseox-plus-v3.exe" from download location – Figure 3-3 should appear

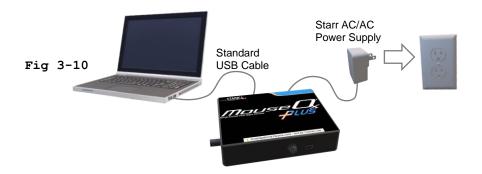
#### Perform steps 1-5 and follow the on-screen instructions



# Activate Software

# After computer restarts:

- 4) Connect MouseOx plus systems that you want to use in simultaneous operation to the PC or a powered USB hub. Another option is to only have MouseOx Plus with simultaneous key code controller to PC or a powered USB hub using included USB cable,
  - a) Wait a few seconds to allow Windows to recognize MouseOx



5) Start MouseOx 3.0 software: Windows <u>Start</u> button → <u>Starr Life Sciences</u>→ <u>MOX3.0</u>
 a) The MouseOx Plus Main Menu should appear. (Figure 3-11)

		Fig 3-11	
Ν	🖳 MouseOx Plus 3.0 Main Menu		- 🗆 X
MouseOx Detected	Hardware Detected: MouseOx detected		
r	START Pleyback Bosako Seraite FIRDAPB Configure Confirm	Versies: 28.19.25 STARR Life Sciences Corporation 333 Alighept Avenue, Suite 300 Dakmont, PA 15139 WWW.starriffesciences.com	
		TARR Life Spences logo and other STARR Life Spences maks are owned by STARR Life Spences and m	
	Technology Warning: Patient No. 8,005,624. Other U.S. and Foreign patients an	een maks are owned by STIERE UIE Sciences Cooporation and may not be used without express within pa re pending. STARE UIE Sciences Schware is copyright protected. This beinetier sensor, measurement cont er system, or center portions of R, will subject you to del and central pendies, and will be prosecuted to the	rol unit and software are all protected by U.S. and international

- b) "MouseOx Detected" should appear in the upper left corner of the screen
  - i) If "MouseOx not detected" is displayed see Appendix A Troubleshooting, Section 3

6) Click <u>Configure</u> - Figure 3-6 should appear

	🖳 MouseOx Plus 3.0 Main Menu			L ,
	Hardware Detected: MouseOx detected			
		Custom ID/Name Temp Port Options:	Mode	Sensor Type
		Subject #1 Temperature	Anesthetized	Extra Small Collar
	START Playback	Blink Sensor Digial Input	Awake	Extra Small Throat
	MouseOx Serial #: 1F0DAFB		Animal Type	Small Collar
	Configure Confirm		Neonatal Mouse	Small Throat
			Adult Mouse	Medium Collar
			Neonatal Rat	Medium Troat
			Medium Rat (<100g)	Large Collar
			Large Rat (>100g)	Large Throat
			Carge Nat (* 100g)	XL Collar
				XL Throat
				XXL Collar
				XXL Throat
				Thigh
				Rat Foot
				Mouse Paw
				MRI
Enter Product Key	Product Key Standard	Activated Software		View Sizin Chart
	Submit Product Key Simultaneous	Modules		

- a) Enter your **Simultaneous Software License Key** (from Starr Life Sciences)
- b) Click Submit Product Key
  - i) Checks should appear next to activated software modules
- c) If any other MouseOx plus systems are detected by the software they will become detected by the software. You can always close this software and connect any addition MouseOx systems to the computer through a powered USB Hub. As long as the Simultaneous MouseOx is detected by the software, all other detected MouseOx systems will be detected and unlocked.

Fig 3-12

# **Computer Settings**

## To avoid disruption of data collection

- Disable Windows Sleep, Standby and Hibernate Modes on your PC
- Disable automatic Windows time changes (Daylight Savings, time zone) and set system time manually.

# **Running the Software**

# Configure Subject

Click <u>Configure</u> on the MouseOx Plus Main Menu (Fig 4-1 should appear)

Make Selections

- You must select a Mode, Animal Type and Sensor type.
- Animal Type and Mode selections will determine which sensor choices are available
- Click <u>View Sizing Chart</u> for guidance regarding animal size
- After selections are made click Monitor Subject

## Mode

- Awake (If Conscious Software Module is active)
  - Awake Mode assumes lots of motion. The software will assume rapid changes in the signal are caused by motion artifact. Rapid changes will result in data rejection and delayed signal optimization until the rate of apparent physical movement slows.
- Anesthetized
  - o Anesthetized Mode assumes limited motion
  - Rapid changes of the signal will be assumed to be caused by rapid changes in physiology, not by motion (e.g. reactions to experimental interventions). This can be used for conscious, active animals but will allow more motion artifact distortion of signals.
  - Motion is more likely to trigger signal optimization

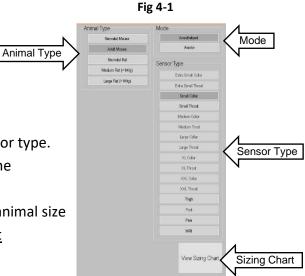
## Animal type

• Sets initial signal levels and tunes signal optimization appropriately for the size of animal selected

## Sensor type

There are 16 variations of the pulse-oximetry sensor. The various sensors are designed to accommodate different measurement sites and a wide range of animal sizes. See Sizing Chart on Configuration Screen

- **Collar** Designed to be placed dorsally around the neck of the subject. Intended for use with conscious ambulatory subjects or prone anesthetized subjects.
- **Throat** Designed to be placed ventrally around neck of the subject. Intended for use with supine anesthetized subjects.
- **Mouse Thigh** Designed specifically for placement on thigh/femur of an anesthetized mouse. Note: Has been used successfully to measure SpO2 across the head of neonatal mice and the base of the tail of large anesthetized rats



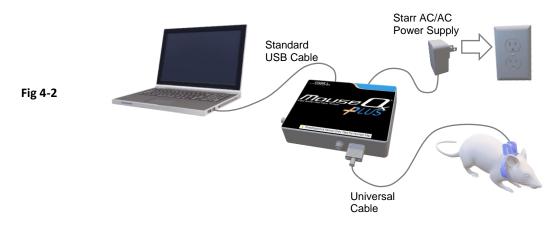
- Rat Foot Recommended for placement on the foot of an anesthetized rat.
   Note: Has been successfully used on the feet of other small animals, rabbit ears and the head of neonatal mice.
- **Mouse Paw** Recommended for placement on the paw of an anesthetized mouse. *Note: Has been successfully used on the tail of anesthetized mice.*
- **MRI** Sensor has 5'-7' of fiber optic cable allowing the sensor to be placed on the subject within the body coil/cage without causing interference.

Note: Standard MouseOx sensors are often used successfully on subjects in an MRI as long as the sensor itself is not located within the body coil/cage

Note: MouseOx pulse-oximetry sensors have been used successfully on many different anatomical locations on many different animals (pulse>90 BPM). E.g., neck, wrist, foot, tail, ear; marmosets, rabbits, guinea pigs, chickens, hamsters, tree shrews, degus, ferrets, squirrels, chinchillas, Canada geese, gerbils, Reese's monkeys, armadillos.

# Monitor Subject(s)

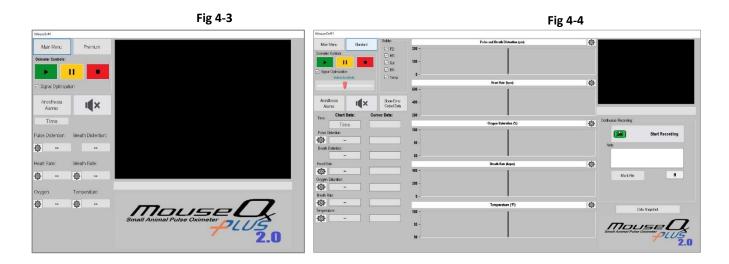
Make sure the MouseOx power supply is plugged in and the sensor is properly attached to the subject.



# Click Monitor Subject on the Main Menu

Depending on your software license either Fig 4-3 or 4-4 will appear

- Standard Software Figure 4-3
- Premium Software figure 4-4



<u>Standard/Premium</u> button – Toggles between Standard/Summary screen and Premium/Detail screen <u>Main Menu</u> – takes you to Main Menu/Configure screen



# **Oximeter Controls**

	Fig 4-5	PhotoPlethysmoGram (PPG)		Fig 4-6	
	MouseOx#1		MouseOx#1		
Oximeter Controls	Main Menu Premium Oximeter Controls:		Main Mere Bandard Demeter Cotrols Signal Optimization Maria Service Femp	Pulse and Breath Dielention (µn) 480 400 280 HeartRate (tipm)	* ************************************
	Ø 1.34.00     Breath Distention:       Ø 391.8 µm     na       Heart Rate:     Breath Rate:       Ø 614 bpm     Ø 106 brpm	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Ansethesa Aanse Time Co-bet Date 01:32:51 Pute Daterton Break Daterton min 0:0 µm break Daterton min 0:0 µm break Daterton 0:0 µm	648 - 600 - 392 - 0xygen Saturation (%) 100 - 80 -	Continuous Recording Start Recording Note: Mark File 0
	Oxygen Temp. • 0.5 9 99.4 % Ø 22.6 °C Multiplexer Controls: Channe# Menu 1 •	mail Animal Pulse Oximeter		60- Breath Rate (byper) 200- 0- Trend Line Graphs	Des Snaphet Des S

# Click <a>(Start Monitoring)</a>

- The red LED on the MouseOx sensor should turn on
- A waveform should appear in the PhotoPlethysmoGram window (Standard Fig 4-5, Premium Fig 4-6)
- The message "Signal Optimization" will appear under the window until optimum signal is achieved
- Data fields and trend line graphs will display no data or "greyed" values until Signal Optimization is finished
- If a signal is not acquired within 2 minutes adjust the sensor placement and click Reset U

### Click II (Pause)

- Stops data acquisition but doesn't reset oximeter control settings.
- Can be useful to pause monitoring before adjusting sensor placement.
- Click **b** to resume data acquisition

## Click **<u>(Reset</u>**

- Resets controller without disrupting data acquisition
- Resets electronics/software to initial values determined by initial subject configuration.

## Click (Stop)

- Stops data acquisition and resets controller settings
- If you click **<u>(Reset)</u>** Signal Optimization will resume

### Signal Optimization - ON/OFF Check box

Recommended setting = On. There are circumstances when it is useful to turn it off (See Appendix D for more detail)

#### Show Error Coded Data - ON/OFF Check box (Premium Only)

Determines whether error coded data is displayed on Trend Line Graphs

#### Motion Sensitivity (Conscious Software Module)

Moving the slider to the right will increase motion sensitivity and maximize motion artifact rejection. If you have difficulty getting data from a conscious moving animal, move the slider to the left to relax rejection criteria.

#### Anesthesia Alarms

Opens settings for specialized anesthesia monitoring alarms (See Appendix B for more detail)

▲ (Silent/Alarm) – Turn audible alarm On/Off

Parameter Alarms – Click 💆 next to each parameter to set alarm conditions

Trend Line Graphs (Premium Only) -Displays approximately 16 seconds of data for each parameter.

- Pulse Distention Pulse Perfusion expressed as measurement of distance of pulsatile deflection (μm)
- Breath Distention Calculated measurement of deflection of capillary bed due to work of breathing
- Enabled in Anesthetized Mode only
  Heart Rate (bpm)
  Oxygen Saturation SpO2 (%)
- Breath Rate (brpm) Fig 4-7

Visible (Premium Only) –Select which Trend Line Graphs are visible (Fig 4-7)

**Data Cursor** (Premium Only) – As you click/drag the Data Cursor in the Trend Line displays, values will be displayed in the Cursor Data fields (Fig 4-6)

Visible:

☑ PD ☑ HR

☑ BR ☑ Temp

# Recording Data (Premium Only)

#### **Continuous Recording** – Record continuous streaming data

• While MouseOx is actively monitoring a subject Click 💹 (Start Recording) - Fig 4-8 should appear

		Fig 4-9	
F	ig 4-8	🖉 Sove As	
ve Data	- 🗆 X	← → · · ↑ □ « mouse → STARR Test Files v ▷ /2 Search STARR Test File	e
		Organize 🛩 New folder    🗄 🗰	
		Desitop # ^ Name ^ Date modified	Тура
Start Sav	ving Data	👆 Disserie ads 🚿 📄 1 Trend 051 621 0905 09;tat 4/16/2021 9:05 AM	Text
		Documents # Thread 072621120720.tst 3/26/202112:07 PM	Tast
	5	🔤 Pictures 🛷 📄 17-and 1009211110236xt 4/0/2021 11:10 AM	Tex
		30 Dbjects I Trend 162521121614.5xt 3/25/2021 12:16 PM	Tec
		Labels 17rend 361221103654.txt 4/12/2021 10:56 4M	Text
Save PPG Waveform		MouseOx Softex 17 and 481421104853.txt 4/14/2021 1048.4M	Tex
		Thend 482521114853.5tt 3/26/2021 11:48 AM	Tex
TE: Data File Will b	be Much Larger. See	- 13 Irena 301421113025.txt 4/14/2021 11:00 AM	Text
er Manual.	3	<ul> <li>OneDrive</li> <li>v</li> </ul>	
		File name: r3/STASR Life Science/\/MouseOx 2.0 File/\STARR Text File/\(Trend 231521092339.rst	
		Save as type:	

- Data from the Monitor Subject Screen will be saved as a "MouseOx Primary Data File" to the hard drive @ 15 Hz in ".tdms" format.
- Default file name is a Windows date/time code with format mmddyyhhmmss. You can change the name but you must keep the .tdms extension.
- Save PPG Waveform select to record the PPG waveform @ 300Hz
- File size
  - Without PPG waveform ~ 150k/min, 9MB/hr, 216 MB/day
  - With PPG waveform ~300k/min, 18MB/hr, 432 MB/day

Notes:

- Currently MouseOx Playback can only open a "Primary MouseOx Data File.tdms"
- If you click <u>Pause</u> while recording, the Elapsed Time in the data file will be incorrect. The Computer Clock data will still be correct
- You can open the file using MouseOx Playback or Microsoft Excel with the TDM Importer Add-In from Measurement Computing
- Parametric data is recorded at 15 Hz, PPG waveform is recorded at 300 Hz

### Note/File Marker (Premium Only)

While MouseOx is recording data you can insert a File Marker/Note into the data file at any time. These File Markers/Notes are saved in the Primary Data File.

- Optional Enter text into "Note" field (Fig 4-10)
- Click <u>Mark File</u>
  - File Marker Index is incremented
  - File Marker Index and Note text are inserted into Primary Data File
  - o Vertical line placed on Oxygen Saturation trend graph
  - Note field cleared

Note: Carriage returns in the Note field can cause formatting issues when opening data files Note: After <u>Mark File</u> has been used once the keyboard space-bar can be used to trigger a file marker



# Schedule Recording (Premium Only)

Schedule Recording is a pop-up menu that can set up a run time off time scenario. for example, if data needs to be collected once an hour the system can turn on for a few minutes every hour then shut off until the next cycle is ready to start again. The intended use is for very long-term studies so that the system doesn't have to create data files that are just too large. This feature is only available if continuous recording is active.

MouseOx#1			
Main Menu Standard Visible:		eath Distention (µm)	
Oximeter Controls:    PD  HR	200-		
Sat			
Signal Optimization	100-		
Motion Sensitivity			
Act	0_l	· · · · · · · · · · · · · · · · · · ·	
	Heart	Rate (bpm)	
Schedule Recording			
Time On (min): Time Off (min):	Increment FM with every new ON cycle		Continuous Recording:
10 20			
ON Counter (min:sec):	AUTO TIMER is		Stop Recording
9 :46	ACTIVE Close		Note:
	Uxygen	Saturation (%)	≥
Breath Distention:	100-		
na 0.0 µm			
Heart Rate: 270 bpm 0 bpm	80-		Mark File 0
Oxygen Saturation:	, i i i i i i i i i i i i i i i i i i i		
<b>71.6 %</b> 0.0 %	60 -		Schedule Recording
Breath Rate:	Breath	Rate (brpm)	9:46
134 brpm 0 brpm	400-		Data Snapshot
Temperature:			
🔯 na na	200-		
		·	Small Animal Pulse Oximeter
			2.0
	,		

- Time On (min): Key in the desired time for the system to be active and powered on.
- Time Off (min): Key in the desired time for the system to be inactive and powered off.
- Counter (min:sec): -This is a countdown timer to indicate time left until the next state.
- Increment FM with every On Cycle This will increment the FM (file marker) every time the system turns on. This will be useful for analyzing the data so the different points of time can be identified.

#### Data Snapshot (Premium Only)

A Data Snapshot is a set of discrete values for each parameter obtained by averaging valid data over a specified period. This is contrasted with "Continuous Recording" which acquires all parameters continuously at 15 Hz.

Note: Data Snapshots can be triggered manually or automatically at a recurring interval.

Note: Data Snapshot runs independently of Monitoring and/or Continuous Recording

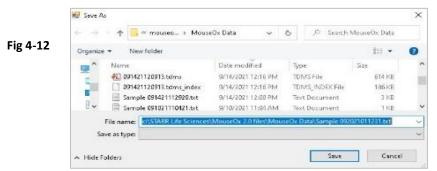
• Click <u>Data Snapshot</u> - Fig 4-11 should appear

	Data Snapshot Sample Size:	<ul> <li>✓ Seconds (5-100)</li> </ul>	Time-Out Limit	<ul> <li>Seconds (15-1000)</li> </ul>			Puice Destantion: 363.8 µm
Fig 4-11	Manusi: Start Write Data to File Note: Write Data to File FileName Get New File		les (I-100) Stop Data Sot		Subject Num: Poise Dusterbon: Poise Dusterbon: Poise Dusterbon: Hourt Rub: Subradon: Denish Rub: Temperature:	Snapshot Complete	Persh Dectarion: na Heart Rate: 430 bpm Solucion: 95.6 % Persh Rate: 215 brpm Temperature: 21.7 °C

- Manual Snapshot
  - o Enter a value for Sample Size in seconds
    - Error coded data will be omitted and not count towards the cumulative sample time
  - Enter a value for Time-Out Limit in seconds
    - If Sample Size can't be accumulated for a parameter within the Time-Out Limit the Snapshot terminates for that parameter
    - Excessive error codes can cause frequent Snapshot termination which indicates a noisy, potentially low-quality signal
  - o Click Start
    - The cumulative average will appear grey in each field until the valid sampling criteria has been met.
    - The final value will be displayed in black/blue
  - Note Optional text in the Note field will be written to file with Snapshot data

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- Click <u>Write Data to File</u>
  - If writing to file for the first time or the "New File" box is selected Fig 4-12 should appear



- The default filename contains the prefix "Snapshot" and the Windows Date/Time code (MMDDYYhhmmss)
- You can change the name but must keep ".csv" file extension
- Subsequent Snapshot data will be appended to the same file unless you select "New File"
- Automatic Snapshot same as Manual except:
  - Enter a value for Recurring Interval in minutes
    - This is the time between Data Snapshots
  - o Click Start
    - "Recurring Snapshot is Active" message is displayed
    - If you enter a new value for Sample Size while Recuring Snapshot is active the new setting will take effect instantly.
    - If you change the Sample Interval while Recurring Snapshot is active you must click <u>Stop/Start</u> for the setting to take effect.
    - In order to start a new file, you must click <u>Stop</u>, check the "New File" Box then Click <u>Start</u>
    - While Recurring Snapshot is active you can click <u>Stop/Start</u> at any time to initiate a new sample. The Sample Interval will resume from the new start point.

#### Click <u>Close</u>

- Returns to Monitor Subject screen
- Recurring Snapshot continues to run until you click the Auto Stop button on the Data Snapshot screen
- o Recurring Snapshot can run concurrently with Continuous Recording

			Fig 5-1		
Viewing Data	Main Mersu	16 -	Sund/	Ø 8.4md #	Notes:
Viewing Data	Open File Here		+ ••••	Ø	
	Viable:	- -	ver čak	¢	
Open Data File	PIEnor Code	10 - 0 -	ł		
	E WOP	100	Gall Alline (11)	Creation Education	x: Esport
From the Main Menu Click <u>Playback</u> – Fig 4-13 should appear	⊠ 9R ⊠ BD	10 500 -	d/ws)(e)	le Hurthan	+omas ⊡*csv ⊡*sters
	⊡ PD ⊟ Activity	200 -	Rhos (spa)	() Brach () de	Cobine:
Click <u>Open File</u>	Compression:	ai - 1 -	1		Additional Channels
ener <u>open me</u>	Mn	16 - 8 -	laninger	©	Mus ID Notes
	felice + sans		Filefinium)	• P. 60 DOM NO.	PEG
Select the file to open from the Windows dialog Box	Curror: Computer Time		xm	<b>(</b> ), 4443.	Frpod Sample Rale
and click <u>Open</u> (Must be a MouseOx Primary Data File)	Dosped Time.			after Terpester	8letTime End Time Creat
	< >	100 10 -		¢ Terpestre	Sat Sat Filo
					Y
Data should appear in the Graphs. Notes and					
			Fig E 2		
	Gifter (Befrierergebuten: J.# fre	eljelousede Doenjelstel 115520aiers	Fig 5-2		
Гime fields – Fig 5-2	6. (Anno 196 Arlan an Anno 2017) Marin Manar Vitan	- "		Swynan 1	Notas: Pra Logo Secus de 16 Projecto de la dela 19
Time fields – Fig 5-2	Open File Sex:	- "		Seepect M     1     1     1     1     1	Note: Process and the M Process and the M Proces
Time fields – Fig 5-2 <b>View</b>	Open File View Here; View Here; Visible: Z Subject #		uuto d	1	P34 to be 64 body de de de la trafficiente de la contrar. P35 1, 11 43 54 body
Time fields – Fig 5-2 View Visible	Open File View Sec. View Visible:	"		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	P34 to 20 S1 DC Brite de la Britis contrat. 1933 - 11 A3 S1 DC Brite
Time fields – Fig 5-2 View Visible	Open File         Voice server           Value         2           2         Subject #           2         File           4         Code           2         No           2         HP           2         DR			1      The National      The Value	P34 to 20 S1 DC Brite de la Britis contrat. 1933 - 11 A3 S1 DC Brite
Time fields – Fig 5-2 View Visible	Open File         Vere           Value         2.5 Alpect #           2.5 Alpect #         2.1 M           2.1 M         2.1 M	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		1     1	Profile Section Sectio
Time fields – Fig 5-2 <b>View</b> Visible Select the check box next to each parameter to view/hide	Open File Veek Vasible: 2.5 Alject # 2.5 Maject #	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		1     1	Professional State of the second state of the
Time fields – Fig 5-2 View Visible Select the check box next to each parameter to view/hide Compression (X-Axis)	Open File         Maximum           View         25.0 pcc           25.0 pcc         25.0 pcc           2.0 pc         20.0 pcc           2.0 pc         20.0 pcc           2.0 pcc         2.0 pcc           2.0 pcc         2.0 pcc           2.0 Advety         2.0 pcc			1      1     1     1      1     1      1	Professional State
Time fields – Fig 5-2 View Visible Select the check box next to each parameter to view/hide <b>Compression (X-Axis)</b> Max = 100% (view entire file)	Open Tile         Max           Vale         25.4 jacc #           25.4 jacc #         25.4 jacc #           27.4 jacc #         25.4 jacc #           27.4 jacc #         25.4 jacc #           27.4 jacc #         25.4 jacc #           27.6 jacc #         25.4 jacc	L L Data Cursor			Professional State
Time fields – Fig 5-2 View Visible Select the check box next to each parameter to view/hide <b>Compression (X-Axis)</b> Max = 100% (view entire file)	Open Flag         Yes           Winder         -           25 Addres #         -           25 Addres #         -           25 Addres #         -           26 Addres #         -           26 Addres #         -           26 Addres #         -           26 Addres #         -           27 Addres #         -           28 Addres #         -           36 Addres #	""		1           The Money           0           Price Sciel           0           Nagger Strateliev           310 Strateliev           255 Byger           19848 Siles           215 Dyger           215 Dyger           215 Dyger           19848 Siles           215 Dyger           215 Dyger           19848 Siles           215 Dyger           19848 Siles           215 Dyger           19848 Siles           215 Dyger           216 Dyger           217 Dyger           218 Dyger <t< td=""><td>Control Control Public     Control Control Public     Control Con</td></t<>	Control Control Public     Control Control Public     Control Con
Time fields – Fig 5-2 View Visible Select the check box next to each parameter to view/hide <b>Compression (X-Axis)</b> Max = 100% (view entire file)	Open F1         Yes           Watelet         27,64367 /r           27,64367 /r         -           27,64367 /r         -           27,64367 /r         -           27,64367 /r         -           26,6437 /r         -           -070         -           -070         -           -071         -           -072         -           -073         -           -074         -	L Andrew Curson		1           Prof. Marco           0           Prov. Case           0           Prov. Case           0 </td <td>Provide State State     Provide State     ProvideState     ProvideS</td>	Provide State State     Provide State     ProvideState     ProvideS
Time fields – Fig 5-2 View Visible Select the check box next to each parameter to view/hide Compression (X-Axis) Max = 100% (view entire file) Min = 0%	Open F Int         View           2 Stapher #         -           3 Stapher #         -           Max         -           Max         -           Other         -           Stapher         - </td <td>""</td> <td></td> <td>1         1           1         1</td> <td>Market State Stat</td>	""		1         1           1         1	Market State Stat
Cursor	Open F In         View           Vera         Vera           2:54/2012         2:54/2012           2:54/2012         2:54/2012           2:54/2012         2:54/2012           2:54/2012         2:54/2012           2:54/2012         2:54/2012           3:56/2012         2:54/2012           Max         4           Sequestion         4	L Andrew Curson		1           1	Maria Carlos de
Time fields – Fig 5-2 View Visible Select the check box next to each parameter to view/hide Compression (X-Axis) Max = 100% (view entire file) Vin = 0% Cursor Time	Open F In         View           Vera         Vera           2:54/2012         2:54/2012           2:54/2012         2:54/2012           2:54/2012         2:54/2012           2:54/2012         2:54/2012           2:54/2012         2:54/2012           3:56/2012         2:54/2012           Max         4           Sequestion         4	L Andrew Curson		1           Professor           0           Proverse           0	The Section of Section 2015 Se

Computer Time: displays the time of day recorded from the computer clock at the time of recording

Elapsed Time: Displays elapsed time in seconds from the beginning of the file. Start = 0.0 sec

### Click View PPG

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If PPG waveform is present in data file Fig 5-3 should appear

## Notes

Displays any Notes that were entered during data acquisition

# Export

Export all or part of the current data file as ".csv" or ". tdms" format

- Format
  - Select .csv or. tdms
    - Csv = comma separated values. For use with spread sheet software
- Options
  - o All Channels
    - Exported file will contain all data channels and can be opened in MouseOx Playback
  - o Visible Channels
    - Only selected/Visible data channels on the Playback screen will be exported
  - o Additional Channels
    - ID Custom subject description (Multiplexer)
    - Notes Entered during initial data acquisition
    - CT Computer Time/Clock
    - P-P Cardiac Peak-to-Peak Interval
  - o PPG Unfiltered cardiac PhotoPlethysmoGram waveform (if recorded in original data file)

#### Export Sample Rate

 $\circ$  ~ Select 1Hz or 5Hz to export compressed parametric data. Compressed data is omitted.

Note: MouseOx Primary Data files are recorded at 15Hz/parametric data, 300Hz PPG.

↑ 📙 « mou... → MouseOx Ex

- Start Time
  - o Click and drag the Data Cursor to the desired starting point and click Set

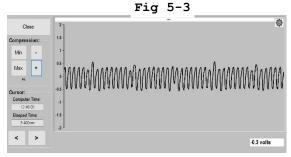
🚽 Save A

- End Time
  - o Click and drag the Data Cursor to the desired end point and click Set

Click Create File – Fig 5-4 should appear

The default file name contains a Windows date/time code and MouseOx format code. You can change the file name but do not change the tdms/csv extension.

Default save location is C:/Starr Life Sciences/MouseOx 2.0 Files/MouseOx Export Data



Note: National Instruments provides an "add-in" for Microsoft Excel and Apache Open Office that allows TDMS files to be imported directly.

# **Temperature Probe**

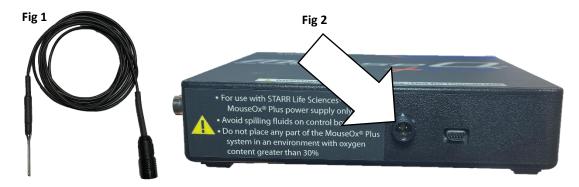
The MouseOx Plus Temperature Probe can be used to measure the core body temperature of a small animal or to monitor ambient temperature during experimental procedures. The sensor probe is made of implant grade titanium and is MRI compatible.

3 standard lengths are available (2, 4 & 7 meter). Contact Starr Life Sciences for custom lengths

SNSR-TEMP-2M SNSR-TEMP-4M SNSR-TEMP-7M (Recommended for MRI)

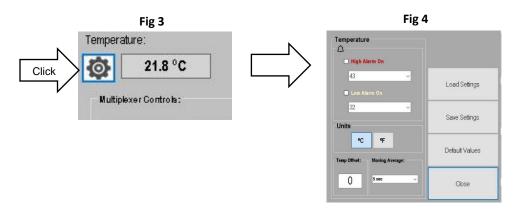
# **User Instructions**

Plug the sensor (Fig 1) into the 3-Pin connector on the front of the MouseOx control box (Fig 2)



#### Settings

Settings for the Temperature Probe are available through the Temperature Settings 🔅 button on the Monitor Subject screen (Fig 3)



- High/Low Alarms Optional Enter values for High/Low threshold alarms. Check box to set as active.
- Select °C/°F (Default: °C)
- Temperature Offset The standard accuracy/precision of the MouseOx Temperature Probe is listed below. If you would like to apply a calibration/correction offset temperature, enter a correction value and click <u>Save Settings</u>

- E.g., Place a calibrated temperature device alongside the MouseOx Probe in a water bath. Add warm water until the calibrated temperature device indicates approximate expected body temperature and record the difference between the calibrated device and the MouseOx Temperature Probe. Use the offset function to apply the difference.
- Moving Average The Temperature Probe has a very fast response time. Select a moving average filter size to reduce displayed noise if desired.
- Click <u>Save Settings</u>
- Click Apply/Close Window All settings are saved and will be reloaded by default

# Apply Temperature Offset when using MUX8X8

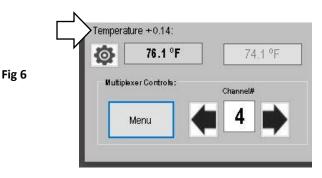
The MUX8X8 allows you to attach 8 pulse-oximetry sensors and 8 Temperature Probes through a single MouseOx Plus Controller. In order to apply offset correction values to multiple Temperature Probes use the following instructions:

While MouseOx is actively monitoring and temperature probes are attached to the MUX8X8:

- 1. Click Menu in Multiplexer Controls
- 2. Select "8 Chan + Temp" at top of form
- 3. Click MUX Summary, Fig 5 will appear
- 4. Click on the Temp Offset field associated with the active channel
- 5. Enter the correction factor into the Offset Field and click Apply Offset
- 6. Click <u>↑</u> ↓ to select the next channel and repeat the process
- 7. When finished click <u>Apply Offset</u> & <u>Close</u>
- 8. Click Save Multiplexer Configuration before exiting the Multiplexer Menu
- 9. The temperature offset for each channel is displayed on the Monitor Subject screen (Fig 6)

					-				
Channel #	Custom ID/Name	Oxygen Saturation (%)	Heart Rate (bpm)	Breath Rate (brpm)	Pulse Distention (µm)	Breath Distention (µm)	Core Temperature (°C/°F)	Apply Offset (°F)	Close
#1	Subject#1	95.5	429	215	352.4	na	76.2 ºF	0.2	
#2	Subject#2	95.6	429	215	352.2	na	76.0 ºF	-0.1	
#3	Subject#3	95.6	429	215	349.7	na		015	
#4	Subject#4	95.6	429	215	348.1	na	Inter Offset	.14	
#5	Subject#5						$\mathcal{V}$	0	
#6	Subject#6							0	
#7	Subject#7							0	
#8	Subject#8							0	

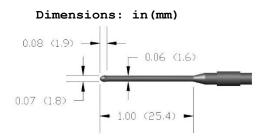
Fig 5



# Specifications

Measurement Resolution +/- 0.1 °C or °F Measurement Range 15 °C - 50°C (59 °F - 122°F) Measurement Response Time Update 0.72 sec

Probe Material: 6AL4V ELI ASTM F-136° Implant Grade Titanium.



# STARR

# MouseOx 3.0

MouseOx 3.0 software is required for simultaneous operation of the MouseOx 2.0 software. This software removes the Multiplexer features of the 2.0 software and adds a group of MouseOx Navigation buttons to switch to the different 2.0 main software screens available for each MouseOx that is connected and detected by the computer.

# **Key Code Process**

The MouseOx 3.0 software is intended to be used with the latest MouseOx systems. The MouseOx with the simultaneous key code associated with it will be a system designed with the 1408FS Plus daq card. This system uses the bulk communications protocol. The software will accept standard MouseOx plus systems, however computer processing speed may limit the performance. the systems with the Bulk protocol hardware will require less processing from the computer. The simultaneous MouseOx and simultaneous keycode must be connected and accepted by the MouseOx 3.0 software first. Once this is accomplished the additional MouseOx systems will be detected or if the program is closed and any additional MouseOx systems are connected they will be detected the next time the MouseOx 3.0 software is opened.

Product Key	
-	Standard
Enter Product Key	Simultaneous
	Premium
Submit Product Key	Awake

# Configure

Since there are multiple MouseOx systems intended to be used in this 3.0 configuration. Each MouseOx system must be configured so that the software has all the start-up and calibration information for each MouseOx. The start-up conditions are the mode and animal type, the calibration information is the sensor type. To do this simply select "Configure" for each MouseOx, select the required constants for each MouseOx, then select "Confirm". During this configure step the user will have the opportunity to key in subject identification and blink the sensor LED so that the MouseOx being configured can be identified.

START	Playback	Custom ID/Name
MouseOx Serial #: 1F	ODAFB	Subject #1
Configure	Confirm	Blink Sensor

# Accessibility

MouseOx #1 is the master MouseOx. The controls for this MouseOx effect the other MouseOx systems detected. "Play" can be selected for each of the MouseOx systems detected, however the "Play" button from the MouseOx #1 screen is the play that runs them all. This is for timing requirements. To move to each of the MouseOx systems just use the controls at the bottom left of the screen. *Note: No other MouseOx system can run if MouseOx #1 isn't running*.

#2	#3
#5	#6
	#2 #5

As each additional MouseOx screen is opened it will go to the front of the already opened screens. Each screen is movable and sizable. It is recommended to do all screen sizing and display adjustments before running the system.

MouseOx#1			💀 MouseOx#	4					-	
Main Menu Oximeter Controls:	Standard	Visible: 고 PD 20 고 HR	Oximeter Controls	Standard	-Visible: ✓ PD ✓ HR ✓ Sat	200 - 100 -	Pulse and Breath Distention (µm)	<b>\$</b>		
Signal Optimiza	Tile Display Oximeter Controls:	Standard	Signal Optim	izaton enstivity	☑ BR ☑ Temp ☑ Act	0 -	Heart Rate (bpm)	\$		
Anesthesia Alarms Time: Chart Data:	Signal Optimi: Motor S	Z Tile Display Oximeter Controls:	Anesthesia Alarms Chart D Time:	ata: Cur	Show Error Coded Data	400 - 200 -	Oxygen Saturation (%)	¢	-Continuous Recording:	
Pulse Distention:	Anesthesia Alarms Chart Da Time:		Pulse Distention:			100 - 80 -			Note:	
Heart Rate:	Pulse Distention:	Anesthesia Alarms Time: Chart Da	Heart Rate:			60 - 400 - 200 -	Breath Rate (brpm)	\$	Mark File	0
Breath Rate:	Heart Rate:	Pulse Distention:	Breath Rate:			0-	Temperture ("F)	\$		
MouseOx Navigatio	\$	Heart Rate:	MouseOx Navig #1	#2	#3	95 - 90 -			Simail Animal Pulse Oximeter	₹ <b>0</b> 711/5 3.0
#4	MouseOx Navigati #1	<b>\$</b>	#4	#5	0-		J. Temperture (°F)			Send Yo
	#4	MouseOx Navigati	m: #2	#3	100 - 95 - 90 -					
		#4	#5	#6						High

Each screen except MouseOx#1 has a "Tile Display" button. If "Tile Display" is pressed from a premium MouseOx screen all detected MouseOx systems premium screens will be evenly spaced and displayed. See image:

MouseOx#1			px: 🛃 MouseOx#2	- 🗆 🗙
Main Menu Standard Visible:	Pulse and Breath Distention (µm)	( <b>\$</b>	Tile Display Standard Visible: Pulse a	nd Breath Distention (µm)
Oximeter Controls:	200-		Oximeter Controls	
Signal Cotimization			Coast Optimization	
Notion Sensitivity Temp	0-	*	Notion Sensibility	Heart Rate (bpm)
Act 🖉	Heart Rate (bpm)		Act 400-	Heart Rate (bpm)
Show Error				
Anestresis Albrits Coded Data	200-	Continuous Recording:	Anaginas Acons Coded Data 200-	Continuous Recording
Time: Chart Data: Cureor Data:	Oxygen Saturation (%)	Start Recording	Time: Chart Data: Cursor Data: 01	vgen Saturation (%)
Pulse Disterson:	100-	New	Pulse Distertion: 100	Note
Breath Distertion:		Prov.	Breath Underston	
	60 -		60-	
Heart Rate:	Breath Rate (brpm)	Nork File 0		Breath Rate (brpm) Kith File 0
Oxygen Saturation:	400-	Schedule Recording	Oxygen Saturation:	
Breath Rate	,		Breath Rote:	
	Temperature (*C)	Simultaneous Data Snapshot	Breach Rate: 0	Temperture (%)
Temperature:	40-		Temperature: 100-	
MouseOx Nav/gation:			NouseOx Nov(gation:	
#1 #2 #3	30-	3.0	#1 #2 #3 90-	3.0
#4 #5 #6			44 #5 #6	
MouseOx#3	and a first of the second s	- 🗆 X	MouseOx#4	- • ×
MouseOx#3	Pulse and Breath Distention (µm)	×	HouseOx#4 Tie Doptoy Standard      Mether Pulse a	nd Breath Distention (µm)
MouseOx#3     Visible:			₩ MouseOx#4           Trie Davizy         Standard           ₩ MouseOx#4         ₩ MouseOx#4           Trie Davizy         Standard           ₩ MouseOx#4         ₩ MouseOx#4	
MouseOx#3 Tie Doplay Sondard Visible Oxineter Controls	Pulse and Breath Distension (µm)		MouseCur4	
MouseOx#3 Tie Digity Standard Vitable: Diameter Contain Standard Vitable: Vie Rigity Standard Vie Rigity Standard Vitable: Vie Rigity Standard Vie Ris	Pulse and Breath Distention (µm)	@	Image: Control of the second	nd Breath Distortion (um)
MouseOx#3 Tie Ospioy Sondord ✓ PO Oxnete Cateloi ✓ Signal Optimization ✓ Signal	Pulse and Breath Distension (µm)		MoureCr44      Te Orbory     Storded      Sold	
MouseCarl	Pulse and Breath Distension (jum)	@	MouseCr44         Pales           Technin         Social           Social         Social	nd Breath Distortion (um)
Massel 4 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	Pulse and Breath Distension (jum)	@	MouseCr44       MouseCr44	nd Breath Distortion (um)
Market All States and	Pulse and Breath Distention (µm) 200 Beart Rate (bpm)	•	MouseCr44      MouseCr44      MouseCr4      MouseCr4	nd Breath Distortion (um)
Molecity Sended View Molecity Sended View View View Control View View View Control View View View View View View View View	Pulse and Breach Distension (µm)	Contract Rendry	Acathese Acres      Constant     Consta	nd Breach Distention (µm)
	Pulse and Breath Distention (µm)	Contract Rendry	Image: Second	nd Breach Distention (µm)
	Pulse and Breath Distention (µm)	Contrasa Recording	MouseCr44         MouseCr44           Technon         Strike           Strike	nd Breath Distortion (µm)
Marcelor Marcel	Pulse and Breath Distention (jum)	Contract Rendry	MouseCo-F4     MouseCo-F4       Tec Daylor     Street       Tec Daylor     Street       Street     Street	nd Breach Distention (µm)
Molection Molection	Pulse and Breath Distention (µm)	Image: Contract Second ry       Image: Contry <t< td=""><td></td><td>ed Brenh Distortion (µn)</td></t<>		ed Brenh Distortion (µn)
Averbasic Corper States Text Desity Dimeter Corper Dimeter	Pulse and Breath Distention (µm) 200	Image: Contract Second ry       Image: Contry <t< td=""><td>Image: Control of Control o</td><td>ed Brenh Distortion (µn)</td></t<>	Image: Control of Control o	ed Brenh Distortion (µn)
Molection Molection	Pulse and Breath Distention (jum)	Contrast Resolution		rd Breath Distortion (µm) 400- Learn Bate (pm) 400- Learn Bate (
	Pulse and Breath Distention (µm) 200	Image: Contrast Recording       Image: Contrecond Recond Recond	Image: Section of the sectio	rd Breath Distortion (µm) 400- Learn Bate (pm) 400- Learn Bate (
Averbasic Competition Competi	Pulse and Breath Distention (µm) 203	Image: Contrast Recording       Image: Contrecond Recond Recond	Image: Sector	rd Breath Distortion (µm) 400- Learn Bate (pm) 400- Learn Bate (
	Pulse and Breath Distention (µm) 203	Contrast Resolution	Image: Section of the sectio	ed Brenh Distertion (jm)

UM-MOX 3.0 / 2.0 Rev 2.0

If "Tile Display" is pressed from a standard MouseOx screen all detected MouseOx systems standard screens will be evenly spaced and displayed. See image:



# STARR-Link

The 3.0 software will accept the use of the STARR-Link. The STARR-Link is now custom configurable. This way if only Saturation and Heartbeat are desired for each of the MouseOx systems being used, the user can configure the STARR-Link to output only the desired information. Go to the STARR-Link section while in the configure section for any MouseOx and select the "Configure" button. The STARR-Link configure form will be made visible. Use the list boxes available to make the desired selections.

🚽 MouseOx Plus 3.0 Main Menu	- 🗆 ×	💀 STARRLink	– 🗆 X
Handware Detected: MouseOx detected STARRLink detected	STARR // -		
Custom D/Name Temp Port Options	Node Sensor Type	a 13	
Subject #1 Temperature	Anesthelized Extra Smar Color	Channel 7:	Channel 6:
Bink Sensor	Aadke Exto Small Throat	MouseOx #1 V	MouseOx #1 ~
MouseOx Seria II 1700475	Animal Type Brull Color		
Configure Confirm	Neonatar Mouse Small Throat	Oxygen Saturation V	Temperature ~
	Aduit Mouse Medium Collar	Channel 5:	Temperature  Channel 4: MouseOx #1
	Neonatal Rut Medium Trtat	MouseOx #1	MouseOx #1 ~
	Medium Rat (*100g) Large Collar		HIGGGCOX HT
	Large Rot (H100g)	Heart Rate 🗸 🛄	Breath Distention
	Xi, Color	Channel 3:	thannel 2:
	XL Throat		Criannei 2.
	XXL, Collar	MouseOx #1 ~	₿ MouseOx #1 V
	XXL, Threat	De al Data	Error Code 🗸
	Thip	Breath Rate	Error Code 🗸
	Rat Foot	Channel 1: Ū	Channel 0:
	Nouse Pole		
	UR.	MouseOx #1 V	Channel 2: MouseOx #1 ~ Error Code ~ Channel 0: MouseOx #1 ~
		Pulse Distention	File Marker
Product Key	View Sizing Chart		
Standard		Sector S	
Simultaneous			
Submit Product Key Premium Settings Channel Configure			Set and Close
Submit Product Key	1		

# Simultaneous Data Snapshot

The data snapshot in the MouseOx 3.0 software is the same as the data snapshot provided in the 2.0 software. The main difference is that the Data snapshot provided with 3.0 allows for simultaneous analysis of the measured parameters.



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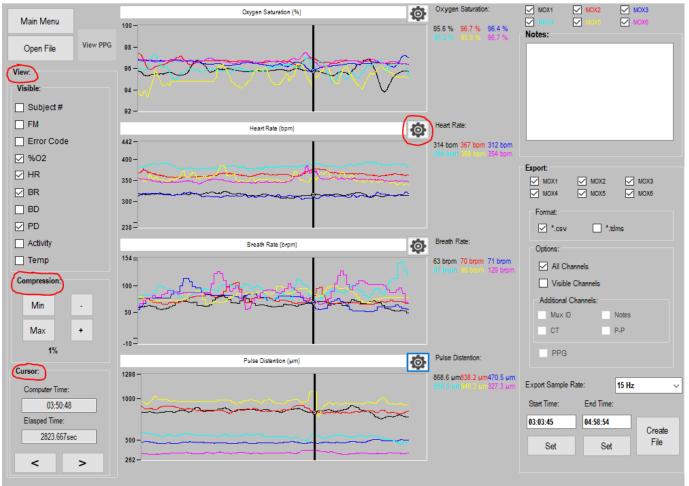
# Playback

The playback features of the MouseOx 3.0 software are the same as defined in the 2.0 playback section with the addition of the multiple data files being viewed simultaneously. Each MouseOx data set is color coded based on the check boxes in the upper right portion of the screen. The cursor data is also color coded. The export options allow the user to pick which subject to create a file for, or to create an individual file for each subject.

Main Menu	Channel #	ø	Subject #:	✓ MOX1 ✓ MOX2 ✓ MOX3 ✓ MOX4 ✓ MOX5 ✓ MOX6
Iviain ivienu	16		1 1 1	✓ MOX6 ✓ MOX6 ✓ MOX6 Notes:
Open File View P	G 0	-	File Marker:	
iew:	50 -	Ø	0 0 0	
/isible:	0- <b></b>		0 0 0	
Subject#	Error Code	Ø	Error Code:	
☐ FM ☐ Error Code	an a		0 3 3 0 0 0	
2 Endi Code 7 %02	Oxygen Saturation (%)	ø	Oxygen Saturation:	
- ] HR	80 300 100 100 100 100 100 100 100 100 10	liciter:	96.1 % 94.6 % 97.4 % 06.7 % 95.5 % 97.2 %	Export:
BR	Heart Rate (bpm)	ø	Heart Rate:	MOX4 MOX5 MOX6
] BD ] PD			308 bpm 390 bpm 432 bpm 384 bpm 348 bpm 401 bpm	Format:
Activity	Breath Rate (brpm)	ø	Breath Rate:	Options:
Temp	400 0	-	63 brpm 68 brpm 78 brpm 100 brpm 88 brpm 84 brpm	All Channels
compression:	Breath Distention (µm)	ø	Breath Distention:	Visible Channels
Min -		~	0.0 µm 0.0 µm 0.0 µm 0.0 µm 0.0 µm 0.0 µm	Additional Channels: Mux ID Notes
Max +	Pulse Distention (µm)	Ø	Pulse Distention:	CT P-P
100%			640.0 µm1194.0 µr754.2 µm 677 8 µm1083.7 µr481.3 µm	PPG
ursor:	Activity	ø	Activity:	Export Sample Rate: 15 Hz
Computer Time: 03:17:01			0 1 0	Start Time: End Time:
Elasped Time:				03:03:45 04:58:54
796.800sec	Core Temperature	ø	Temperature:	Crea
< >	90 -		na na na na na na	Set Set File

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Using the "View" features, the "Compression" features, and the "Cursor" features the data can be visibly analyzed. Each graph also has a settings button to allow scaling and panning of the data visible in each graph.



C:\STARR Life Sciences\MouseOx 3.0 files\MouseOx Data\6 awake Subjects 1.tdms



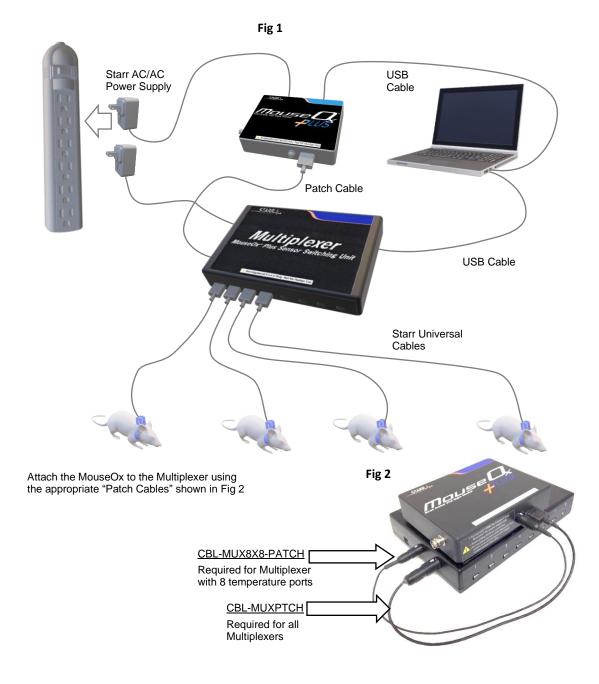
# Multiplexer

The Multiplexer allows a single MouseOx Plus Controller to switch between multiple subjects. MouseOx software allows the user to manually switch between subjects or to automate cyclic recording of all channels.

There are 3 versions of the Multiplexer available:

- 1. MOX-MUX16 16 oximeter ports
- 2. MOX-MUX8 8 oximeter ports
- 3. MOX-MUX8X8 8 oximeter ports, 8 temperature ports

Attach all cabling and power supplies according to Figs 1 & 2



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Run/Restart MouseOx software

- "Multiplexer Detected" will be displayed on the MouseOx 2.0 Main Menu
- "Multiplexer Controls" will become visible on the lower left corner of the Monitor Subject screen (Fig 3).



**Channel #** - Displays current active channel number. Data from this channel is displayed on the Monitor Subject screen and is recorded to file if recording is active

Click <u>←</u>/<u>→</u> buttons to manually select which Multiplexer channel is active and displayed on the Monitor Subject screen Note: <u>←</u>/<u>→</u> are disabled if Auto-Cycle is active

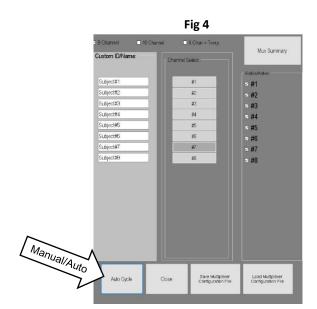
# **Configure Multiplexer**

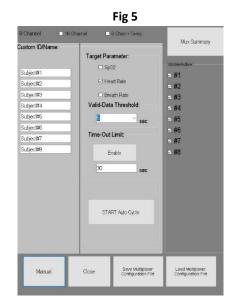
Click Menu in Multiplexer Controls (Fig 3) - Fig 4 should appear

### 8 Channel/16Channel/8 Channel + Temp

Select 8-Channel, 16-Channel or 8 Chan + Temp to correspond with the version of Multiplexer being used

• Selection determines whether 8 or 16 channels are displayed on forms (Fig 4/5)





### **Custom ID/Name (Optional)**

Enter a descriptive name to be associated with each channel. Text will be recorded in the MouseOx Primary Data File along with the data associated with that channel

#### **Visible/Active Channels**

Select which Multiplexer channels are visible/active during Manual and Auto-Cycle operation

#### Click Manual/Auto-Cycle

- Manual (Fig 4) Manually select which channel is active using the Channel Select buttons
- Auto Cycle (Fig 5) Automatically cycle through Visible/Active channels

#### Auto-Cycle controls (Fig 5)

When active, Auto Cycle will step through each Active/Visible Multiplexer channel when the following settings are satisfied

#### **Target Parameter**

MouseOx will monitor/record all data from each channel until it accumulates sufficient valid data for the specified "Target Parameter". The amount of data required to proceed is determined by the Valid Data Threshold

#### Valid-Data Threshold

Enter the number of seconds (5-99999) worth of Target Parameter data required in order to proceed

#### **Time-Out Limit**

If Time-Out Limit is reached before the Valid Data Threshold is achieved the MUX will proceed to the next active channel

#### Click Start Auto Cycle

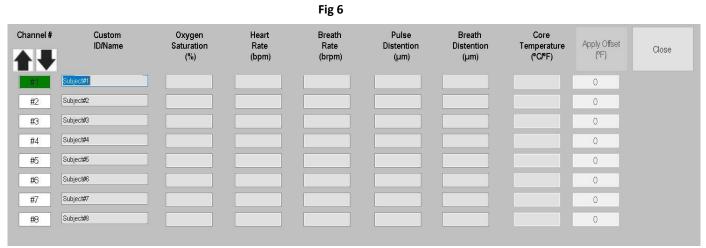
Initiates the Auto-Cycle process starting with the first channel in the Visible/Active list.

- As each channel becomes active data is displayed on the Monitor Subject screen and is highlighted on the Mux Summary screen.
- Clicking <u>STOP/START Auto Cycle</u> will reset the cycle to the first active Channel selected.

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Click Mux Summary - Fig 6 should appear (8 or 16 channels depending on Multiplexer)

- Active channel is highlighted green
- Most recent measurements are displayed for each channel until subsequent update/refresh
- <u>Apply Offset</u> See Temperature Probe section for detailed instructions
- Click 🛧 🖶
  - Increment/Decrement active channel
  - Works with Manual or Auto Cycle



#### **Recording While Using Multiplexer**

Continuous Recording runs independently of Multiplexer operation

Fig 7

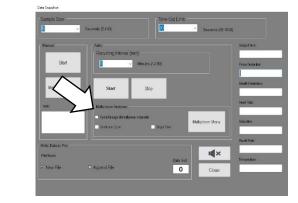
- Data from the active channel is recorded to file while it is displayed on the Monitor Subject screen
- Active Channel# and Custom ID will be recorded along with each data set

Click <u>Close</u> to return to the Monitor Subject screen

- The current active Multiplexer channel is displayed in the Multiplexer Control box (Fig 3)
- Auto-Cycle will continue to function until you click <u>STOP Auto-Cycle</u> on the Multiplexer Menu

#### Using Data Snapshot with Multiplexer

The Manual and Automatic Data Snapshot functions run independently of the Multiplexer. When a Multiplexer is detected by MouseOx software the Multiplexer Features appear on the Data Snapshot screen (Fig 7)



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Manual Snapshot – Works same as if no multiplexer is present. See "Data Snapshot" section of this User Manual

- Select any Multiplexer channel using the <u>←/→</u> buttons on the main screen or <u>↑</u>/<u>↓</u> buttons on the Multiplexer
   Summary form
- Click the <u>Start</u> button in the "Manual" section on the Snapshot screen
- When Snapshot is finished click Write Data to File

#### Automatic Snapshot

- Single Channel Recurring Works same as if no Multiplexer is present with additional ability to manually choose which Multiplexer channel is active
  - Select any Multiplexer channel using the <u>←/→</u> buttons on the main screen or <u>↑</u>/<u>↓</u> buttons on the Multiplexer Summary form
  - On Snapshot screen set Sample Size, Time-Out Limit and Recurring Interval
  - DO NOT select "Cycle Through All Channels"
  - Click Auto <u>Start</u> button First time through enter file name and location Note: If you change Mux channel during Auto-Execution, subsequent data will be recorded from new active channel
  - Click "Auto" <u>Stop</u> button when finished
  - All channels (1 Pass) Automatically step through all Visible/ Active channels 1 time
    - o Set Sample Size & Time-Out Limit (No Recurring Interval)
    - Select "Cycle Through All Multiplexer Channels" check box
    - Select "Single Pass" check box
    - $\circ\quad$  Click Auto  $\underline{Start}$  button First time through enter file name and location
- All Channels Recurring Automatically step through all Visible/ Active channels then repeat at specified Recurring Interval
  - Set Sample Size, Time-Out Limit and Snapshot Interval
  - Select "Cycle Through All Multiplexer Channels" check box
  - o Click Auto Start button First time through enter file name and location
  - Click Auto Stop button when finished
- All Channels Continuous Automatically step through all Visible/ Active channels then repeat
  - Set Sample Size & Time-Out Limit (No Recurring Interval)
  - o Select "Cycle Through All Multiplexer Channels" check box
  - Select "Continuous Cycle" check box
  - Click Auto Start button First time through enter file name and location
  - o Click Auto Stop button when finished

# Cleaning the Multiplexer

The Multiplexer and all accompanying cables should be cleaned using only light detergent and water.

# Appendix A – Troubleshooting

# 1. Software Versions

Some problems can be resolved by downloading and installing the latest versions of MouseOx and InstaCal software from <a href="https://www.starrlifesciences.com/resource/mouseox-software-download/">https://www.starrlifesciences.com/resource/mouseox-software-download/</a>

# 2. Power Supply

A large number of technical support requests result from users inadvertently using the wrong power supply. Make sure you are using the original power supplies that came with your STARR products.

- The MouseOx and accessories each require a specialized <u>12 Volt ~AC power supply</u>
- RECOMMENDED: Only use power supplies purchased through STARR Life Sciences or authorized distributors

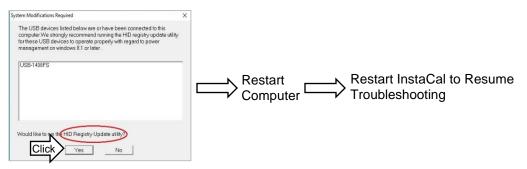
### 3. "MouseOx not detected"

To simplify troubleshooting, first unplug any MouseOx accessories that are connected to your computer (STARR-Link, Multiplexer).

- Make sure the USB cable is properly connected to the MouseOx and your PC Make sure USB connectors are fully inserted into each socket.
- Close/Restart the MouseOx software.

If the "MouseOx not detected" error message is still present

- Close the MouseOx software
- Run InstaCal software (Start + Measurement Computing + InstaCal)
  - $\circ~$  If the HID Registry Update utility dialog box appears, click  $\underline{Yes}$  and follow the on-screen instructions



• The Instacal PC Board List should appear showing the USB-1408FS(-Plus)



Starr Product Codes USB-1408FS(-Plus) = MouseOx USB-1024LS = Multiplexer

- USB-3103 = STARR-Link
- USB-DIO32HS = DP1224

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- If USB-1408FS does not appear on the list
  - Check USB connections again and click the InstaCal Refresh <u>⊍</u> button
  - If the USB-1408FS still does not appear, contact STARR Life Sciences.
- If USB-1408FS does appear on the list

- Run the MouseOx software
- o If the "MouseOx not detected" error message is still present
  - Close the MouseOx software
  - Unplug the MouseOx USB cable
  - Click the InstaCal Refresh <u>U</u> button
    - The message "USB-1408FS with serial #xxxxxx...has not been detected" should appear
      - Click <u>OK</u>
  - The InstaCal PC Board List should show no "Boards" attached
  - Reconnect the MouseOx USB cable
  - Click the Instacal Refresh <u>U</u> button
- o If the USB-1408FS does not appear, contact STARR Life Sciences
- o If the USB-1408FS does appear
  - Run the MouseOx software
  - If the "MouseOx not detected" error continues to appear, contact STARR Life Sciences

### Note: This procedure can be used to troubleshoot connectivity of the STARR products listed above

Note: DO NOT use the "Calibrate" and "Test" functions found in InstaCal. Doing so can permanently damage the MouseOx and will void the product warranty.

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# Appendix B – Alarms

MouseOx provides visual and audible alarm indicators. There are 2 types of alarms:

- Threshold Alarms Set High/Low threshold values for each of 5 parameters
- Comparative/Anesthesia Alarms
  - o Available in Anesthetized Mode
  - Triggered when relationship between 2 parameters meets preset criteria.

#### **Setting Alarms**

You can access Alarm Settings from the MouseOx Main Screen or the Monitor Subject Screen

- Main Screen
  - o Click Settings Figure A-1 should appear
  - o Access Settings for all Threshold and Comparative alarms

		J	
△Pulse Distention (µm)	∴Heart Rate (bpm)	△ 02 Saturation (%)	⚠Breath Rate (brpm)
High Alarm On	Girlingh Alarm On	High Alarm On	High Alarm On
I Low Alarm On II	I Low Alarm On 120 ✓	☑ Low Alarm On 70 ✓	Low Alarm On
Anesthesia Alarm #1 Enable Distention Compare Alarm (Alarm disabled at Pulse Distention <25 µm)		Temperature	
Anesthesia Too Deep Breath Destention is GREATER than	100 % of Pulse Destention	43 ~	Load Settings
Anesthesia Too Light Breath Destention is LESS than Anesthesia Alarm #2	20 % of Pulse Destention	32 Vinits	Save Settings
Enable Rate Compare Alarm     Anesthesia Too Deep     Heart Rate is GREATER than     75	imes Breath Rate	•C •F Temp Offset: Moving Average:	Default Values
Anesthesia Too Light Heart Rale is LESS than 3.5	times Breath Rate	0 5 sec ~	Close

Fig A-1

- Monitor Subject Screen
  - o Click the Anesthesia Alarm button to set the Comparative Alarms
  - Click the Settings <u>\$\$</u> icon next to each parameter field to set High/Low Threshold Alarms.

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#### **Threshold Alarms**

- Choose value from pull down menu or enter custom value
- High Threshold must be greater than Low Threshold
- Check the box next to each Alarm to enable
- Alarms are disabled for each parameter when a parameter specific error code is encountered
- There is currently no alarm for Breath Distension

#### Threshold Alarm Default Values

High alarm defaults are also the maximum value for each parameter

Parameter	High Alarm	Low Alarm
Pulse Distention	800 µm	10 µm
Heart Rate	900 BPM	120 BPM
Oxygen Saturation	100%	80%
Breath Rate	450 BrPM	40 BrPM
Body Temperature	43 °C	32 °C

#### **Comparison/Anesthesia Alarms**

The MouseOx<sup>®</sup> Plus software provides you with two types of alarms that can be used specifically to monitor depth of anesthesia. These are the "Distention Compare Alarm" and the "Rate Compare Alarm". It should be noted that we do not recommend specific values for these alarms, and that they are available for your use based on your own experience. The reason that we do not make specific recommendations is because parameter levels may be dependent on items that we cannot control, such as dosage, time after dosage, type of anesthesia, where it is delivered, etc.

- Threshold Alarms have precedence over anesthesia alarms.
- Comparative Alarms are disabled whenever either parameter is affected by an error code

#### **Distention Compare Alarm**

The ratio of (Breath Distention)/(Pulse Distention) serves as a means of monitoring depth of anesthesia. The idea behind this alarm is that excessive anesthesia levels generally tend to suppress breathing. A frequent response to decreased ventilation is gasping which results in an increase in work of breathing. An increase in work of breathing is detectable in the photoplethysmmograph signal and is expressed as Breath Distention. An increase in Breath Distention relative to Pulse Distention indicates increasing depth of anesthesia. Useful setting values are significantly dependent on subject size and physiological state and must be determined empirically. Examples of each type of alarm are given below.

Example 1 – Anesthesia Too Deep

If the Anesthesia Too Deep value is set to 80%, the alarm would be triggered when the Breath Distention becomes greater than 80% of the Pulse Distention.

#### Example 2 – Anesthesia Too Light

If the Anesthesia Too Light value is set to 20%, the alarm would be triggered when the Breath Distention becomes less than 20% of the Pulse Distention.

- The alarm settings cannot be set such that there is overlap between the Too Deep and Too Light settings
- Settings are limited to the values in the drop-down menus
- Alarm is automatically disabled if the Pulse Distention drops below 25 μm.

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#### **Rate Compare Alarm**

The Rate Compare Alarm is triggered when the ratio of (Heart Rate)/(Breath Rate). The idea behind this alarm is that excessive anesthesia levels generally tend to suppress breath rate relative to heart rate.

Example 1 – Anesthesia Too Deep Rate Compare Alarm

If the Anesthesia Too Deep alarm is set to 7.5, the alarm is triggered when the Heart Rate becomes greater than 7.5 times the Breath Rate.

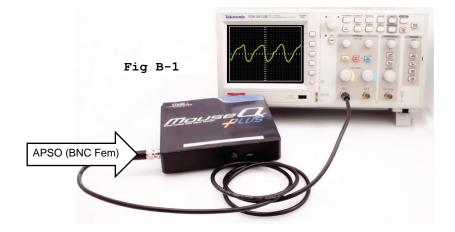
Example 2 – Anesthesia Too Light Rate Compare Alarm

If the Anesthesia Too Light alarm is set to 3.5, then the alarm is triggered when the Heart Rate becomes less than 3.5 times the Breath Rate.

- Values can be selected from the drop-down menus or entered manually
- The alarm settings cannot be set such that there is overlap between the Too Deep and Too Light settings.

# Appendix C – Analog Pulse Signal Output

The Analog Pulse Signal Output (APSO) port provides an analog voltage signal output of the IR/PPG raw cardiac waveform.



The primary application for the MouseOx<sup>®</sup> Plus APSO is event triggering. There are some things to be aware of before you use this signal however.

- The signal operates on a floating ground. You must be sure that the device to which you connect the signal has a floating, differential input.
- The output signal from the APSO spans ± 5 volts, but is usually much smaller. It is AC-coupled, indicating that its mean value resides around 0 volts, so it can easily be amplified externally.
- The signal is continuous and has no delay, outside of that associated with both low and high-pass analog filtering. This delay is inconsequential for the purposes of cardiac triggering, although we do not know its magnitude specifically.
- Amplitude is subject to all of the analog amplification methods used by the MouseOx<sup>®</sup> Plus control system. Thus, it can suddenly increase or decrease in amplitude as the MouseOx<sup>®</sup> Plus controller makes its adjustments. You can eliminate these changes by turning off Signal Optimization.
- The signal does undergo the analog filtering and amplification that occurs before we digitize it and use it to calculate the oximetry parameters.

Additionally, the signals are subject to various forms of noise in our system, which includes motion artifact due to animal motion, variations in amplitude due to changes in signal amplification from the MouseOx<sup>®</sup> Plus controller as we just described, small variations in amplitude due to breathing artifact on the signal and various characteristics of peripheral microvascular physiology that can make the signal shape vary.

In the following pictures, we see sample signals from the APSO on an oscilloscope in three different time compressions. Note that the signal is not completely repetitive in shape or amplitude as is the case with a pure sine wave. The reason for this is that the signal represents the received infrared light from the photodiode that has not been digitized and undergone the filtering used to optimize the signals to allow measurements to be made from them by the MouseOx<sup>®</sup> Plus.



If you observe the figure directly above, you can see that there is a fast downstroke followed by a slow upstroke. The fast downstroke represents increased peripheral blood flow associated with cardiac ejection, or systole. The slow upstroke is associated with diastole. It is our observation that the most repeatable (jitter-free) portion of the signal is the vertical middle of the downstroke, which represents some part in the middle of the cardiac ejection phase. We cannot say exactly what portion this is, since we do not know what delays are associated with blood flow to the periphery. Regardless, it might be best to set the trigger at this point, and add any desired delay externally, if possible.

#### Recommendations for use as a trigger:

1] Once you get good signals as indicated by the MouseOx<sup>®</sup> Plus software, turn off the Signal Optimization.

- 2] Use the middle portion of the downstroke as a trigger point, then delay from that location if necessary.
- 3] Make sure that the animal is anesthetized or restrained sufficiently to prevent motion from affecting the signal. However, you do not want to over-anesthetize the animal such that it starts to gasp, as this will cause the signal to "jump" at each inhalation.
- 4] Make sure that the device into which you are plugging the APSO signal has a high input impedance and that it is nongrounded (*i.e.*, has a floating differential input).

# Appendix D – Signal Optimization

Signal Optimization refers to the process by which the MouseOx continually adjusts sensor sensitivity and LED brightness to achieve an optimal signal for a particular subject. The sensor drive parameters are adjusted to adapt to the animal's size, skin/hair color, and amplitude of pulsatile signal. If the Signal Optimization box remains checked after the signal is initially optimized, the MouseOx will continuously make adjustments to ensure valid signal acquisition regardless of physiological variation.

- Signal Optimization should always be on when you start monitoring
- Always leave Signal Optimization on until the signal is fully optimized.
- The signal is fully optimized when
  - Error Code "9 Signal Optimization" is rarely displayed.
  - The red and yellow waveforms in the PhotoPlethysmoGram (PPG) are consistent, significantly coincident with each other and are not clipped by the upper and lower boundaries of the display.
- Under most circumstances Signal Optimization should be left ON allowing MouseOx to make small continuous adjustments

There are situations in which it can be beneficial to turn Signal Optimization off.

- When using the Analog Pulse Signal Output (APSO) for triggering
- When sudden, large and transient physiological changes can be anticipated,
  - Turning off Signal Optimization prior to a disruptive event can minimize the difficulty reacquiring signal.
  - $\circ$  Signal Optimization can then be turned back ON after the transient effects have subsided.

Two examples of large transient physiological changes:

1) When an animal is conscious and very active, motion artifact can trigger Signal Optimization and change settings that would otherwise still be optimized for the animal immediately following cessation of motion. If Signal Optimization is active this may cause MouseOx to run through the Signal Optimization process causing excess data to be discarded. Turning off Signal Optimization may allow more valid data to be acquired. Since motion artifact only invalidates the signal during the physical motion of the animal, statistical outliers can be manually excluded from data acquired during the period of motion.

2) When an experimental stimulus is administered it may cause a transient physiological response that is unrelated to salient experimental parameters. E.g., the act of injection can cause transient physiological response due to the stress of the needle puncture. That transient disruption can trigger the automatic Signal Optimization and disrupt signal acquisition. Turning off Signal Optimization just prior to the needle puncture can prevent Signal Optimization from straying too far from subsequent optimal settings.