

# PneuView® 3.2 Software Manual



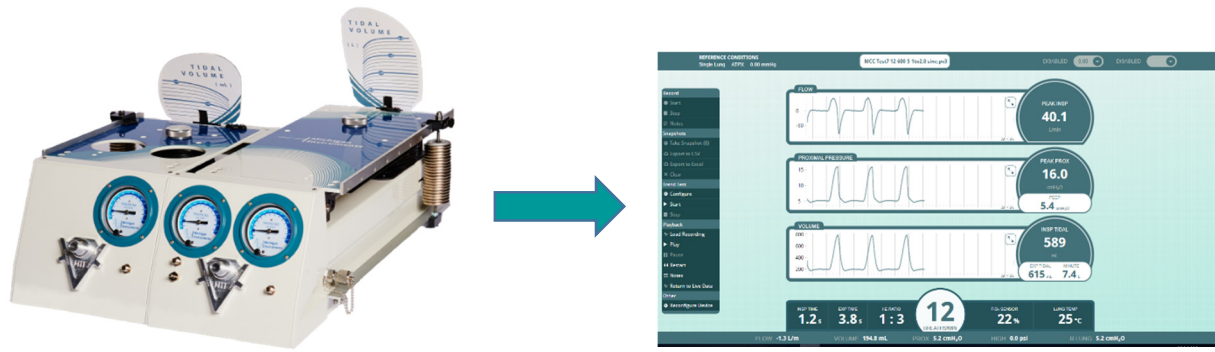
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## System Overview

The Michigan Instruments' PneuView® System is comprised of a PneuView Lung simulator (multiple models available), a PneuView Electronics Module, and PneuView Software which acquires and interprets data from the Electronics Module.



This system is intended to provide an adjustable, passive, mechanical simulation of human lungs and allow for the interpretation of data from the simulated lungs and airway during ventilation.

## Common Applications

The simulation and data gathering capabilities of the PneuView System make it an ideal tool for applications such as:

- Training healthcare professionals on the use of mechanical ventilators and other respiratory support devices
- Periodically testing on the proficiency in use of mechanical ventilators and other respiratory support devices
- Designing ventilation devices and other equipment related to lung ventilation
- Performing periodic functional testing on mechanical ventilators and related equipment
- Diagnosing and Troubleshooting device malfunctions and limitations

## The PneuView Electronic Module



The PneuView Electronic Module is the interface between the PneuView lung and the PneuView software. This module is built into the lung as shown on the left. It incorporates pressure transducers, environmental sensors, signal conditioning and analog-to-digital converter circuitry. The Electronic Module communicates with PneuView software installed on a computer.

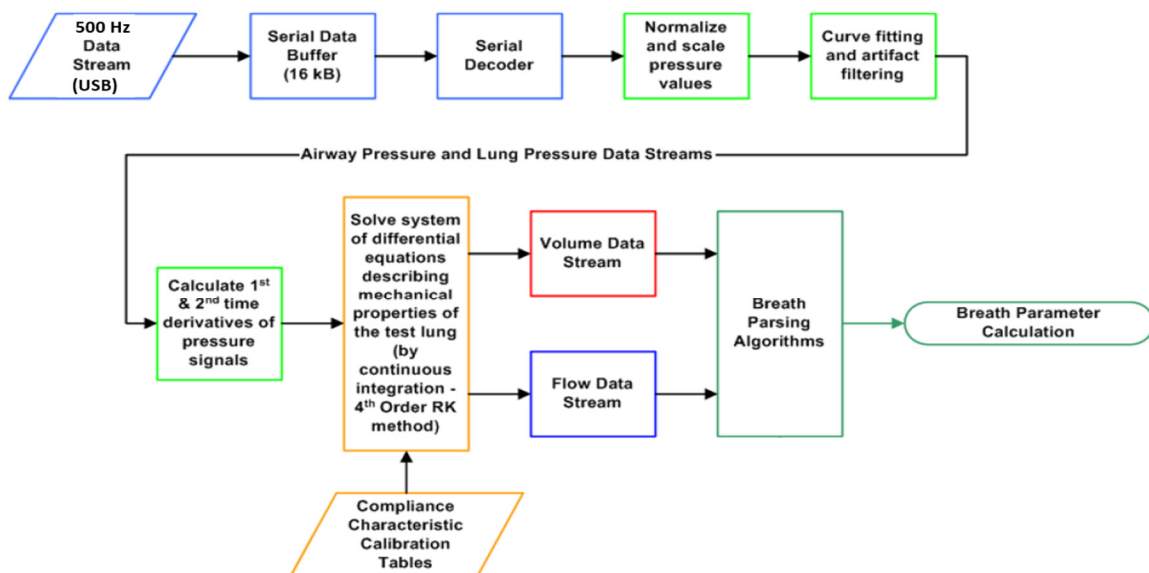
During ventilation, the software captures and presents real-time data, displaying numerical and graphical results. This data can be graphed, tabulated, or digitally recorded, then retrieved for later review and analysis. PneuView<sup>®</sup>3 software is exclusively designed to be used with Michigan Instruments' PneuView3 generation of lungs.

## Data Acquisition & Analysis

The PneuView software uses pressure data and other directly measured environmental data to make calculations of timing, volume, and flow parameters. Pressures are “sampled” at a rate of 500 Hz (500 times per second) using high resolution pressure transducers connected to the airway and lung(s) of the PneuView lung. This raw data is used to calculate a variety of ventilation parameters.

This pressure data is then plotted and processed using known compliance characteristics (volume-pressure relationship) over time to calculate breath-to-breath volume and flow values.

## PneuView System Breath Calculation Engine Overview



Accuracy of these measurements and calculations displayed by the PneuView software is dependent on the following:

1. Proper calibration of the PneuView lung  
Of particular importance is the performance and calibration of the lung's Compliance Spring(s) on the unit. (Michigan Instruments recommends that PneuView lungs be calibrated by a factory-authorized service provider at least every 2 years to confirm their calibration and performance.)
2. Proper setup/configuration of the software when acquiring data. Especially important is ensuring the lung compliance is entered correctly on the main PneuView screen, but settings of Gas Standard and Atmospheric Pressure also play a role in accuracy.

## Measured and Calculated Data - Standard PneuView Notations and Nomenclatures

Parameter	Notation/Nomenclature	Units	Resolution
Breath Rate	Breaths/Min or BPM	Breaths/Min	1 BPM
Tidal Volume	INSP or EXP TIDAL	mL	1 mL
Minute Volume	MINUTE	L (liters)	0.1 L
Real-time Volume	VOLUME	mL	0.1 mL
Peak Inspiratory Flowrate	PEAK INSP	L/min	0.1 L/min
Real-time Flow	FLOW	L/min	0.1 L/min
Airway Pressure	PEAK PROX	cmH <sub>2</sub> O	0.1 cmH <sub>2</sub> O
Right and Left Lung Pressure	R LUNG L LUNG	cmH <sub>2</sub> O cmH <sub>2</sub> O	0.1 cmH <sub>2</sub> O
PEEP Pressure	PEEP	cmH <sub>2</sub> O	0.1 cmH <sub>2</sub> O
Inspiratory Time	INSP TIME	seconds	0.1 sec
Expiratory Time	EXP TIME	seconds	0.1 sec
Insp. to Exp. Ratio	I:E RATIO	--	0.1 : 0.1
Oxygen Percentage	FiO <sub>2</sub>	%	xx%
Lung Temperature	LUNG TEMP	°C	xx°C
High (Supply) Pressure	HIGH	psi	0.1 psi

## Unpacking Your PneuView System

Upon receipt and unpacking of the PneuView System, inspect the lung and all accessories for damage or missing components. If you find damage or missing items, contact Michigan Instruments immediately.

## Standard Components and Accessories

Every PneuView System is shipped with the following standard accessories\*.

- ✓ PneuView Lung
- ✓ PneuView Lung Accessory Kit
- ✓ Carrying Case
- ✓ 12V DC Power Supply for PneuView Electronics Module
- ✓ USB Communication Cable (USB 2.0 A-B configuration)
- ✓ PneuView Manuals and Installation Software (on USB Flash Drive)
- ✓ Certificate of Calibration with Final Test Data
- ✓ Laptop Computer with latest version of PneuView software installed\*\*

\*Shipped with listed accessories, unless otherwise specified and arranged prior to shipment.

\*\*Laptop Computer supplied with a PneuView System where allowed by manufacturer's distribution policy.

## PneuView Lung Setup

The setup for the PneuView lung is described in an Operation Manual separate from this Software Manual. Both manuals can be found on the flash drive included with the accessory kit, or downloaded from Michigan Instruments' website: [www.michiganinstruments.com](http://www.michiganinstruments.com).

## Computer Requirements for PneuView3 Software

- Intel Core i3 (or higher) Processor
- 4 GB Memory (minimum)
- 500 GB Hard Disk Drive (minimum)
- 1366x768 pixel resolution (or higher) Display
- Intel HD Graphics 5500 (or higher)
- Windows 8.1 (or higher) Operating System (32 or 64 bit)
- 1 available 2.0 (or higher) USB port

## Limitations of Liability

Michigan Instruments, Inc. (MII) warrants that the PneuView® software will conform to the published specifications and documentation if it is used on a computer system for which it is designed. MII also warrants that the supplied distribution media and documentation are free from defects in materials and workmanship for 90 days after delivery. MII will replace defective media or documentation at no charge, provided the item is returned to MII within 90 days of delivery.

Except as provided above, MII makes no warranty or representation, implied or expressed, with respect to this program or documentation, including their quality, performance, merchantability, or fitness for a particular purpose.

Because computer programs are inherently complex and may not be completely free of errors, you are advised to verify your work. In no event, will MII be liable for direct, indirect, special, incidental, or consequential damages arising out of the possibility of such damages. In particular, MII is not responsible for any costs including, but not limited to, those incurred as a result of lost profits or revenues, loss of use of the PneuView® software or computer hardware, loss of data, claims by third parties or for other similar costs. In no case shall MII's liability exceed the amount of the purchase price.

## Software Installation Procedure

If the complete PneuView System was purchased, a laptop computer that has the PneuView software installed may be included. If this is the case, proceed to “Making Connections” and “Launching PneuView” sections.

The latest version of PneuView software is available from Michigan Instruments, supplied on a USB flash drive.

Follow the procedure below to complete the software installation:

Step 1: Insert the flash drive into a USB port on your computer.

Step 2: Copy the PneuView3 folder onto the computer desktop.

The following subfolders and their contents can be found inside the PneuView3 folder.

**Info** - promotional brochures and videos for Michigan Instruments' products

**Install** – the setup file to install the PV3 software

**Manuals** – TTL and PV3 software operation manuals in .pdf format

**Photos** – a picture of each available model to use for desktop wallpaper if desired

**Michigan Instruments .com** – a shortcut to our website

Step 3: Open the Install folder and double-click on the setup file.

During the installation you will be asked where to install the software and if you want to install a desktop shortcut (which is recommended). After the installation is complete, you have the option to launch the PV3 Software.

## Making Connections

Step 1: With the lung set up as desired, connect the 12V DC power supply to the PneuView Electronic Module.

Step 2: Connect the lung to a computer running PneuView software using the USB cable provided with your system.

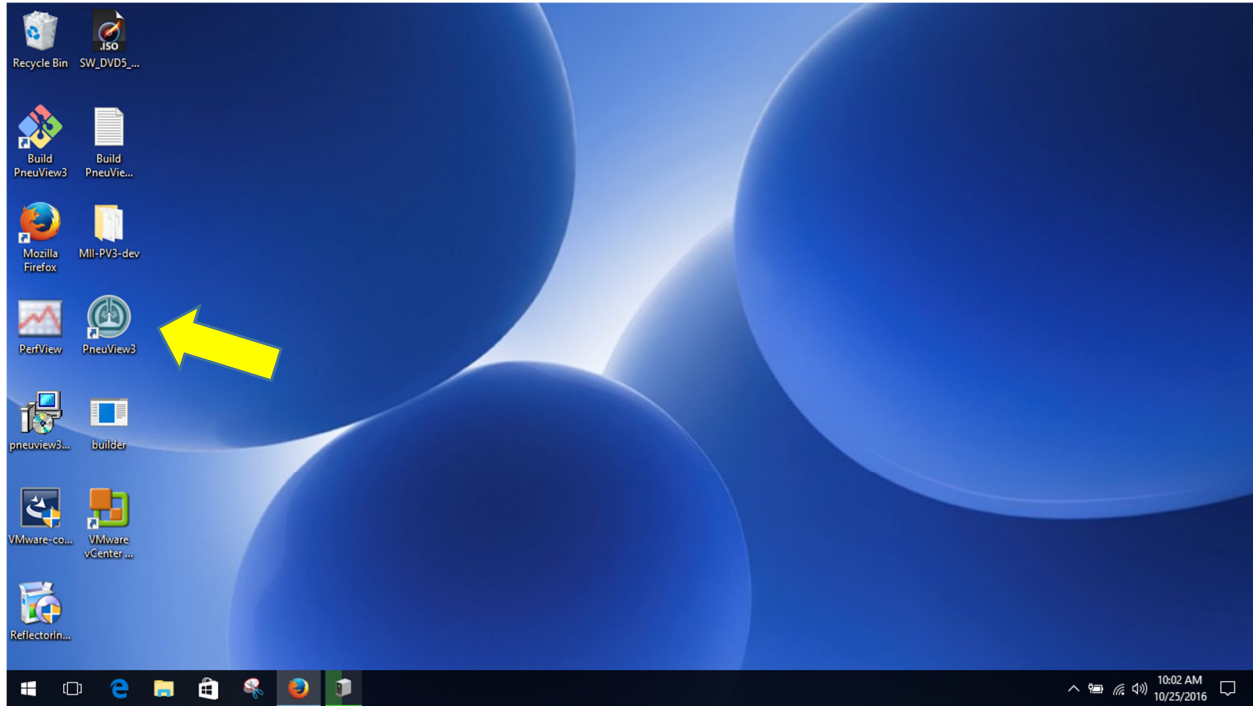


Step 3: Flip the switch on the PneuView Module to the On position. A green LED indicator on the switch will light up to confirm power to the unit.



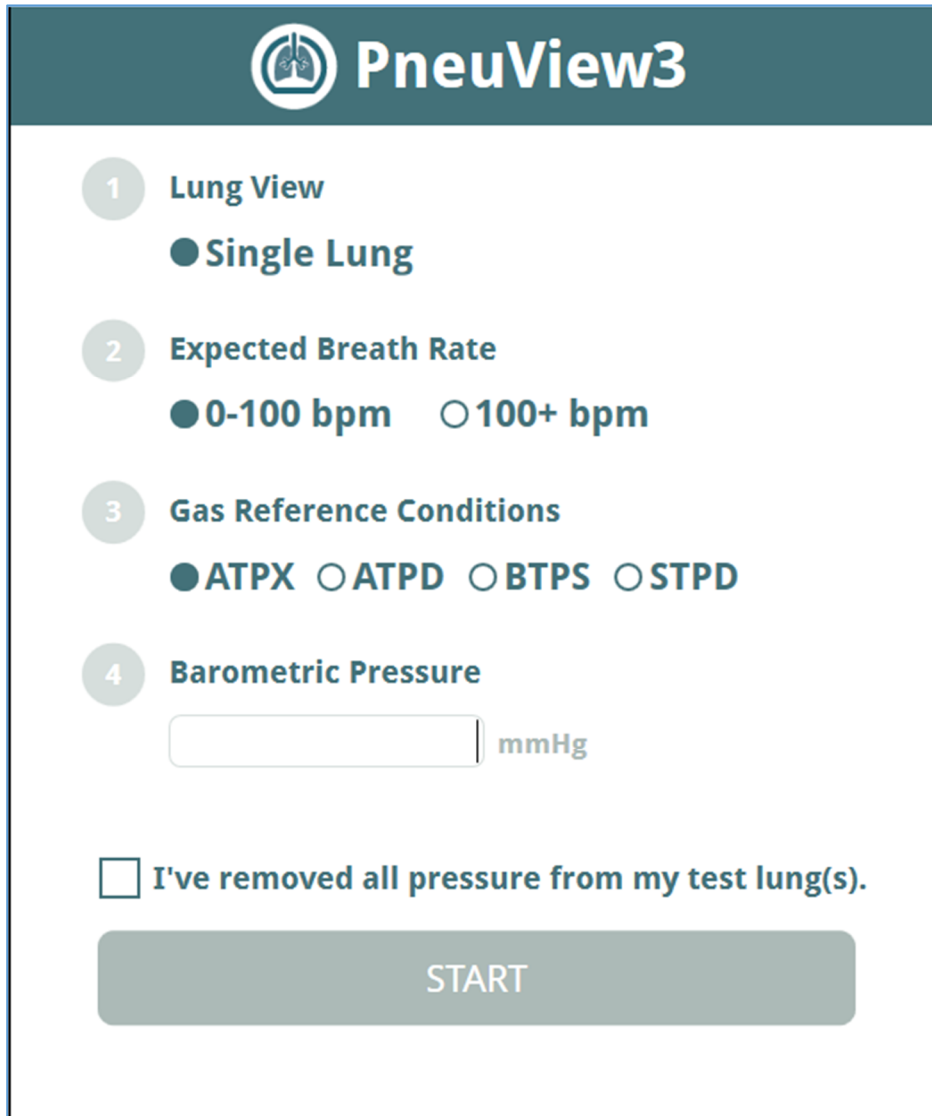
## Launching PneuView

During PneuView software installation, an icon to start PneuView can be created on the computer's desktop, as shown below. Double click on the PneuView3 icon to launch the PneuView application.



PneuView may also be launched by locating the PneuView3 folder in Program Files and double clicking the PneuView3 application file in that folder.

## PneuView Setup Screen (When Connected to Lung)

The image shows the PneuView3 Setup Screen. At the top is a dark teal header with the PneuView3 logo and name. Below the header, there are four numbered steps in grey circles: 1. Lung View, 2. Expected Breath Rate, 3. Gas Reference Conditions, and 4. Barometric Pressure. Under 'Lung View', there is a radio button for 'Single Lung'. Under 'Expected Breath Rate', there are two radio buttons: '0-100 bpm' (selected) and '100+ bpm'. Under 'Gas Reference Conditions', there are four radio buttons: 'ATPX' (selected), 'ATPD', 'BTPS', and 'STPD'. Under 'Barometric Pressure', there is a text input field followed by 'mmHg'. Below these options is a checkbox labeled 'I've removed all pressure from my test lung(s)'. At the bottom is a large grey button labeled 'START'.

When launched, the PneuView Setup Screen appears (as pictured above).

You must make selections or entries for the following fields. If you do not see the above screen check that the power switch on the lung is turned on and the USB cable connection to the computer is secure.

### Lung View

Select the desired lung(s) for data acquisition. If using a single lung, this selection is automatically set and no selection is required.

### Expected Breath Rate

Select the anticipated breath rate range. The options are 0-100 or 100+ breaths per minute (bpm).

## Gas Reference Conditions

Selects reference values. The options are:

ATPX - Ambient Temperature and Pressure, Relative (X) humidity (Actual Conditions)


ATPD - Ambient Temperature and Pressure, Dry (Actual Temp, 760 mmHg, 0% humidity)

BTPS – Body Temperature, Pressure, Saturated (37°C, 760 mmHg, 100% humidity)

STPD - Standard Temperature and Pressure, Dry (21°C, 760 mmHg, 0% humidity)

## Barometric Pressure

Set reference barometric pressure. This will help to fine-tune the pressure, volume and flow readings displayed by the lung. Please note that this reference does not affect the oxygen sensor reading.

 **PneuView3**

1

**Lung View**

● Single Lung

2

**Expected Breath Rate**

● 0-100 bpm ○ 100+ bpm

3

**Gas Reference Conditions**

● ATPX ○ ATPD ○ BTPS ○ STPD

4

**Barometric Pressure**

mmHg

☒ I've removed all pressure from my test lung(s).

START

**CAUTION:** Before selecting “START”, confirm that the lung is at zero pressure (open to atmosphere). Selecting “START” while the lung is under pressure will result in incorrectly calculated values.

Once confirmed, check the box “I’ve removed all pressure from my test lung(s).” then click the “START” button to advance to the Main Screen for live data acquisition. Pressure/ventilation may now be applied to the lung.

### **PneuView Setup Screen (When Not Connected to Lung)**

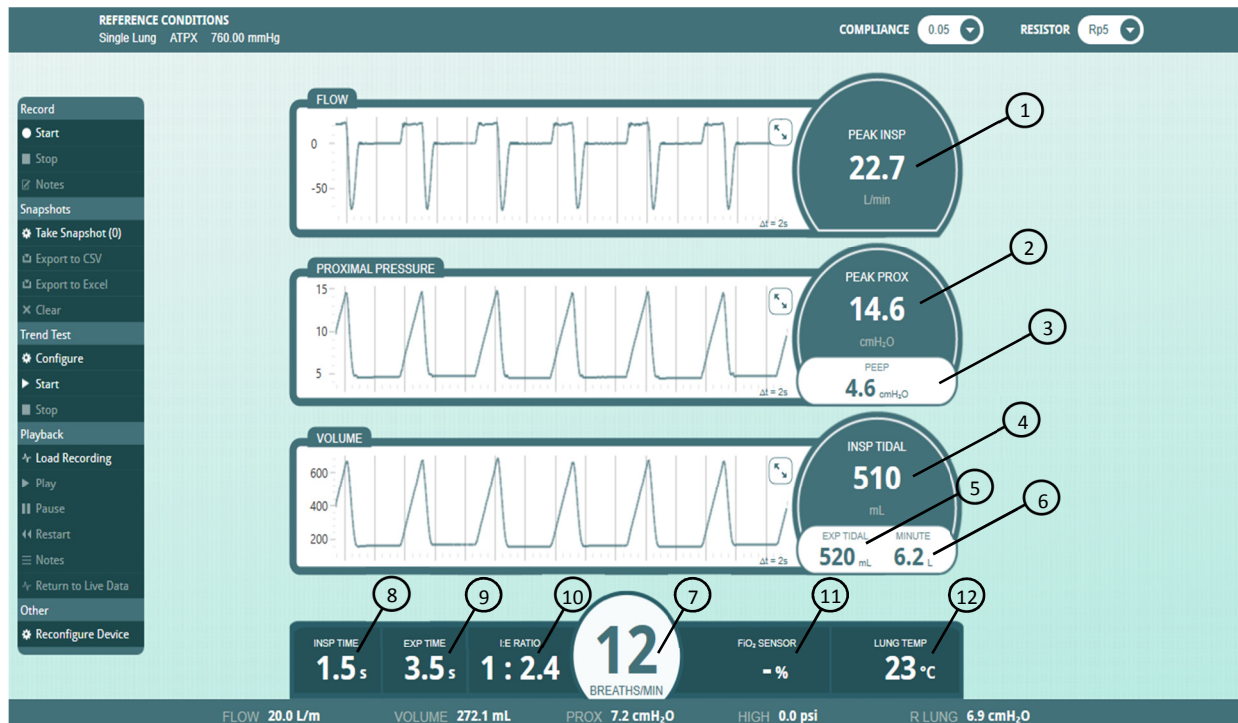
If the PneuView lung’s Power Supply is not plugged in or turned on, “START” may still be selected to enter the Main Screen without streaming live data. The only function available in this mode is Playback, where a previously saved recording may be opened and played.



If the lung is turned on and the USB data cable is properly connected, “RECONNECT” may be selected to launch the full PneuView Setup Screen.

# PneuView Main Screen

All data acquisition modes are initiated in PneuView's Main Screen, as shown below.



The Main Screen is divided into the following regions

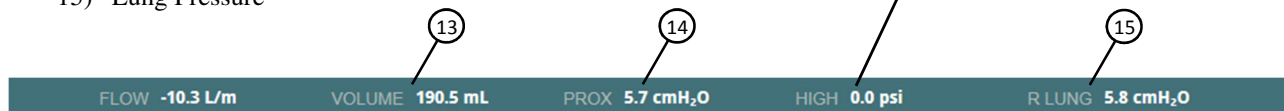
## Breath-to-Breath Values

- 1) Peak Inspiratory Flow
- 2) Peak Proximal (Airway) Pressure
- 3) PEEP Pressure
- 4) Tidal Volume (Inspiratory)
- 5) Tidal Volume (Expiratory)
- 6) Minute Volume
- 7) Breath Rate
- 8) Inspiratory Time
- 9) Expiratory Time
- 10) I:E Ratio

## Real-Time Values

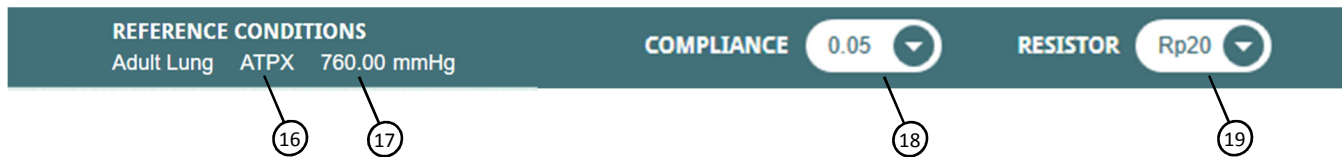
- 11) FiO<sub>2</sub>
- 12) Temperature (lung)
- 13) Tidal Volume (Right and Left if working with Dual Adult lung)
- 14) Proximal (Airway) Pressure
- 15) Lung Pressure

High Pressure – when using the DISS High Pressure Port located on the side of the lung.

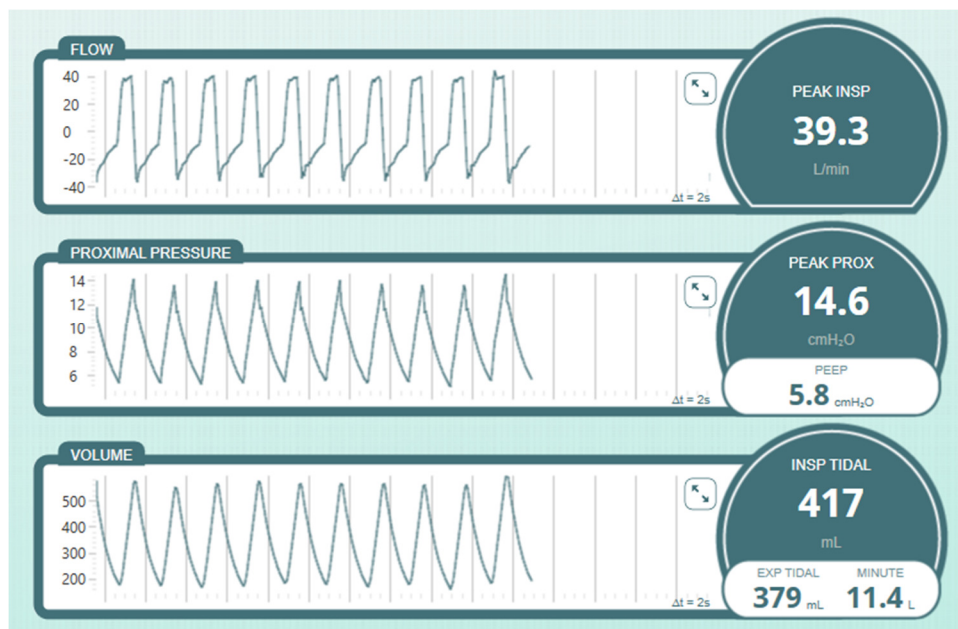



## Reference Conditions

- 16) Gas Standard
- 17) Barometric Pressure
- 18) Compliance Setting (Right and Left if working with Dual Adult)
- 19) Resistance Setting (Right and Left if working with Dual Adult)



## Waveform Displays



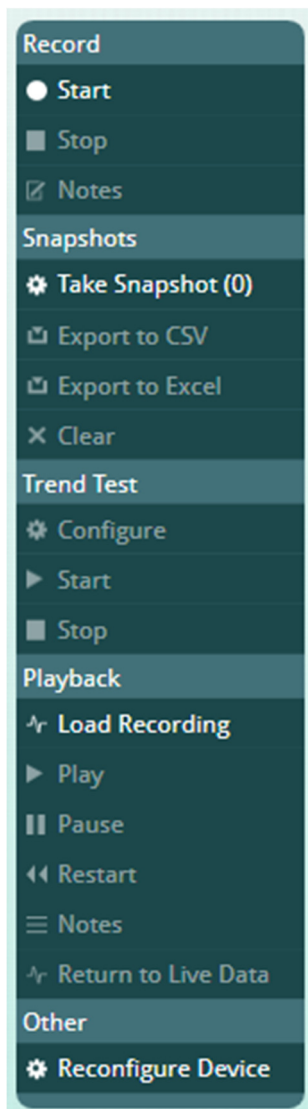
- The waveforms displayed are Flow, Pressure, and Volume.
- The Y-axis can be scaled for optimal viewing by using the scaling icon in each waveform. 
- The X-axis of the display is set for 20 seconds.

## Modes of Operation

PneuView software offers the following “Operating Modes” to view, record, store, and review ventilation data.

### Live Data Acquisition Mode

This mode is the initial default running mode of operation when a powered PneuView lung is connected via USB to a computer running the PneuView software. Real-time data is displayed on the screen. The accuracy of the data is dependent on the variables mentioned in the “Data Acquisition & Analysis” section. Additional modes of operation can be accessed from the Mode Selection Menu located on the left side of the Main Screen.



### Record Mode

This mode is available to record a “run” of lung ventilation data. All raw data is saved during a recording session. The user determines the Start and End points of a recording.

### Snapshots Mode

This mode is used to “grab” a set of numeric data when it appears on the screen. There is no limit to the number of snapshots that can be taken in a session. They are saved in a .csv or .xlsx table format and can be viewed with a spreadsheet application.

### Trend Test Mode

This mode is used to look at the values for the measured and calculated ventilation parameters over an extended period.

### Playback Mode

This mode is used to replay previously saved recordings. The Playback mode is stand alone and does not require a connection to the lung.

### Other

The “Reconfigure Device” option, as of this release, is still under construction. If selected, an “Oops...” error will occur and lock up. You will need to close the PneuView software and re-start it.

## Operating Modes How-To Guides

With live data being streamed and displayed on the Main Screen, all modes of operation are available. If the PneuView software is loaded and not acquiring live data, only the Playback mode will be active and available for selection.

### Record Mode

PneuView software allows recording a “run” of ventilation data, as seen in real time by the system. This recording can be retrieved and replayed in the Playback mode as described in the following pages. Recordings can be from less than 1 second to many hours in length. This is only limited by the available memory or other capabilities of the computer being used.

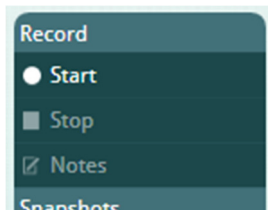
During recording, the raw, real-time data being captured by the software is held in the volatile memory of the computer. It is not saved as a file until the “Save” option is selected. When saving a recording, the file is written to the location of your choice.

### Make a Recording

**Step 1:** Ensure setup and references are correct, and data is being actively acquired.

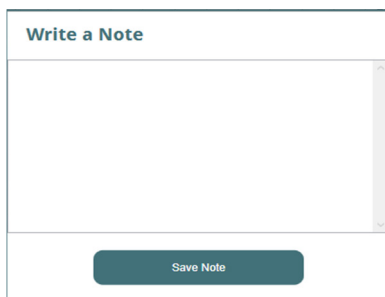
Check that the Reference Conditions, Compliance, and Resistance values shown on the Main Screen are correct. Ensure that live data is being displayed on the Main Screen.

**Step 2:** Select “Start” under Record in the Mode Selection Menu.



Once a recording has started, the “Start” option will dim (to disable) and the “Stop” and “Notes” options will brighten (to enable), making them available for selection.

**Step 3:** Add a Note to your recording (optional)



Notes may be added at any time during the recording. Select the “Notes” option under Record in the Mode Selection Menu each time you would like to add an entry. In the “Write a Note” dialog box, enter the desired notes. Select “Save Note” to close the box during the recording.



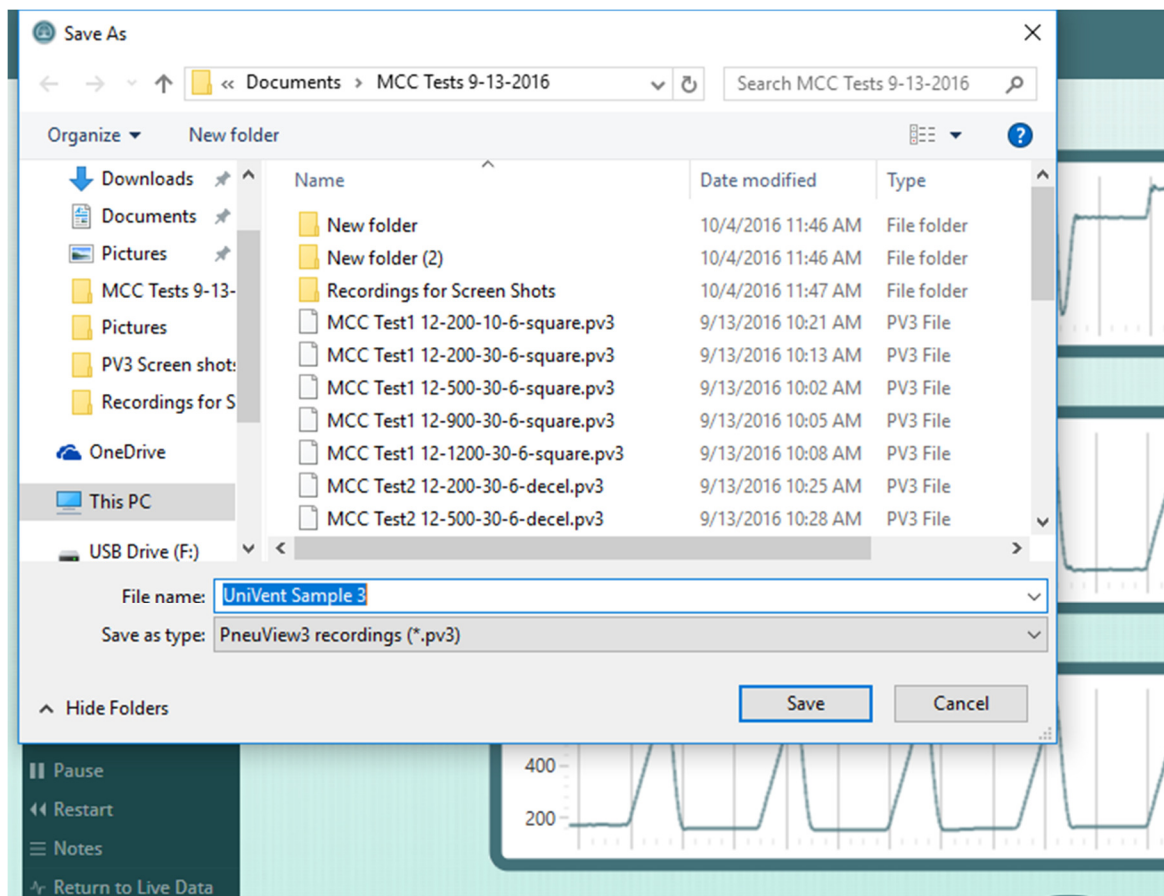
**Step 4:** Select “Stop” under Record in the Mode Selection Menu.

The “Write a Note” dialog box will always appear after pressing “Stop”, but adding a note is optional. Select “Save Note” to move on to save or discard your recording.

NOTE: There is no practical limit as to the length of a recording. It is determined by available storage space and the processing capabilities of your computer. During recording, the data is held in the volatile memory of the computer, then written to the specified drive when the file is saved.

**Step 5:** Save the Recording

Once you click on “Save Note” in the “Write a Note” dialog box, you are prompted to save the file using normal Windows file-saving protocols (as shown below). By default, recording files are saved with a .pv3 file extension. You may select “Cancel” to discard the recording without saving.



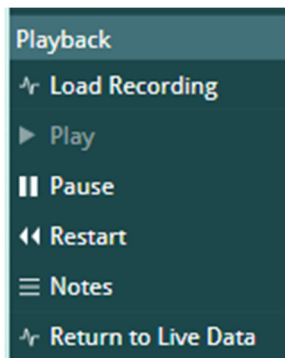
It is not recommended to change the .pv3 extension, as PneuView will not retrieve and playback recordings if saved with an alternate extension.

## Playback Mode

Once recordings have been saved, they can be retrieved and played back. The playback does not require a connection to the PneuView lung. The Playback mode uses the raw data from the recorded file to display waveforms and data, as was seen during the live data acquisition.

### Playback a Recording

#### Step 1: Load a Recording and Play



While viewing the Main Screen, select “Load Recording” under Playback in the Mode Selection Menu. You will be prompted to select a recorded file using standard Windows file selection protocols. (Double-click a .pv3 file or highlight the file and click “Open” to load the file to playback in the Main Screen.) The Play option will then be enabled.

Press “Play” under Playback in the Mode Selection Menu to begin playback of the recorded file.

#### Step 2: Pause, Restart, Notes and Return to Live Data during playback

Once the playback of a recording has started, the Pause, Restart, and Notes options become enabled in the Mode Selection Menu. These options function as follows:

“Pause” – Stops playback at its current point and freezes the waveform and readings display. The Play option is then re-enabled. Press “Play” to resume the playback from its current point.

“Restart” – Begins playback from the start of the recorded file.

“Notes” – Displays the notes saved with this recording and may be selected at any time after loading a recorded file.

“Return to Live Data” – Selection of this option will take you from Playback mode to live data acquisition. This option is disabled if the connection to the lung is not active.

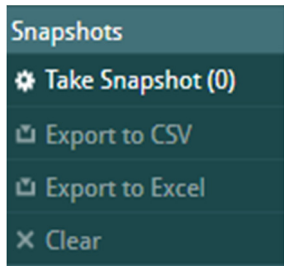
## Snapshots Mode

PneuView software allows you to create a table of information by taking “Snapshots” of the numerical data on the screen. These tabulated snapshots can then be exported to a .csv or .xlsx spreadsheet for storage and review. The Snapshots mode is often used for collection and comparison of results against target or standard settings.

NOTE: The Snapshots mode only records numerical data at a single point in time. If waveforms or a streaming data replay is desired, use the Record mode.

## Make a Table of Snapshots

**Step 1:** Take a “Snapshot” to start a new table.



While viewing live data on the Main Screen, press the “Take Snapshot” option under Snapshots in the Mode Selection Menu to save the breath data displayed. Breath data from the last displayed breath will be recorded to the table each time the “Take Snapshot” option is pressed. The “Export to CSV”, “Export to Excel” and “Clear” options are enabled after the first snapshot is taken.

**Step 2:** Add snapshots to the table.

Continue to take snapshots as desired. The counter “( )” will continue to increment the number with each snapshot taken.

NOTE: There is no practical limit to the number of snapshots that can be added to the table. It is limited by available storage space and processing capabilities of the computer. During a snapshot session, data is held in the volatile memory of the computer, then written to the hard drive when the file is saved.

**Step 3:** Press the “Clear” option to clear the Snapshots from the data table in memory. You may elect to do this at any time while taking snapshots if you desire to scrap them and start over. After saving results, it is recommended to clear the snapshots afterwards. The data table is not cleared from memory automatically after saving them. Failure to do so will result in subsequent snapshots being appended to those that were saved prior.

**Step 4:** Save results by selecting “Export to CSV” or “Export to Excel” options. The Export to Excel option will pop up a box allowing you to specify a Name and Notes prior to saving the file.

A screenshot of a dialog box with two input fields: "Name" and "Notes". Below the fields is a "Save" button.

**Step 5:** Name and save your file.

Once saved as a .csv or .xlsx file, the tabulated snapshot data can be viewed, sorted, and manipulated as allowed by the spreadsheet capabilities.

NOTE: Comments or notes to a Snapshot file can be added in the spreadsheet being used to view the table or results.

## Trend Test Mode

PneuView's Trend Test Mode can be used to look at the consistency or variability of ventilation parameters over time. This can be very useful for applications such as:

- Troubleshooting intermittent ventilator performance problems.
- Confirming ventilator performance following repair or upgrade.
- Quantifying the variability of a ventilation device or technique over time.

**CAUTION:** As a Trend Test is designed to run for an extended period of time, there are precautions that must be considered. They are as follows:

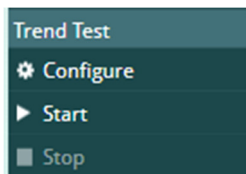
- Screen savers should not be used as they may disrupt a Trend Test ending it prematurely.
- Turn Off Display setting in Power Options should be set to Never.
- Sleep or Hibernate modes on the computer are to be disabled.
- Microsoft® Automatic Updates may schedule an auto re-boot after making an update. Consult with your IT or computer management support personnel to review what actions may be taken to prevent auto re-boots.
- When running a Trend Test, consider disconnecting the computer from the internet, either by disabling the wireless network adaptor (or disconnecting the network cable). Always consult with IT or your computer support department before doing so.

The Trend Test can be used to track the following breath parameters:

- |                          |                       |
|--------------------------|-----------------------|
| • Breath Rate            | • Minute Volume       |
| • Tidal Volume           | • I:E Ratio           |
| • Peak Inspiratory Flow  | • Inspiratory Time    |
| • Peak Proximal Pressure | • Expiratory Time     |
| • PEEP Pressure          | • High Pressure (psi) |

## Run a Trend Test

**Step 1:** Configure the test.



To set up a Trend Test, select the “Configure” option under Trend Test in the Mode Selection Menu. The following screen appears.

A configuration window for a Trend Test. It includes a "Directory:" label and a "Choose Output Directory" button. A "Test Name:" label is followed by a text input box, with "Clear All Values" and "Save as Default Setup" buttons nearby. Below is a table with columns for "Check box to include in Pass/Fail criteria", "Target", "% Tolerance", and "+/-Tolerance". The table lists various respiratory parameters. At the bottom, there are "Duration:" fields for hours and minutes, a "Sample Rate" dropdown menu, and "Accept" and "Cancel" buttons.

Check box to include in Pass/Fail criteria	Target	% Tolerance	+/-Tolerance
<input type="checkbox"/> Breath Rate			
<input type="checkbox"/> Tidal Volume			
<input type="checkbox"/> Peak Flow			
<input type="checkbox"/> Peak Proximal			
<input type="checkbox"/> PEEP			
<input type="checkbox"/> Minute Volume			
<input type="checkbox"/> I:E Ratio	1:		
<input type="checkbox"/> Insp Time			
<input type="checkbox"/> Exp Time			
<input type="checkbox"/> High Pressure			

- Select “Choose Output Directory” to specify a default folder to store the trend results files (Summary and Running Log) which are stored as .csv files that can be read by most spreadsheet applications. The path to the default folder will appear in “Directory:”
- Enter a “Test Name:” in the box provided. This name will serve as a prefix to the trend test result file names. By default, the date and time are appended to the file name after the test is completed. Example “UniVent731 Running Log 2017-09-13 10.09.53.csv”

**Directory:** C:\Trend Results Choose Output Directory

**Test Name:** UniVent731 Clear All Values Save as Default Setup

Check box to include in Pass/Fail criteria

	Target	% Tolerance	+/-Tolerance
<input checked="" type="checkbox"/> <b>Breath Rate</b>			
<input type="checkbox"/> <b>Tidal Volume</b>			
<input type="checkbox"/> <b>Peak Flow</b>			
<input type="checkbox"/> <b>Peak Proximal</b>			
<input type="checkbox"/> <b>PEEP</b>			
<input type="checkbox"/> <b>Minute Volume</b>			
<input type="checkbox"/> <b>I:E Ratio</b> 1:			
<input type="checkbox"/> <b>Insp Time</b>			
<input type="checkbox"/> <b>Exp Time</b>			
<input type="checkbox"/> <b>High Pressure</b>			

**Duration:** 0 h 1 m

**Sample Rate** 4 per minute Accept Cancel

- c. Select the parameters that define whether the test will “Pass” or “Fail”.  
Click on the box to the left of the parameter name to select and un-select the parameter. All parameters are tracked during a trend test, but only those selected are used to determine the final Pass/Fail status of the test. If a parameter is selected, a “Target” and a “Tolerance” must be entered for that parameter. You may only choose one tolerance (% or +/-) for each parameter chosen for Pass/Fail. A red box indicates a required entry and the “Accept” button is disabled until all parameter requirements are satisfied.
- d. If desired, for reference purposes, a “Target” may be specified for a parameter. Enter a target and leave the box to include in Pass/Fail criteria unchecked. The target value will appear in the Trend Test Summary report. Even if a tolerance value is entered, no range for Low/High values appear in the report. Only parameters selected for Pass/Fail criteria will have Low/High values calculated.
- e. Set the test “Duration:”. A test duration can range from 1 minute to 1000+ hours.
- f. Select the “Sample Rate”.  
The sample rate can be set for 60, 4, or 1 per minute. Depending on the setting, the software will record a set of numerical results every 1, 15, or 60 seconds and store them in the trend results files.

**Directory:** C:\Trend Results Choose Output Directory

**Test Name:** UniVent731 Clear All Values Save as Default Setup

Check box to include in Pass/Fail criteria

	Target	% Tolerance	+/-Tolerance
<input checked="" type="checkbox"/> <b>Breath Rate</b>	12		1
<input checked="" type="checkbox"/> <b>Tidal Volume</b>	500		20
<input checked="" type="checkbox"/> <b>Peak Flow</b>	21		5
<input checked="" type="checkbox"/> <b>Peak Proximal</b>	14.8	10	
<input checked="" type="checkbox"/> <b>PEEP</b>	5.4		1
<input checked="" type="checkbox"/> <b>Minute Volume</b>	5.8		2
<input checked="" type="checkbox"/> <b>I:E Ratio</b> <b>1:</b>	2.4	10	
<input checked="" type="checkbox"/> <b>Insp Time</b>	1.5		.75
<input checked="" type="checkbox"/> <b>Exp Time</b>	3.5		.75
<input type="checkbox"/> <b>High Pressure</b>			

**Duration:** 0 h 2 m

**Sample Rate** 4 per minute Accept Cancel

Other Commands:

Clear All Values

Save as Default Setup

“Clear All Values” – You may clear all of the entries in the configuration screen by selecting this button. Essentially, this command lets you start from scratch.

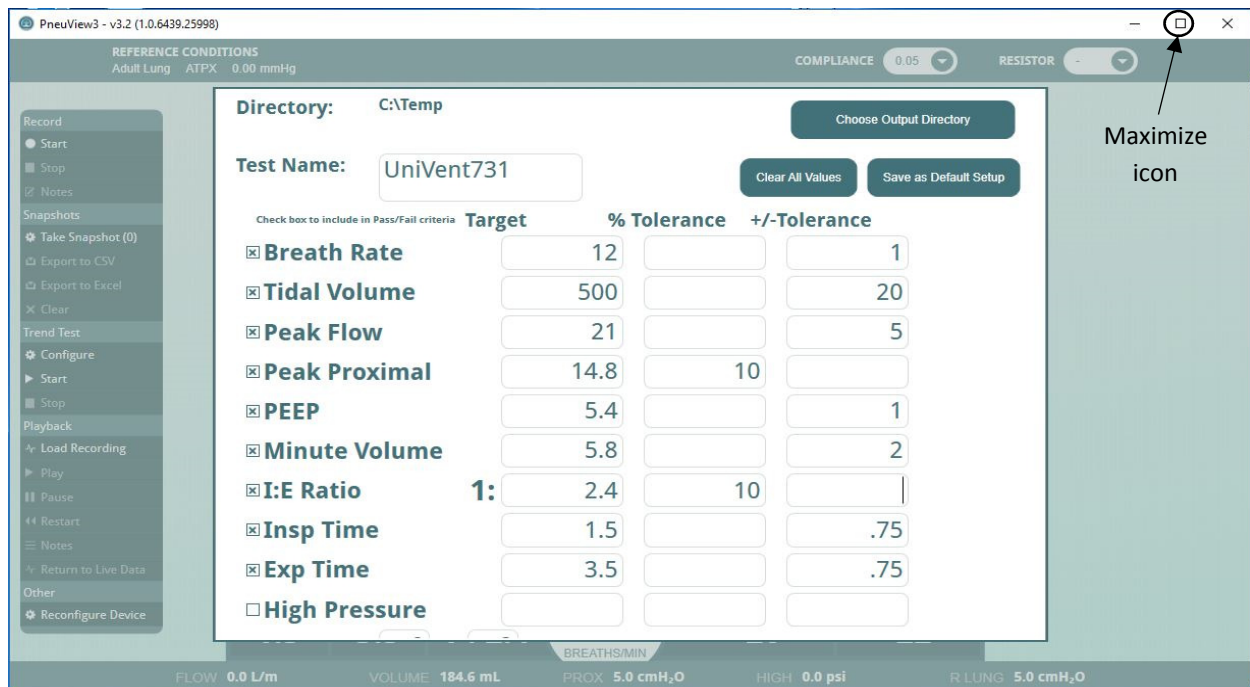
“Save as Default Setup” – This button will save a setup as a default. The default setup will be retrieved whenever you start a new PneuView session. Items saved in the default setup include Directory, Test Name, Parameter Targets/Tolerances, Duration and Sample Rate. The following dialog box will appear to confirm the Default Setup has been saved.



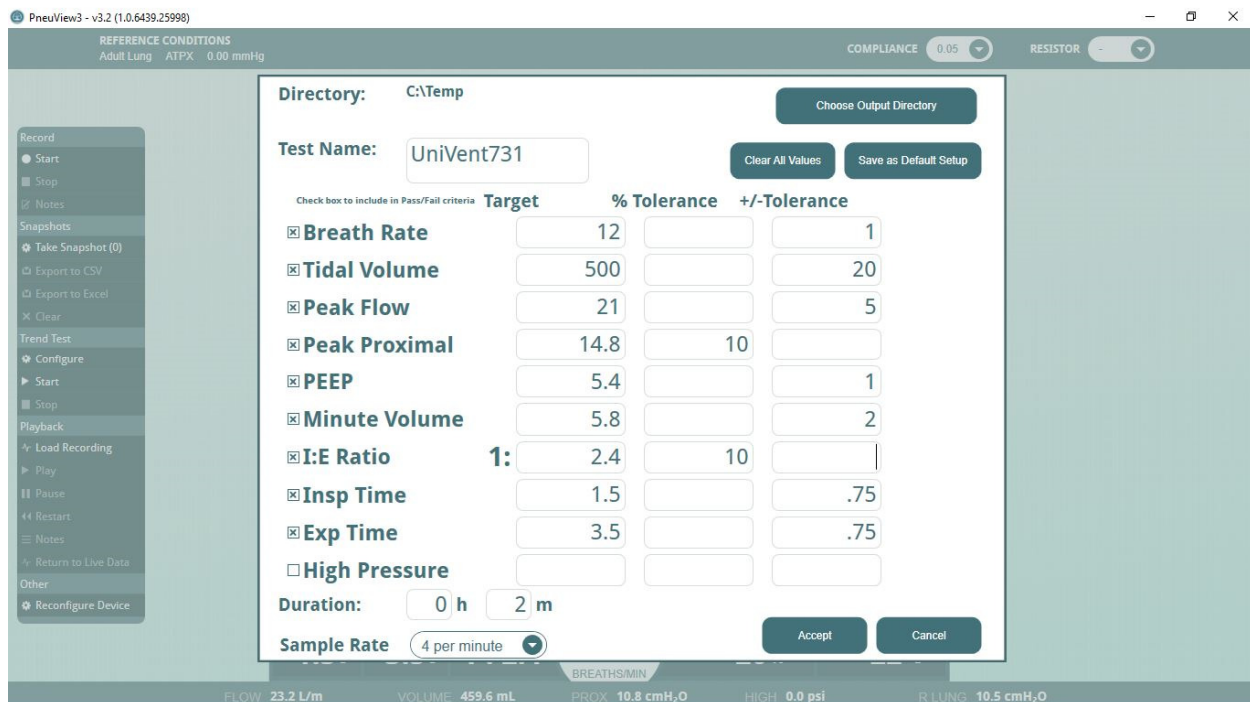
- g. Press “Accept” to accept the test setup and return to the Main Screen. Pressing “Cancel” will close the configuration screen and return to the Main Screen.



NOTE: If the configuration screen becomes truncated and the Duration and Sample Rate are not visible, click on the “Maximize” icon.

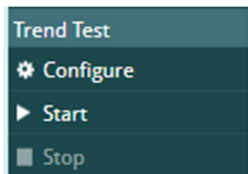


Doing so will expand the PneuView window to full screen making them accessible again.

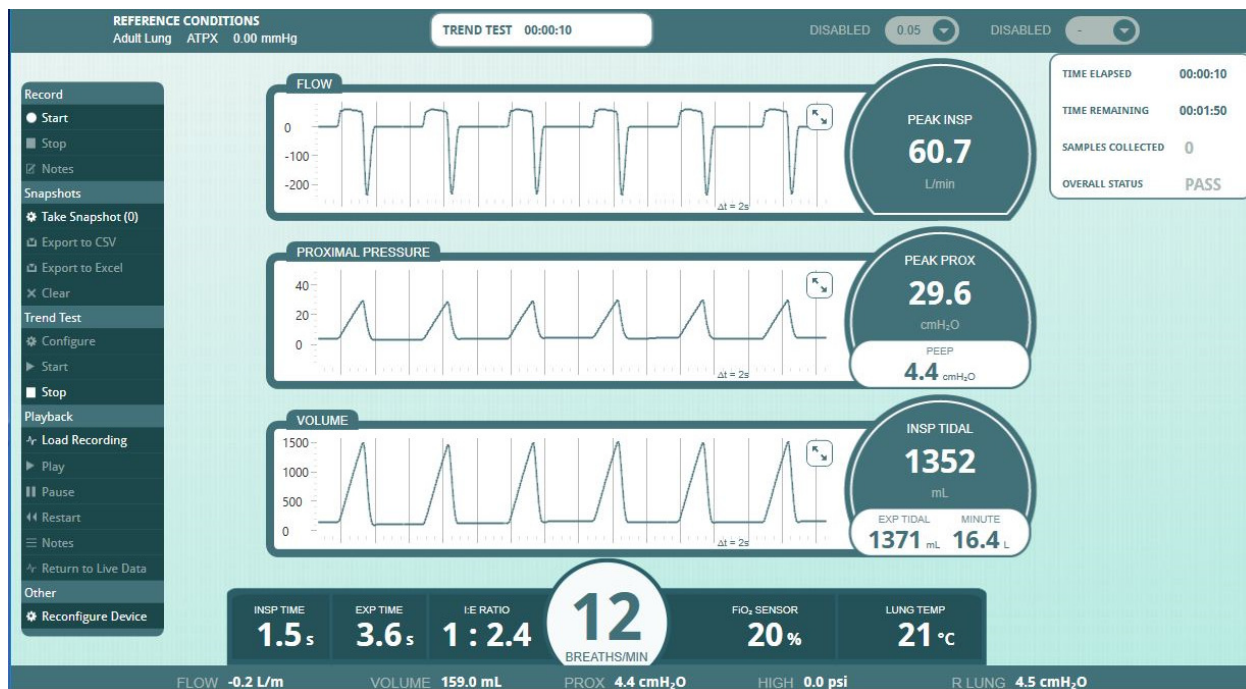




## Step 2: Start the test.



Press “Start” under Trend Test in the Mode Selection Menu. Once “Start” is selected, a Trend Test timer appears at the center top of the Main Screen showing progress of the test. A test status box is also displayed in the upper right corner of the screen. This box displays the Time Elapsed, Time Remaining, total Samples Collected and an Overall Status. The status will show FAIL if any parameter falls outside of their stated tolerance.

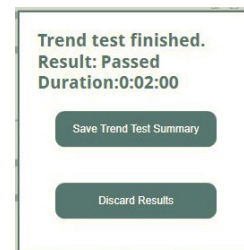


## Step 3. Stop the test.

A Trend Test may be stopped at any time by pressing “Stop” under Trend Test in the Mode Selection Menu. A confirmation dialog box will appear.



When the set duration for the test is completed (or Stop has been pressed), a message appears to indicate the Trend Test is finished. It provides an overall Result (Passed or Failed) and displays the duration of the test. You may choose to save or discard the test results. When “Save Trend Test Summary” is selected, you are prompted to save two files, a Running Log and a Summary.



**Step 4:** Save the Trend Test results.

Trend Test results are saved in a .csv file format. CSV files can be opened in a spreadsheet application, such as Microsoft Excel®. When either trend file is opened, all saved data is available. At this point, the trend data can be formatted and/or graphed.

## **Viewing Recordings, Tables, and Trend Results**

Files are “saved” in the following formats:

<b>PneuView File Type</b>	<b>Format (Saved as...)</b>
Recordings	Customized PneuView file – Extension of .pv3
Snapshot / Table	CSV* or Excel** file – Extension of .csv or .xlsx
Trend Test File	CSV file – Extension of .csv

\*CSV is a simple file format used to store tabular data, such as a spreadsheet or database. Files in the CSV format can be imported to and exported from programs that store data in tables, such as Microsoft Excel\*\* or OpenOffice Calc. CSV stands for "comma-separated values".

\*\*Excel® is a licensed spreadsheet application product of Microsoft Corporation.

The location of these files is determined by the user, during the setup of a Trend Test or at the time of saving Recordings and Snapshot files.

### **Viewing Recordings**

Recordings are viewed using the Playback Mode as described in the earlier “How-to” section.

## Viewing Snapshot Tables

A table of Snapshots is saved in a .csv or .xlsx format. These files are most easily viewed, analyzed, and manipulated using Microsoft Excel or a similar spreadsheet program. The data is shown below. Note that all settings and parameters are recorded.

	A	B	C	D	E	F	G	H	I	J	K
1	Name	Impact 731 - Tidal Volume Test									
2	Date	9/14/2017									
3	Notes	Test output at settings of: Rate 12, PEEP 5, I:E 1:2.5, and Tidal Volumes of 300, 600, 900, and 1200 mL.									
4											
5	Snapshot #	Time	L Comp	R Comp	L Res	R Res	BPM	VT Insp	VT Exp	PIP	PEEP
6	1	10:51:35		0.05		Rp5	12	311	311	11.4	5.5
7	2	10:52:14		0.05		Rp5	12	620	620	16.7	5.5
8	3	10:52:51		0.05		Rp5	12	914	914	21.8	5.5
9	4	10:53:15		0.05		Rp5	12	1211	1211	27.4	5.6
10											
11	Snapshot #	Time		Peak Flow	Min Vol	I-Time	E-Time	I:E Ratio	FiO2	Temp	P High
12	1	10:51:35		14.2	3.909	1.4	3.6	= "1:2.65"	20	22	0.0
13	2	10:52:14		27.8	7.471	1.5	3.5	= "1:2.43"	20	22	0.0
14	3	10:52:51		41.1	10.733	1.5	3.5	= "1:2.42"	20	22	0.0
15	4	10:53:15		53.4	14.878	1.5	3.5	= "1:2.41"	20	22	0.0

Data may be reformatted and edited to produce the desired reports. (See sample below of a reformatted Snapshot table using the above “raw” results.)

Name	Impact 731 - Tidal Volume Test								
Date	9/14/2017			Technician	M. Smith				
Notes	Test output at settings of: Rate 12, PEEP 5, I:E 1:2.5, and Tidal Volumes of 300, 600, 900, and 1200 mL.								
Snapshot #	Time		R Comp	R Res	BPM	VT Insp	PEEP	I-Time	Pass/Fail
1	10:51:35		0.05	Rp5	12	311	5.5	1.4	PASS
2	10:52:14		0.05	Rp5	12	620	5.5	1.5	PASS
3	10:52:51		0.05	Rp5	12	914	5.5	1.5	PASS
4	10:53:15		0.05	Rp5	12	1211	5.6	1.5	PASS

## Viewing Trend Test Results

Upon completion of a trend test, the data taken will be stored in two (2) .csv files in the folder specified in the trend test setup window (set by clicking on the “Choose Output Directory”). These 2 files are “Running Log” and “Summary”. Data can be analyzed and formatted by opening the .csv files created by a trend test. These files are most easily interpreted via Microsoft Excel or a similar program.

### Trend “Summary” Files

A “summary” file provides the basics of any Trend Test. All 10 trended parameters are shown along with any target and tolerance that may have been entered. The minimum, maximum, and average of each parameter for the entire duration of the test is shown, along with the time at which the minimum and maximum were recorded.

A sample of the unformatted (raw) summary .csv data is shown below.

	A	B	C	D	E	F	G	H	I	J	K
1	Parameter	Low	Target	High	Min	Avg	Max	Unit	Min Time	Max Time	Status
2	BPM	11	12	13	11.9	12	12.1	bpm	0:00:28	0:02:13	PASS
3	VT Insp	475	500	525	483.9	486.9	491.3	mL	0:02:58	0:01:58	PASS
4	Peak Flow Insp	--	--	--	21.6	21.8	21.9	L/m	0:03:38	0:01:43	
5	PIP Prox	--	--	--	14.2	14.3	14.4	cmH2O	0:04:53	0:04:18	
6	PEEP	4	5	6	5.3	5.4	5.5	cmH2O	0:02:27	0:04:17	PASS
7	Min Vol	--	--	--	5.864	5.969	6.069	L	0:02:43	0:04:22	
8	I:E Ratio	--	1:2.50	--	1:2.48	1:2.47	1:2.45	1:x	0:04:03	0:02:28	
9	I-Time	1.3	1.5	1.7	1.4	1.4	1.5	sec	0:04:03	0:00:28	PASS
10	E-Time	--	--	--	3.5	3.6	3.6	sec	0:02:12	0:01:52	
11	P High	--	--	--	-0.03	-0.01	0.03	psi	0:00:00	0:00:00	
12											

In the example above, BPM, VT Insp, PEEP and I-Time were selected for Pass/Fail criteria. These parameters show a Pass or Fail status in the final column. In this particular example, the parameters show “PASS” based on the set Target and Tolerance. Targets may be set for any parameter and will appear on this report, but only those selected during the test configuration will be used to determine the test’s Pass or Fail status.

The data can be re-formatted or copied to a template where the results can be displayed and recorded as needed. A sample of the above data in a formatted trend summary file is shown below.

<b>Test Name</b>	Quick Trend - Default Settings				<b>Unit Tested</b>		Impact 731-173456			
<b>Date</b>	14-Sep-17									
<b>Duration:</b>	5 minutes				<b>Sample Rate</b>		1 per minute			
<b>Operator</b>	M. Johnson									
<b>Parameter</b>	<b>Low</b>	<b>Target</b>	<b>High</b>	<b>Min</b>	<b>Avg</b>	<b>Max</b>	<b>Unit</b>	<b>Min Time</b>	<b>Max Time</b>	<b>Status</b>
BPM	11	12	13	11.9	12	12.1	bpm	0:00:28	0:02:13	PASS
VT Insp	475	500	525	483.9	486.9	491.3	mL	0:02:58	0:01:58	PASS
Peak Flow Insp	--	--	--	21.6	21.8	21.9	L/m	0:03:38	0:01:43	
PIP Prox	--	--	--	14.2	14.3	14.4	cmH2O	0:04:53	0:04:18	
PEEP	4	5	6	5.3	5.4	5.5	cmH2O	0:02:27	0:04:17	PASS
Min Vol	--	--	--	5.864	5.969	6.069	L	0:02:43	0:04:22	
I:E Ratio	--	1:2.50	--	1:2.48	1:2.47	1:2.45	1:x	0:04:03	0:02:28	
I-Time	1.3	1.5	1.7	1.4	1.4	1.5	sec	0:04:03	0:00:28	PASS
E-Time	--	--	--	3.5	3.6	3.6	sec	0:02:12	0:01:52	

## Trend “Running Log” Files

When a “running log” trend file is opened, a data table will be displayed in which the 10 parameters charted by a trend test appear across 40 columns. Each parameter is represented by four consecutive columns displaying minimum, maximum, average and tolerance values, respectively. If any of the first three values fall outside of the tolerance that was specified during setup, then the tolerance column will read “FALSE,” otherwise “TRUE” will be displayed.

Rows on the data table represent data samples in the order that they were taken. Columns are labeled with the name of the parameter that they represent and appear in the following order:

**Inspiratory tidal volume field (Columns A-D)**

**Peak flow rate field (Columns E-H)**

**Peak proximal pressure field (Columns I-L)**

**Inspiratory/expiratory ratio field (Columns M-P)**

**Breath rate field (Columns Q-T)**

**High pressure value field (Columns U-X)**

**Inspiratory time field (Columns Y-AB)**

**Expiratory time field (Columns AC-AF)**

**Positive end expiratory pressure field (Columns AG-AJ)**

**Minute volume field (Columns AK-AN)**

A sample of unformatted\* (raw) trend running data is shown below.

\*In the illustration that follows, data was moved to one page for viewing purposes, but otherwise, it is as it appears when the file is first opened.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	BPM min	BPM max	BPM aver	BPM withi	VT Insp m	VT Insp m	VT Insp av	VT Insp wi	Peak Flow	Peak Flow	Peak Flow	Peak Flow	Insp within tolerance	
2	11.9	12.1	12	PASS	484.3	490.5	487.4	PASS	21.6	21.8	21.7			
3	11.9	12.1	12	PASS	484.2	491.3	486.4	PASS	21.6	21.9	21.8			
4	11.9	12.1	12	PASS	483.9	491.3	487.8	PASS	21.6	21.9	21.8			
5	11.9	12.1	12	PASS	483.9	488.8	486.6	PASS	21.6	21.9	21.8			
6	11.9	12.1	12	PASS	483.9	488.8	486.3	PASS	21.7	21.9	21.8			
7														
8														
9	PIP Prox m	PIP Prox m	PIP Prox a	PIP Prox w	PEEP min	PEEP max	PEEP aver	PEEP withi	Min Vol m	Min Vol m	Min Vol a	Min Vol within tolerance		
10	14.2	14.3	14.3		5.3	5.5	5.4	PASS	5.89	6.042	5.967			
11	14.2	14.4	14.3		5.3	5.5	5.4	PASS	5.89	6.049	5.964			
12	14.2	14.4	14.3		5.3	5.5	5.4	PASS	5.864	6.061	5.976			
13	14.2	14.4	14.3		5.3	5.5	5.4	PASS	5.877	6.047	5.97			
14	14.2	14.4	14.3		5.3	5.5	5.4	PASS	5.889	6.069	5.969			
15														
16														
17	I:E Ratio m	I:E Ratio m	I:E Ratio a	I:E Ratio w	I-Time min	I-Time max	I-Time ave	I-Time wit	E-Time min	E-Time max	E-Time ave	E-Time within tolerance		
18	1:2.48	1:2.44	1:2.46		1.4	1.5	1.4	PASS	3.5	3.6	3.6			
19	1:2.48	1:2.45	1:2.49		1.4	1.5	1.4	PASS	3.5	3.6	3.6			
20	1:2.48	1:2.45	1:2.46		1.4	1.5	1.4	PASS	3.5	3.6	3.6			
21	1:2.48	1:2.45	1:2.47		1.4	1.5	1.4	PASS	3.5	3.6	3.6			
22	1:2.49	1:2.45	1:2.50		1.4	1.5	1.4	PASS	3.5	3.6	3.6			
23														

The information can be reformatted as needed. A sample of formatted trend data follows.

Sample	BPM min	BPM max	BPM avg	Status	VT min	VT max	VT avg	Status	Flow min	Flow max	Flow avg	Status
1	11.9	12.1	12	PASS	484.3	490.5	487.4	PASS	21.6	21.8	21.7	
2	11.9	12.1	12	PASS	484.2	491.3	486.4	PASS	21.6	21.9	21.8	
3	11.9	12.1	12	PASS	483.9	491.3	487.8	PASS	21.6	21.9	21.8	
4	11.9	12.1	12	PASS	483.9	488.8	486.6	PASS	21.6	21.9	21.8	
5	11.9	12.1	12	PASS	483.9	488.8	486.3	PASS	21.7	21.9	21.8	
Sample	PIP min	PIP max	PIP avg	Status	PEEP min	PEEP max	PEEP avg	Status	Vmin min	Vmin max	vmin avg	Status
1	14.2	14.3	14.3		5.3	5.5	5.4	PASS	5.89	6.042	5.967	
2	14.2	14.4	14.3		5.3	5.5	5.4	PASS	5.89	6.049	5.964	
3	14.2	14.4	14.3		5.3	5.5	5.4	PASS	5.864	6.061	5.976	
4	14.2	14.4	14.3		5.3	5.5	5.4	PASS	5.877	6.047	5.97	
5	14.2	14.4	14.3		5.3	5.5	5.4	PASS	5.889	6.069	5.969	
Sample	I:E min	I:E max	I:E avg	Status	T-I min	T-I max	T-I avg	Status	T-E min	T-E max	T-E avg	Status
1	1:2.48	1:2.44	1:2.46		1.4	1.5	1.4	PASS	3.5	3.6	3.6	
2	1:2.48	1:2.45	1:2.49		1.4	1.5	1.4	PASS	3.5	3.6	3.6	
3	1:2.48	1:2.45	1:2.46		1.4	1.5	1.4	PASS	3.5	3.6	3.6	
4	1:2.48	1:2.45	1:2.47		1.4	1.5	1.4	PASS	3.5	3.6	3.6	
5	1:2.49	1:2.45	1:2.50		1.4	1.5	1.4	PASS	3.5	3.6	3.6	

## Ongoing PneuView Software Development

Like most application software, there are always changes and improvements required to meet the needs and requirements of both customers and operating platforms. At Michigan Instruments, we appreciate this fact, and understand that development of our PneuView Software is never “done”. We welcome your input and comments when it comes to performance issues and any new features that require our attention.

## Updates and Support

If you need assistance or have questions don't hesitate to contact us by e-mail at [techsupport@michiganinstruments.com](mailto:techsupport@michiganinstruments.com). You may also reach us by phone at (616)-554-9696 or toll free (800)-530-9939.

**Thank you for choosing PneuView!**



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