

Sensormedics Oscillator

An alternative way to ventilate a patient is with high frequency oscillation. When using conventional ventilators you can be limited by the amount of pressure required to ventilate and oxygenate.

Oxygenation can be improved by increasing mean airway pressure. This can be accomplished by:

- 1) Increasing Peak Airway Pressures
- 2) Increasing PEEP
- 3) Increasing Inspiratory Time

When adjusting these values, the adjustments required can cause more harm than good being done. Using high Peak Airway Pressures can lead to barotrauma and pneumothoraces. Using longer inspiratory time (inverse I:E ratios) can cause hyperinflation by not allowing enough time for exhalation. Increasing PEEP can lead to a decrease in tidal volume when trying to eliminate high peak pressure. Which results in hypercapnea do to the decrease in minute ventilation.

The Sensormedics Oscillator allows you to ventilate using a high Mean Airway Pressure (oxygenation) and very small tidal volumes (amplitude) and fast breath rate (frequency). This is the only form of ventilation with an active exhalation. The oscillator pushes and pulls the small tidal volume (amplitude) around the set Mean Airway Pressure. This results in little pressure changes in the lung and therefore reduces damage.

Adjusting the Controls & Displays

Bias Flow- Dial which ranges from 0-40LPM (3100A). It is the continuous gas flow which fills the circuit with fresh gas and removes carbon dioxide. In the 3100A the bias flow is set to 20LPM which should not need adjusting unless using high amplitude ($\Delta P > 70\text{cmH}_2\text{O}$). When using higher amplitudes a higher bias flow is needed to insure clearance of carbon dioxide in the circuit. Changes in bias flow will cause changes to the Mean Airway Pressure. Therefore when adjusting bias flow to aid in CO_2 removal be sure to readjust the Mean Airway Pressure.

Mean Pressure Adjust- A dial that controls the Mean Airway Pressure and has a digital display of the set value. Ranges from 3-45 cmH_2O and the setting is controlled by a green balloon valve on the expiratory limb.

Please note: Any changes to bias flow, % inspiratory time, frequency and power will result in a change to Mean Airway Pressure.

Mean Pressure Limit- A dial that ranges from 10-45 cmH_2O and is controlled by the blue balloon valve. This setting should be adjusted to be just above the 'ADJUST' value. In order to do this you can set the ADJUST then turn down the LIMIT until you see a decrease in you Mean Airway Pressure. Once you start to get a decrease turn the LIMIT up just past the point of change to Mean Airway Pressure. There is no value to record. If the green balloon valve (ADJUST) fails then the pressure will not exceed the blue balloon valve (LIMIT).

Power- A dial with a ten-turn control that adjust the amplitude (ΔP). Maximum proximal amplitude $> 90\text{cmH}_2\text{O}$. This determines the displacement of the oscillator piston. The ΔP value will be initially set to generate adequate chest wall vibration. The ΔP has a digital display with the value measured at the patient end of the circuit. These high pressures are not seen at the alveoli due to the attenuation of the endotracheal tube.

% Inspiratory Time- A dial that ranges from 30-50%. It determines the % of time the piston is moving forward for inspiration.

Frequency- A dial that ranges from 3 to 15Hz. 1Hz = 60 breaths per minute

Reset/Power Fail- A push button used to reset alarms once the problem has been rectified. Also used to pressurize system when pressure has been lost (eg. disconnection).

Start/Stop- A push button to start the oscillator (piston) oscillating. A green LED indicates it is started.

Alarms

Power Failure- A visual and audible alarm when no mains power connected to the machine. Once power is restored the alarm must be reset. This alarm also occurs when turning off machine, and once again the alarm must be reset.

Upper & Lower Mean Airway Pressure- They are audible and visual alarms that are adjusted using thumb wheels from 0-49cmH₂O. They should be set 2-3 above and below set Mean Airway Pressure.

If the Mean Airway Pressure falls below 20% of the set Max.(Upper) Mean Airway Pressure the red balloon valve opens, dumping all pressure in circuit and the oscillator will stop.

If pressure in the circuit exceeds 50cmH₂O the red balloon valve will open dumping all pressure in the circuit and the oscillator will stop.

Source Gas Low- A visual alarm indicated by yellow LED. The gas supply is not hooked up properly or there is a problem with the oscillator cooling gas. The cooling gas is a gas flow that helps prevent the oscillator from over heating.

Battery Low- A visual alarm indicated by yellow LED. A 9V battery must be replaced to have a power failure alarm functional.

Oscillator Overheat- A visual alarm indicated by yellow LED. If the cooling gas has failed the oscillator will begin to overheat, if not remedied the oscillator will stop functioning.

Oscillator stopped- A visual and audible alarm when the ΔP has fallen below 7cmH₂O which causes the oscillator to stop. Once pressures are restored to the system, the oscillator begins to function again.

45 Second Silence- When activated alarms are silenced for 45 seconds and cannot be reset, the alarm must time out.

Sensormedics 3100B

Is the oscillator used for patients above 35kg. The 3100A can be used in larger patients but you may be limited to the amount of driving pressure available. The 3100B has a higher driving pressure therefore can meet the patients needs.

Variations to the 3100B

Bias Flow- Ranges from 0-60LPM

Mean Pressure Adjust- Ranges from 5-55cmH₂O

Power- Maximum proximal amplitude >130cmH₂O

Max Mean Airway Pressure- Unlike the 3100A, the 3100B does not have a Mean Pressure Limit dial. When the pressure in the circuit reaches the set Max P_{aw} the red balloon valve dumps the pressure and then the oscillator tries to repressurize. The RED balloon valve also opens and dumps when pressure in circuit is >60cmH₂O for 5 seconds or if pressure falls below 5cmH₂O.