PERCUSSIONAIRE®

Bronchotron® Transport System

High-Frequency Percussive Ventilation

User Manual

MADE IN THE USA

1st Edition
First Printing April 2021

This manual was originally released and supplied in English.
For a list of available translations, contact customerservice@percussionaire.com.

All ventilators should be operated and serviced only by trained professionals. Percussionaire® Corporation's sole responsibility with respect to its ventilators, accessories, components, and software, and their use, are as stated in the warranty provided in the manuals. The information set forth herein is believed to be accurate; it is not a substitute for the exercise of professional judgment.

Table of Contents

Chapter 1: Introduction

This chapter provides an overview of the Bronchotron® Transport device and High-Frequency Percussive Ventilation (HFPV).

Bronchotron® Transport Controller

The Bronchotron® Transport is a pneumatically powered, flow-regulated, time-cycled ventilator that provides high-frequency percussive ventilation (HFPV), between 200-800 cycles per minute. These high-frequency pulses ramify throughout the airways and alveolar ducts, augmenting diffusive ventilation in the gas exchange regions of the lungs, allowing improved ventilation and FRC, CO_2 removal, airway clearance, and lung recruitment.

Powered directly by wall gas source or through oxygen blender

Operates from a single oxygen cylinder or from a standard high-flow blender. It does not depend on electrical power.

Invasive or Non-Invasive Mechanical Ventilation

Patients can breathe spontaneously at any point in the breath cycle.

Selectable Inspiratory and Expiratory Time

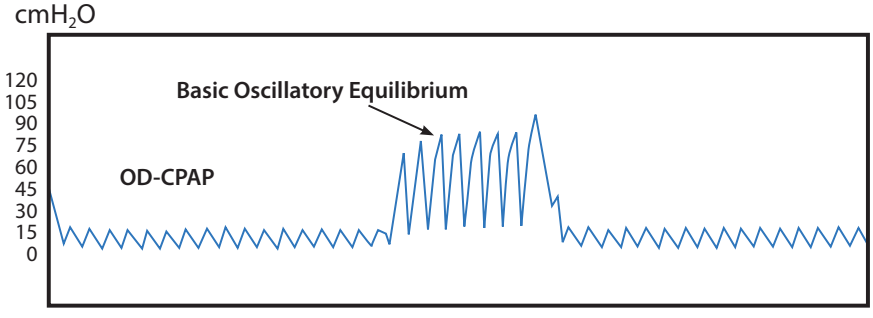
The Bronchotron® Transport gives clinicians a rugged and portable option for High Frequency Percussive Ventilation, specially designed for transport.

High-Frequency Percussive Ventilation (HFPV)

This HFPV system supports both diffusive and convective flow by stacking breaths in cumulative subtidal volumes, allowing for air exchange, airway clearance, and lung recruitment for most patient populations, neonatal to adult.

Percussive Lung Inflation

The following chart displays a typical multistage Bronchotron® percussive lung inflation.

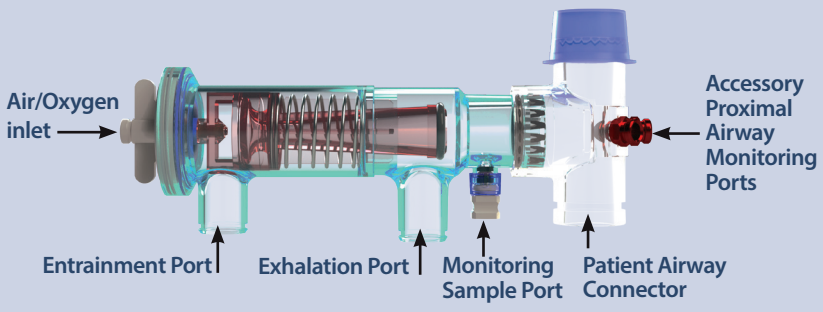


Phasitron® Breathing Circuit A50605-D

NOTE: *The Phasitron® breathing circuit is part of the system and can not be used independently or with any other manufacturer's products.*

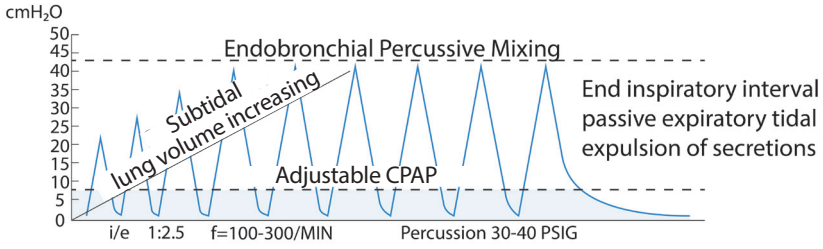
The patented Phasitron® uses a unique sliding venturi mechanism to protect the lung from overpressure. By automatically adjusting to the resistance of the lung, the Phasitron® precisely and safely delivers the optimal amount and pressure of air required by the alveolar space. When lung resistance is low, as in a compliant lung, all the pulsed air from the device enters the mouth of the venturi tube inside the Phasitron® and is delivered instantly to the patient. If needed, each pulse of the Phasitron® is capable of entraining up to four times as much additional air into the venturi, which is delivered directly to the patient.

Phasitron® Breathing Circuit



HFPV Lung Recruitment Protocol Chart

The chart below illustrates the typical high-frequency percussive ventilation algorithm:



This is a method of preventing recruited bronchial airways and alveoli from deflating to a collapsed end resting position during each expiratory lung deflation.

Document Symbols

⚠	**WARNING**		**Type BF Applied Part**
⚠	**CAUTION**		**Single Patient Use**
	Read the manual before use	Rx Only	**Prescription Only**
CE	**CE marking**	REF	**Catalog Number**
	Manufacturer	LOT	**Lot Number**
	Manufacture Date	EC REP	**European Representative**
NON STERILE	**Non-Sterile**	LATEX	**Not Made with Natural Rubber Latex**
PHT DEHP DIBP DBP BBP	**Does Not Contain the Phthalate Plasticizers DEHP, DIBP, DBP, or BBP**		**Disposal**

Chapter 2: Intended Use

Indications for Use

The Bronchotron® Transport is indicated for transport of patients that require high-frequency percussive ventilation. The device is intended for hospital or pre-hospital use, emergency care, intra-hospital, and external hospital transport.

Patient Population

The Bronchotron® Transport is for use on neonatal, pediatric, and adult patient populations.

Absolute Contraindications

• Untreated tension pneumothorax	• Untrained or unskilled operator

Relative Contraindications

• History of pneumothorax	• Myocardial infarction
• Recent pneumonectomy	• Vomiting
• Pulmonary hemorrhage	• Pulmonary air leak (without functioning chest tube)

Possible Adverse Reactions

• Decreased cardiac output	• Increased intracranial pressure
• Pneumothorax	• Increased air trapping
• Hyper-oxygenation	• Pulmonary air leak
• Pulmonary hemorrhage	• Hyperventilation
• Gastric distension	• Apnea

Physiological Benefits of TRUE-IPV®

• Recruitment of atelectatic lung	• Mechanical bronchodilation
• Improved FRC	• Improved breathing pattern
• Decreased work of breathing	• Increased secretion mobilization

Clinical Limitations/Restrictions

Use of the Bronchotron® Transport is limited to individuals who have received proper training.

Warnings and Cautions

Read all safety instructions and the entire Bronchotron® Transport User Manual before using the device.

NOTE: *A **WARNING** icon indicates a risk of injury to patient or operator.*
*A **CAUTION** icon indicates a risk of equipment damage.*

⚠ WARNINGS

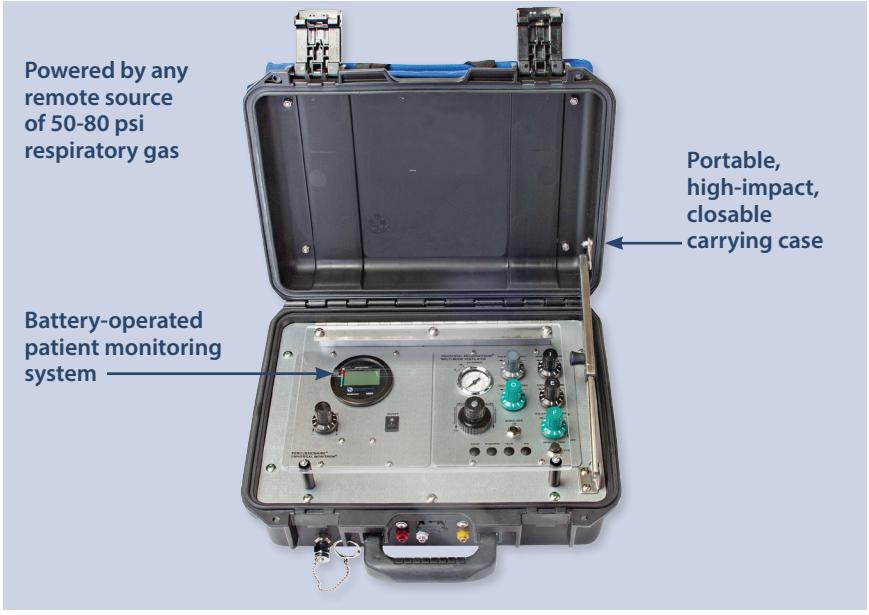
Accessories	Use only Percussionaire® accessories explicitly designed for use with the Bronchotron®. Using accessories not specifically designed for use with the Bronchotron® may cause harm to the patient.
Airway Obstruction and Suctioning	Because pulmonary alveoli cannot be ventilated when their transmitting airways are obstructed, suctioning should be performed as necessary.
Disconnect Protection	For ventilator-dependent patients, do not rely on any single alarm to detect a circuit disconnect condition. Test the operation of the Phasitron® breathing circuit disconnect function daily and whenever a change is made to the Phasitron® circuit. An increase in circuit resistance can prevent the proper operation of some alarms. Speaking valves, Heat Moisture Exchangers (HMEs), and filters create additional circuit resistance and may affect the performance of alarms chosen for circuit disconnect protection.
Drive Pressures	Always check the drive pressure settings on the Bronchotron® before starting ventilation.
Clinical Support	A clinician must be available at all times when the HFPV® device is used on a patient with an indwelling airway (endotracheal or tracheostomy tube). HFPV® devices enhance secretion clearance. Patients must be assessed for a reduced vital capacity/FRC or the need for assistance in clearing airway secretions.
Malfunction	If the Bronchotron® malfunctions, do not utilize it any further. Report any malfunctions immediately.

Patient Monitoring	Before placing a patient on the Bronchotron® ventilator, complete a clinical assessment to determine: • The device alarm settings. • If alternative ventilation equipment is needed. • If an alternative monitor is required. Clinicians should evaluate how their patients tolerate treatment. Auscultation and observation of the mechanical vibrations of the chest and abdomen are primary indicators of effective treatment. Monitor the patient while using the Bronchotron®.
Personnel Qualifications	The Bronchotron® Transport is a restricted medical device designed for medical transport under the supervision of physicians and respiratory clinicians. Change the device settings only on the order of the supervising physician or respiratory clinician. Read and understand the user manual before operating the Bronchotron®. Operators must receive training in the use of the Bronchotron® and each therapeutic procedure before providing HFPV on a patient.
Pre-Use Check	Always conduct a pre-use check before use of the Bronchotron®.
Responsibility of the Clinician	It is the responsibility of the clinician to read and understand the user manual and be fully trained before using the Bronchotron®. Maintain close supervision of the patient. Caution: Federal law restricts this device to sale by or on the order of a physician.
Safety Regulations	Do not connect the device to equipment that does not comply with the applicable safety regulations for the intended use.
Guidelines	All guidelines in this manual are only suggested; always follow hospital or institutional protocols.

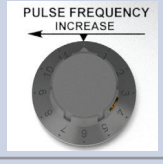
⚠ CAUTIONS

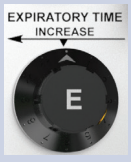
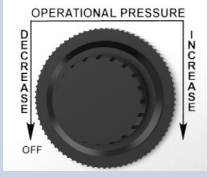
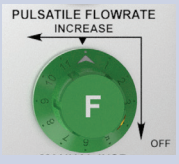
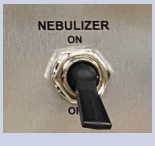
Accessories	Use only Percussionaire® accessories designed specifically for use with the Bronchotron®. Using accessories not intended for use with the Bronchotron® may cause equipment damage.
Modifications	Never attempt to modify the Bronchotron®, as this may cause equipment damage.
Qualified Service Personnel	Only Percussionaire®-authorized service personnel may open the Bronchotron® for any device servicing or repair.
User Manual	Follow the instructions in the user manual when using the Bronchotron®.

Chapter 3: System Description

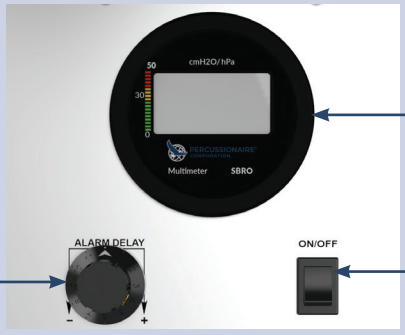


Bronchotron® HFPV® Controller Functions

	**PSI Pressure Gauge** • Powered by any remote source of 50-80 psi medical grade oxygen or blended gas.
	**Pulse Frequency** • Controls the high-frequency rate from 200-800 bpm with an automatic i:e ratio.
	**Oscillatory CPAP** • Determines the pulse amplitude delivered to the patient during the expiratory phase. The Oscillatory CPAP is limited to approximately 20% below the high-amplitude setting, which is selected by pulsatile flow. This prevents the selection of an incompatible oscillatory CPAP during the adjusted expiratory interval.

	**Inspiratory Time** • Selects the time interval (adjustable from <0.8 seconds to 6 seconds) in which the inspiratory amplitude (set with the pulsatile flowrate) is delivered.
	**Expiratory Time** • Selects the time interval (adjustable from <0.8 seconds to 6 seconds) that the expiratory amplitude is being delivered.
	**Operational Pressure** • Controls the operating pressure of the entire unit. • Device on/off switch
	**Pulsatile Flowrate** • Determines the pulse amplitude delivered to the patient during inspiratory time.
	**Manual Inspiration** • Delivers a regulated source of gas through the Phasitron® venturi. ⚠ **WARNING:** The longer the Manual Inspiration button is pressed, the greater the potential for large volumes to be delivered.
	**Tubing Connectors** • Red – pressure monitoring • White – breathing circuit • Yellow – not used
	**Nebulization** Controls the flow of gas to the aerosol circuit. Nebulizer toggle valve provides for a constant flow for nebulization and/or humidification. This is part of the fresh gas supplied to the patient.

Monitron® Patient Monitoring System



The patient monitoring system provides:

- An instantaneous digital readout of effective cycling frequency.
- Audible alarming for failure to maintain a proximal airway pressure.
- A digital presentation of proximal airway pressure rise and mean.

	**On/Off Disconnect Alarm** The on/off power switch activates the disconnect alarm. Failure to turn the switch off upon purposeful disconnect will result in an audible alarm.
	**Alarm Delay** The alarm delay sets the auditory alarming parameters for failure to maintain a proximal airway pressure rise. 12:00 is a delay of approximately 2.0 seconds.

Digital Multimeter (DM)

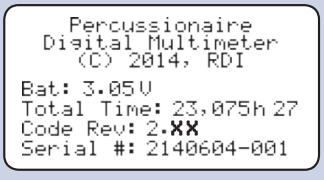
The Digital Multimeter (DM) has six different operating modes: POST, Wake, Active, Report, Sleep, and Fault.

Power-On Self-Test (POST) Mode

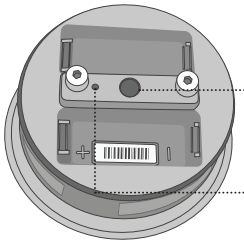
When batteries are installed in the Digital Multimeter (DM), the software displays the software revision, battery voltage, total usage time, and serial number for 15 seconds. This start-up mode allows the software to perform additional tests on the hardware that are part of the Power-On Self-Test. If any errors are detected, the DM enters the Fault mode. The POST checks require that the measurement port be left disconnected and exposed to the atmosphere for the entire duration.

NOTE: *Do not install DM until the POST check is complete, and the screen is blank, indicating Sleep mode.*

System Information Page

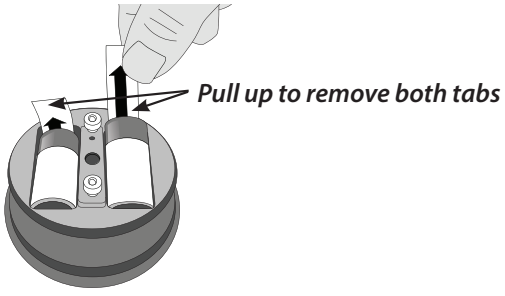


Rear view of DM



⚠ **CAUTION:** Do not insert any object into the measuring port.

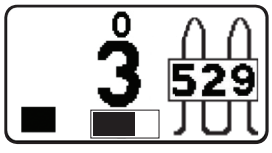
NOTE: *To access battery pull tabs, turn the DM counterclockwise and remove from device.*



NOTE: *To ensure correct atmospheric pressure calibration at startup, remove batteries, wait 30 seconds, and reinstall. Allow 15 seconds for Power-On Self-Test. When screen goes blank, the multimeter can be installed into the device.*

Wake Mode

To wake up the DM, ensure the ventilator pressure is greater than 2.5 cmH_2O/hPa at the Phasitron® patient delivery port for more than 1 second. The DM remains on for the first 15 seconds, showing the bar-graph timer. Stopping usage within 12 seconds causes the DM to enter Report mode. After 15 seconds, the current session continues counting from 16 seconds, which turns into Active mode.



Bronchotron® Transport

DM Screen in Wake Mode

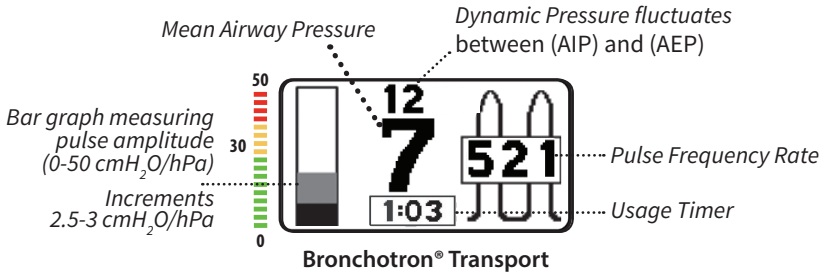
Active Mode

Model: SBRO
Device: Bronchotron® Transport
Display Metrics: Pulse Frequency Rate, Mean Airway Pressure, Dynamic Pressure (AIP and AEP), Usage Timer and Pulse Amplitude Bar Graph

At 16 seconds, the DM enters Active mode. The timer bar will change to a numeric display, showing the current usage Session Timer. The screen (right side) displays the currently measured pulse frequency rate.

Mean Airway Pressure (MAP) averages pulse amplitude over 5 seconds. At 100 samples per second, this is an average of 500 measurements. Above the MAP is a Dynamic Pressure, which changes between average inspiratory pressure (AIP) (higher reading) and average expiratory pressure (AEP) (lower reading) as the Bronchotron® cycles.
DM Range: 0-99 cmH_2O/hPa.

NOTE: *The DM Display represents an estimate of pressure in the lung (after resistance of ET tube, etc.). 100 measurements per second are taken at the Phasitron®. The time duration of the average depends on the time duration of pulsatile flow or O/CPAP.*

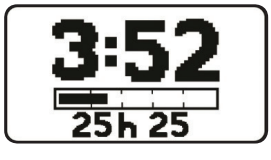
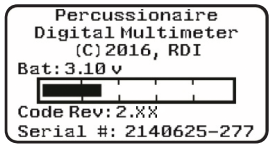


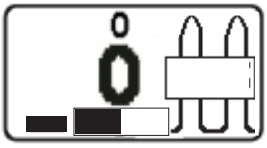
Pulsating grey color represents AIP.
Solid black shows PEEP (only when adding PEEP with PEEP valve).

Pulsating Bar Graph

The pulsating bar graph on the left side displays pulse amplitude calculated as average peak maximum pressure sample in the last 5 seconds minus minimum pressure sample in the last 5 seconds. The bar graph is a visual representation better reflecting AIP values and represents an estimate of airway pressure. The solid bar at the base of the bar-graph display represents PEEP, and the pulsating peaks represent AIP.

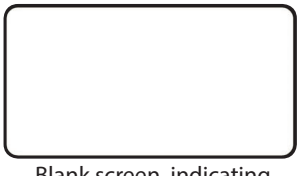
Report Mode

A. 	The Session Timer and the Total Usage Timer **(A)** are displayed for 2 seconds, followed by the System Information page **(B)** for 2 seconds, alternating. The alternating page display continues for 5 minutes or until usage resumes and the DM enters **Active** mode.
B. 	During the 5-minute period, a horizontal bar graph indicates the time by moving from left to right at a fixed rate. After 5 minutes of no usage, the system information page is no longer displayed and the time display flashes (2 seconds on, 2 seconds off) **(C)** for an additional 25 minutes.

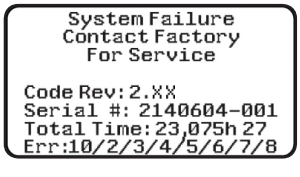
C.		The DM enters **Sleep** mode after 25 minutes.
D.		Measurements drop to zero on the display screen when the Bronchotron® Transport ventilator is off.

NOTE: *When the Bronchotron® Transport is turned off, the measurements will drop to zero after a few seconds.*

Sleep Mode

 Blank screen, indicating DM Sleep mode	In Sleep mode, the LCD is off, but the microcontroller continues to sample and calculate the pressure at the measuring port five times a second. If the pressure is greater than 2.5 cmH_2O/hPa at the Phasitron® patient delivery port for 1 second over any 3-second period, the DM enters Wake mode.

Fault Mode

	The DM displays an error message on the LCD stating, "Contact Factory for Service" and stays in **Fault** mode until both batteries are removed. The displayed information includes the software revision, DM serial number, the Total Usage time, and an error code for the exclusive use of the factory.

In all other modes, the software continuously monitors the hardware for errors as well as verifying that each data sample is valid. If an error is detected, the software logs the error and reboots the processor. Rebooting allows the DM to recover from a transient error. After reboot, the processor returns to the mode it was in before the reboot. If more than one error is detected in any 10-second period, it is considered a fatal error, and the software enters **Fault** mode.

NOTE: *Pressure faults are triggered by a continuous pressure of more than 150 cmH_2O for more than 5 seconds during Wake and Active modes.*

NOTE: *If **System Failure** screen is displayed, remove batteries for 30 seconds. Replace batteries (note that positive terminals face same direction) and wait 30 seconds until the screen turns off. If POST check runs correctly, DM may be used. If System Failure screen recurs, contact an authorized Percussionaire® service center.*

Fault Detection

The DM has both hardware and software fault detection. This is a dedicated hardware "watchdog" that runs on an independent clock source and can continue to operate even if the main microprocessor's clock fails or the microcontroller pauses in any way. The independent fault detection is reset each time a valid pressure reading (free of hardware and software errors) is obtained.

In addition to the hardware fault detection, the software also implements a fault detection "watchdog". This "watchdog" detects if a software task fails to complete within the specified time, logs an error, and resets the processor.

Fault Logging

The software keeps track of several types of hardware and data faults. All faults are logged in the microcontroller's memory and are retained even if the batteries are removed. If multiple faults happen within 10 seconds of each other, the DM stops normal operation and enters Fault mode. In this mode, a subset of the collected fault information is displayed on the LCD. This data is intended for manufacturing and repair use only.

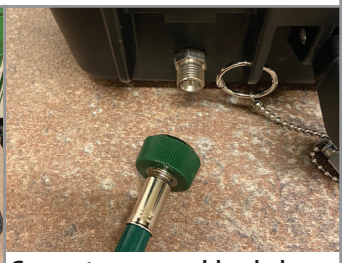
The user can exit the Fault mode by removing and replacing the batteries. This resumes normal operation of the DM but does not erase the faults stored in memory or fix the problem that caused the fault.

Chapter 4: Setup

1. Remove chained cap and connect the Bronchotron® to a 50 psi medical gas source capable of delivering 25 LPM, such as an O_2 supply or a high-flow blender.

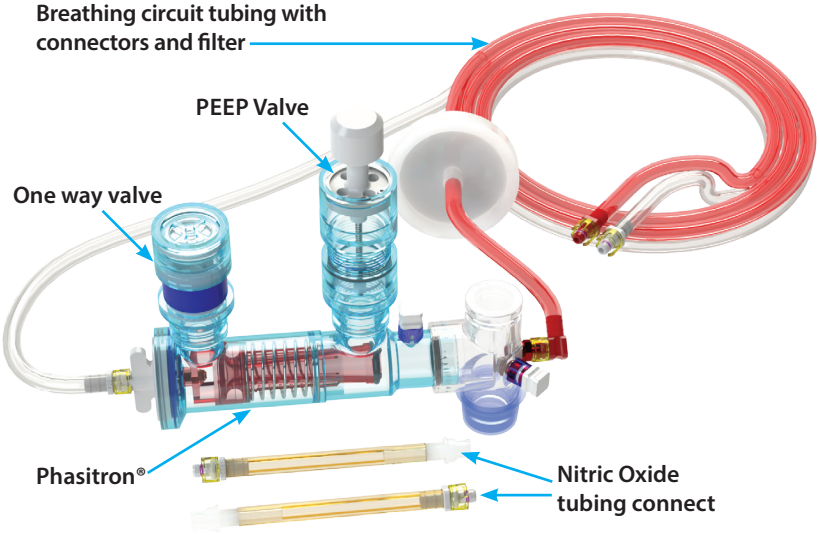
Device closed

Device with lid latched open

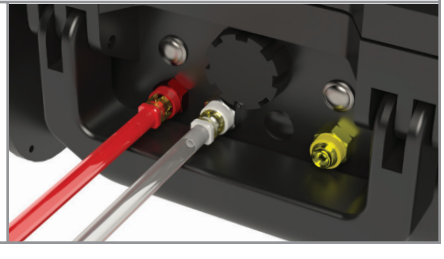


Connect oxygen or blended gas to DISS connection on the front of the device

Phasitron® Breathing Circuit, #A50605-D



2. Connect the paired red and white/clear hoses to the connections on the front of the device.



Chapter 5: Pre-Use Check

Pre-Use Check with Blender

1.	Connect blender to high-pressure air hose and listen for blender alarm.
2.	Connect blender to high-pressure oxygen hose and listen for blender alarm to stop.
3.	Disconnect the air hose and listen for blender alarm. Leave O_2 supply connected.
4.	Reconnect blender to high-pressure air hose. Listen for blender alarm to stop.
5.	Go to step 1 (below).

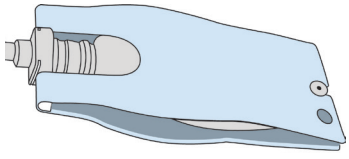
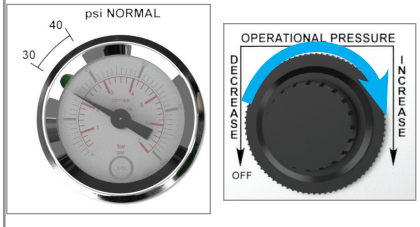
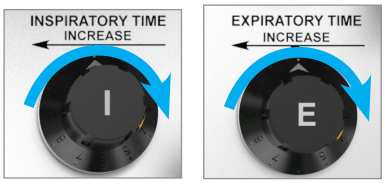
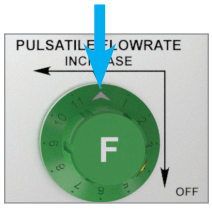
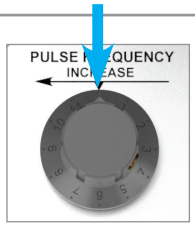
Pre-Use Check

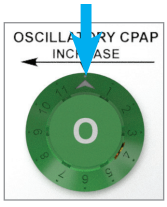
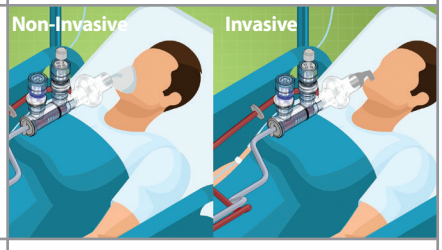
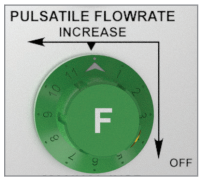
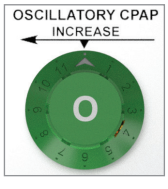
1.	Connect a Siemens®-style 1-liter ventilator test lung to the Phasitron®.
2.	Connect the Phasitron® tubing connections to the Bronchotron®, matching the color-coded connectors.
3.	Rotate the **OPERATIONAL PRESSURE** knob full counterclockwise to the stop (off) position.
4.	Connect the Bronchotron® to the remote gas source.
5.	Turn the **OPERATIONAL PRESSURE** knob clockwise to start the Bronchotron®. Turn the knob until it reaches 40 psig.
6.	Turn off **OSCILLATORY CPAP** (full clockwise).
7.	Turn the green **PULSATILE FLOWRATE** knob until the multimeter display registers an **AIP of 20 cmH_2O**.

8.	Turn the green **OSCILLATORY CPAP** knob counterclockwise until the multimeter display registers an **AEP of 10 cmH_2O**.
9.	Adjust the grey **PULSE FREQUENCY** control knob until the multimeter display registers a frequency of 500.
10.	Set inspiratory time and expiratory time to 2.0 seconds to get a rate of ~ 15 (Adult/Peds). Set inspiratory time and expiratory time to 1.0 seconds to get a rate ~ 30 (Neonatal). 
11.	Check for AIP (high reading) of 20 ± 1 and AEP (low reading) of 10 ± 1.
12.	Verify the pulse frequency will go higher than 700 and lower than 225, then return to 500.
13.	Increase the operational pressure to 50 psig.
14.	Verify the pulsatile flowrate will achieve an AIP of 50 cmH_2O.
15.	Verify the oscillatory CPAP will reach a minimum AEP of 20 cmH_2O.
16.	Return the pulsatile flowrate to an AIP of 20 cmH_2O and oscillatory CPAP to an AEP of 10 cmH_2O.
17.	Turn on the disconnect alarm.

Alarm Check

1.	Trigger the failsafe alarm by pinching off clear Phasitron® tubing.
2.	Trigger the low-pressure alarm by disconnecting test lung.
3.	Turn off the Bronchotron® by rotating the **OPERATIONAL PRESSURE** regulator control knob to zero. • Turn off disconnect alarm. • Disconnect gas supply. • Cover with equipment bag.

1.	Connect a Siemens®-style 1-liter ventilator test lung to the Phasitron®.	
2.	Rotate black **OPERATIONAL PRESSURE** regulator control knob clockwise (right) → until the operational pressure monitoring gauge registers 30 psi. The Bronchotron® will start cycling.	
3.	Rotate the black **INSPIRATORY** and **EXPIRATORY TIME** control knobs for a rate of 30. • For a rate of 30, set both I and E time for 1 second, as shown.	
4.	Rotate the green **PULSATILE FLOWRATE** control knob arrow to the 12:00 ↑ position. Turn the green **PULSATILE FLOWRATE** knob until the multimeter display registers an AIP of 20 cmH_2O.	
5.	Rotate the grey **PULSE FREQUENCY** control knob arrow to the 12:00 ↑ position.	

6.	Rotate the green **OSCILLATORY CPAP** control knob arrow to the 12:00 ↑ position.	
7. 8.	If using the Bronchotron® non-invasively, attach the Phasitron® to the appropriate mask and place on patient. If using the Bronchotron® invasively, attach the Phasitron® to the appropriate indwelling artificial airway.	
9.	Start rotating (adjusting) the **PULSATILE FLOW** control knob arrow clockwise or counterclockwise until a gentle chest excursion is observed (rise and fall, similar to bagging).	
10.	Start rotating (adjusting) the **OSCILLATORY CPAP** control knob arrow clockwise or counterclockwise until the entire bilateral chest is observed to be shaking (oscillating).	

Neonatal Starting Guidelines

NOTE: *These are merely suggested guidelines based on clinical consensus.*

Operating Pressure (psi)	**40**
High Amplitude (AIP) (pulsatile flowrate) (cmH_2O) (set on digital meter)	**15-20**
I time (seconds)	**1.0**
E time (seconds)	**1.0**
Oscillatory CPAP (cmH_2O) (set on digital meter)	**4-8**
High Frequency rate (cycles)	**600**
FiO_2 %	**Per MD order**

For basic CO_2 manipulation: Increase pulsatile flow in 2-4 cmH_2O. increments up to 28-34 cmH_2O.

For basic oxygenation improvement: increase PEEP in 2 cmH_2O increments up to 8-12 cmH_2O.

Increase FiO_2 appropriately.

Neonatal Strategies

Neonatal Patient blood gas manipulation ***(Manipulation choices are stated in order of most common progression but do not need to be followed in any special order.)***

Decrease CO_2 Only	**Increase Oxygenation with $PaCO_2$ in Acceptable Range**	**Increase PaO_2 and Lower $PaCO_2$**	**Raise CO_2 with Low Existing PIP**
a. Increase high amplitude (pulsatile flow) by 2 cmH_2O at a time up to maximum (AIP 28-34 cmH_2O). b. Decrease pulse frequency by 50 cycles per minute. Do not go below 400.	a. Increase FiO_2 if at low level. b. Increase oscillatory CPAP (low amplitude) by 2 cmH_2O. (Maximum AEP 12 cmH_2O). c. If maximum low amplitude oscillatory CPAP is reached: • Increase pulse frequency by 50 cycles per minute. Do not go above 800. (May cause some increase in CO_2.) • Increase time at P high — Increase I time by 0.1-0.2 seconds up to 1.5 seconds maximum. **BE PATIENT: it can take up to 2-4 hours for recruitment to take place.**	a. Increase pulsatile flow (high amplitude) by 2-4 cmH_2O at a time up to maximum (AIP 28-34 cmH_2O). b. Increase oscillatory CPAP (low amplitude) by 2, but keep the gap between P high and P low the same by increasing pulsatile flow. (Maximum AEP 12 cmH_2O.) If the gap is decreased, then CO_2 removal may not be as effective.	a. Decrease conventional rate by 5 bpm (minimum 15/min) by increasing exp. time. b. Decrease time at P high by decreasing I time by 0.1 to 0.2 seconds down to minimum 0.7 seconds. c. Increase pulse frequency in increments of 50 cycles per minute. Do not go above 800.

Pediatric Starting Guidelines

NOTE: *These are merely suggested guidelines based on clinical consensus.*

	Pediatrics < 10 kg	Pediatrics 10-20 kg	Pediatrics > 20 kg
Operating Pressure (PSI)	40	40	40
High Amplitude (pulsatile flowrate) (cmH_2O) (set on digital meter)	24-28	24-28	28-32
I time (seconds)	1.0	1.5	2.0
E time (seconds)	1.0	1.5	2.0
Oscillatory CPAP (cmH_2O) (set on digital meter)	6-8	6-10	8-10
Pulse Frequency rate (cycles)	500	500	500
FiO_2 %	Per MD order	Per MD order	Per MD order

Pediatric Strategies

For basic CO_2 manipulation:
Increase pulsatile flow in 2-4 cmH_2O increments up to 40-44 cmH_2O in pediatrics.

For basic oxygenation improvement:
Increase PEEP in 2 cmH_2O increments up to 14-16 cmH_2O.

Increase FiO_2 appropriately.

For more in-depth guidelines:
Pediatric patients < 10 kg, refer to neonatal guidelines.

Pediatric patients > 20 kg, refer to adult guidelines.

Pediatric patients 10 - 20 kg, refer to either guideline.

Adult Starting Guidelines

NOTE: *These starting guidelines are to be used as a reference and were developed by an independent group of clinicians by clinical consensus.*

Operating Pressure (psi)	40-42
High Amplitude (pulsatile flowrate (cmH_2O) (set on digital meter)	AIP 28-32 (maximum 40-46) Alternately, adjust pulsatile flowrate to match mean airway pressure (MAP) on current ventilator.
I time (seconds)	2.0
E time (seconds)	2.0
Oscillatory CPAP (cmH_2O) (set on digital meter)	AEP 10-12 (maximum 14-18)
Pulse Frequency Rate (cycles)	500 (400-700) adjust in increments of 50 cycles
FiO_2 %	Per MD orders

Adult Strategies

Manipulation of controls to affect a change in arterial blood gases is essentially the same in all patient populations, the main difference being maximums. Below are guidelines for adults and neonates. Guidelines for pediatrics will be dependent on patient size. For small patients use neonatal guidelines. For larger adolescents to teens use the adult guidelines

Adult Patient Blood Gas Manipulation ***(Manipulation choices are stated in order of most common progression but do not need to be followed in any special order)***		
Decrease CO_2 only	**Increase Oxygenation with $PaCO_2$ in Acceptable Range**	**Increase PaO_2 and Lower $PaCO_2$**
a. Increase pulsatile flow by 2 cmH_2O at a time up to maximum AIP 40-46 cmH_2O (high amplitude). b. Decrease pulse frequency by 50-100 cycles per minute. Do not go below 400. c. Lengthen I time to 3.0 seconds and shorten E time to 1 second. If all of the above have not achieved desired CO_2 level, creating a mild to moderate cuff leak per auscultation can be used depending on your infection control/VAP guidelines.	a. Increase FiO_2 if at low level. b. Increase oscillatory CPAP (low amplitude) by 2 cmH_2O (maximum16-20). c. If maximum oscillatory CPAP is reached: • Increase pulse frequency by 50-100 cycles per minute. Do not go above 700. (May cause some increase in CO_2.) • Increase time at P high — Increase I time by 0.5-1.0 seconds up to 3.5 seconds maximum. **BE PATIENT: it can take up to 2-4 hours for recruitment to take place.**	a. Increase pulsatile flow by 2 cmH_2O at a time up to maximum AIP 40-46 cmH_2O (high amplitude). b. Increase oscillatory CPAP by 2 cmH_2O, AEP (low amplitude) but keep the gradient between AIP (high amplitude) and oscillatory CPAP (low amplitude) the same with adjustment. I.e., raise CPAP up by 2, raise AIP (high amplitude) by 2. If the gap is decreased, then CO_2 removal may not be as effective.

Chapter 7: Cleaning and Disinfection

Controller

NOTE: *All single-patient use components and Phasitron® are not intended for cleaning, sterilization, or re-use. Replace single-patient use components regularly, following your healthcare institution's protocol.*

1.	Do not spray any cleaning solution directly onto the controller.
2.	Do not submerge or allow liquids to enter the controller.
3.	Clean the controller according to hospital/institutional protocols. Always clean between patients and when visibly soiled.
4.	Clean the controller with a clean, lint-free cloth or paper towel moistened with the 70% isopropyl alcohol solution.
5.	Use only institution/hospital approved disinfectants and cleaners.

Digital Multimeter (DM)

Clean the DM when visibly soiled using 70% isopropyl alcohol or according to facility protocols. Do not spray any type of cleaner directly onto the DM.

⚠ **CAUTION:** Use of cleaning methods not outlined in these instructions may cause damage to the DM.

⚠ **WARNING:** Percussionaire® makes no claims regarding the efficacy of the listed chemicals or processes as a means for controlling infection. Consult your hospital's infection control officer or epidemiologist. To clean or sterilize mounted devices or accessory equipment, refer to the specific instructions delivered with those products.

⚠ **CAUTION:** The battery cell used in this device may present a risk of fire or chemical burn hazard if mistreated. Do not recharge, disassemble, heat above 100°C (212°F), or incinerate. Replace cell with type recognized CR123A only, or Percussionaire® part PRT-B13350. The use of another cell may present a risk of fire or explosion.

Dispose of in accordance with appropriate regulations, country, state, and local laws.

Phasitron® Kit A50605-D

The Phasitron® breathing circuit kit is a single-use, single-patient circuit used for patient transport only. After patient transport is complete, discard Phasitron® breathing circuit according to hospital/institutional protocol.

⚠ **WARNING:** Do NOT reuse the Phasitron® breathing circuit kit.

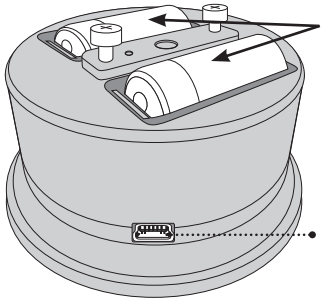
Cleaning and Disinfecting Solutions

The Phasitron® breathing circuit has been tested for biocompatibility with the following cleaning and disinfecting solutions:

Chemical Class	Active Ingredient
Bleach	5.25% Sodium hypochlorite
Alcohol	70% Isopropyl alcohol
Peroxide	3% Hydrogen peroxide

⚠ **WARNING:** Always follow institutional/hospital protocols for cleaning and disinfection.

Chapter 8: Maintenance



Side view of DM

Changing Digital Multimeter (DM) Batteries

A Low Battery indicator is displayed when battery capacity is nearing depletion.

1.	Press on the DM's bezel and twist counterclockwise approximately 20 degrees.
2.	Gently pull on the multimeter to remove it from the housing.
3.	Remove the two old batteries and discard appropriately.
4.	Install two new batteries. Note that the positive terminals face the same direction. Wait 30 seconds until the screen turns off.
5.	Install the DM back into the housing and twist clockwise until the stop is felt.
6.	See POST mode instructions to verify display operation.

Chapter 9: Troubleshooting

Problem	Possible Cause	Repair
Bronchotron® will not start.	a) Not connected to gas source. b) Regulator is off.	a) Connect to gas source. b) Rotate regulator knob clockwise.
Fails to maintain pressure	a) Check for leak at the patient mask or airway. b) May have an internal leak.	a) Adjust mask or airway. b) Service is required.
Breathing circuit will not function.	a) Circuit assembled improperly.	a) Refer to the assembly section.
Pressure or frequency of percussion is not correct.	a) The device requires calibration.	a) Service is required.
Bronchotron® shuts down.	a) Check for an obstruction in the tubing.	a) If there is no obstruction, service is required.

NOTE: *For issues not found in Troubleshooting, please contact a Percussionaire®-authorized service center.*

⚠ **WARNING:** If you notice any unexplained changes in the performance of the device, if the device is making unusual sounds, or if the device is dropped or damaged in any way, discontinue use and contact an authorized Percussionaire® service center.

Chapter 10: Technical Specifications

Bronchotron® Controller

Pulse Frequency	200-800 pulses per minute
Pulse/interval ratio	Adjustment from 1:1 to 1:2.5 automatic
Operating Range	Temp., 0°C to 49°C (32°F to 120°F) Humidity 5% -95%
Storage and Transport Range	Temp., -20°C to 60°C (-4°F to 140°F) Humidity < 93% non-condensing
Battery	Multimeter uses (2) CR123A batteries Percussionaire® part PRT-B13350
Run Time	Continuous
Mean Airway Pressure (MAP)	Digital display, 1 to 99 cmH_2O/hPa
Average Inhalation Pressure (AIP)	Digital display
Average Exhalation Pressure (AEP)	Digital display
Alarm	Airway pressure over 120 cmH_2O/hPa Audible indicator (pneumatic pressure failsafe) with pressure relief
Gas Source	Oxygen 50-80 PSI, 3.45-5.5 BAR
Gas Consumption	25 LPM
Dimensions	48.26 cm x 38.1 cm x 17.78 cm (19"x 15" x 7")
Weight	6.25 kg (13.8 lb)
Required Maintenance	Every 3 years
Accessories	Phasitron® Kit A50605-D
Inspiratory time	Range < 0.8 seconds (full counterclockwise) to 4-6 seconds (full clockwise)
Expiratory time	Range < 0.8 seconds (full counterclockwise) to 4-6 seconds (full clockwise)

Digital Multimeter (DM) Specifications

Size	73 mm diameter (2.87" diameter)
Mass	165 g (0.36 lb)
Operating Range	Temp., -20°C to 60°C (-4°F to 140°F) Humidity < 93% non-condensing
Storage and Transport Range	Temp., -20°C to 60°C (-4°F to 140°F) Humidity < 93% non-condensing
Display	128 x 64-pixel FSTN chip-on-glass LCD with reflector
Fault Detection	Independent hardware and software "watchdogs"
Serial Port	USB (firmware upgrade)
Thermal Rate Range	-40°C to +60°C 50-999 pulses per minute
Pressure Range	0-150 cmH_2O/hPa
Pressure Resolution	1 cmH_2O/hPa
Pressure Accuracy	Greater of ± 0.5% of reading or 1 cmH_2O/hPa
Battery Type	CR123A 3.0V (2)
Battery Duration	3,250 operational hours at 35°C (95°F)
Shelf Life	3.5 years at 35°C (95°F)

Phasitron® A50605-D

Size	13.5 mm x 17 mm (5 ¼" x 6 ¾")
Weight	123 g (0.27 lb)
Operating Range	Temp., 0°C to 49°C (32°F to 120°F) Relative humidity range 5% to 95%
Storage and Transport	Temp., -40°C to 60°C (-40°F to 140°F) Humidity < 93% non-condensing
Rate Range	0-999 pulses per minute
Pressure Range	0-150 cmH_2O/hPa
Filtration Efficiency	BFE 99.999%, VFE 99.9999%
Red Line Filter	0.027 micron hydrophobic
Disposal	Recycle according to local laws.
Service Life	7 days
Shelf Life	2 years from date of manufacture

Chapter 11: Service and Repair

Preventive Maintenance

Percussionaire® Corporation recommends annual preventive maintenance (PM) for each device. An annual PM consists of a thorough cleaning, functional evaluation, and, if necessary, recalibration. A mandated service is required every three (3) years after the first date of purchase, but not longer than 4 years. A full service consists of all new components, including front panel, metering valves, elastomeric seals, sleeves, and cartridges. The device is factory calibrated and receives a functional evaluation, conformance certification and a one-year warranty on all parts replaced. A device that has not received a mandated full service for ten years, whether in use during that period or not, is considered beyond economic repair. Intervention by an unauthorized individual or repair maintenance facility will cause the immediate expiration of the clinical readiness of the device.

Returns and Shipping

To return a Percussionaire® device to a factory service center for repair, overhaul, or annual preventive maintenance, contact your distributor.

Disposal of Equipment

At the end of useful life of a unit, disposal should be in accordance with local, state, federal, and international laws

Chapter 12: Limited Warranty

Percussionaire® warrants that the Bronchotron® Transport shall be free from defects of workmanship and materials and will perform in accordance with the product specifications for one year from the date of first use (proof of delivery will be required). If the product fails to perform in accordance with the product specifications, Percussionaire® will repair or replace – at its option – the defective material or part. Percussionaire® will pay customary freight charges to and from Percussionaire® or an authorized Percussionaire® service center. Device service kits are newly manufactured and will be warrantied from the time of installation, not to exceed the current kit's shelf life. This warranty does not cover damage caused by non-approved cleaning or sterilization, accident, misuse, abuse, alteration, and other defects not related to material or workmanship. Percussionaire® disclaims all liability for economic loss, loss of profits, overhead, or consequential damages which may be claimed to arise from any sale or use of this product.

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P20050 Rev A