PERCUSSIONAIRE®

TXP®5 System

User Manual

High-Frequency Percussive Ventilator (HFPV)

MADE IN THE USA

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One or more patents may cover the devices and products contained in this manual.

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 TXP® 5 emergency high-frequency ventilator.

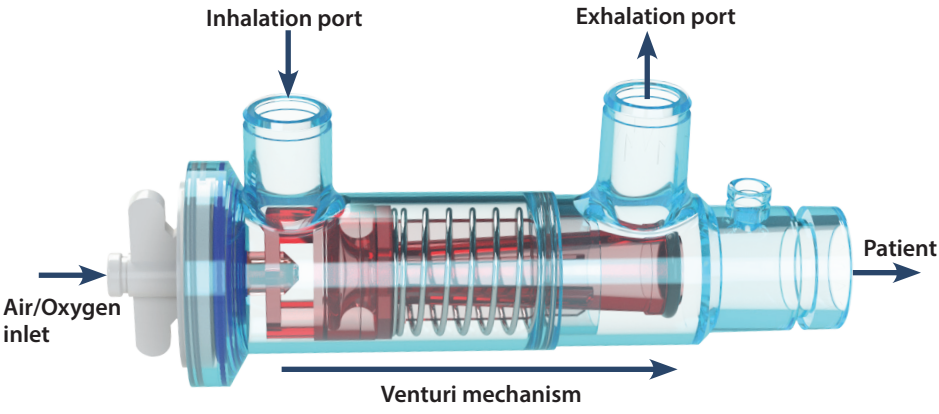
High-Frequency Percussive Ventilation

High-Frequency Percussive Ventilation (HFPV) is a flow-regulated and time-cycled hybrid form of high-frequency ventilation which can be lifesaving for patients with fragile, small, congested, or stiff lungs weakened by barotrauma or infection. HFPV is a solution that requires neither the pressure of mechanical ventilation nor the breathing action of the patient. This HFPV system supports both diffusive and convective flow by stacking pulses in cumulative subtidal volumes, allowing for air exchange, airway clearance, and lung recruitment for most patients.

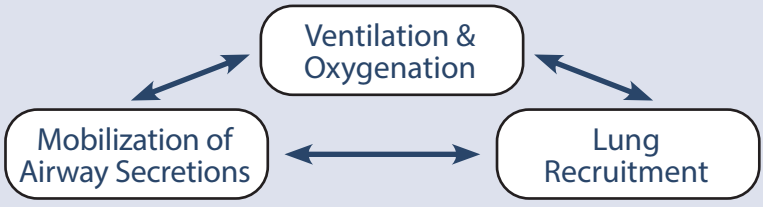
Phasitron® Breathing Circuit A50606-TXP

HFPV provides respiratory assistance as the patient breathes through the Phasitron®. The patented Phasitron® uses a unique venturi mechanism to protect the lung from over-pressure. 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 TXP® 5 enters the mouth of the venturi. Each air pulse draws up to four times as much additional air into the venturi tube. This low-pressure entrained air automatically fills the available space in the lung. The Phasitron® continuously and instantaneously adjusts to keep a gentle and safe air pressure even in a compromised lung.

Phasitron® Breathing Circuit A50606-TXP



Effects of HFPV



The effects of HFPV occur with or without the cooperation of the patient. HFPV provides a sub-tidal gas exchange within the respiratory bronchioles with associated alveolar recruitment maintaining a minimal mean intrathoracic expiratory pressure increase for peripheral lung stabilization. This allows for mechanical ventilation to provide for peripheral lung recruitment while minimizing the potential for induced barotrauma.

Document Symbols

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

Warnings and Cautions

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

⚠ Warnings

Clinical support	If the HFPV device is used on a patient with an indwelling airway (i.e., endotracheal or tracheostomy tube), a clinician must be available at all times. These devices enhance secretion clearance. Patients must be assessed for a reduced functional residual capacity (FRC).
Patient Monitoring	Complete a clinical assessment before placing a patient on the TXP® 5 ventilator.
Personnel Qualifications	The operator of the TXP® 5 is responsible for reading and understanding the manual before use. TXP® 5 is a medical device designed for hospital use by trained clinicians under the supervision of a physician. Only change the prescription and device settings on the order of the supervising physician.
Pre-Use Check	Always conduct a pre-use check before starting HFPV with the TXP® 5.
Suctioning	Perform suctioning as necessary; pulmonary alveoli cannot be ventilated when their transmitting airways are obstructed.

⚠ Cautions

Cleaning	Do not use any steam cleaning methods to clean the device or Phasitron® A50606-TXP breathing circuit. Always follow hospital/institutional protocols for cleaning and disinfection.
Maintenance	The TXP® 5 must not be opened by anyone other than Percussionaire®-authorized service personnel. Maintain and service the TXP® 5 device according to the recommendations provided in this manual. Only use Percussionaire® accessories explicitly designed for use with the TXP® 5 device.
Malfunctions	If the TXP® 5 malfunctions, it should not be utilized any further. Report any malfunctions immediately.
Read and Understand Manual	All persons providing HFPV therapy must be trained in the use of the TXP® 5.
Safety	Do not place objects on top of the TXP® 5. Do not cover the device during use. Do not lean on device.

Chapter 2: Intended Use

Indications for Use

The TXP® 5 is designed for emergency ventilation of adult, pediatric, or neonatal patients. The device is intended for hospital or pre-hospital use, emergency care, intra-hospital, and external hospital transport. The TXP® 5 is intended for use under the supervision of a licensed physician, by both properly trained clinicians and personnel with limited training. The TXP® 5 requires a 50 psi source capable of maintaining 15 LPM. A medical source of compressed oxygen or air is preferred, but other emergency sources may be used.

Patient Population

TXP® 5 ventilator is intended for use on neonatal, pediatric, and adult patient populations.

Absolute Contraindications

• Untreated tension pneumothorax	• Untrained or unskilled operator

Relative Contraindications

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

Possible Adverse Reactions

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

Physiological Benefits of HFPV

• Recruitment of atelectatic lung	• Mechanical ventilation
• Improved FRC	• May improve breathing pattern
• Decreased work of breathing	• Increased secretion mobilization

Clinical Limitations/Restrictions

Use of the TXP® 5 is limited to qualified individuals who have received training.

⚠ **WARNING:** Suctioning should be performed as necessary; pulmonary alveoli cannot be ventilated when airways are obstructed.

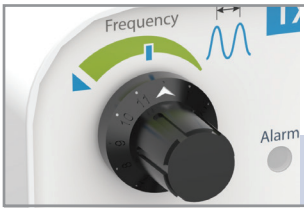
⚠ **WARNING:** When using an HME (Heat-Moisture Exchanger), connect between the Phasitron® breathing circuit and the patient. Follow all setup instructions provided by the HME manufacturer.

NOTE: *Any HME attached to the Phasitron® breathing circuit should comply with ISO 9360-1 or ISO 9360-2.*

Chapter 3: System Description

The TXP® 5 ventilator provides high-frequency percussive ventilation (HFPV) as the patient breathes through the Phasitron® breathing circuit.

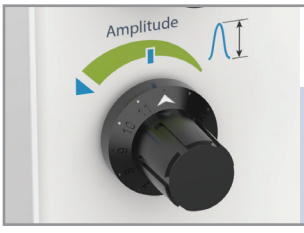
Frequency Control Knob



The Frequency knob controls the frequency rate from approximately 200-700 pulses (inflations) per minute.

NOTE: *The rate may differ at different altitudes.*

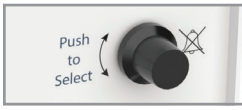
Amplitude Control Knob



The Amplitude control knob determines the amplitude delivered to the patient during the pulse.

NOTE: *Amplitude is affected by lung compliance and resistance.*
Amplitude is attenuated by resistance and compliance to an airway pressure.

Control Knob



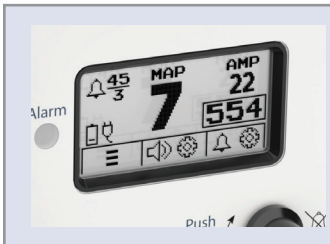
Use the control knob to select menus and silence alarms.

Tubing Connectors

Connect the Phasitron® breathing circuit easily by inserting the tubing connectors into the bulkhead fittings.

⚠ **CAUTION:** Ensure the connection is straight to prevent crimping the O-ring and causing a leak.

Digital Display



The treatment screen displays Amplitude, Mean Airway Pressure, Frequency, alarm high and low setpoints, battery condition, charging status, and power plug indicator.

The display has three menu options:

- Main menu
- Volume settings
- Alarm Settings

Power-On Self-Test (POST) Mode

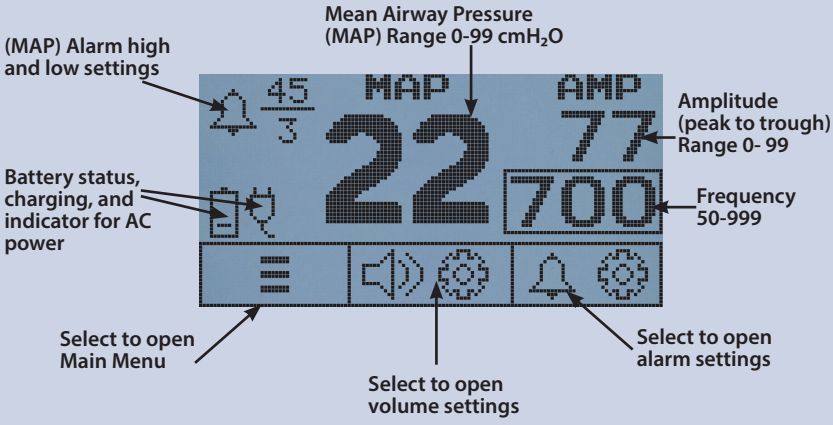
Push the control knob for more than .5 of a second to power on the display. The screen displays the POST screen while it evaluates system processes before proceeding to the treatment screen. The POST screen is displayed for 3 to 5 seconds.

NOTE: *If a technical issue arises during POST, the System Failure screen will appear.*

Treatment Screen

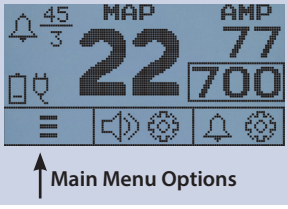
Once POST is complete, the treatment screen is displayed.

The treatment screen displays several menu options. Turn the knob until the desired menu option highlights. Push the knob to select.

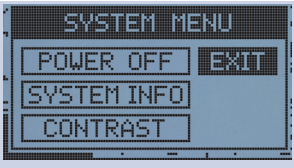


NOTE: *Displayed values may read zero if the TXP® 5 is not on or pulsing.*

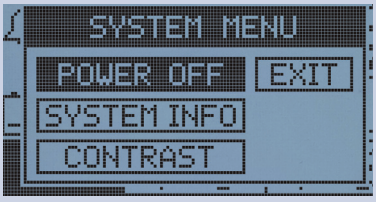
Main Menu Options



Turn the control knob to highlight the main menu button. Push the control knob to select. A popup will appear with menu options.

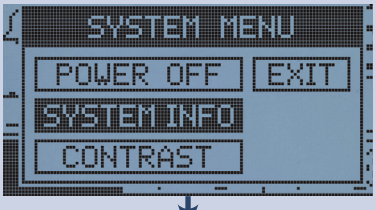


Power Off

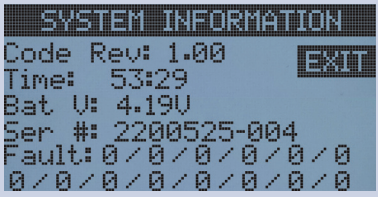


Highlight **POWER OFF** by turning the control knob. Push the control knob to select.

System Information

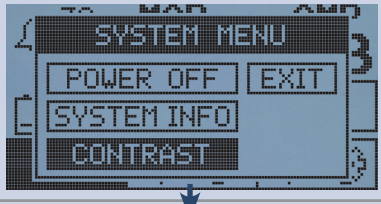


Turn the control knob to highlight **SYSTEM INFO**.
Push the control knob to select.

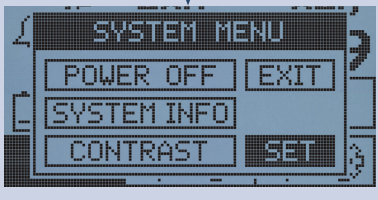


A popup will appear displaying system information. Turn the control knob to highlight **EXIT** to return to the treatment screen. Push the control knob to make selection.

Contrast

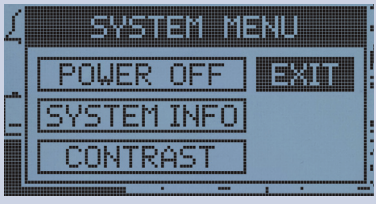


Turn the control knob to highlight **CONTRAST**. Push control knob to select. Rotate control knob clockwise to increase (darken) or counterclockwise to lower (lighten).



Push control knob to **SET**.

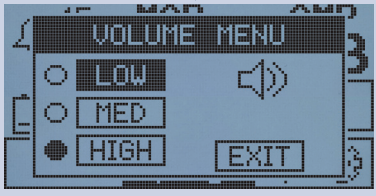
Exit Menu



Turn the control knob to highlight **EXIT**. Push the control knob to select and return to the treatment screen.

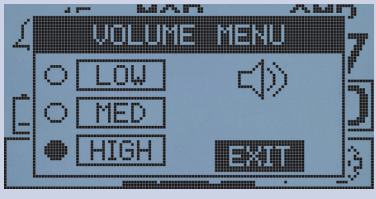
Volume

Turn the control knob to highlight the volume icon on the treatment screen. Push the control knob to select.



A popup will appear displaying volume options. Turn the control knob to highlight the desired volume. Push control knob to select:

LOW – volume set to 25% of speaker output
MED – volume set to 50% of speaker output
HIGH – volume set to 100% of speaker output
A confirming tone will sound when the volume selection is made.

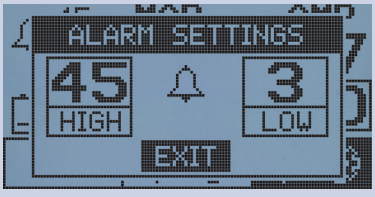
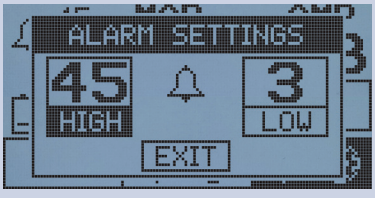
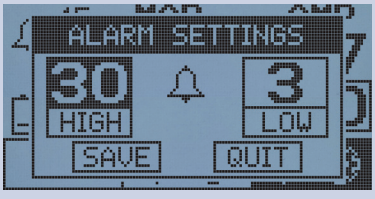


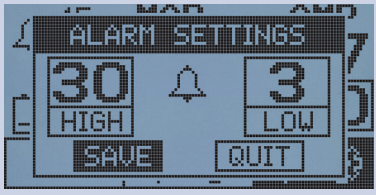
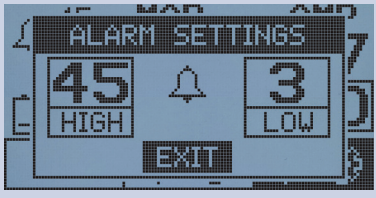
Turn the control knob to highlight **EXIT**. Push to select. This will return the user to the treatment screen.

Chapter 4: Alarms

Alarm Settings

NOTE: *Alarms are controlled by the Mean Airway Pressure settings.*

	Turn the control knob to highlight the alarm icon. Push the control knob to select.
	Alarm default set to: High 45 Low 3 An alarm popup will appear.
	Turn the control knob to highlight the value to be changed. Push to select.
	Turn the control knob to raise or lower the alarm value. Push to select.

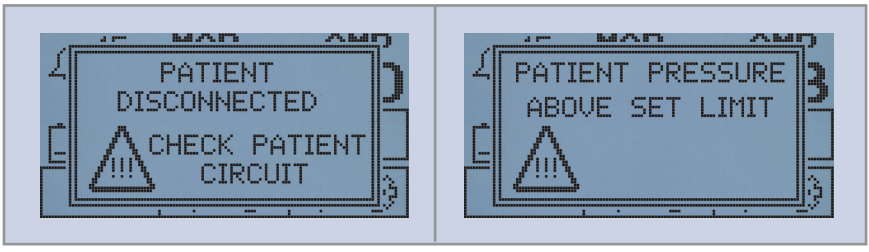
	When satisfied with the new alarm settings, turn the control knob to highlight the **SAVE** button. Push to select. This will return the user to the treatment screen, or select **QUIT** to return to the treatment screen without updating or changing alarm settings.
	Highlight and select **EXIT** to return to the treatment screen without updating or changing alarm settings.
	The alarm parameters display on the treatment screen.

NOTE: *The process is the same for setting both high and low alarms.*
NOTE: *The alarm setting will not change if the user presses **EXIT** before confirming the change.*

Alarm Conditions

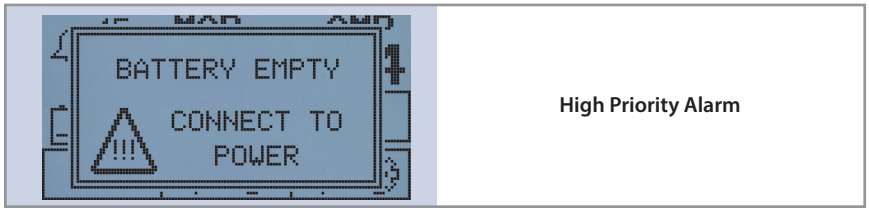
High Priority

A high priority alarm will alert at 1 second. During a high alarm event, the LED flashes and a high priority alarm tone will sound. Pushing the control knob acknowledges and silences the alarm, but the visual flashing LED continues until the alarm condition resolves. After 30 seconds of a high priority alarm condition, a maximum volume alarm tone will sound, overriding any pre-selected alarm volume level.



Battery Empty

A **battery empty** high priority alarm will alert at 3% remaining battery power.
During this high priority alarm event, the LED flashes and a high priority alarm tone will sound. The alarm can be silenced, but the visual flashing LED continues until the alarm condition is resolved. After 30 seconds of a high priority alarm condition, a maximum volume alarm tone will sound, overriding any pre-selected alarm volume level.



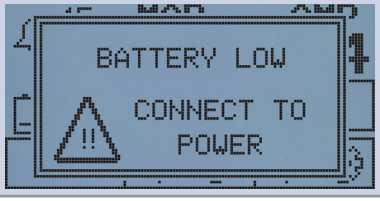
Loss of Power Alarm

A high priority alarm will sound when the TXP® 5 battery is drained beyond critical, and the device is not connected to AC power. When battery power is less than 2%, the screen shuts off, and the unit emits a high priority alarm tone until the control knob is pressed to silence the alarm tone. The unit will display the battery charge symbol.
Device will continue to ventilate the patient as set.

Medium Priority

Battery Low

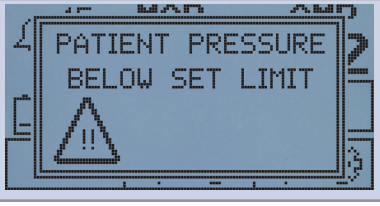
A **low battery** medium priority alarm will alert at 10% remaining battery power. During this medium alarm event, the LED flashes and a medium priority alarm tone will sound. The alarm can be silenced, but the visual flashing LED continues until the alarm condition is resolved. After 30 seconds of a medium priority alarm condition, a maximum volume alarm tone will sound, overriding any pre-selected alarm volume level.



Medium Priority Alarm

Patient Pressure Below Set Limit

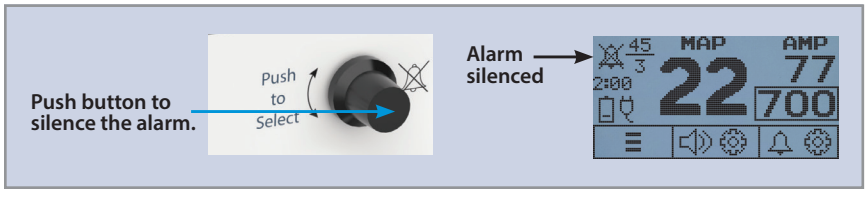
A medium priority alarm will alert at 1 second. During a medium alarm event, the LED flashes and a medium priority alarm tone will sound. Pushing the control knob acknowledges and silences the alarm, but the visual flashing LED continues until the alarm condition is resolved. After 30 seconds of a medium priority alarm condition, a maximum volume alarm tone overrides any selected volume level.



Medium Priority Alarm

Alarm Silence

Pushing the control knob will silence an alarm. Once the alarm is silenced, a 2-minute countdown begins. If, after 2 minutes, the alarm condition persists, normal alarming will resume.
When an alarm is silenced, the alarm screen will flash (on and off) until the alarm condition is resolved.



Battery Discharge

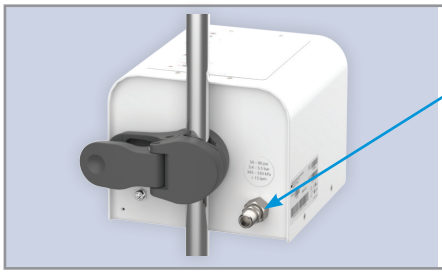
Battery at 10%	Low Battery Alarm Connect to AC power and begin charging for normal operation.
Battery at 3%	Battery Empty Alarm Connect to AC power and begin charging for normal operation.
Battery at 2%	Loss of Power Alarm The LED is Off. The backlight is off. Battery charge symbol is displayed. The Alarm is sounding. The display is no longer functioning, except the mute button. Once Mute is pressed, it mutes the alarm permanently. Connect to AC power and begin charging for normal operation.
Battery at 1%	Screen is blank; the system is in an extremely low power mode. Connect to AC power to wake the display and begin charging for normal operation.

NOTE: *Device will operate normally when connected to AC power and charging.*
NOTE: *Ventilation will continue and is unaffected when the display is in low power mode.*

Chapter 5: Setup

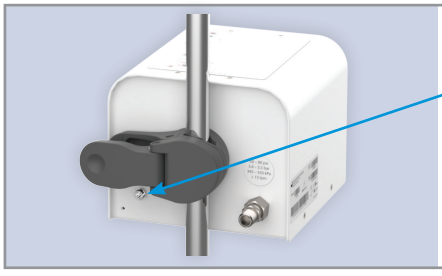
Controller and Stand

DISS Gas Connection



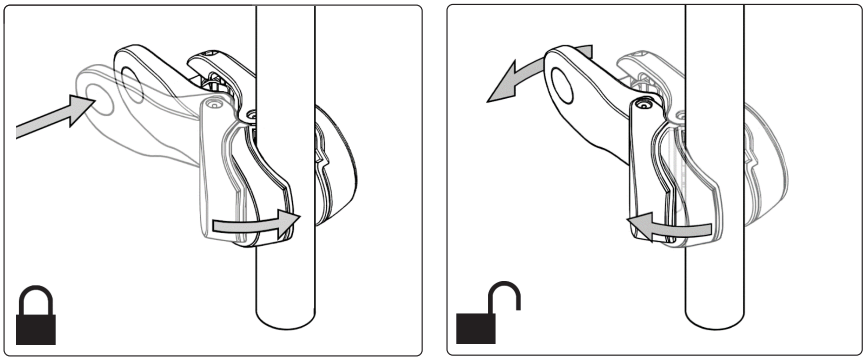
Blended Gas/Air Connection
Connect the ventilator to hospital wall gas/air, blended gas, oxygen cylinders, or a mobile compressor.

Power Supply

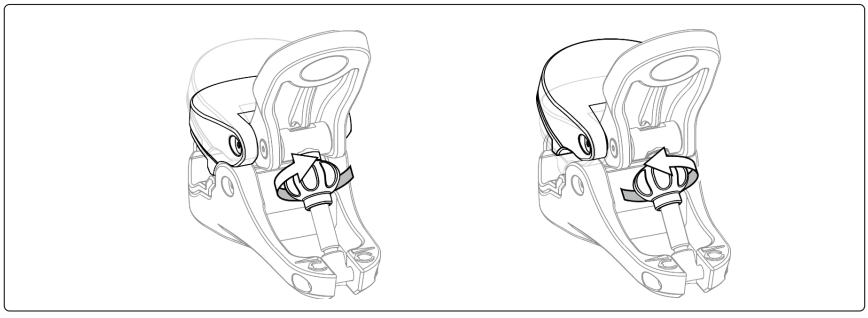


AC Power Connection
Connect the ventilator using supplied AC/DC power adapter to hospital AC power outlet.

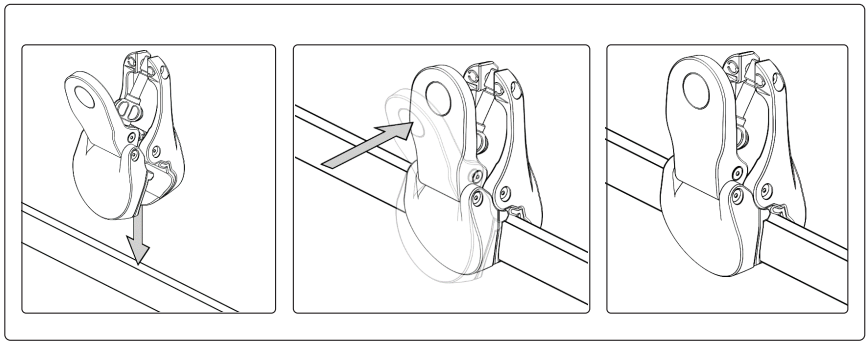
Mounting to Pole/Post



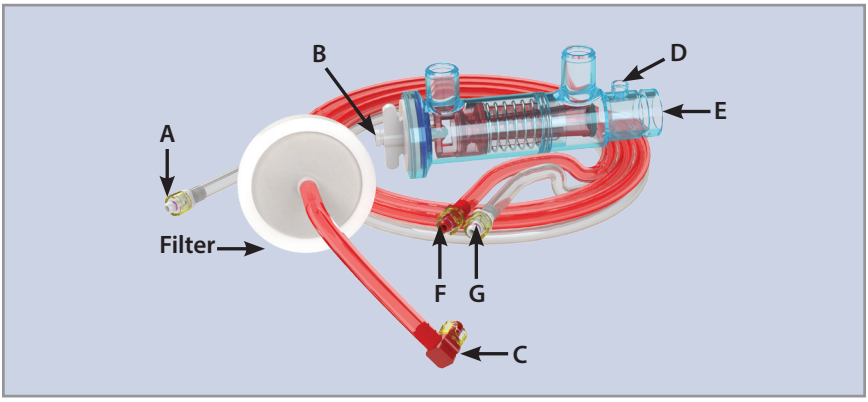
Adjusting Clamp Range and Tension



Mounting to Rail



Phasitron® A50606-TXP Assembly



The Phasitron® A50606-TXP is the mechanical/physiological breathing circuit interface. The Phasitron® has a sliding venturi that acts as both the inhalation and exhalation valve.

1.	Connect clear tubing connector **(A)** to white cap on rear of Phasitron® **(B)**.
2.	Connect red tubing connector **(C)** to front measuring port on Phasitron® **(D)**.
3.	Connect Phasitron® delivery port **(E)** to patient interface.

Connect Tubing Harness

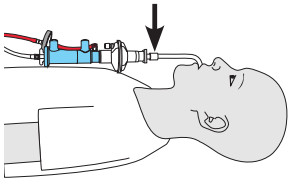
4.	Connect red connector on breathing circuit harness **(F)** to red bulkhead connector labeled "Monitor."
5.	Connect clear connector on breathing circuit harness **(G)** to silver bulkhead connector labeled "Phasitron."

Configurations

The Phasitron® A50606-TXP kit can be used invasively or non-invasively using standard endotracheal tubes or mask.

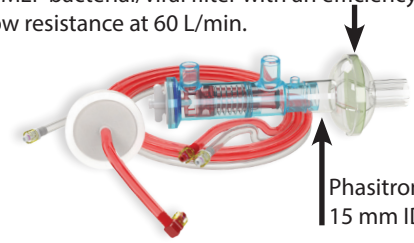
Intubated Patient with Phasitron®

Supplemental oxygen can be added after filter.



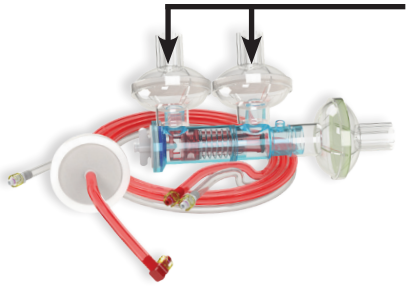
Standard Circuit

Recommended HME/HMEF bacterial/viral filter with an efficiency of > 99.999% and 2 cmH_2O or less flow resistance at 60 L/min.



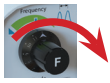
Optional PEEP Valve Kit (PRT-A70143)

Optional Secondary Filters



Chapter 6: Pre-Use Check

1. Rotate the **Frequency** knob to full clockwise position.

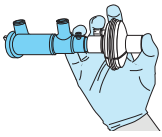


2. Rotate the **Amplitude** knob to full clockwise position.

3. Connect TXP® 5 to gas supply source.

4. Connect the Phasitron® to the TXP® 5 red and silver bulkhead fittings.

5. Close the Phasitron® patient port, with or without filter, ensuring a tight seal.



6. Rotate the **Amplitude** knob to full counterclockwise position.

7. Observe frequency on right side of display less than 250 pulses per minute.

8. Observe Mean Airway Pressure on display greater than 20 cmH_2O.
Open the Phasitron® patient port; the disconnect alarm must sound.
Re-close port to stop alarm and continue.

9. Rotate the **Frequency** knob to the left, full counterclockwise position.

10. Observe an increase in pulse frequency to a rate greater than 550 pulses per minute.

11. Observe Mean Airway Pressure on display greater than 20 cmH_2O.

12. Rotate the **Frequency** knob to arrow up 12:00 position.

13. Rotate the **Amplitude** knob slowly clockwise. Observe a decrease in amplitude until "off" at the full clockwise position.

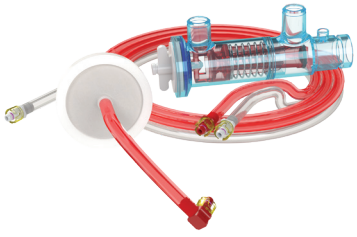
14. Check is complete.

Chapter 7: Ventilation Settings

Standard Circuit Initial Settings

1.	Set Frequency by turning arrow straight up (rate of 500 +/- 25).
2.	Attach Phasitron® to patient hospital approved HMEF.
3.	Start with Amplitude control knob turned full clockwise (right).
4.	Slowly turn Amplitude control knob counterclockwise (left), until patient's chest is observed to be moving (wiggle). Ensure that the chest is moving, just below the ribs.
5.	Observe patient SpO_2 and CO_2.
6.	After 30 minutes, draw an ABG.
7.	Record Mean Airway Pressure (MAP), high-frequency rate, and amplitude along with SpO_2 and CO_2.

Adjustment Options: Standard Circuit



Increase pO_2 and decrease CO_2

- Increase amplitude in steps of 2-4 cmH_2O.

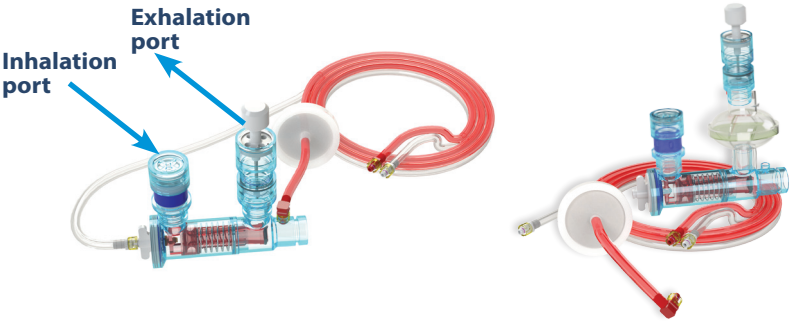
Increase O_2 if CO_2 is OK

- If device is plugged into an O_2 outlet, the delivered FiO_2 will be 60%.
- If more than 60% FiO_2 is needed, oxygen may be added between the Phasitron® and the patient to achieve close to 100%.
- Increase Frequency by 100 (repeat to a maximum of 700). This may increase MAP which may affect pO_2.

Decrease CO_2 if O_2 is OK

- Increase Amplitude in steps of 2-4 cmH_2O (while keeping MAP within desired range).
- Decrease Frequency by 100 pulses in a stepwise fashion to a low of 300.

Adjustment Options: Standard Circuit with Optional PEEP Valve and Inspiratory Valve



Increase pO_2 and Decrease CO_2

- Increase Amplitude in steps of 2-4 cmH_2O. Watch for increase in MAP.

Increase O_2 if CO_2 is OK

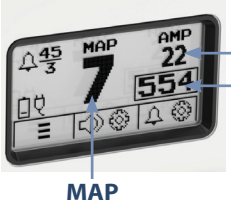
- If the device is plugged into an O_2 outlet, the delivered FiO_2 will be 60%.
- If more than 60% FiO_2 is needed, oxygen may be added between the Phasitron® and the patient to achieve close to 100%.
- Increase the Mean Airway Pressure (MAP) by 2 cmH_2O with the mechanical PEEP valve.
- Increase Frequency by 100 (repeat to a maximum of 700); this may increase CO_2.

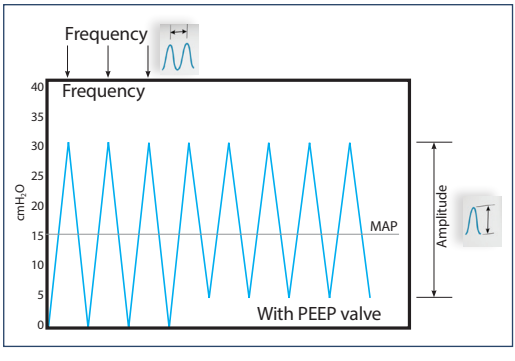
Decrease CO_2 if O_2 is OK

- Increase Amplitude in steps of 2-4 cmH_2O (while keeping MAP within a desired range).
- Decrease Frequency by 100 pulses, in a stepwise fashion, to a low of 300.

Increase CO_2 if O_2 is OK

- Decrease Amplitude in steps of 2-4 cmH_2O (while keeping MAP within a desired range). If MAP is decreasing, adjust PEEP valve to a higher PEEP setting for similar MAP.
- Increase Frequency by 100 pulses to a maximum of 700.





Patient Monitoring

Clinicians should evaluate how their patients tolerate the ventilation. Auscultation and observation of the mechanical vibrations of the chest and abdomen are primary indicators of effective treatment. During HFPV, it is vital to maintain an unobstructed and unrestricted airway.

⚠ **WARNING:** Follow proper suctioning procedures to maintain a patent airway.

⚠ **WARNING:** Regular patient assessment, along with continuous monitoring of SpO_2 and end-tidal CO_2, are necessary to ensure blood gases are at the proper level.

Assessment

• SpO_2	• Blood pressure and perfusion
• Chest wiggle	• Breath sounds
• Ventilator settings	• Phasitron® and ETT positioning
• Blood gas ~ 30 minutes after starting HFPV or after an adjustment and then PRN per institution protocol	

Ventilation

Control over arterial pCO_2 is achieved by manipulating delivered volumes.

- $HF = VCO_2 + (VT)2 \times f$

Increase Ventilation

To increase ventilation and decrease pCO_2:

- Increase amplitude in 2-4 cmH_2O increments. Amplitude is directly related to volume delivery.
- Decrease frequency. This will increase pulse to pulse time, therefore increase volume.

Oxygenation

Control over arterial pO_2 is achieved by manipulating FiO_2 or increasing the Mean Airway Pressure. The following will increase FiO_2 and/or Mean Airway Pressure, increasing arterial pO_2.

Increase Oxygenation

Increase FiO_2	Connect the unit to a blended air/O_2 system; adjust FiO_2 on blender. If the TXP® 5 is connected to an oxygen source between the patient and the filter, FiO_2 of approximately 98% can be expected. See page 31 for FiO_2 measurements.
Increase Amplitude	This will increase Mean Airway Pressure, which will increase pO_2. There will also be an increase in volume, which will decrease pCO_2
Increase Frequency	This will increase Mean Airway Pressure, which will increase pO_2. This may also increase pCO_2.
Attach accessory PEEP valve to Exhalation port and one-way balancing gate valve to the Inhalation port	This will increase FRC, which will increase Mean Airway Pressure. This will increase MAP, without changing Amplitude.

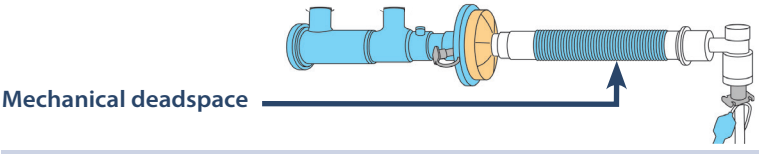
In the face of a challenging clinical scenario with worsening ventilation and/or oxygenation, a complete assessment of the patient is necessary to find the cause for V/Q inequality. Common V/Q problems associated with acute or chronic respirator injuries are noted below.

NOTE: *Any increase in MAP will increase pO_2. Any increase in Amplitude or Frequency will increase MAP.*

NOTE: *Amplitude and Frequency are interconnected, changing one parameter will affect the other.*

Decrease Ventilation: Increase pCO_2

a. Reduce amplitude (this will also decrease MAP): Decrease in 2-4 cmH_2O increments.
b. Frequency: Increase in increments of 60.
c. Mechanical deadspace: Add 6-inch corrugated tubing (as shown below).



NOTE: *In the face of a challenging clinical scenario with worsening ventilation and/or oxygenation, complete assessment of the patient to find the cause of V/Q inequality.*

Chapter 8: Cleaning and Maintenance

Cleaning

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.*

Before cleaning any part of the TXP® 5, disconnect external power sources.

⚠ **WARNING:** Do not perform maintenance or service on the TXP® 5 while it is powered on or in use. Maintenance or service procedures performed during use may temporarily alter the performance and result in patient harm.

TXP® 5 Controller

Clean the controller according to hospital/institutional protocols. Always clean between patients and when visibly soiled. Clean the controller with a clean, lint-free cloth or paper towel moistened with water (including water mixed with soap or a mild detergent) or 70% isopropyl alcohol.

⚠ **CAUTION:** Do not spray any cleaning solution directly onto the controller.

⚠ **CAUTION:** Do not immerse or allow liquids to access the controller.

⚠ **CAUTION:** Use only approved cleaning solvents recommended in this manual.

⚠ **CAUTION:** Before plugging it in to an external power source, allow the TXP® 5 to dry completely after cleaning.

Digital Display Screen

Clean the display screen using 70% isopropyl alcohol and according to facility protocols. Do not spray any type of cleaner directly onto the LCD.

⚠ **CAUTION:** The use of cleaning methods not outlined in these instructions may cause damage to the display.

⚠ **WARNING:** The cell used in this device may present a risk of fire or chemical burn hazard if mistreated. Do not disassemble, heat above 100°C (212°F), or incinerate. The use of another cell may present a risk of fire or explosion.

At the end of useful life of a TXP® 5 unit, disposal should be in accordance with local, state, federal, and international laws.

Phasitron® A50606-TXP Breathing Circuit Kit

The Phasitron® A50606-TXP is a single patient device. Follow hospital guidelines for cleaning and disinfection. Percussionaire® recommends changing the Phasitron® breathing circuit every seven days or sooner if visibly soiled. Do not exceed seven days.

⚠ **WARNING:** The Phasitron® kit is for single patient use only.

⚠ **CAUTION:** Do not use harsh cleaners, solvents or detergents. Equipment damage could occur.

⚠ **CAUTION:** Failure to follow the manufacturer's cleaning instructions could cause equipment damage.

Cleaning and Disinfecting Solutions

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

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

Maintenance

TXP® 5 Controller

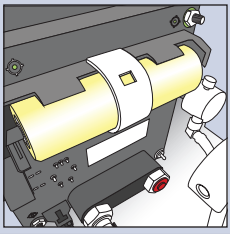
The TXP® 5 should be checked by an authorized Percussionaire® service technician anytime clinical efficacy is not as expected. Perform a pre-use check before ventilating a patient. Perform preventive maintenance and functional evaluation annually.

Lithium-ion Battery Care

The internal battery is lithium-ion. To maximize battery life, charge the battery before it drains completely. The battery will charge whenever the TXP® 5 is plugged into an external source of power.

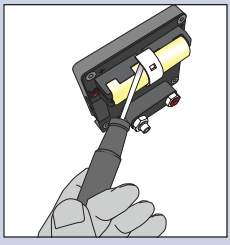
Over time, the capacity of the battery will diminish. Percussionaire® recommends that you replace the battery when it no longer holds a charge. The internal battery must be replaced by authorized Percussionaire® service technicians or Percussionaire®-certified biomed technicians.

Battery Replacement



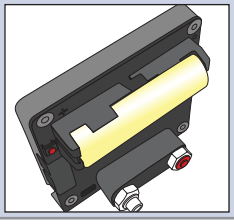
The TXP® 5 uses a Lithium-ion 3.7V 2600mAh rechargeable battery (18650). Percussionaire® part #B21111

NOTE: *Replace the battery every 3 years .*



Open the top case by removing 4 screws.

Use a small flat screwdriver to remove the safety clip from battery.



Insert a new battery noting the positive terminal. Replace the safety clip.

NOTE: *Ensure the battery is fully charged before storing the TXP® 5.*
NOTE: *Only use batteries provided by Percussionaire®.*
Do not use batteries from other manufacturers.

⚠ **WARNING:** Do not damage the rechargeable lithium-ion battery. A damaged battery may cause an explosion or fire and may result in personal injury and/or property damage. To prevent injury or damage:

- Do not use or charge the battery if it appears to be damaged. Signs of damage include, but are not limited to, discoloration, warping, and leaking battery fluid.
- Do not expose the battery to fire, high temperature.
- Do not immerse the battery in water.
- Do not use or store the battery inside a vehicle during hot weather.
- Do not drop or puncture the battery.
- Do not open the battery or short-circuit its contacts.

⚠ **WARNING:** Avoid contact with the rechargeable lithium-ion battery if it appears to be leaking. Battery fluid is corrosive. Contact with battery fluid may result in personal injury and/or property damage. To prevent injury or damage:

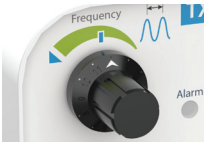
- If the battery leaks, avoid contact with the battery fluid.
- If the battery fluid gets into your eyes, immediately rinse your eyes with clean water and seek medical attention. Do not rub your eyes.
- If battery fluid gets onto your skin or clothing, immediately use clean water to wash off the battery fluid.

Chapter 9: Troubleshooting

⚠ **WARNING:** *If there are any unexplained changes in the performance of the device, if the device makes unusual sounds or is damaged in any way, discontinue use. Begin troubleshooting process and contact distributor or an authorized Percussionaire® service center.*

Problem	Possible Cause	Corrective Action
No Percussion	No air or gas supply to the TXP® 5	Confirm gas supply can deliver 50 psig pressure at 15 LPM flow rate. Connect to a different gas source to confirm pressure and capacity.
	TXP® 5 has air or gas supply, but no percussion.	Make sure the Amplitude knob is turned fully counterclockwise, and the Phasitron® red and clear tubing is connected
	Internal percussion valve failed.	Send device to an authorized service center for repair.
Low Amplitude	Low air or gas supply pressure/flow capacity	Confirm gas supply connection can deliver 50 psig pressure at 15 LPM flow rate. Connect to a different gas source to confirm pressure and capacity.
	Gas supply air leak	Listen for air leaks. Visually inspect both the gas supply connections and the Phasitron® to TXP® 5 connections. Inspect for damaged O-rings at the tubing connectors.
	Correct amplitude, but the display is indicating a lower than expected pressure.	The TXP® 5 displays the pulse amplitude pressure in the small upper-right part of the display. The numbers near the center of the display indicate Mean Airway Pressure. This is a lower number than the pulse amplitude pressure. Check with a test lung.

Continued on page 30

Problem	Possible Cause	Corrective Action
Frequency does not change	The Frequency knob is loose on control shaft.	The Frequency knob must be turned fully counterclockwise, to the stop. Remove the Frequency knob with a 3/32" hex key wrench and rotate the valve shaft for a frequency of 200 ppm. Reinstall the knob and confirm the frequency is about 200 ppm at the full clockwise position. 
TXP® 5 has no display	No signal to display	The Phasitron® must be connected to the clear and red tubing. Silver and red connectors on the TXP® 5 face panel must be connected to the Phasitron®.
	Display not activated	The Phasitron® patient port must see a pressure of 2.5 cmH_2O for more than one second to enter wake mode.
	Display does not stay on	Confirm the Phasitron® is connected to the patient, test lung, or occluded for more than 5 seconds to activate display.
	Display not functional	Check power connection and reconnect
TXP® 5 has wrong display	Power-On Self-Test and calibration were unable to start correctly	Turn off device and unplug power. Wait 5 seconds and reconnect power.
	Failed display software	Send the display to an authorized service center for repairs.
Device performance changes	Electrical interference	Move TXP® 5 away from any potential sources of electromagnetic interference (EMI) including MRI equipment, medical imaging systems, security systems, appliances, wireless communications equipment (such as cellular phones), computers, and televisions.

Chapter 10: Technical Specifications

TXP® 5 Ventilator

Accessories	Phasitron® Kit A50606-TXP
Pulse/Interval Ratio	Frequency: 250-350 Ratio: 1:2 Frequency: 350-450 Ratio: 1:1.5 Frequency: 450+ Ratio: 1:1
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
Power Input	90-264 VAC, 50/60Hz, 1 amp
Battery Type	Li-ion 18650 3.7V 2600mAh rechargeable
Run Time	Continuous
Pulse Frequency	200-700 pulses per minute (approximately)
High/Low Pressure Settings	Digital display
Mean Airway Pressure	Digital display, 0-99 cmH_2O/hPa
Pulse Amplitude	Digital display, 0-99 cmH_2O/hPa Accurate to +/- 1 cmH_2O
Alarm: Airway High-Pressure Limit	Audible indicator Red LED display during audible alarm
Alarm: Airway Low-Pressure Limit	Audible indicator Amber LED display during audible alarm
Alarm: Circuit Disconnect Alarm	Audible indicator Red LED display during audible alarm
Gas Source: Hospital Wall Gas, Compressed Oxygen Tanks, or Compressor Flow	50-80 psi, 3.45-5.5 BAR
Flow	15 LPM average
Dimensions (W x H x D)	15.875 cm H x 11.43 cm W x 15.24 cm D (6.25 in H x 4.5 in W x 6.0 in D)
Weight	.5 kg (1.16 lbs)
Required Maintenance	Annual function check/Replace the battery every 3 years

Measured Performance

TXP® 5 Frequency		R=50, C=10 mL/cmH_2O		R=20, C=10 mL/cmH_2O		R=5, C=10 mL/cmH_2O	
300	MAP Amplitude	40 cmH_2O 99+cmH_2O	31 LPM	30 cmH_2O 79 cmH_2O	56 LPM	21 cmH_2O 47 cmH_2O	78 LPM
500	MAP Amplitude	47 cmH_2O 99+cmH_2O	28 LPM	39 cmH_2O 72 cmH_2O	48 LPM	32 cmH_2O 54 cmH_2O	67 LPM
700	MAP Amplitude	52 cmH_2O 99+cmH_2O	23 LPM	48 cmH_2O 87 cmH_2O	36 LPM	44 cmH_2O 66 cmH_2O	50 LPM

Sampled from Phasitron® breathing circuit PN A50606-TXP, inline with TSI 4000 Flow Meter, inline with Ingmar Medical's QuickLung®.
[1]Resistance on QuickLung® set at each of the available resistance settings, while compliance remained set at 10 ml/cmH_2O.
[2]Frequency recorded from TXP® 5 display.

FiO_2 Measurements					
TXP® 5 Frequency		R=50, C= 10 mL/cmH_2O		O_2 Sat without added O_2	O_2 Sat with added O_2 post filter
300	MAP/AMPLITUDE	32/99+	31 LPM	67	94.6 @ 5 LPM
500	MAP/AMPLITUDE	37/92	28 LPM	67	100 @ 5 LPM
700	MAP/AMPLITUDE	39/89	25 LPM	66	100 @ 5 LPM
TXP® 5 Frequency		R=20, C= 10 mL/cmH_2O		O_2 Sat without added O_2	O_2 Sat with added O_2 post filter
300	MAP/AMPLITUDE	23/69	54 LPM	59.7	95 @ 8.5 LPM
500	MAP/AMPLITUDE	29/63	50 LPM	66.5	96.1 @ 8 LPM
700	MAP/AMPLITUDE	34/69	42 LPM	72.1	95.1 @ 4.5 LPM
TXP® 5 Frequency		R=5, C= 10 mL/cmH_2O		O_2 Sat without added O_2	O_2 Sat with added O_2 post filter
300	MAP/AMPLITUDE	14/33	80 LPM	55.8	91.5 @15 LPM
500	MAP/AMPLITUDE	20/38	75 LPM	62.3	100 @ 10 LPM
700	MAP/AMPLITUDE	25/46	68 LPM	73	96.1 @ 8 LPM

Sampled from Phasitron® breathing circuit PN A50606-TXP, inline with TSI 4000 Flow Meter, inline with Ingmar Medical's QuickLung®.

[1]Resistance on QuickLung® set at each of the available resistance settings, while compliance remained set at 10ml/cmH_2O.

[2]Frequency recorded from TXP® 5 display.

Digital Display Specifications

Storage and Transport Range	Temp., -20°C to 60°C (-4°F to 140°F) Humidity <93% non-condensing
Operating Range	Temp., -20°C to 60°C (-4°F to 140°F) Humidity <93% non-condensing
Display:	
Display Type	Transreflective
Visible Area	58.00 mm W x 28.80 mm H
Backlight	LED-white
Pixels	128 x 64
Graphics Color	Black (White – inverted)
Background Color	White (Black – inverted)
Spot Size	0.36 mm W x 0.36 mm H
Step of Points	0.40 mm H x 0.40 mm H
Rate Range	200-700 pulses per minute (approximately)
Pressure Range	0-99 cmH_2O/hPa
Pressure Accuracy	Accurate to +/- 1 cmH_2O
Battery	Percussionaire® part #B21111, Lithium-ion 18650 3.7V

Phasitron® A50606-TXP

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 Range	Temp., -20°C to 60°C (-40°F to 140°F) < 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

Battery: Percussionaire® part # B21111

Battery Type	Lithium-ion 18650 3.7V 2600mAh rechargeable
Diameter	19 mm
Length	69.7 mm
Rated Capacity Nominal	2600mAh
Discharge Cut-Off Voltage	2.75V
Charging Voltage	4.2V
Shipments Voltage	3.5-3.65V SOC < = 30%
Impedance	≤100 mΩ
Standard Charge:	
Constant Current	.2C
Constant Voltage	4.2V
Cut-off Current	0.02C
Standard Discharge:	
Constant Current	.2C
End Voltage	2.75V
Maximum Charge Current:	
Constant Current	0.5C
Constant Voltage	4.2V
Cut-off Current	0.02C
Fast Discharge:	
Constant Current	0.5C
End Voltage	2.75V
Maximum Continuous Discharge Current	3.5A
Operation Charge	0 to 45 Celsius, 60 +/- 25% R.H.
Temperature Range Discharge	Temperature Range Discharge
Cycle life	300+ Cycles
Storage Temperature:	
< = 1 month	-20 to 50 Celsius
< = 3 months	-10 to 30 Celsius
< = 1 year	0 to 30 Celsius
Weight	50 g (approximate)

NOTE: *Only use batteries provided by Percussionaire®.*
Do not use batteries from other manufacturers.

Chapter 11: Service and Repair

Percussionaire® Corporation recommends an annual preventive maintenance (PM) for the TXP® 5. An annual PM consists of a thorough cleaning, functional evaluation, and if necessary, a recalibration.

The standard interface connector (USB) is provided on the internal PCB, which is non-active and only used for calibration and software update. This device does not allow communication.

To return a device to a factory service center for repair,
contact customerservice@percussionaire.com or call (208) 263-2549.

Disposal of Equipment

At the end of useful life of a TXP® 5 unit, disposal should be in accordance with local, state, federal, and international laws.

Battery Disposal

The battery is considered electronic waste and must be disposed of according to local regulations. Follow local governing ordinances and recycling plans regarding disposal or recycling of the battery.

At the end of useful life of a TXP® 5 unit, disposal should be in accordance with local, state, federal, and international laws.

Chapter 12: Limited Warranty

Percussionaire® warrants that the TXP® 5 shall be free from defects of workmanship and materials and will perform per the product specifications for five years from the date of purchase (proof of delivery will be required). The device must be run for 30 minutes annually if kept in storage conditions. Batteries carry a 12-month warranty. 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. This warranty does not cover damage caused by non-approved cleaning or sterilization, accident, misuse, abuse, alteration, or 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.

PERCUSSIONAIRE®
CORPORATION

130 McGhee Road., Suite 109, Sandpoint, Idaho 83864 USA
percussionaire.com +1.208.263.2549

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