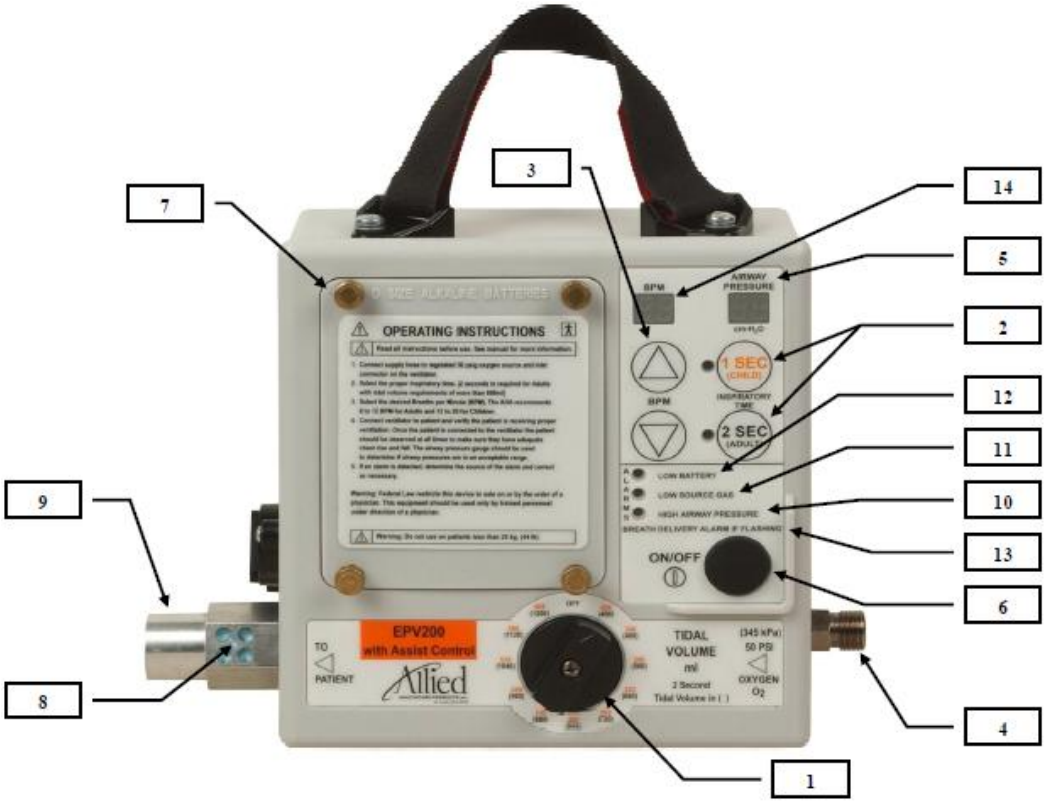
Operation and Maintenance of the EPV200 Portable Ventilator

Applications of the EPV200

- The EPV200 Portable Ventilator is a gas powered electronically controlled mechanical ventilator, designed to provide emergency respiratory support by means of a face mask or an endotracheal tube inserted into a patient's airway.
- The EPV200 is a volume controlled ventilator that delivers time-cycled constant flow breaths with assist-control function for spontaneous breathing.
- The EPV200 is an all-weather ventilator suitable for use at the scene of a medical incident, as well as in pre-hospital, intra-hospital, and inter-hospital transport.
- The EPV200 has been designed to withstand direct exposure to rain, up to 100G shock and vibration, and drops of up to 4 feet.
- The EPV200 ventilator is intended for use on patients weighing greater than 20kg, or 44 lbs.

Overview of Controls and Settings



Item #	Description
1	Tidal Volume Control
2	Inspiratory Time Control
3	BPM Control
4	Oxygen Inlet
5	Airway Pressure Display
6	Power On/Off Switch
7	Battery Compartment

Item #	Description
8	Anti-Suffocation Valve
9	Patient Circuit Connection
10	High Airway Pressure Alarm
11	Low Source Gas Alarm
12	Low Battery Alarm
13	Breath Delivery Alarm if Flashing
14	BPM Display

Notes on Controls and Settings

- The EPV200 is powered by compressed gas but requires 2D cell batteries to power the controls and settings. This means that the EPV200 requires both batteries and a compressed oxygen source to run.
- It features electronic power management alarms to provide advance notice of low gas and low battery status via LED/audible alarms.
- The EPV200 has independent control of Tidal Volume, Inspiratory Time, and Breaths Per Minute.
- It features electronic ventilation alarms to provide notice of dangerous or ineffective ventilation.
- The EPV200 offers an Assist Control function, which will respond to a spontaneous breath by delivering the selected tidal volume of oxygen. It will also reset the breath timing to avoid breath stacking.
- The unit also features a digital manometer to monitor the peak airway pressure delivered during each breath.

On-board Digital Manometer

Overview of Specifications

Specifications - EPV200

Setting Parameters

Ventilation Mode: Assist-Control
Assist-Control: Triggers at less than -2 cm H_2O
Flow Rate: 12-36 LPM
Breathing Rate: Adjustable. 0, 5-30 breaths per minute
Tidal Volume: Adjustable. 200-1200 ml
Inspiratory Time: Selectable. 1 or 2 seconds
PEEP: External. 0-20 cm H_2O (with PEEP adapter)
FiO_2: 100%
Manometer Readout: Digital. 0-99 cm H_2O
Airway Pressure Limit: Fixed. 60 cm H_2O

Alarms

High Airway Pressure: Fixed. 45 cm H_2O
Low Airway Pressure/Circuit Disconnect: Fixed. 9 cm H_2O
Low Source Gas: Fixed. Activates at approx. 40 psi (275 kPa)
Low Battery: Activates when approx. 2 hours run time remain
Alarm Volume: Approx. 60 dB at 1 meter
Alarm Silence: Yes. 110 Seconds

Power Characteristics

Power Source: Pneumatic with electronic controls and alarms
Power Input: Pneumatic. 40-87 psi O_2 and 2 D cell batteries
Internal Battery Type: D cell batteries
Operating Time:
Based on average adult settings of 10 BPM, 640 ml tidal volume, 2 second inspiratory time
Oxygen: Dependent on source capacity. Approx. 65 minutes on D cylinder
Battery Life: 48 hours of continuous use

Physical Characteristics

Dimensions: 3.5" x 7.0" x 9.3" (88.9 mm x 177.8 mm x 236.2 mm)
Weight: 3.1 lbs. (1.4 kg) with batteries
Temperature Ranges:
Operating: -15 to 122°F (-9 to 50°C)
Storage: -40 to 140°F (-40 to 60°C)
Enclosure: ABS plastic with seals to prevent water ingress
Shock Resistance: 30" drop
Vibration Resistance: 100 G
Water Resistance: Spill and rain resistant

EPV200 Connections

Ventilator Connections

Oxygen Connection

- The EPV 200 must be connected to a 40-80 psi compressed oxygen source to operate.
- A single use disposable oxygen hose is supplied with this ventilator. Replacement disposable hoses may be purchased or the ventilator can be connected to the gas source with a reusable oxygen hose.
- The oxygen can be supplied via an oxygen tank using any oxygen pressure regulator with a DISS outlet. Alternatively, the ventilator can be run from a wall oxygen source by fitting the oxygen hose with the appropriate adaptor for the oxygen outlet style used in the facility.
- Connect a compressed oxygen source by attaching one end of an oxygen hose to the DISS oxygen inlet shown above, and then connecting the other end to an oxygen regulator, or hospital or ambulance oxygen outlet.
- Ensure that the oxygen source is pressurized and capable of delivering oxygen at 40-80 psi.

Ventilator Connections

Patient Circuit Connection

- To attach the breathing circuit, press the open end of a three-foot circuit with one-way valve firmly on to the 22 mm patient circuit connection.

- The circuit connection will accommodate any standard 22 mm ventilation circuit with a one-way valve, although the EPV200 has been tested and approved using the Allied three-foot breathing circuits with one-way valve.

Ventilator Connections

Patient Circuits

- Allied offers several affordable circuit configurations to meet the caregiver's requirements.
- All circuits contain three feet of corrugated tubing, a one-way duck-bill valve, an expiratory port capable of accepting a PEEP valve or bacterial filter, and a swivel connector capable of accepting a mask or ET tube.
- Optional configurations incorporate a pre-packaged cuffed mask and/or a bacterial exhalation filter.
- The following part numbers represent the various pre-packaged configurations and accessory items offered for the EPV200.

Ventilator Circuit Configurations for EPV200 Portable Ventilator

Allied Part #		Case Quantity
L599-140*	3 foot circuit, One Way Valve, Swivel Connector, Adult cuffed Mask, Exhalation Filter	10
L599-190**	3 foot circuit, One Way Valve, Swivel Connector, Exhalation Filter (No Mask)	10
L599-130*	3 foot circuit, One Way Valve, Swivel Connector, Adult cuffed Mask (No Filter)	10
L599-180**	3 foot circuit, One Way Valve, Swivel Connector (No Mask or Filter)	10

* circuit configuration designed for use on non-intubated or intubated patients. Mask can be removed to attach to ET tube.
** circuit configuration designed for use on intubated patients. Circuit attaches to ET tube directly.

Circuit Accessories Available From Aliied Healthcare Products, Inc.

Allied Part #		Case Quantity
LPEEP†	Adjustable PEEP Valve, 0-20cm H_2O	12
L599-200	Bacterial Exhalation filter	10
L595161-10	Adult Oxygen Mask	10
L595162-10	Child Oxygen Mask	10

† PEEP valve includes 30mm-18mm adaptor to fit allied 18mm circuit exhalation port

Patient Circuit Connections

Stand alone accessories for patient circuits

PEEP Valve **Part # LPEEP**

This 0-20 cm H_2O disposable PEEP valve attaches to any of the mass casualty circuits.

Disposable Cuffed Masks **Part # L595-161-10, L595-162-10**

These adult and child disposable cuffed masks can be fitted to any of our mass casualty circuits to provide greater flexibility in scope of treatment.

Bacterial Exhalation Filter **Part # L599-200**

The bacterial exhalation filter can be fitted to the exhalation port of any Allied mass casualty ventilator circuit to protect the caregiver from exposure to airborne pathogens. This filter will block 99.9% of pathogens without creating any noticeable resistance to exhalation.

Mask Restraint System **Part # 890113**

This easy-to-use disposable mask restraint system enables the caregiver to quickly attach the cuffed mask firmly over the patient's mouth and nose, freeing both hands to provide care. In the event of an airway obstruction, a simple tug of the elastic band disengages the restraint system, giving immediate access to the patient airway.

Patient Circuit Connections

Fitting of PEEP Valve and Mask or ET Tube

- An External PEEP valve may be fitted to the expiratory port of the patient circuit, allowing adjustable PEEP from 0-20 cm H_2O.

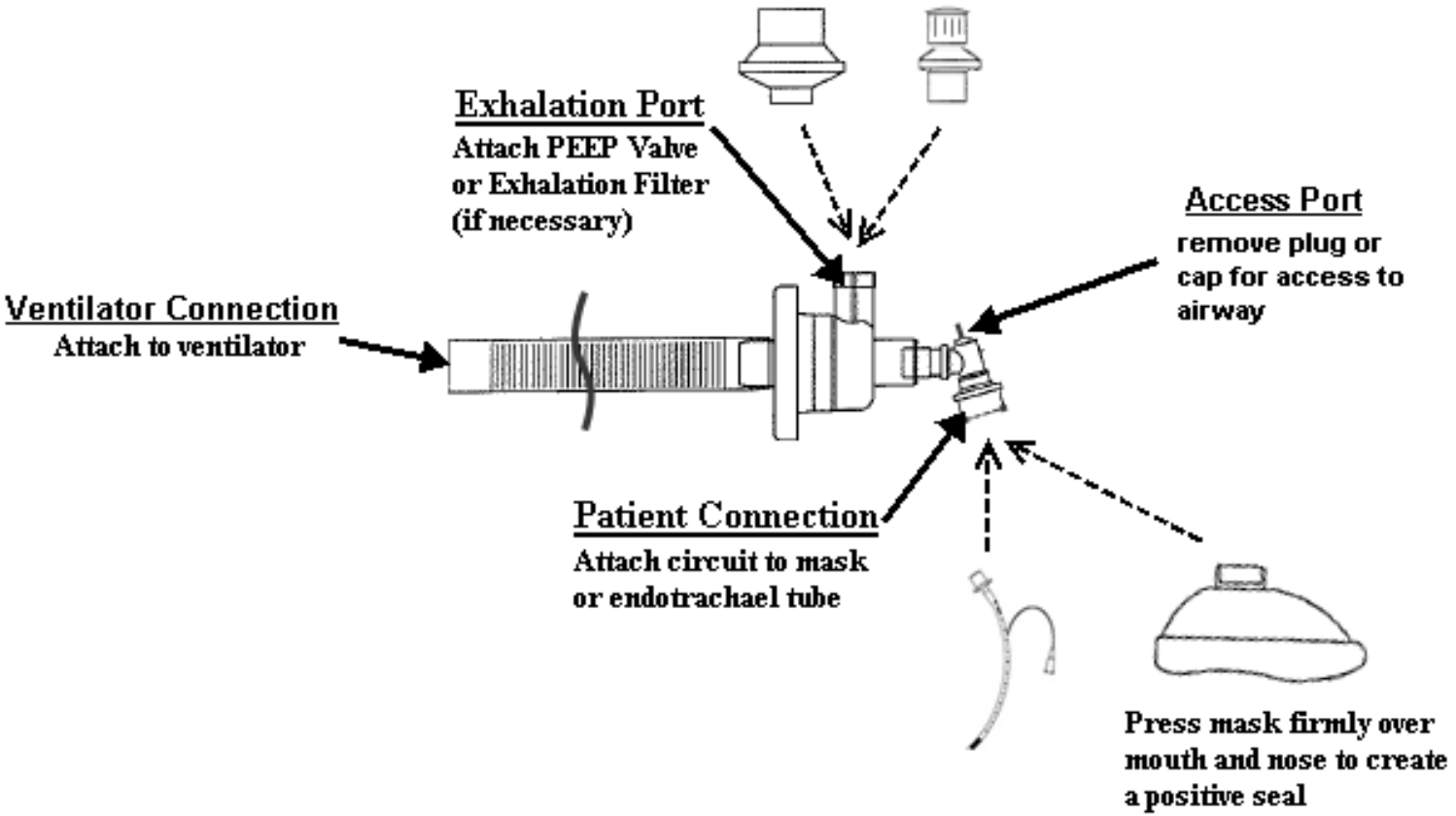
- The swivel connector on the three-foot Allied patient circuit features a 22 mm O.D.,15mm I.D. universal adapter that will accept a standard cuffed mask or endotracheal tube.

- To fit the mask or ET tube, press the open end of the swivel connector on the end of the circuit into the mask or tube inlet opening.

- The patient circuit also contains a removable access port. Ensure that this port is closed during ventilation to prevent loss of airway pressure.

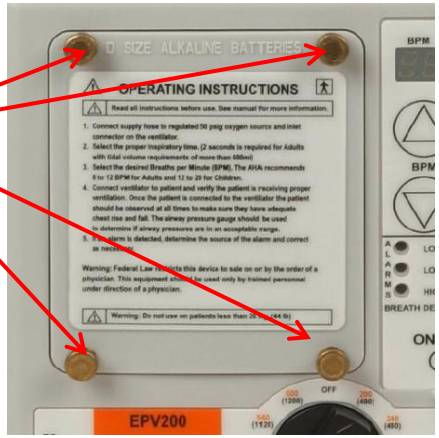
Patient Circuit Connections

Overview of Allied Patient Circuit Connections



Battery Installation

Battery Compartment Thumb Screws



- For the EPV200 to function, two D cell batteries must be installed in the battery compartment. Two D cell batteries are supplied with the unit.
- The batteries will provide 48 hours of run time under ventilation parameters of 10 BPM and 2-second Inspiratory Time, and 640 ml Tidal Volume.
- To install the batteries, loosen the four brass thumb screws on the battery compartment cover.
- Remove the cover and install the batteries as indicated with the positive terminals facing toward the top of the unit as shown.
- Replace the cover with the operating instructions facing up, and tighten the thumb screws to create a positive seal of the rubber gasket.

Start-Up

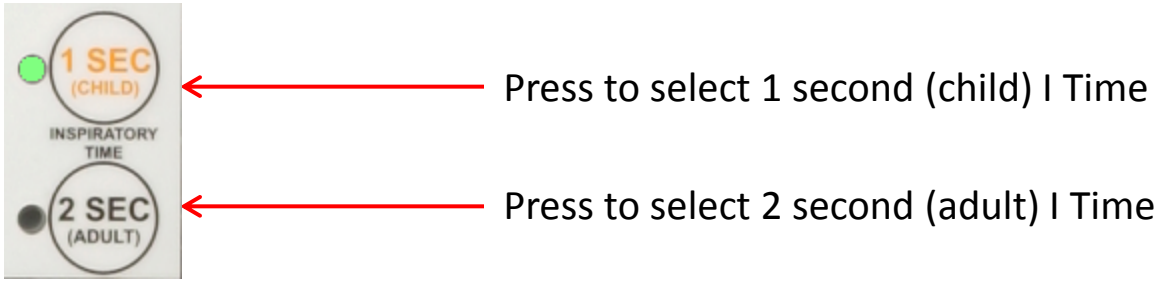
Powering On the Unit

- Ensure that a 40-80 psi gas source is attached and pressurized, and the batteries are installed.
- Ensure that a patient circuit is installed (to prevent patient disconnect alarm from activating, the circuit output should be attached to a test lung or device that provides similar compliance to human lungs).
- Press the power button to power on the unit.
- The unit will go through a start-up mode in which all the LEDs and lights will flash, and then the unit will begin to operate according to the set parameters.

EPV200 Controls and Settings

Controls and Settings

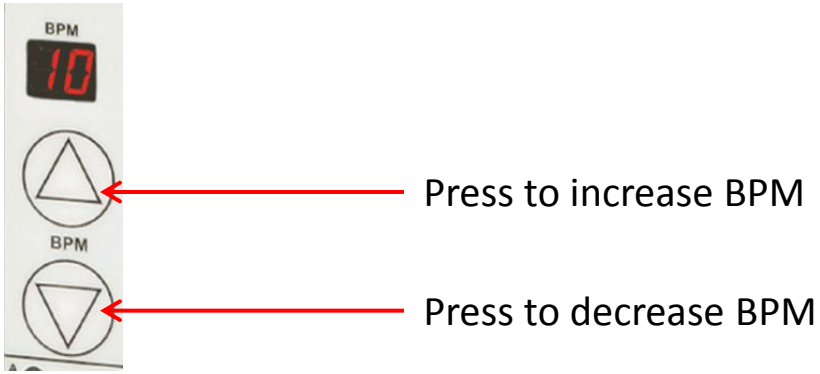
Inspiratory Time Adjustment



- The Inspiratory Time is selectable at 1 second or 2 seconds, and color coded for ventilation of Child **(Orange)** or Adult **(Black)** patients.
- To change the Inspiratory Time setting, press the desired **1 SEC** or **2 SEC** button on the keypad.
- A green LED will indicate the selected inspiratory time

Controls and Settings

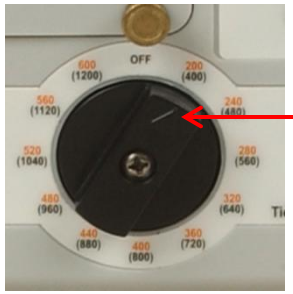
Breaths Per Minute Adjustment



- Can be set at 0 or 8-20 Breaths Per Minute when inspiratory time is set to 2 Sec.
- Can be set at 0 or 8-30 Breaths Per Minute when inspiratory time is set to 1 Sec.
  - The 0 BPM setting allows the ventilator to function solely in Assist mode, and will only deliver the set tidal volume when a breath is initiated by the patient. If using this mode, ensure that the tidal volume knob is set to a accommodate the necessary tidal volume required by the patient.
- To change the Breaths Per Minute Setting, press the up or down arrows on the keypad near the BPM label. The digital readout will display the setting.
- Recommended AHA guidelines for ventilation:
  - Adult: 8-12 BPM
  - Child: 12-20 BPM

Controls and Settings

Tidal Volume Adjustment



Selection Indicator Arrow

- The Tidal Volume is adjustable from 200-1200 ml and is color keyed for 1 Second or 2 Second ventilation
- If your inspiratory time is set to 2 seconds **(Adult),** refer to the **Black** numerical markings and select the most appropriate tidal volume from the choices on the dial.
- If the inspiratory time is set to 1 second **(Child),** refer to the **Orange** numerical markings and select the most appropriate tidal volume from the choices on the dial.
- The following is a table of approximate settings for tidal volume by patient height, derived from ideal body weight with oxygen delivery at 10ml/Kg.

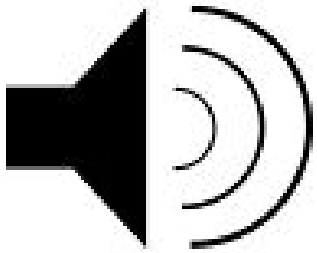
This table is an approximation for reference only. Refer to direction of a physician or medical professional for appropriate settings.

Height Adult Male (in feet' and Inches")	4' 8"	4' 11"	5' 3"	5' 6"	5' 10"	6' 1"	6' 5 "	6' 8"	6' 11"	7' 3"	7' 6"
Height Adult Female (in feet' and Inches")	4' 10"	5' 1"	5' 5"	5' 8"	6' 0"	6' 5"	6' 8"	6' 10"			
Approximate Tidal Volume Setting	**400**	**480**	**560**	**640**	**720**	**800**	**880**	**960**	**1040**	**1120**	**1200**

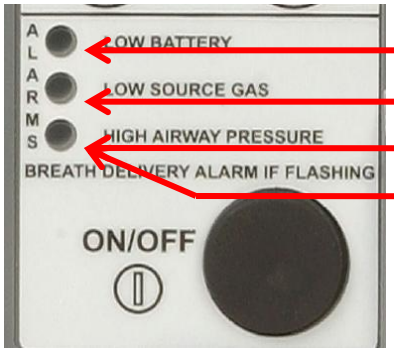
Height Child Male (in feet' and Inches")	3' 11"	4' 1"	4' 2"	4' 4"	4' 6"	4' 8"	4' 9"	4' 11"	5' 1"
Height Child Female (in feet' and Inches")	4' 1"	4' 3"	4' 4"	4' 6"	4' 8"	4' 10"	4' 11"	5' 1"	5' 3"
Approximate Tidal Volume Setting	**200**	**240**	**280**	**320**	**360**	**400**	**440**	**480**	**520**

Safety Alarms

- The EPV200 features the following alarms:
  - High airway pressure
  - Low airway pressure
  - Low battery (visual alarm only)
  - Low Source Gas
- All alarms on the EPV200 are pre-set and non-adjustable.
- Alarms are signaled both audibly and visibly except for the low battery alarm, which provides only a visible alarm signal to conserve battery power.
- When an alarm is activated a 60 Db audible alarm will sound, and the appropriate red alarm LED will illuminate, signaling the type of alarm activated.
- Audible alarms can be silenced for 110 seconds by pressing and holding the selected inspiratory time button for 3 seconds (the one that has a green LED).



60 Db Alarm Tone

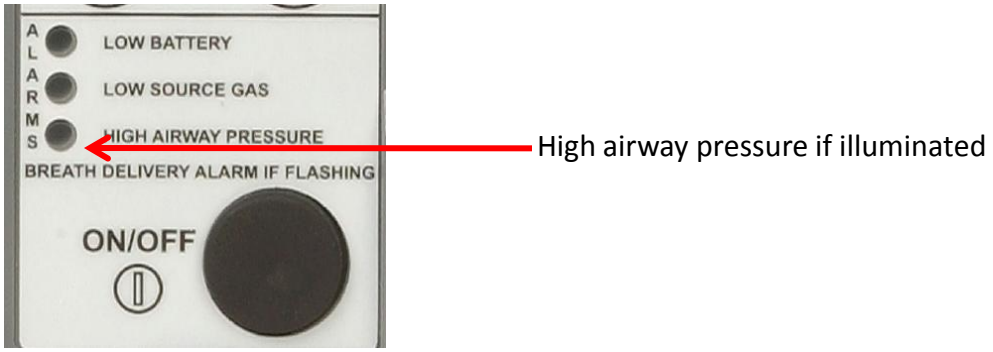


Flashing Alarm Status LEDs

Safety Alarms

Alarm Details

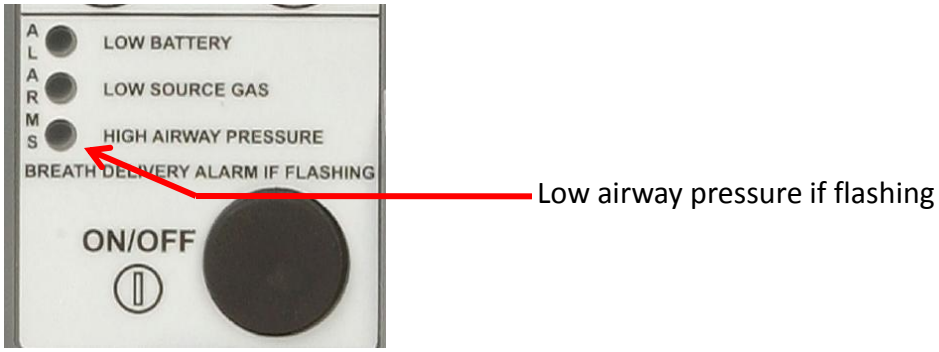
- High Airway Pressure Alarm (audible/visual):
  - Activates at 45 cm H_2O, indicating that the patient airway is obstructed or lungs have becoming non-compliant. Check the connections and airway.
  - Will sound a consistent tone and the High Airway Pressure LED will illuminate
  - Note that the EPV200 features a safety pressure relief that will limit airway pressures to less than 60 cm H_2O, to prevent damage to the lungs.
  - This alarm is automatically cleared when 25 seconds pass without a high airway pressure being detected.
  - This alarm can be silenced for 110 seconds by pressing and holding the selected inspiratory time button for 3 seconds (the one that has a green LED).



Safety Alarms

Alarm Details

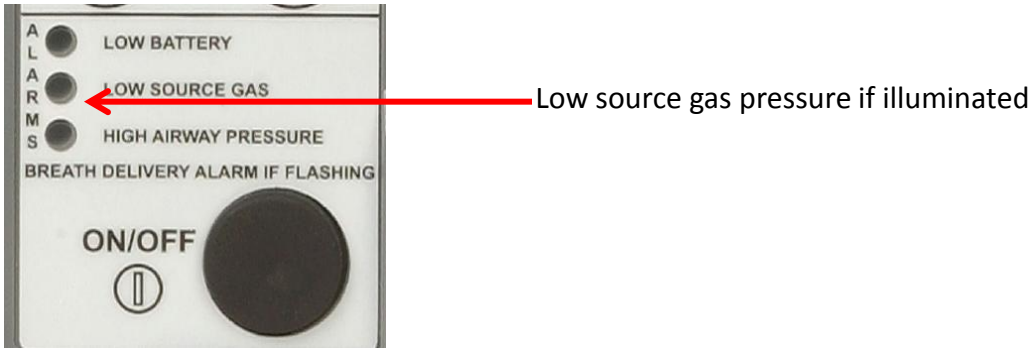
- Low Airway Pressure Alarm (audible/visual):
  - Activates if the airway pressure drops below 9 cm H_2O for >15 seconds
  - This could indicate a circuit disconnect, a leak in the fit of the mask or ET tube, or an open access port in the circuit. Check the connections.
  - Will sound a consistent tone and the High Airway Pressure LED will <u>flash.</u>
  - Note that the digital manometer readout will also display the low airway pressure.
  - The alarm will clear when airway pressure exceeds 9 cm H_2O.
  - This alarm can be silenced for 110 seconds by pressing and holding the selected inspiratory time button for 3 seconds (the one that has a green LED).



Safety Alarms

Alarm Details

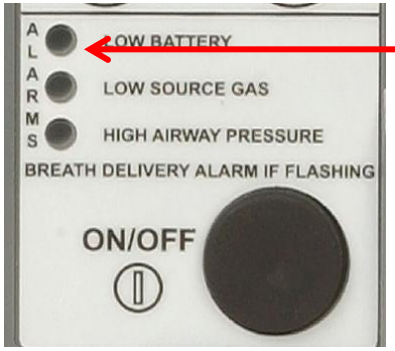
- Low Source Gas Alarm (audible/visual):
  - Activates between 40 psi and 35 psi (275 to 241kPa) source pressure, indicating that the gas source is critically low and supplemental compressed gas should be sought immediately. The run time remaining depends on the size of the cylinder used, but in most cases is less than one minute remaining.
  - It will sound a consistent tone and the Low Source Gas LED will illuminate
  - The alarm will clear when source gas pressure is restored to greater than 40 psi.
  - Should the source gas fall below 35 psi, the unit may cease to function.



Safety Alarms

Alarm Details

- Low Battery Alarm (visual only):
  - Activates when there are less than 2 hours of battery life remaining under continuous use.
  - There is no audible alarm; however, the Low Battery LED will illuminate indicating that the batteries should be replaced.



Low battery if illuminated (visual alarm only)

Spontaneous Breathing

Assist Control Function

- Should the patient begin to breathe spontaneously, the EPV200 will sense this breath being taken, and deliver a breath at the set Tidal Volume and Inspiratory Time.
- The breath assist function is activated when approximately -2 cm H_20 is sensed through the patient circuit.
- The spontaneous breath will reset the breath timing and continue providing breaths at the set breath per minute rate to prevent back to back delivered breaths. This is the anti-breath stacking feature.

Spontaneous Breathing

Assist Control Function

- The gas flow rate delivered to the patient during a spontaneous breath is based on the set Tidal Volume selection and inspiratory time. The table below provides an overview of the approximate flow rate delivered according to the set Tidal Volume and Inspiratory Time.

Tidal Volume Setting		Approximate Flow (LPM)
It = 1 second	It = 2 second	
200	400	12
240	480	14.4
280	560	16.8
320	640	19.2
360	720	21.6
360	720	21.6
360	720	21.6
400	800	24
440	880	26.4
480	960	28.8
520	1040	31.2
560	1120	33.6
600	1200	36

Spontaneous Breathing

Anti-Suffocation Valve

Anti-suffocation valve

- Should the patients demand during a breath exceed the gas flow rate, the additional demand will be supplied with ambient air via the anti-suffocation valve located in the breathing circuit connection fitting. Do not occlude this valve during operation.
- When additional flow is demanded during a spontaneous breath, the resistance provided through the anti-suffocation valve is minimal. The following table indicates the inspiratory resistance at different flow rate demands in excess of the set tidal volume.

Inspiratory Resistance During a Spontaneous Breath

Demanded inspiratory flow rate (LPM) above delivered tidal volume.	15	30	45	60
Inspiratory Resistance (cm H_2O)	0.6	1.7	3.3	5.1

Power Management

EPV200 Run Times

- The EPV200 run time is dependent on the amount of source gas present and limited by the battery life.
- Two D cell batteries at full capacity will run the EPV200 continuously for 48 hours at 10 BPM, 2 second Inspiratory Time and 640 ml Tidal Volume. The batteries are standard Alkaline type and replacement of the batteries will provide an additional 48 hours of run time.
- If the batteries are depleted to a point in which the unit cannot provide effective ventilation, the EPV200 will close the delivery solenoid to stop gas flow, and stop delivering breaths, resulting in an alarm.
- This shut-down sequence will be preceded by redundant visible/audible alarms to provide advance notice to locate and replenish the supplies.

Power Management

EPV200 Run Times (continued)

- The EPV200 does not vent or consume oxygen during normal operation, therefore the run time of the unit from the source gas is directly related to the minute volume of oxygen per the Tv, It, and BPM selections.

- As a reference, the following table indicates the approximate run times for one EPV200 at 10 BPM, and 640 ml tidal volume.

Cylinder Size	Capacity (Liters)	Approximate Run Time
D Cylinder	425	65 minutes
Jumbo D Cylinder	647	99 minutes (1.5 hours)
E Cylinder	684	105 minutes (1.75 hours)
M Cylinder (ambulance)	3454	531 minutes (8.75 hours)
Hospital Oxygen Outlet	Virtually unlimited	48 hours before battery replacement is needed

Initial Operation Procedure

Initial Operation and Check-Out Procedure

The unit should be checked for proper operation upon receipt as well as before each use. The following procedure can be performed upon receipt and after cleaning to prepare the unit for the next use.

- Install the batteries.
- Set the ventilator to the following settings:
  - BPM = 10
  - Tidal Volume = 640
  - Inspiratory Time = 2 seconds
- Connect a 50 psi oxygen source to the unit, pressurize the hose, and turn the power on; it should begin to cycle.
- After 20 seconds confirm that the low airway pressure alarm has sounded and the low airway pressure LED is flashing.

Initial Operation and Check-Out Procedure

- Let the vent cycle for 15 seconds.
- Confirm that the breath delivery alarm LED is flashing and an audible alarm has sounded, indicating that the low airway pressure alarm has tripped.
  - Press and hold the 2 sec Inspiratory Time button for 3 seconds to silence the alarm for 110 seconds.
- Using a stop watch, count the number of breaths delivered in one minute (60 seconds).
  - Confirm that between 9 and 11 breaths have been delivered.
  - Confirm that the inspiratory time is significantly shorter than the expiratory time. (At the settings noted above, the ventilator should provide a 2.0 second inspiratory time and a 4.0 second expiratory time)

Initial Operation and Check-Out
continued

- Attach a 3 foot piece of corrugated tubing (or use the patient circuit) to the patient circuit connection port and occlude the patient end of the circuit with the palm of your hand to create pressure in the vent circuit.
  - Confirm that the high airway pressure alarm LED is illuminated and an audible alarm has sounded.
  - Confirm that the airway pressure does not exceed 60 cm H_2O by monitoring the airway pressure display on the face of the EPV200 ventilator. The airway pressure should read approximately 45 cm H_2O.
  - Press and hold the 2sec Inspiratory Time button for 4 seconds to silence the alarm for 110 sec.
- Turn the source gas off.
  - Confirm that the Low Source Gas LED display is illuminated and an audible alarm has sounded.
  - Press and hold the 2 sec Inspiratory Time button for 4 seconds to silence the alarm for 110 seconds.

Initial Operation and Check-Out
continued

- Press the power button to turn the power off, remove the oxygen hose and corrugated tubing from the unit, and store the unit for future use.

Should the unit fail any of these tests contact Allied Healthcare Products, Inc., Technical Support Center at 1-800-411-5136 for assistance.

Routine Maintenance

Routine Maintenance

Cleaning and Disinfecting

- The EPV200 ventilator should be cleaned and disinfected after each use.
  - Wipe the unit down with a damp rag containing a mild cleaning solution to remove any residue from the surface.
  - Once the residue has been removed, the unit should be wiped with isopropyl alcohol or a cold disinfecting solution to kill bacteria.
  - The unit should then be wiped down with water to remove any film left by the cold disinfecting solution.
  - Make sure the unit is dry before putting the unit away.
- The following is a list of tested disinfecting solutions:

• Isopropyl Alcohol:	70% IPA
• Alconox:	I tablespoon Alconox to 1 gallon H_2O
• Cetylcide:	2 tablespoons Cetylcide to 1 gallon H_2O
• Bleach:	10% bleach in H_2O

Routine Maintenance

- The EPV200 should be checked annually to ensure proper function using the calibration procedure noted in the instruction manual.
- Batteries should be checked regularly and replaced if they are beyond the expiration date on the battery. Replace with standard D cell alkaline batteries.
- After 5 years, or if annual calibration fails, the EPV200 should be serviced by an authorized repair technician.

For technical assistance or to schedule service, contact Allied Healthcare Products, Inc. Technical Support Center at 800-411-5136.

We hope this guide has prepared you to properly and safely use and maintain your EPV200 portable ventilator. If you have additional questions or require technical assistance, please contact our Technical Support Center.

Technical Support Contact Information

techsupport@alliedhpi.com

800-411-5136