The Crossvent 2i+

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8. Discuss how the device can be mounted or positioned during transport (configurations)

9. Provide “clinical tips” regarding use of this device (tips that make things easier or less complicated)

10. Are there any special considerations when integrating this device into your transport program (education, mounting/configuration issues, regulations, calibration, maintenance)
The Crossvent 2i+

1. How is this ventilator classified?

The Crossvent 2i color screen Intensive Care/Transport Ventilator is, electronically controlled time cycled, volume or pressure limited ventilator. It is capable of volume ventilation or pressure ventilation.

2. Ventilator Concept (brief theory of operation and features)

Modes: Assist Control, SIMV, SIMV with Pressure Support, and CPAP. Spontaneous breaths can be triggered by either pressure or flow. In order to volume ventilate and take advantage of flow triggering a flow sensor must be used.

The flow sensor gives you the ability to measure exhaled tidal volumes.

Alarms; pressure, rate, exhaled tidal volume or minute volume, oxygen concentration, mean airway pressure, PEEP, low battery and fail-to-cycle. This device has an Auto-Set feature.

A fully charged battery will last ~ 2.75 hours. To charge a fully exhausted battery takes 2.5 hours. Note: Battery life can be extended by turning off the backlight.

Your Two Choices with this Ventilator

**Time Cycled, Pressure Limited, Constant Flow (just like an MVP 10)**
- constant flow is set to ON
- this is a CMV mode, the patient cannot trigger the ventilator
- breaths are delivered based on the rate set, the inspiratory time set, and peak pressure set
- when constant flow is set to ON the only modes of ventilation available is CMV and CPAP
- your patient will not be synchronized with the delivered breaths from the ventilator

**Volume Limited Ventilation (must use pneumotach)**
- constant flow is set to OFF
- the patient can now receive synchronized breaths
- when constant flow is set to OFF the available modes are: Assist control, SIMV, SIMV with Pressure Support
- you will now have to set a sensitivity (flow trigger), watch for auto cycling if you have a large leak around the ET tube
- flow triggering set to ON allows you to see the patients respiratory rate and measure exhaled tidal volume (you will lose some tidal volume due to ventilator circuit compliance)

3. An overview of the device (an in-service) including an explanation of the modes of ventilation and how to set them up

**Parameter Choices on Power Up for Volume Ventilation**
- volume ventilation: you must choose whether you prefer tidal volume to be fixed or inspiratory time to be the fixed value when you manipulate ventilator flow
- example: if you choose “I” time to be fixed then when you manipulate ventilator flow the volume will change
- example: if you choose volume to be fixed then when you manipulate ventilator flow the “I” time will change
- the preferred thing to do is to set “I” time to be fixed
Manual Controls

- Max Pressure knob controls the peak pressure
- Peep knob controls the positive end expiratory pressure
- Flow knob controls the flow in lpm.

The Screens

- Touch screen display
  - to make changes use the edge of your fingernail to activate the key, do not use the flat pad of your finger

-Main Menu Screen

![Main Menu Screen]

- The Main menu offers control over the various modalities. These include:
  - Assist Control (constant flow off)
  - SIMV (constant flow off)
  - CPAP (constant flow on, flow trigger off)
  - Sensitivity (constant flow off)
  - SIMV Rate (constant flow off)
  - Pressure Support (constant flow off)

- The Main Screen may look “busy” to some but it helps if you focus on what you can set from this menu and what is being monitored
- Some things are the same on each of the screens
  - The pressure manometer will always be on the left side
  - The top row (MAIN, ALARM 1, ALARM 2, LOCK, and ALARM QUIET) will always be located at the top of each screen
  - The bottom row (PEEP, EXTERNAL POWER OR BATT <Battery>, AUTO SET, AND UP/DOWN ARROWS) will always be located at the bottom of each screen

- Alarm 1 Menu Screen

-In the Alarm 1 Menu, high and low limits are set for:
  - Peak Pressure
  - Rate
  - Exhaled Tidal Volume / Exhaled Minute Volume
-In the Alarm 2 Menu, high and low limits are set for:

- Peep
- Mean Pressure
- Oxygen
The Rear View and Connections

- air / oxygen supply outlet
- proximal and distal airway pressure nipples
- external power charger connection
- relief valves
- patient outlet
- exhalation valve and airway pressure connections

Ventilator Mode Set Up

**Assist Control (Constant Flow must be off)**

- choose Assist Control mode
- set respiratory rate by pressing RATE and adjusting with arrow keys.
- adjust flow trigger level to ensure that patient is able to trigger the vent
- set desired PEEP level
- set alarms by pressing AUTO SET twice within 5 seconds, or by manually setting each alarm in the ALARM screens.
- for Pressure Limited Ventilation: Decrease MAX PRESS knob until desired peak pressure

Note: Make sure peak pressure alarm (ALARM 1 screen) is not limiting the tidal volume delivery (or limiting the pressure limited breath).
SIMV (Constant Flow must be off)

- choose SIMV mode
- set SIMV RATE
- adjust flow trigger level to ensure that patient is able to trigger the vent
- set desired PEEP level
- set pressure support if desired
- set alarms by pressing AUTO SET twice within 5 seconds, or by manually setting each alarm in the ALARM screens.
- for Pressure Limited Ventilation: Decrease MAX PRESS knob until desired peak pressure is observed.

Note: Make sure peak pressure alarm (ALARM 1 screen) is not limiting the tidal volume delivery (or limiting the pressure limited breath).

For Constant Flow IMV Ventilation (flow trigger not available in this mode)

- turn on constant flow
- set desired respiratory rate
- set desired inspiratory time
- set desired flow rate
- set Peak pressure by turning MAX PRESS knob and observing Peak pressure (upper left corner).
- set desired PEEP
- set alarms by pressing AUTO SET twice within 5 seconds, or by manually setting each alarm in the ALARM menus.

For Nasal Prong CPAP it is probably best to use the vent with Constant Flow On (flow trigger off)

4. Ventilator set up

Flow Sensor (pneumotach)

- attach “patient proximal” tubing side of flow sensor (marked with white line) to “Patient Prox” output fitting (blue) of Crossvent.
- attach “patient distal” tubing side of flow sensor (clear line) to “Patient Distal” output fitting (silver) of Crossvent.

Ventilator Circuit

- attach inspiratory limb of circuit to “Patient” fitting of Crossvent.
- attach proximal pressure line to “Gauge” fitting of Crossvent
- attach exhalation valve pressure line to “Exp. Valve fitting of Crossvent.

Leak Test

- perform a leak test
5. What disease processes do best with which ventilator settings and why

-Pre term infants (under 30 week’s gestation) seem to do best in Pressure mode. Why? The vent is easier to manage due to ratio of volume lost in the circuit to the actual volume to the patient. Ex. If you are loosing 5cc’s from your delivered volume due to tubing compliance and the baby is only .8kg (800gms) you must set your set VT at ~ 15-20cc/kg to get an exhaled volume to your liking.
-Any conditions requiring high pressures (>35) to ventilate seem to need Pressure ventilation as you can create a square wave with the pressure by adjusting your flow. (adjusting for a stronger more powerful delivery)
-Volume ventilation seems to be the ventilation of choice due to its consistencies, however; this does have its limitations. i.e. Air leaks, extremely non-compliant lungs, and limited wave forms.
-Pressure Support is an excellent tool to use in any spontaneous breathing pt.

6. Clinical details to look for and be aware of during flight when using this device

-Gas consumption of air and oxygen.
-Battery life using back light or not.
-Do not forget your clinical skills; look for chest rise, spontaneous breathes, increase work of breathing.
-Make sure the bumps are not creating auto-cycling by using your display window of breath type. Lower left corner.
-Set your alarms according to possible mishaps. I.e. accidentally spinning the flow, pressure, and peep knobs.
-Stay on top of your exhaled volumes for trending purposes in order to catch drifts in compliance.

7. Why is this device so useful on transport and how has using this device changed things for your transport team

-Volume control capability. NICU’s around the country are now using volume ventilation over pressure due to its consistent delivery. Ventilators are more advanced to handle this tiny population in regards to sensitivity and precise volumes delivered. It is nice to hand a patient off to its admitting facility with the same parameters they use.
-Phuemotach has provided the ability to measure volumes and fine tune your patients like the “big boy ventilators in all the hospitals” acquiring minute ventilation, tidal volumes, flow triggering for smooth synchronization is a huge step in transport ventilation.
-Flow triggering and pressure support have brought much needed comfort to our spontaneous breathing patients. There is less need for sedation and we actually get a chance to see their needs based on clinical observation instead of sedating them into control.
-ability to compute Mean Airway Pressure
-very long battery life (2 hours 40 minutes on fully charged battery)
-reliability (absence of rotating or sliding mechanical parts, ability to withstand vibration)
-high visibility touch screen keypad
-since more referral hospitals are purchasing high tech ventilators, we can match those settings, whether it is assist control or SIMV, when we arrive. We don’t have to change modes and stabilize all over again.
8. Discuss how the device can be mounted or positioned during transport (configurations)

- Internal wiring and circuitry can be left untouched as a custom mounting plate is used for external ventilator connections.
- The smooth touch screen with lock feature provides safety from accidental changes.
- The recessed knobs also provide safety from accidental changes.

9. Provide “clinical tips” regarding use of this device (tips that make things easier or less complicated)

- Fine tune one or two alarm limits pertinent to your patient such as peak pressure and rate. This can cut back on unnecessary alarming.
- Keep your inspiratory time set even in volume mode. This will allow you to change to pressure mode from volume without having to turn off the ventilator.
- In pressure mode use your exhaled volumes to measure patient compliance.
- Use the display window of the type of breath to determine how your patient is synchronizing or if they are auto cycling. This will also give you an idea of spontaneous volumes when using the exhaled volume screen in conjunction with the type of breaths.
- Always turn your pressure knob max when using volume ventilation. Don’t be fooled in thinking you are delivering a set volume when you are popping off your breath with your Pressure knob.
- When disconnecting from external power source, be ready to press the POWER SOURCE window to silence alarm.
- When using nasal prongs for CPAP, attach pressure line on expiratory side of prongs.

10. Are there any special considerations when integrating this device into your transport program (education, mounting/configuration issues, regulations, calibration, maintenance)

- Education is the key to using this ventilator to its full potential
- Core knowledge of its capabilities allows you to work around the limitations and ensures a maximum benefit to the diverse needs of your patient.
- When it comes down to a variety of function, this is a very basic, easy to use ventilator that will evolve into consistent standard in patient care.
- Oxygen sensor should be calibrated once per month and battery should be replaced every 2 yrs.