Alberta Children's Hospital

Tracheostomy and Ventilator Education Program

Module 8: Ventilator Support

September 23, 2022

Alberta Health Services

Disclaimer

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Objectives:

- An introduction to home ventilation supports

Ventilator support

- Your child may need ventilator support:
  - This could be 24 hours a day or only when they are asleep (nights and naps)
  - This could be with a plan to eventually decannulate and support by mask ventilation if needed
- When your child is in PICU, they will be on a different ventilator until they can be supported by a home style ventilator
- Your healthcare team will determine the mode, settings, and alarms that best fits your child's respiratory needs

What does ventilator support mean?

- Ventilator support is needed when your child can't breathe well enough on their own, either when they are in a deep sleep or at all
- They may not be able to maintain their O_2 levels and exhale their CO_2 effectively on their on their own
- Ventilators are used to support:
  - When the respiratory center in the brain doesn't work properly to control breathing effectively
  - When the lungs are damaged or have an infection
  - When respiratory muscles are too weak to work properly

What does ventilator support mean?

- Ventilator support can:
  - Provide all the breaths your child needs if your child can't breathe on their own
  - Provide breaths to support your child if they can breathe on their own but need help
  - Your healthcare team will determine how the ventilator will help your child and will make sure the settings will support your child

There is a special mode called Mouthpiece Ventilation, where a mouthpiece is used to breath through on demand – only when needed – can be used for some patients

Ventilator settings

- Ventilators have many different settings to provide support:
  - Modes:
    - Spontaneous: the ventilator provides pressure to help your child breathe and your child controls their respiratory rate and breath volume
    - Pressure Control: the ventilator provides pressure to a set level to allow your child to get the breath volume they want
    - Volume Control: the ventilator provides breath volume to a set level to allow your child to get the pressures they want
    - CPAP: the ventilator provides a set pressure for both breathing in and breathing out and your child controls their breath volume and respiratory rate

Ventilator settings

- Settings:
  - Pressure Support: the ventilator provides a set pressure to help your child breathe through the circuit without having to work hard
  - PEEP: the ventilator provides a set pressure to keep the alveoli of the lungs open at the end of a breath to prevent them from collapsing
  - Respiratory Rate: the ventilator provides a set number of breaths in a minute
  - Trigger: the ventilator can be set to be able to sense a small effort to breathe and give your child the breath they want when they want it

Ventilator settings

- Alarms:
  - Power Alarms: the ventilator will alarm if the battery is low and the ventilator needs to be plugged in
  - High Pressure Alarms: the ventilator will alarm if pressure is too high – there could be water in the circuit, your child could be coughing and need suctioning, your child is breathing against the ventilator
  - Low Pressure Alarms: the ventilator will alarm if pressure is too low – there could be a leak in the circuit or the circuit is disconnected
  - High Volume Alarms: the ventilator will alarm if volumes are too high per breath or over a minute – this could mean your child is upset or needs suctioning
  - Low Volume Alarms: the ventilator will alarm if volumes are too low per breath or over a minute – there could be a leak or a disconnect

Ventilator settings

- Alarms:
  - Circuit Disconnect Alarm: the ventilator will alarm if it senses a circuit disconnect or a large leak in the circuit – there may be a disconnect in the circuit or a leak
  - High and Low Respiratory Rate Alarms: the ventilator will alarm if the respiratory rates are too high or too low – your child might need to be suctioned, or there could be water in the circuit, or a leak
  - Apnea Alarm: the ventilator will alarm if your child hasn't triggered a breath within a time window – this could mean your child is disconnected or your child is breathing to shallowly

Ventilator support

- Your healthcare team will continue to make changes on your child's ventilator to optimize the best settings and alarms to meet your child's needs
  - Your child's settings and alarms will change many times until they settle
- When your child's settings are stable, your healthcare team will switch them to a home style ventilator to get used to it before going home

Ventilator support

- When ready, your healthcare team will arrange to have your child's home ventilator to be set up in hospital for them to get used to before going home
- You will be supported by the CCAN team, your Home Care team, and the Respiratory Outreach Team (ROP) – a team of respiratory specialists that will take care of your child ventilator equipment in the community
  - They manage your child's ventilators and circuits, connectors, humidity set ups, and will monitor your child's settings
  - They provide your home ventilators and all supplies, will teach you about their contact information and 24 hour support, cleaning schedules and instructions, alarms, what to do, and when to call for help

Ventilator support

- Your child's breathing will be supported by:
  - A stationary ventilator that is your home unit and has a heated humidity set up
  - A portable ventilator in a carry bag that is intended to be used when your child needs to go places
  - A bagging unit that can be used to give breaths to your child by hand when your child is off their ventilator and needs breathing support
  - Your tracheostomy supplies and emergency kit
  - You will have extra circuits, connectors, humidity set ups and other equipment like your suction units

Ventilator support

- It is very important to know your child's ventilator needs:
  - If they only need support when they are asleep for nights or naps
    - Emergency Tip: If there is something wrong with the ventilator, you can wake them up while you get your other ventilator ready
  - If they need 24 hour ventilator support and can't breathe on their own
    - Emergency Tip: You will need the bagging unit to provide manual breaths while you set up your second ventilator

Bagging unit

- A bagging unit (bagger or manual resuscitator) (Remembering Module 7 – how to give breaths) is a device that can be used to provide breaths for your child when off the ventilator if needed
- It should be checked to make sure it's the right size and the mask that comes with it is the right size as well
- It can be connected to O_2 if needed
- If your child has a PEEP setting on the ventilator of 5 cmH20 or higher – their bagging unit must have a PEEP valve attached to it as well to match the PEEP on the ventilator

Bagging unit with PEEP valve

The bagging unit has a plastic cap on the top connector – to connect the PEEP valve, remove this cap and place the valve in that spot

Confirm the PEEP valve is securely attached to the bagging unit

Dial the top of the valve to set the PEEP to the ventilator PEEP setting

The bagging unit is ready for use

Bagging unit

- When using the bagging unit:
  - Take your child off the ventilator gently and connect the bagging unit to the tracheostomy tube
  - Silence the ventilator or turn it off if needed
  - You may need to hold and secure the trach tube and bagging unit to prevent the weight of the bagging unit from pulling the trach tube
  - Ventilate by squeezing the bag gently as you have been instructed for your child to get good chest rise
  - Watch for chest rise, the rate of breathing that should match the ventilator and your child's regular respiratory rate, and how your child is tolerating being bagged
  - Always confirm settings before placing your child back on the ventilator and confirm your child is tolerating the ventilator breaths well

Home ventilator

- There are several types of home ventilators
- We will focus on the Trilogy 200 home ventilator because it is the most common one right now

Trilogy 200 home ventilator

- Can be used for infants to adults for home ventilation
- Can be used for support when sleeping or 24 hours per day if needed
- Has very good sensitivity to sense small efforts to breathe
- Has alarms to alert parents and caregivers
- Has an alarm log to track alarm events
- You will have two ventilators that are the same, and can be switched out as needed:
  - 1 is a portable ventilator for when you go out with an HME
  - 1 is for home in your child's room with a heated humidity set up

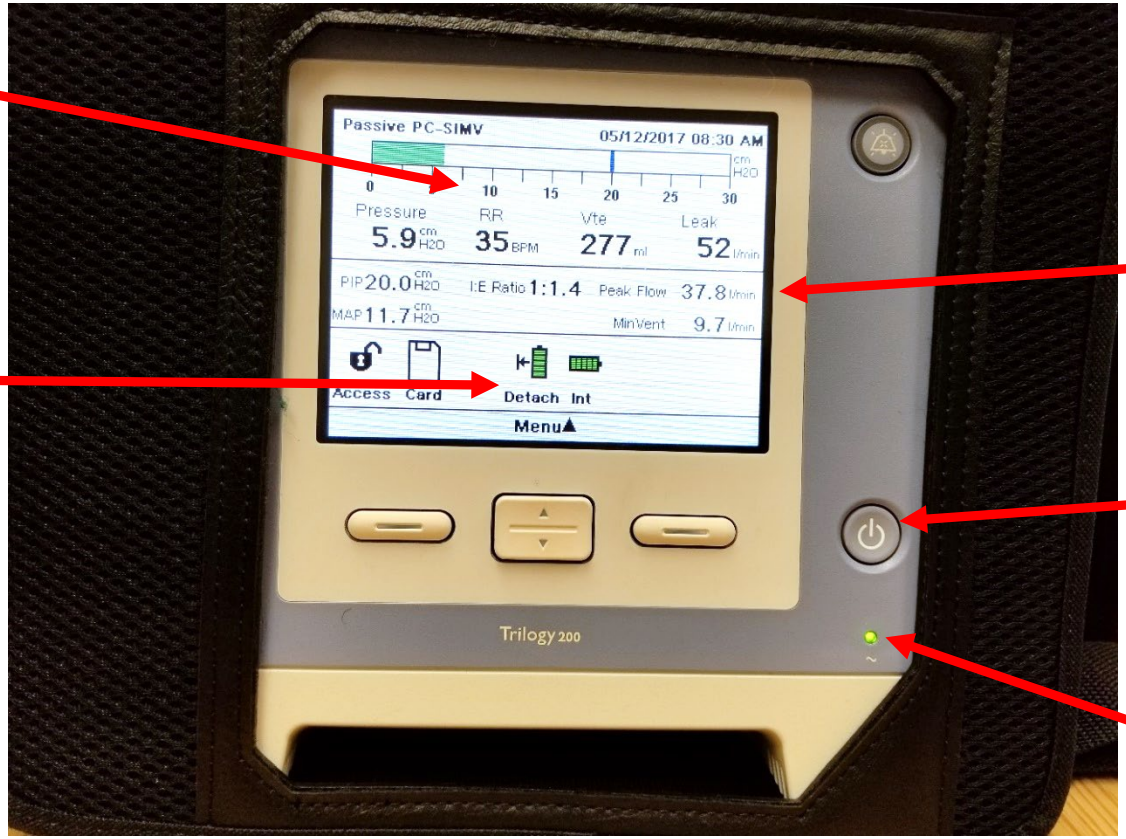
Trilogy 200 home ventilator

- Displays important information on the front screen
- Does not provide O_2 by itself but O_2 can be connected from a concentrator or tank for oxygen
- Has an external and internal battery and plug in power
- Both batteries when fully charged can provide approximately 6 hours of use
- Will alert parents and caregivers of power situations
- Never change any settings or alarm parameters – contact your ROP, Complex Airway Physicians or Home Care RRT's and Nurses if you have questions
- The ventilator is connected to either a heated or a portable circuit that connects to your child's trach tube

Trilogy screen

Monitored settings

Battery

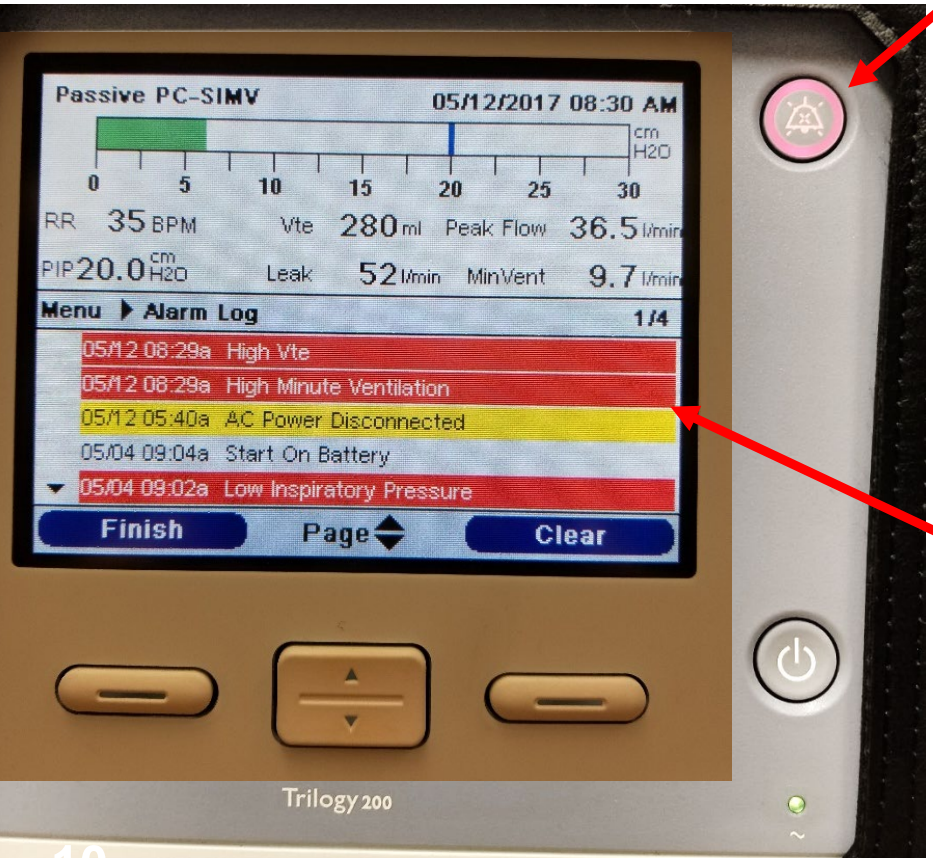


Measured settings

Start/Stop - Power Button (On/Off Button)

Green light = plugged in power

Trilogy screen



Alarm Indicator/Audio Pause:

- Silences for 2 minutes
- LED solid yellow – low priority alarm
- LED flashing yellow – medium priority alarm
- LED flashing red – high priority alarm
- You should always check your alarms and confirm that your low Vt, low min vent, low RR, apnea AND your circuit disconnect set appropriately

Alarm log:

- Shows list of alarm conditions and times they happened

Trilogy set up

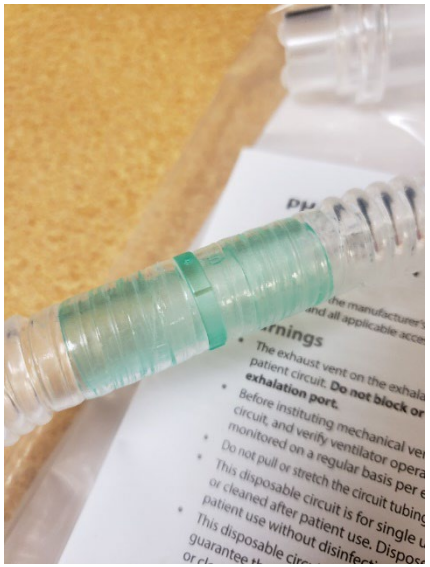
- The ventilator should always have a bacterial filter on the circuit connecting to the ventilator at all times
- There is also a grey inlet filter at the back of the machine that protects from debris in the air – it should be changed monthly and washed/dried in between changes

Trilogy circuit set up

- You will have 2 types of circuits (pediatric or adult)
  - Portable non-heated circuit
  - Non-portable heated circuit
- The circuits in hospital are different than the ones for home
- The home circuits need to be assembled and you will be shown how to do that for both circuits
- Some parts are re-usable and washable, the rest are disposable and must be replaced on a schedule that your ROP staff will go through before you go

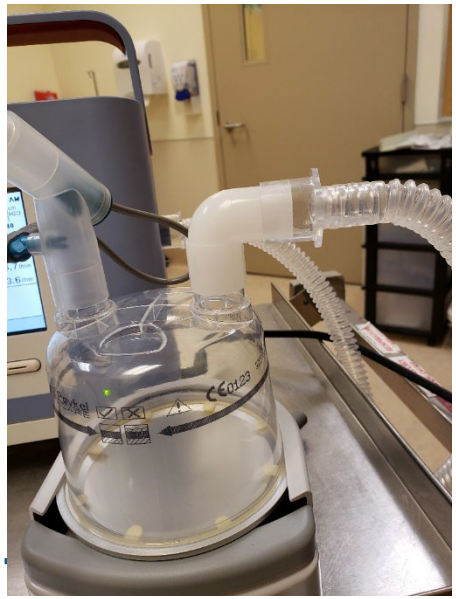
Trilogy circuit set up

- Portable non-heated circuit
  - The circuit may come with parts that need to be removed and replaced with an adaptor
  - You will be shown which circuits to use, how to put them together, and what is re-usable and disposable



Trilogy circuit set up

- Non-portable heated circuit
  - The circuit will come with heater wires and humidity pots and heaters
  - You will be shown which circuits to use, how to put them together, and what is re-usable and disposable



Trilogy circuit set up

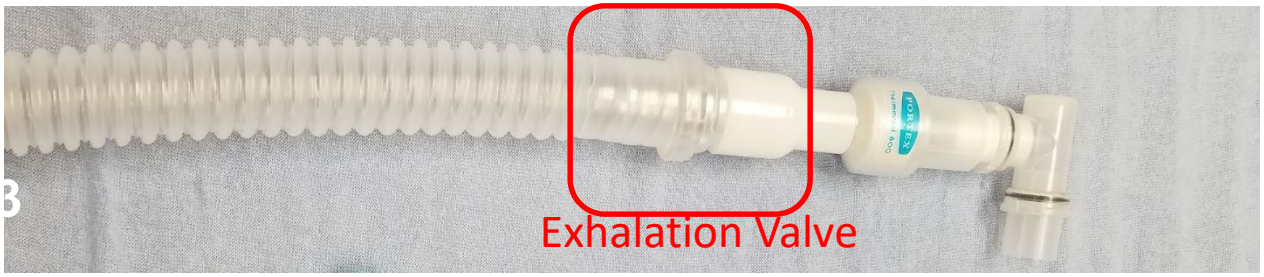
- Circuit adaptors
  - There are many adaptors for circuits that may be used in your child's set up
  - You will be shown which adaptors to use, how to put them together, and what is re-usable and disposable

Circuits

- Circuits and connectors are supplied by ROP for home
- All circuits are one limb passive circuits
- Follow cleaning instructions carefully and circuits are changed as per ROP instructions
- Use distilled H_20 in your humidity chamber – tap water will leave mineral deposits
- Try to keep the circuit midline of your child for the best trach positioning

Portable Unheated Circuit

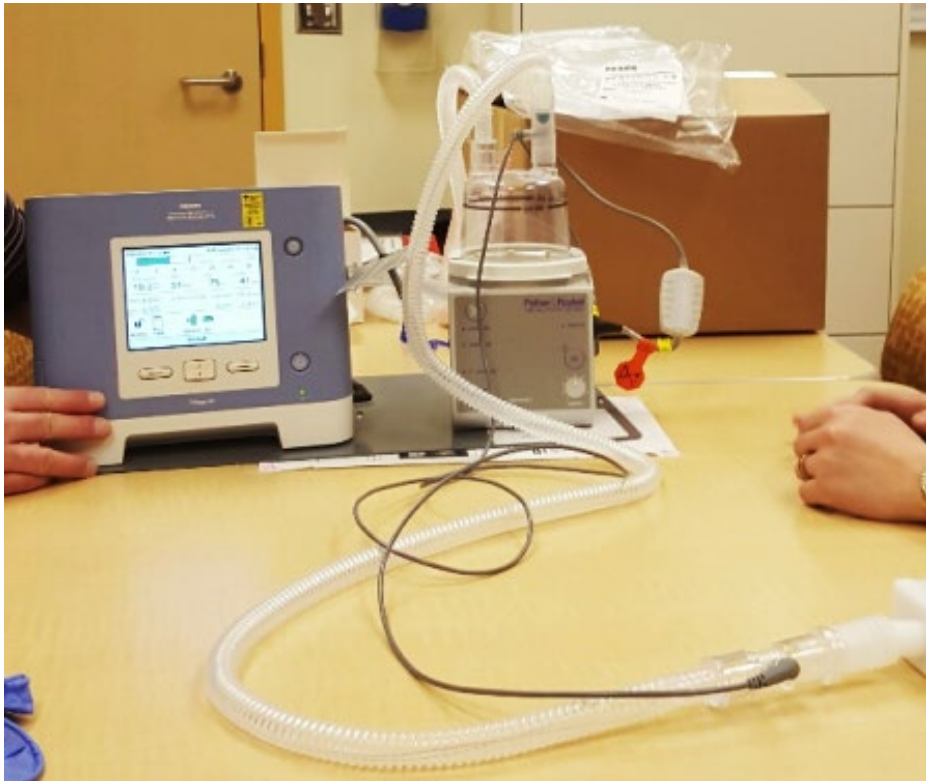
- Always use with the Thermovent 600 or 1200 HME as your humidity source – never have heated humidity on this circuit with the HME in place
- This circuit is for your portable ventilator for when your child is in their stroller or in the car
- This circuit has an Exhalation Valve which where your child's exhaled air goes out – never block or cover this valve



Non Portable Heated Circuit

- This circuit has heated wires that connect to the humidifier pot to warm and humidify the air for your child – never use an HME with this system
- This circuit is for home on your child's bed side table for when your child is in their bed for night time and naps
- This circuit also has an Exhalation Valve which where your child's exhaled air goes out – never block or cover this area

Non Portable Heated Circuit



Heated Humidity

Humidity for your home ventilator with a humidifier pot:

- Always use distilled H20 to fill to the fill line and make sure that the unit is plugged in and set properly for heat and humidity as you have been instructed by ROP
- Watch for water (rain out) in the circuit – drain any water in the circuit into a trash container – never drain it back into the humidifier pot
- Always turn off your humidifier off when your home ventilator is not in use - empty the humidifier pot and clean it as your cleaning instructions direct – never leave standing water in the pot

Home Set Up

- The home ventilator needs to be set up on a stable, level surface with room around the unit to allow for air flow
- The portable ventilator should be set up on the stroller as prescribed with no risk of blockage of the air inlet – take care to make sure that the heated humidifier set up is safe and won't tip over easily
- All supplies should be set up near the home ventilator at home and in the go bag and emergency kit with the portable ventilator for trips (always have an extra circuit, HME's, and connectors as well)

Troubleshooting the Ventilator

- Always check your child first – are they ok, do they need suctioning, is their tracheostomy tube clear
- Get help if you are not alone
- Assess the situation – can you quickly check the circuit for a leak or disconnect – if yes, do so = if not, bag your child as you have been instructed and switch to your second ventilator
- You have 2 ventilators – always go to the second ventilator if you can't quickly fix the situation bagging in between
- Once you are sure that your child is ok, then check the ventilator and call ROP for guidance

Ventilator

- ACH Trach and Ventilator Video Resource
  - Ventilator information starts at time 20:26

Ventilator alarms

Plain Language Description: Trilogy Ventilator Alarms

- All alarms should be treated the same – always assess and check your patient, then check the circuit – if you can't quickly troubleshoot and fix, start bagging and call for help
- All alarms will continue to alarm until the condition causing the alarm is corrected
- A record of alarms is kept in the "Alarm Log" screen

	Alarm	Considerations
High Priority Alarms	Check Circuit Alarm OR Low Circuit Leak Alarm: Check the ventilator circuit	Is there a pinch in the circuit/water in the circuit? Is there a leak in the circuit
	Circuit Disconnect Alarm: Check the ventilator circuit	Is the circuit disconnected from the child? From the Trilogy? Is there a leak in the circuit? Are all the parts connected correctly?
	High VTE Alarm: This indicates that the child istaking a large breath	Does they look upset/crying? Does they need a suction?
	Low VTE Alarm: This indicates that the child is taking a smaller breath	Normal for a child that was just suctioned Do they have a leak around their trach? Is there a leak in the circuit? Are they taking small breaths? Breath holding? Bearing down?
	High Respiratory Rate Alarm: This indicates that thechild is breathing fast	Are they upset/crying? Do they need a suction? Are they triggering every breath on the Trilogy? Is there rain out in the circuit?
	Low Respiratory Rate Alarm: If the child is on a set Respiratory Rate on the Trilogy this alarm would be rare	Is there a leak in the circuit?
	High Minute Ventilation Alarm: This indicates that thechild is taking a lot of breaths/bigger breaths over one minute	Are they angry/upset? Do they need a suction?
	Low Minute Ventilation Alarm: This indicates that thechild is taking less breaths/smaller breaths over one minute	Are they triggering every breath? Have you been suctioning many times over the last minute? Is there a leak around the trach? Is there a leak in the circuit?
	Apnea Alarm: This indicates that the child hasn't triggered a breath within the apnea alarm setting	Have you been suctioning many times over the last minute? Check the circuit, is the circuit connected correctly? Does the child have a set rate? Are they breathing over it adequately?
	Loss of Power Alarm: Complete Power Failure has occurred/Internal battery is depleted	Plug into power source BAG patient as needed OR switch to second vent
	Ventilator inoperative alarm: Internal error in ventilatorthat may affect therapy	Device may shut down BAG patient as needed OR switch to second vent
	Ventilator Service Required Alarm: Ventilator requiresservice - will continue to operate perhaps at a limited capacity	BAG patient, switch to second vent, call ROP
Medium Priority Alarms	High Inspiratory Pressure Alarm: indicates that the delivered pressure exceeds the set pressure by 5 cmH2O	Is the child coughing? Upset? Do they need a suction? Obstruction?
	Low Inspiratory Pressure Alarm: occurs when the delivered pressure is less than the set pressure by 5cmH2O	Is there a leak around the trach? Is there a leak in the circuit?
	Note: These alarms go from a medium priority alarm to a high priority alarm if problem does not resolve.	

Summary:

- This module has provided a basic introduction to home ventilator supports
- If you have concerns or questions, please talk to your healthcare team