

**Title: Targeted Tidal Volume Ventilation (TTV)**

<b>Manual Classification:</b> Service Specific NICU – Medical	<b>Effective Date:</b> 15 November 2015	<b>Expiry Date:</b> 15 November 2018	<b>Keywords:</b> <i>(supply 5 keywords - search engine)</i> TTV Tidal volume Ventilation
--	--	---	---

<b>Facilitator</b> <i>sign/date</i>	<b>Sponsor</b> <i>sign/date</i>	<b>Process Authorised</b> <i>sign/date</i>
<b>Name and title:</b> Arun Nair, Neonatologist, NICU	<b>Name and title:</b> David Bouchier, Clinical Director NICU	<b>Name and title:</b> David Graham, Clinical Director Child Health

© Waikato DHB, 2013

1. Background
2. Setting up the ventilator (SLE 5000)
3. Changing the settings according to clinical situation
4. Trouble Shooting
5. Step by Step Guide

## 1. Background

In contrast to pressure-targeted ventilation, volume-targeted ventilation (e.g. TTV) delivers a desired volume of gas and allows pressures required to deliver this volume to vary. The aim of TTV is to prevent over-distension of the alveoli and thereby limit volutrauma. Targeting a selected tidal volume, and achieving and maintaining the tidal volume with pressure ventilation, also limits barotraumas. This ventilation provides a stable, consistent tidal volume and minute ventilation independent of respiratory compliance. It also provides an “auto wean” feature: as compliance improves, pressure automatically decreases. It is therefore a preferred mode for fast changing compliance, e.g RDS after surfactant or weaning after surgery/muscle relaxant administration.

## 2. Setting up the ventilator

TTV can be applied to all modes of pressure cycled ventilation, provided that a flow sensor is in situ. TTV cannot be applied in HFO or HFO+CMV.

Once an applicable mode has been selected, and the following parameters have been set (PEEP, PIP, Ti, rate and FiO2), the user may then choose to apply TTV. Please make sure that the leak compensation has been activated, and the leak is less than 20%. (if there is a bigger leak, then the expired tidal volume is incorrectly measured, and volume-targeted ventilation is not possible)

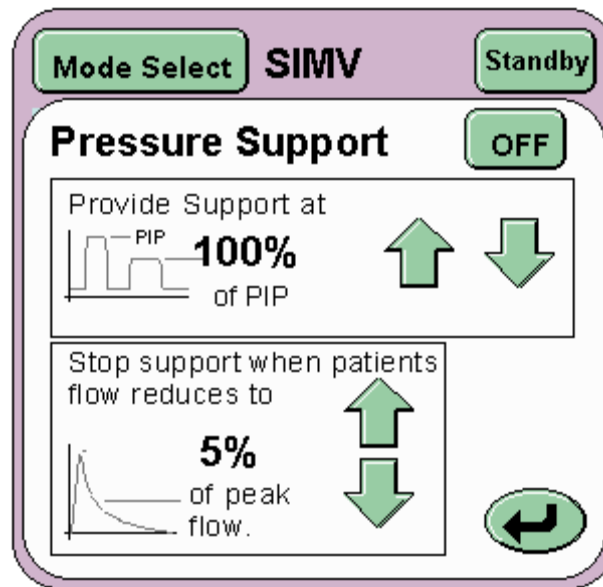
CMV, PTV, PSV and TTV:

In addition to basic settings for CMV, PTV, PSV the user sets the following:


- Enables Targeted Tidal Volume (Tidal Vol) and selects volume to be delivered (usually 4-6ml/kg)
- Max PIP
- Max Ti

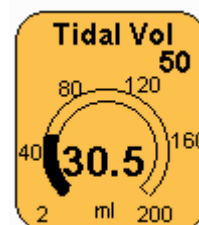
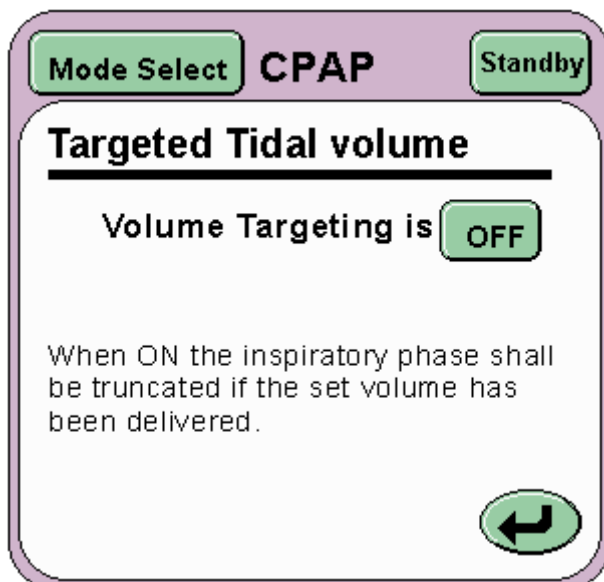
SIMV and TTV:

This mode can be used for TTV setting as well. However, as spontaneous breaths are not supported, the ventilator will alarm “low VT” if only small volume breath is taken spontaneously, as the VT is measured breath by breath, rather than over a few breaths (as seen in other ventilators). It is recommended to use PS with 100% support when using SIMV with only few spontaneous breaths. When the infant is breathing up, the PS can be reduced. In addition, if the ventilation is stable, and there is no evidence of leak, it should be considered to change the mode from SIMV/PS to PSV.



The **Pressure Support** panel allows the user to set the **Provide Support at percentage**, and the **Stop Support when patient flow reduces to percentage** (Termination Sensitivity) of the SIMV breath. The panel allows the user to increase or decrease the percentage values via the arrow buttons.

The **Return** button  returns the user to the current mode panel.



The **Targeted Tidal Volume** panel allows the user to turn ON or OFF volume targeting. Volume targeting (TTV) is activated by the **ON/OFF toggle** button (T). When Volume Limiting is ON the Tidal volume parameter panel appears allowing the Tidal Volume limit to be set.

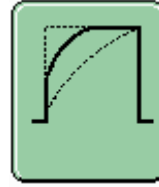
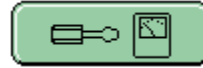


The **Return** button returns the user to the current mode panel.

Once TTV has been activated and a target tidal volume selected, the following occurs:

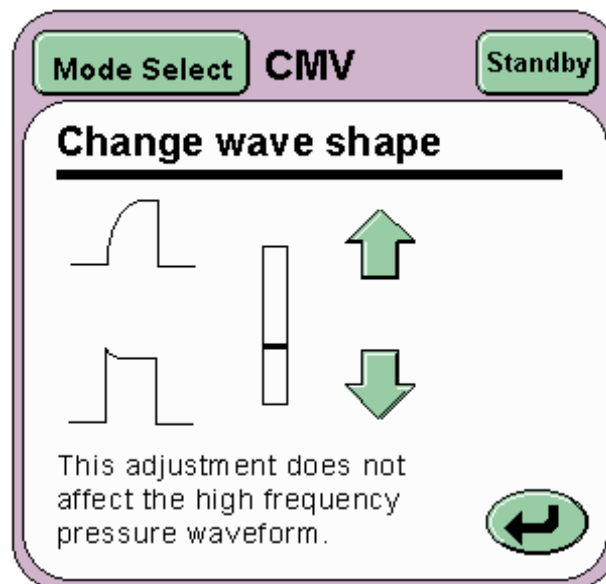
- PIP becomes MAX PIP
  - To achieve the TTV only a percentage of the MAX PIP will be used (depending on the compliance/resistance of the lungs)
  - The MAX PIP is not delivered to the patient, unless the TTV is not being achieved
  - If the resistance of the lungs increases, the measured PIP will increase up to the MAX PIP allowed, in order to achieve TTV. No more than the MAX PIP will be delivered to the patient, unless it is increased by the user
  - If compliance increases, the measured PIP automatically decreases to maintain the TTV. In effect, weaning down the pressures as the lungs improve. The setting of the MAX PIP does not need to be changed in this case.
  
- Ti becomes MAX Ti
  - The required volume is delivered before the Ti is reached
  - The actual or measured Ti is displayed on the right hand side of the screen and within the eyebrow on the parameter setting
  - If volume cannot be achieved, the MAX Ti can be increased to allow for the delivery of the TTV
  - If the measured Ti is felt to be too short, then the user may “slow down” the wave shape, by using the wave shape button, to prolong the breath to increase the measured Ti, i.e. decreasing the inspiratory rise time

To modify the wave shape the user should select the **Options and Service Data Button** in the mode panel.



Then select the **Wave Shaping button**

The user can alter the wave shape on the **Change Wave Shape** panel. There are two default values for the wave shape, one for standard ventilation and one for standard ventilation with TTV.



- On discontinuing TTV the ventilator defaults to a safe PIP level of 5 mbar above the set PEEP level, irrespective of what the user has set. The user will then have to reset the PIP to the required level.
- The inspiratory time  $T_i$  will change to Max  $T_i$  as the delivered volume limits the backup breath rather than the inspiratory time. The actual inspiratory time ( $T_i$  Meas.) will be displayed in the lung mechanics and measurement panel and parameter window.

**3. Changing the Settings according to Clinical Situation**

if high CO<sub>2</sub> – increase TTV, increase rate, increase PS

if low CO<sub>2</sub> – decrease TTV, decrease rate, decrease PS

**4. Alarms and Trouble Shooting**

1. Check baby
  - a. Air entry
  - b. Chest expansion
  - c. ETT position
2. Check ventilator
  - a. New leak – take off TTV if leak > 20%
  - b. Blocked ETT?
3. Low VT
  - a. Check pressure limit high enough
  - b. Check Ti long enough
4. Low VT on single breaths
  - a. PS setting in SIMV mode not high enough

**5. Step by Step Guide**

1. Test the ventilator and set up for ventilation
2. Choose mode
  - a. CMV
  - b. SIMV plus PS
  - c. PSV
3. Check leak <20%
  - a. Choose leak compensation – 20%
4. Choose TTV
  - a. Determine volume (4-6ml/kg)
  - b. Set MAX PIP
  - c. Set Max Ti
5. Blood gas after 30 min
  - a. Change settings according to results

*Disclaimer: This document has been developed by Waikato District Health Board specifically for its own use. Use of this document and any reliance on the information contained therein by any third party is at their own risk and Waikato District Health Board assumes no responsibility whatsoever.*