ASV®

Adaptive Support Ventilation

HAMILTON MEDICAL

Our passion: Intelligent Ventilation solutions

Ever since we were founded in 1983, our focus has been on supporting the frontline heroes of critical care - with ventilation technologies that are safe, effective, and lung-protective. And we want to lessen the load for those who make extraordinary efforts every day, helping seriously ill patients fight their way back to health.

That is why we are committed to helping medical teams deliver the best respiratory care - to anyone, anywhere. That commitment is present in everything we do.

Bob Hamilton
CEO

What is ASV?

Ventilation adapted to the patient

The ventilation mode ASV continuously adjusts breath-by-breath, the respiratory rate, tidal volume, and inspiratory time depending on the patient's lung mechanics and effort, 24 hours a day, from intubation to extubation.

ASV automatically employs lung-protective strategies to minimize complications from AutoPEEP and volutrauma/barotrauma[1]. It also helps to prevent apnea, tachypnea, dead-space ventilation, and excessively large breaths[1].

Within the rules of this lung-protective strategy, ASV encourages the patient to breathe spontaneously[2, 3].

The highest-ranking ventilation mode

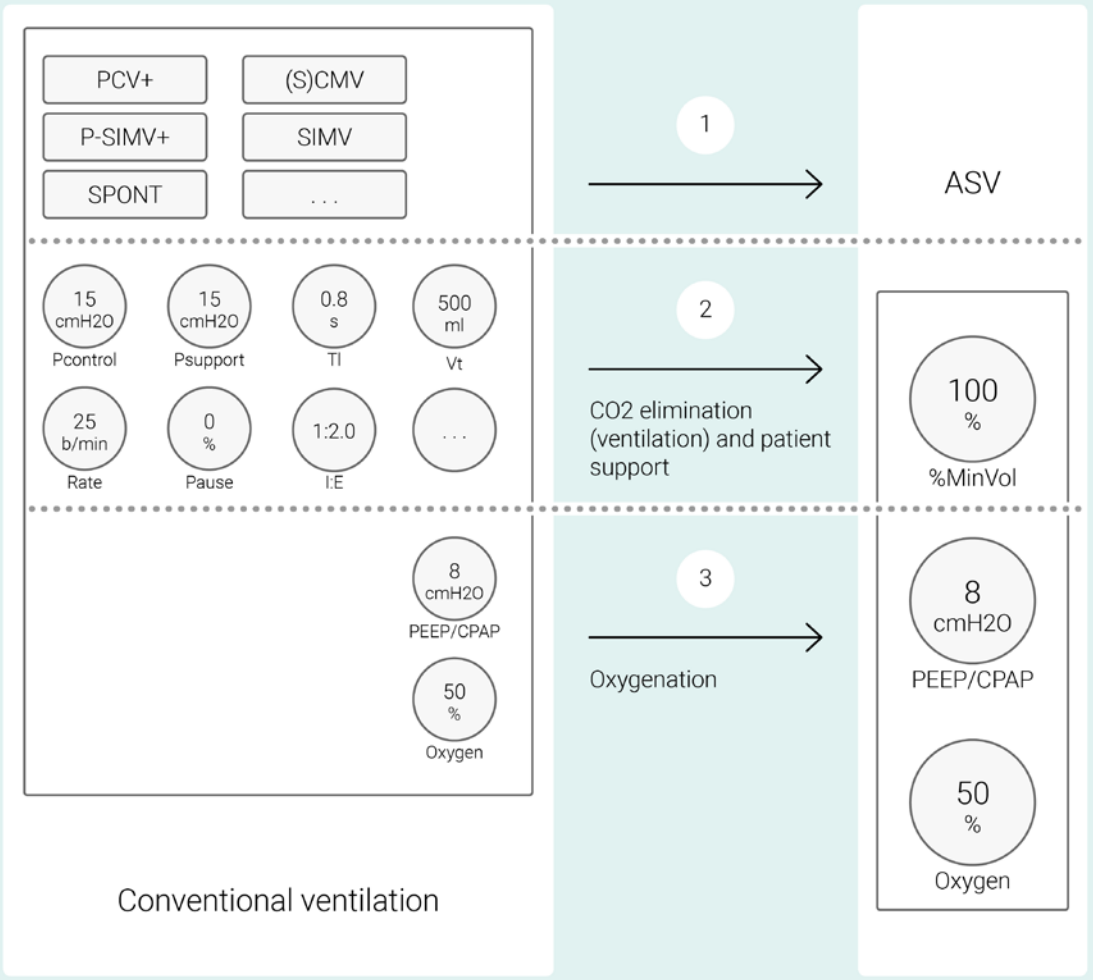
ASV is a well-established mode in critical care since 1998 and has become a standard mode in many hospitals around the world. ASV and INTELLiVENT-ASV* were named as the highest-ranking ventilation modes on the market, based on technological capabilities related to the goal of patient safety, comfort, and liberation[4].

Criteria	INTELLiVENT-ASV	ASV	Smart-Care®	Auto-mode	NAVA®	PAV
Patient safety	6	3	1	3	0	0
Patient comfort	4	4	3	3	4	3
Liberation	3*	1	3	1	1	0
Points total	13	8	7	7	5	3

1. Sulemanji D, et. al. Anesthesiology. 2009;111(4):863-870 | 2. Petter AH, et. al. Anesth Analg. 2003;97(6):1743-1750 | 3. Linton D, et. al. Sou Af Med J. 1995 May;85(5): 432-5. *Erratum in: Respir Care. 2013 Apr;58(4):e51 | 4. Mireles-Cabodevila E, et. al. Respir Care. 2013 Feb;58(2):348-66.

One mode from intubation to extubation

In conventional ventilation modes, the clinician sets ventilator controls such as tidal volume, pressure, respiratory rate, and expiratory and inspiratory time to achieve clinical targets, including a certain level of alveolar ventilation and oxygenation for the patient depending on the patient's activity. ASV simplifies ventilation for the user by providing one mode for both active and passive intubated patients, and only three parameters to control ventilation as well as oxygenation.

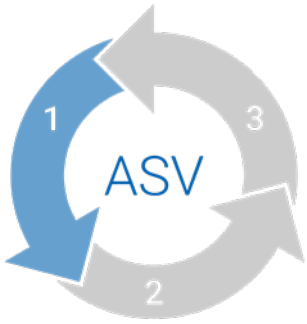


How ASV works

Setting the target

Conventional ventilation modes are set manually and need continuous assessment by the clinician. ASV automates this process, making it the world's first Intelligent Ventilation mode.

The clinician sets the target minute volume and the ventilator determines the combination of tidal volume and respiratory rate, taking into consideration the respiratory mechanics of the patient[5].



1. Assess the patient's lung mechanics breath by breath.

ASV in passive patients

In passive patients, ASV is a volume-targeted pressure-controlled mode with automatic adjustment of inspiratory pressure, respiratory rate, and inspiratory/expiratory time ratio.

Maximum tidal volume is controlled in the safety window via patient compliance and the set Plimit. Expiratory time and maximum respiratory rate are determined according to the expiratory time constant to prevent dynamic hyperinflation.

2. Optimize the tidal volume/respiratory frequency combination breath by breath based on lung mechanics.

ASV in active patients

In spontaneously breathing patients, ASV is a volume-targeted pressure support mode with automatic adjustment of pressure support to achieve the ASV target for the tidal volume.

The automatic decrease of pressure support, when the patients recover their inspiratory strength, is very useful for weaning. ASV can also be used to perform a weaning trial before extubation.

3. Achieve optimum tidal volume/ respiratory frequency by automatically adjusting mandatory rate and inspiratory pressure

5. Arnal JM, et. al. Intensive Care Med. 2008 Jan;34(1):75-81.

Ease of use

One mode for all

ASV can be used on adult and pediatric intubated patients, including postoperative, COPD, and ARDS patients[6,7,8,9]. It supports both active and passive patients, and automatically adjusts the level of support needed.

Provide patient-centered care with fewer resources

Studies have shown that ASV requires fewer manipulations and generates fewer alarms than conventional modes[6, 7, 10]. This may help to decrease the workload of the clinical staff[11].

6. Celli P, et. al. Transplant Proc. 2014 Sep;46(7):2272-8. | 7. Sulzer CF, Chioléro R, Chassot PG, Mueller XM, Revelly JP. Anesthesiology. 2001;95(6):1339-1345. | 8. Gruber PC, Gomersall CD, Leung P, et al. Anesthesiology. 2008;109(1):81-87. | 9. Kirakli C, Ozdemir I, Ucar ZZ, Cimen P, Kepil S, Ozkan SA. Eur Respir J. 2011;38(4):774-780 | 10. Petter AH, Chioléro RL, Cassina T, Chassot PG, Müller XM, Revelly JP. Anesth Analg. 2003;97(6):1743-1750. | 11. Kirakli C. et. al. Chest. 2015 Jun;147(6):1503-1509.

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What ASV does, for us as therapists, is it allows us to make sure that we are tailoring each breath to the patient's needs at that time.

Craig Jolly, RRT, Adult Clinical Education Coordinator
University Medical Center, Lubbock (TX), USA

Four steps - as simple as that

Step 1: Set patient height and sex

First you set the patient's height and sex. The ventilator will then calculate the patient's ideal body weight.

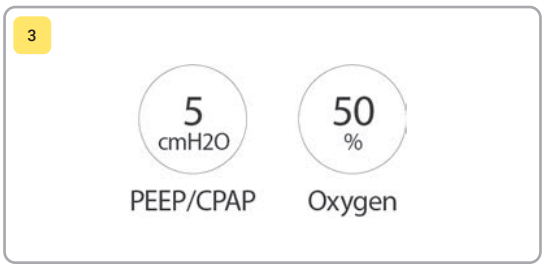
Step 2: Set the target minute volume

Determine the target minute volume based on the selected percentage of normal minute volume. ASV sets a default target minute volume of 100%.

This equals a normal minute ventilation of 100 ml per kg per minute in adults and up to 300 ml per kg per minute in children. Depending on patient conditions, a higher minute volume might be necessary to reach an appropriate CO2 level.

Step 3: Set oxygenation controls

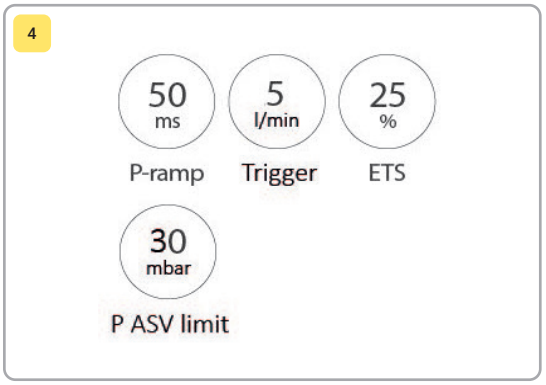
PEEP and Oxygen are set by the user to provide appropriate oxygenation for the patient.



Step 4: Set controls for synchronization and lung protection

Define the values for pressure ramp, trigger, expiratory trigger, and maximum pressure limit.

You can then start the ventilation.

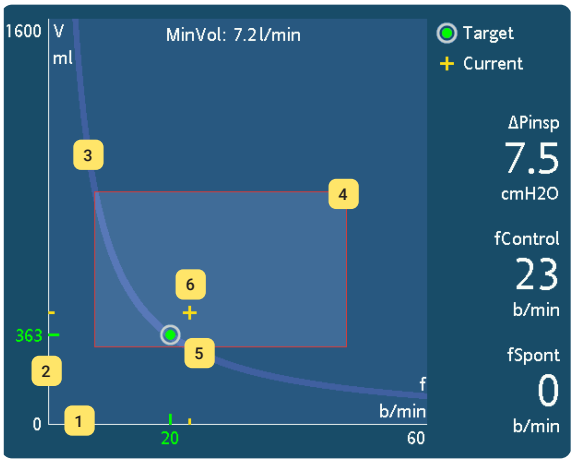


Lung-protective ventilation

Guiding the patient toward the target

ASV continuously adjusts the settings to keep the patient within the safety window (red square), and guides the patient's current values (yellow cross) to the target point (green circle), for both active and passive patients. When the patient's condition meets the target point, the patient is considered optimally ventilated according to ASV.

1. Horizontal axis for respiratory rate (f)
2. Vertical axis for tidal volume (Vt)
3. Minute volume curve
4. Safety frame defined by lung-protective rules
5. Target point
6. Current patient value



Applying lung-protective rules

This lung-protective strategy supports the patient's safety while maintaining an operator-preset, minimum minute ventilation that is independent from the patient's activity.

ASV delivers the set minute ventilation according to a lung-protective strategy:

- ✓ to avoid apnea
- ✓ to provide effective alveolar ventilation
- ✓ to minimize dynamic hyperinflation[12]
- ✓ to minimize plateau pressure and mechanical power[12, 13]

12. Iotti GA, Polito A, Belliato M, et al. Intensive Care Med. 2010;36:1371-9. | 13 Buiteman-Kruizinga LA, et. al. Crit Care Explor. 2021 Feb 15;3(2):e0335.

Assess readiness to wean

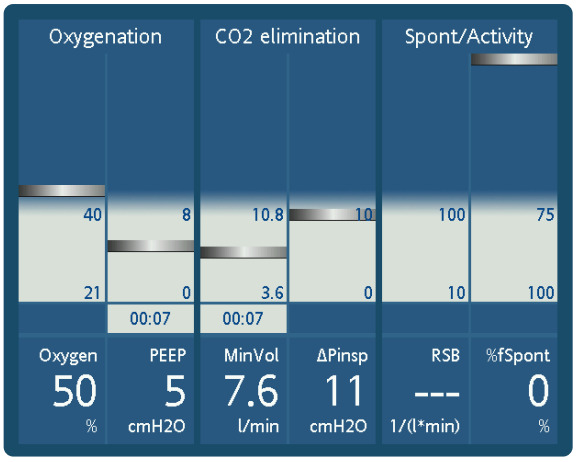
The Vent Status panel displays an overview of the patient's oxygenation, ventilation, and spontaneous activity, to help evaluate the patient's readiness to be weaned.

The six displayed parameters relate to the patient's ventilator dependence, including oxygenation, CO2 elimination, and patient activity.

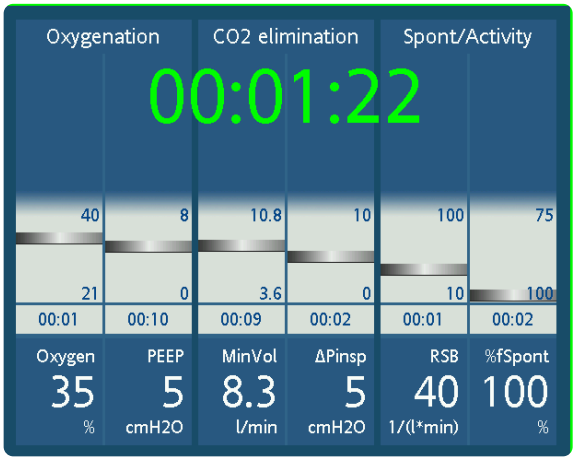
The floating indicators moving up and down within the columns show the value for the given parameters, and are updated breath by breath.

When all indicators have reached the light-blue weaning zone, a timer starts, showing how long the patient has been in the weaning zone. Spontaneous breathing trials should now be considered.

You can define the weaning zone ranges to adapt them to the weaning protocol of your institution.



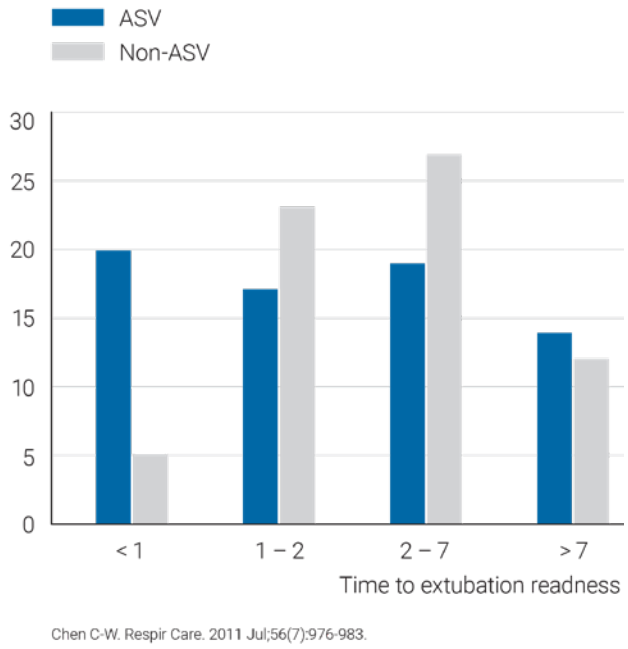
The floating indicators within the columns show the value for the given parameters – updated breath by breath.



When all indicators have reached the light blue weaning zone,spontaneous breathing trials should be considered.

A look at evidence

- In active patients ASV, with %MinVol set close to the satisfactory Minute Volume for the patient's respiratory center, is associated with major unloading of the respiratory muscles[14, 15].
- In the ICU, ASV decreases the weaning duration in patients recovering from acute respiratory failure[16] and COPD patients[11].
- In post-cardiac surgery, ASV allows earlier extubation than conventional modes[7, 8, 17] with fewer manual adjustments[10] and fewer ABG analyses performed[7].
- The driving pressure (ΔP) applied to the respiratory system in pediatric patients is lower using ASV 1.1 compared to APV-CMV[18].
- Compared with PCV, ASV decreases the mechanical power transferred from the ventilator to the respiratory system by lowering pressure and respiratory rate[13].



Chen C-W. Respir Care. 2011 Jul;56(7):976-983.

Patients in the medical intensive care unit could be extubated earlier following the introduction of ASV[16].

7. Sulzer CF, Chioléro R, Chassot PG, Mueller XM, Revelly JP. Anesthesiology. 2001;95(6):1339-1345. | 8. Gruber PC, Gomersall CD, Leung P, et al. Anesthesiology. 2008;109(1):81-87. | 10. Petter AH, Chioléro RL, Cassina T, Chassot PG, Müller XM, Revelly JP. Anesth Analg. 2003;97(6):1743-1750. | 11. Kirakli C. et. al. Chest. 2015 Jun;147(6):1503-1509. | 13 Buiteman-Kruizinga LA, et. al. Crit Care Explor. 2021 Feb 15;3(2):e0335. | 14. Tassaux D, et. al. Crit Care Med. 2002;30(4):801-807 | 15. Wu CP, Lin HI, Perng WC, et al. Respir Care. 2010;55(3):334-341 | 16. Chen CW, Wu CP, Dai YL, et al. Respir Care. 2011;56(7):976-983. | 17. Tam MKP, et. al. J Crit Care. 2016 Jun;33:163-8. | 18. Ceylan G, Topal S, Atakul G, et al. Pediatr Pulmonol. 2021;56(9):3035-3043.

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Most certainly there is a difference between the way I ventilate patients on the street and in the hospital. I do use ASV a lot because I find it gives me peace of mind. I just set up the ventilator from the projected needs of the patients.

Dr. João Alves, Emergency transport physician
National Institute of Emergency Medicine (INEM), Lisbon, Portugal

Increase of efficiency

Reduction of treatment costs

It has been shown that the use of ASV can reduce ventilation time[8, 19]. This makes the ventilator available for the next patient much earlier. A shorter ventilation time also reduces the risk of ventilator associated pneumonia (VAP), which may result in cost savings of up to 57,000 USD per case[20].

Efficient ventilator management

Patients’ lung mechanics change constantly during ventilation. Clinicians, however, do not always have the time to monitor and adjust settings for each patient, minute by minute. ASV helps by adapting to the changing conditions and needs of each patient[12], from intubation to extubation[5]. This reduces the workload of clinicians[21] and simultaneously supports a safe and efficient ventilation[22, 23].

5. Arnal JM, et. al. Intensive Care Med. 2008 Jan;34(1):75-81. | 8. Gruber PC, Gomersall CD, Leung P, et al. Anesthesiology. 2008;109(1):81-87. | 12. Iotti GA, Polito A, Belliato M, et al. Intensive Care Med. 2010;36:1371-9. | 19. Zhu Fang, et. al. Anesthesiology. 2015 Apr;122(4):832-40. | 20. Cocanour CS et. al. Surg Infect (Larchmt). 2005 Spring;6(1):65-72. | 21. Moradian ST, et. al. Anesth Pain Med. 2017 Apr 22;7(3):e44619. | 22. Sviri S. et. al. SAJCC August 2012, Vol. 28, No. 1 | 23. 5. Cassina T, et. al. J Cardiothorac Vasc Anesth. 2003 Oct;17(5):571-5.

More information and free software simulations::
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