ASV® and INTELLiVENT®-ASV

FAQs and troubleshooting

HAMILTON MEDICAL

Content overview

Frequently asked questions (FAQs)

Ventilation settings 4
Safety window 13
Quick Wean 14

Troubleshooting

Sensor-related issues 21
Ventilation settings 24

How to determine which specific condition to select?[1]

Comments: INTELLiVENT-ASV changes target ranges and initial settings depending on the set specific condition to make sure the ventilation settings are appropriate for the patient.

Answer:

- ✓ ARDS: PaO2/FiO2 (P/F ratio) ≤ 200
- ✓ Chronic hypercapnia: PaCO2 ≥ 50 mmHg in past medical history
- ✓ Brain injury: indication for strict control of PaCO2
- ✓ None: other cases

1. On some ventilators, the ARDS/Chronic hypercapnia/Brain injury conditions are listed under the heading ***Specific conditions;*** on other ventilators, the heading is ***Patient conditions***.

What to consider during a bronchoscopy?

Comments: CAUTION! Ventilation measurements and calculation of respiratory mechanics (RCexp) can be affected during bronchoscopy.

Answer:

- ✓ Change to PCV+ mode during bronchoscopy, decrease the sensitivity of the trigger, and then return to INTELLiVENT-ASV afterward.

How to set %MinVol in ASV in passive patients?

Comments:

100% of %MinVol = 100 ml/kg/min (adult patient) is normal %MinVol (all of the following conditions fulfilled):

- ✓ Normocapnia
- ✓ At rest
- ✓ Normal metabolism
- ✓ Normal body temperature
- ✓ Normal lung function

Answer:

- ✓ If the PaCO2 is higher or arterial pH is lower than your target, increase %MinVol.
- ✓ If the PaCO2 is lower or arterial pH is higher than your target, decrease %MinVol.

Any lung disease would require %MinVol higher than 100% for normocapnia (due to increased physiologic dead space) and CO2 production.

Why is the %MinVol limited to 200% in INTELLiVENT-ASV although I think it should be higher?

Answer:

- ✓ Check whether the patient really needs a %MinVol higher than 200% and whether this minute volume would be safe.
- ✓ Check that the patient height and sex settings are correct.
- ✓ If the patient is active, also check whether they are adequately sedated.
- ✓ If a higher %MinVol is really needed, set the %MinVol controller to manual; you can then increase %MinVol up to 350%.

The PaCO2 of my patient on INTELLiVENT-ASV is too high, or too low

Comments:

- ✓ The difference between PaCO2 and PetCO2 (referred as the CO2 gradient) may be large in lung disease, but fortunately when PaCO2 increases or decreases, PetCO2 changes in the same direction.
- ✓ INTELLiVENT-ASV automatically adjusts the %MinVol on the basis of PetCO2, used as a surrogate of PaCO2.
- ✓ The PetCO2 target range is automatically adjusted based on the peak pressure (automatic permissive hypercapnia), except if the patient condition is Brain injury.
- ✓ The PetCO2 target range automatically proposed by INTELLiVENT-ASV can be adjusted by a manual control, the Target Shift.

Answer:

- ✓ If the desired PaCO2 is significantly lower than the current value, apply a proportional shift of the PetCO2 target range to the left, towards a lower level.
- ✓ If the desired PaCO2 is significantly higher than the current value, apply a proportional shift of the PetCO2 target range to the right, towards a higher level.

The PaCO2 of my patient on INTELLiVENT-ASV is too high, or too low

The PetCO2 target can be shifted significantly (±20 mmHg – 2.6 kPa) to permit, if indicated:

- ✓ The manual setting of a CO2 target considerably different from the normal value
- ✓ The manual compensation for large CO2 gradients

When the PetCO2 target is manually shifted to the left, it is possible that the desired drop in PaCO2 is not completely reached, due to safety limitations involving permissive hypercapnia. Before attempting a further shift to the left, carefully consider which PaCO2 level you would accept in this difficult-to-ventilate condition.

When the PetCO2 target is manually shifted to the right, it is possible that the desired increase in PaCO2 is not completely reached, due the safety limitations of minimum %MinVol equal to 70%. If a lower %MinVol is really needed, set the %MinVol controller to manual; you can then decrease %MinVol to below 70%.

How to set the initial PetCO2 target range?

Comments: The default PetCO2 target range settings are appropriate for most cases. It is important, however, to always review the settings. Reasons for changing the target range include:

- ✓ The range is not suitable for a particular patient.
- ✓ There is a large CO2 gradient.

For details, see the *INTELLiVENT-ASV Operator's Manual* for your ventilator.

Answer:

- ✓ Select one or more specific conditions only if the patient has a condition; if you are unsure, do NOT select any of the options.
- ✓ Use the default PetCO2 target range to start with.
- ✓ Perform a blood gas analysis (BGA) after 30 minutes, or earlier if clinically indicated.
- ✓ If necessary, shift the PetCO2 target range using the BGA values as a guide[2].

On this page, the terms *target range* and *target shift* refer primarily to the PetCO2 target range and the associated Target Shift control.[3]

2. Use the Target Shift control to adjust the target ranges. For details, see the *INTELLiVENT-ASV Operator's Manual* for your ventilator.
3. While not discussed very much here, you can also move (shift) the target range for SpO2 to the left and to the right.

How does ASV ventilate in spontaneously breathing patients?

Comments: ASV applies the principle of adapting pressure support for maintaining the patient's Vt at the Vt target.
The target minute ventilation is the minimum guaranteed by ASV, but the actual minute ventilation is determined by the patient.

- ✓ Pressure support is set by ASV to achieve the ASV target for Vt, while the patient is free to increase the respiratory rate above the target rate.
- ✓ ASV decreases the pressure support to a minimum of 5 cmH2O. When this level is reached, the patient's Vt may be higher than Vt target, but never lower.

Answer:

Minute volume	Vt	P_{INSP}	RR	I/E
ASV + patient	ASV + patient	ASV	Patient	Patient

How does INTELLiVENT-ASV ventilate in spontaneously breathing patients?

Comments: After five consecutive patient-triggered breaths with PetCO2 below the upper PetCO2 limit, the automatic adjustment of %MinVol also starts to take into account the patient's spontaneous RR.
When Brain injury is selected, the automatic adjustment of %MinVol is always based only on PetCO2.

Answer: In spontaneously breathing patients, the automatic adjustment of the %MinVol control depends on combined information from PetCO2 and the spontaneous RR.
If PetCO2 is below the upper limit (i.e., the patient is doing well), the adjustment of %MinVol depends on the spontaneous RR. If RR is too high, %MinVol and consequently pressure support are increased. Conversely if RR is low, %MinVol and consequently pressure support are decreased. Should PetCO2 exceed the upper limit, the %MinVol adjustment will again be based only on PetCO2.

How to ventilate a patient with high drive in ASV?

Comments:

Case 1: High need for support from the patient, frequently due to one or more of the following conditions:

- ✓ High O2 consumption and CO2 production, deteriorated lung function for gas exchange, metabolic acidosis

Case 2: Dysregulation of the respiratory center.

Answer:

Case 1: High drive can be controlled by combined interventions to lower the work of breathing and therefore oxygen consumption and CO2 production:

- ✓ Increase in ventilatory support by increasing %MinVol
- ✓ Increased sedation and control of high temperature
- ✓ In the special case of metabolic acidosis, it is also necessary to manage the underlying metabolic derangement

Case 2: Sedation alone or sedation with paralysis can control high drive due to central dysregulation.

How does INTELLiVENT-ASV ventilate a patient with high drive?

Comments:

Case 1: High need for support from the patient, frequently due to one or more of the following conditions:

- ✓ High O2 consumption and CO2 production, deteriorated lung function for gas exchange, metabolic acidosis

Case 2: Dysregulation of the respiratory center

Answer:

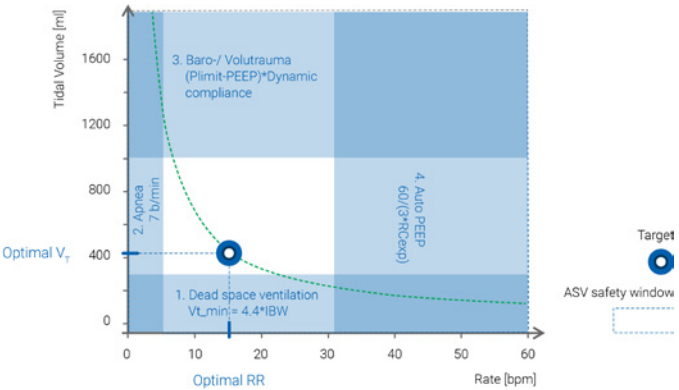
Case 1: High drive can be controlled by combined interventions to lower the WOB and therefore oxygen consumption and CO2 production:

- ✓ Increased sedation and control of high temperature
- ✓ In the special case of metabolic acidosis, it is also necessary to manage the underlying metabolic derangement
- ✓ Normally INTELLiVENT-ASV automatically reacts by increasing the %MinVol control and therefore pressure support, thus helping to lower the high drive. If you consider the reaction of INTELLiVENT-ASV to be insufficient, you can switch to manual control of %MinVol and increase the setting

Case 2: Sedation alone or sedation with paralysis can control high drive due to central dysregulation

How does the shape of the ASV safety window change according to the patient's lung condition?

Comments: The shape of the safety window changes based on the patient's lung mechanics. The calculations are as follows:



Answer:

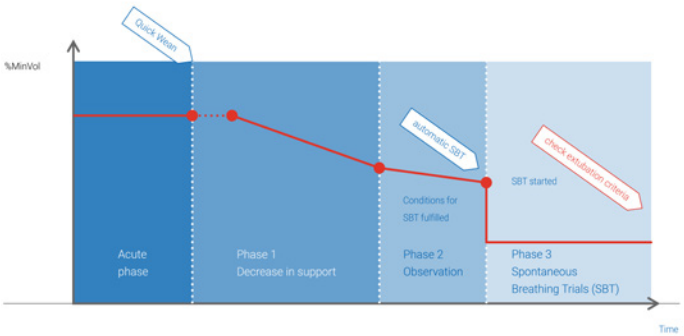
Normal lungs: large square-shaped safety window

Restrictive lung diseases: wide, low rectangular-shaped safety window

Obstructive lung diseases: tall, narrow rectangular-shaped safety window

What happens when Quick Wean is activated?

Comments:



The following actions aid the de-escalation of ventilatory support:

- ✓ The target PetCO2 is increased by 5 mmHg (0.6 kPa).
- ✓ The lower and upper target RR are increased.
- ✓ If the patient's condition is considered stable, %MinVol and therefore pressure support are gradually decreased.
- ✓ The readiness-to-wean criteria are screened.

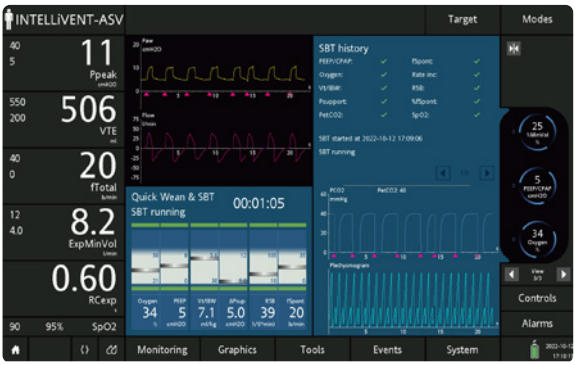
Quick Wean is not available when Brain injury is selected.

When can/should activation of automated spontaneous breathing trials (SBTs) be considered?

Comments: Enable SBTs only to evaluate the patient for separation from the ventilator.

Answer: Consider SBTs when “non-respiratory” readiness-to-wean criteria are met:

- ✓ Patient is awake.
- ✓ Cough reflex is present.
- ✓ Hemodynamics are stable.
- ✓ Minimal vasopressor support is required.



Why do SBTs not start?

Comments: Possible causes:

- ✓ The patient is passive.
- ✓ %MinVol is set to Manual.
- ✓ Quick Wean and Automatic SBT are disabled.
- ✓ The criteria for starting SBTs are not met; the patient's dependency on the ventilator is too high to start an SBT.

Answer:

- ✓ Make sure the patient is breathing spontaneously and meets the criteria before enabling Quick Wean.
- ✓ Make sure Quick Wean and Automatic SBT are enabled.
- ✓ Check if %MinVol is set to Automatic.
- ✓ Reassess the patient for severity of respiratory failure and sedation.

When can/should enabling of Quick Wean (without automated SBTs) be considered?

Comments: Quick Wean (without automated SBTs) can be enabled even if the patient is still on low levels of sedation and/or low doses of vasopressors.

Answer: Consider enabling Quick Wean without automated SBTs when all of the following criteria are met:

- ✓ Sedation is stopped or decreased to "comfort sedation".
- ✓ Hemodynamic condition is stable.
- ✓ Oxygenation is adequate.
- ✓ Patient is quiet and spontaneously breathing, and you have the clinical impression that they could do more.

How often can/should performing SBTs be considered?

Comments:

First SBT was successful

Assess patient readiness for extubation, and continue with NIV, CPAP or high flow nasal cannula therapy, if necessary.

First SBT failed

- ✓ Identify the causes of the failure and the reasons why the patient still needs ventilatory support. Correct if possible.
- ✓ Try a second SBT after the causes of failure have been corrected, as long as the patient still meets the general weaning criteria.

Answer: If your organization's weaning protocol does not indicate otherwise, it is recommended not to do more than one SBT within a 24-hour period.[4,5]

4. Esteban, A. N Engl J Med. 1995 Feb 9;332(6):345-50.
5. MacIntyre, N. Chest. 2001 Dec;120(6 Suppl):375S-95S.

How to limit the number of automated SBTs performed per day?

Comments:

- ✓ SBT can be manually started by touching Start SBT, provided that the patient is spontaneously breathing.
- ✓ Touch Stop SBT to stop an ongoing SBT.

Answer: When Quick Wean is enabled:

- ✓ You can disable automated SBTs and start an SBT manually, provided that the patient is spontaneously breathing.
- ✓ You can specify when automated SBTs can take place, by setting the After and Before times for the SBT time-range parameter.

To perform a single automated SBT:

HAMILTON-G5/S1

Set Time between two SBTs to --- (OFF)

- ✓ Only one SBT will be performed.

Set Time between two SBTs to 24 hours

- ✓ Only one SBT per day will be performed.

HAMILTON-C3/C6

Set Time between two SBTs to (30–240 min)

- ✓ If only one SBT is planned, deactivate automated SBTs after the first SBT is completed.

Can Quick Wean be enabled for difficult-to-wean patients?

Answer: Yes. For these patients, proceed as follows:

- ✓ Enable Quick Wean.
- ✓ Closely monitor the patient's breathing efforts and signs of fatigue.
- ✓ If you judge that the ventilatory support provided to your patient is not sufficient, disable Quick Wean to return to normal INTELLiVENT-ASV operation.

Poor-quality SpO2 signal with frequent alarms

Oxygenation adjustment OFF (no SpO2)

Possible causes:

- ✓ Patient has low perfusion.
- ✓ NIBP cuff is on the same arm as the sensor.
- ✓ Sensor is incorrectly positioned.

Solutions:

- ✓ Try a different finger and change the position every 4 hours (reusable) or every 8 hours (single use).[6]
- ✓ Try an ear sensor.
- ✓ Temporarily set Oxygen and PEEP to Manual.[7] Try setting them to Automatic again once distal perfusion has improved.

6. Times according to the manufacturer's recommendation (Masimo and Nihon Kohden).
7. Setting a control to Manual can also be referred to as deactivating a controller; setting a control to Automatic can be referred to as activating a controller.

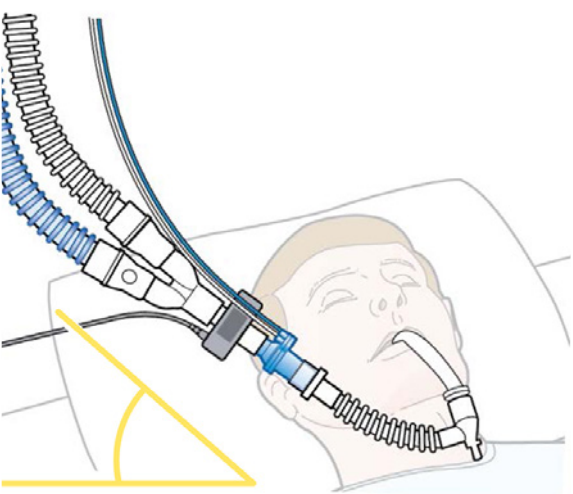
Poor-quality PetCO2 signal with frequent alarms

Ventilation adjustment OFF (no PetCO2)

Possible causes: Condensation or secretions may be present in the CO2 airway adapter.

Solutions: Check the CO2 sensor:

- ✓ If there is moisture in the adapter and the sensor is not properly positioned, correct the position (the circuit must be angled upwards, the adapter windows must be vertical).
- ✓ If there are secretions in the adapter, replace it and recalibrate the sensor offline.



The monitor for vital signs shows a different SpO2 result than the ventilator

Possible causes:

- ✓ Manufacturers use different algorithms to measure SpO2.
- ✓ The sensors are placed too close to each other, causing signal interference.

Solutions:

If using multiple sensors, ensure there is at least one finger without an SpO2 sensor between the sensors.

In doubt, perform a blood gas analysis (BGA) with SaO2 measurement. Consider that:

- ✓ On average SpO2 is an overestimation of SaO2, with minimal bias and good precision if SaO2 is > 90% and a poorer match in the case of lower SaO2 values.
- ✓ With abnormal levels of COHb or MetHb, the match between SpO2 and SaO2 is lost and conventional pulse oximetry is to be considered unreliable.

Whenever you consider the SpO2 provided by the ventilator to be unreliable, set Oxygen and PEEP to Manual.

INTELLiVENT-ASV repeatedly applies high levels of FiO2 for short periods of time

Possible causes:

- ✓ Deterioration of the patient's condition
- ✓ Low SpO2 sensor signal resulting in an inaccurate SpO2 measurement
- ✓ Other factors causing a sudden drop in SpO2 (disconnection, suctioning, patient positioning, and so on)
- ✓ PEEP is at high limit

Solutions:

- ✓ Check the patient's condition.
- ✓ Check the SpO2 signal quality and change the sensor positioning or use an ear sensor, if necessary.
- ✓ Increase the high PEEP limit, if clinically indicated.
- ✓ Set the Oxygen control to Manual, if the above is not desired.

SpO2 does not match with SaO2 measured by CO-oximetry on a blood sample

Possible causes[8]:

- ✓ Poor perfusion
- ✓ Motion
- ✓ Skin pigmentation
- ✓ Nail polish
- ✓ Vascular dyes (for example, methylene blue)
- ✓ Severe anemia
- ✓ Abnormal levels of dyshemoglobins like Carboxyhemoglobin, Methemoglobin, Sulphemoglobin

Solutions:

- ✓ Assess the patient, verify proper sensor placement, take action to improve the signal quality.
- ✓ In the presence of abnormal levels of dyshemoglobins and in any case if the difference between SpO2 and SaO2 is > 4%, set Oxygen and PEEP to Manual.

8. Jubran A. *Pulse oximetry.* Crit Care. 2015 Jul 16;19(1):272. doi: 10.1186/s13054-015-0984-8. PMID: 26179876; PMCID: PMC4504215.

RR is too high and %MinVol is at 200%

Possible causes:

- ✓ Inappropriate setting of height resulting in an inappropriate IBW/PBW calculation
- ✓ High respiratory drive (tachypnea) due to non-respiratory causes such as metabolic acidosis, pain, anxiety, and so on

Solutions:

- ✓ Ensure the patient's height is correctly set.
- ✓ If the tachypnea is not related to a respiratory issue, it will not respond to an increase in %MinVol. Treat non-respiratory causes for tachypnea.

PEEP does not decrease

Possible causes:

- ✓ PEEP decreases only if SpO2 is above the target range.
- ✓ Oxygenation has not yet improved sufficiently.
- ✓ The SpO2 target has been shifted to supra-normal values.
- ✓ PEEP is at the lower PEEP limit.

Solutions:

- ✓ Check the SpO2 target range, and adjust, if appropriate.[2]
- ✓ Decrease the lower PEEP limit.
- ✓ Decrease PEEP manually, if clinically indicated.

2. Use the Target Shift control to adjust the target ranges. For details, see the *INTELLiVENT-ASV Operator's Manual* for your ventilator.

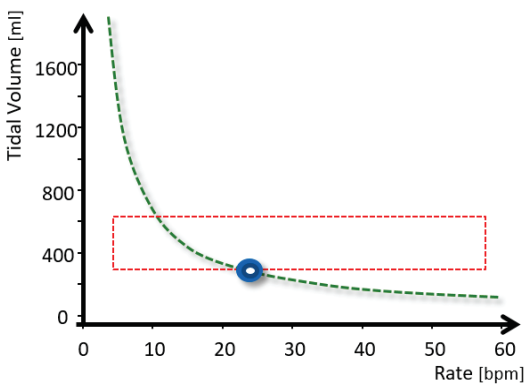
Vt is very low and RR is very high

Possible causes:

- ✓ The minimum Vt is 4.4 ml/kg IBW/PBW for patients with severe restrictive lung disease.
- ✓ Plimit[9] might be too low.
- ✓ RCexp is very short.

Solutions:

- ✓ Check Pplat.
- ✓ Check Plimit and increase it, if appropriate.
- ✓ Check for the cause of such a severe restrictive state and correct if possible.



9. Depending on your ventilator, this parameter is named Plimit or Pasvlimit.

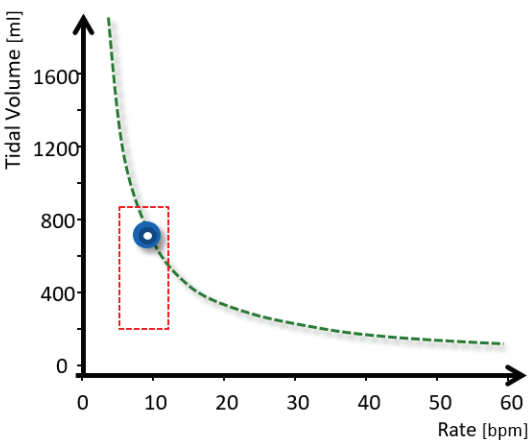
Vt is high and RR is very low

Possible causes:

- ✓ Severe airway obstruction with very long RCexp
- ✓ INTELLiVENT-ASV adapts RR to counteract air-trapping and autoPEEP

Solutions:

- ✓ Reconsider the diagnosis.
- ✓ Check the ET tube: Verify the size and ensure the positioning is correct with no kinking or biting, and that no secretions are accumulated.
- ✓ If secretions are present, perform suctioning.



More information:

www.hamilton-medical.com/intellivent-asv

Manufacturer:

Hamilton Medical AG

Via Crusch 8, 7402 Bonaduz, Switzerland

+41 (0)58 610 10 20

info@hamilton-medical.com

www.hamilton-medical.com

ELO20220910N.00