WEINMANN
medical technology

MEDUVENT Standard

Step-by-step instructions for devices from software version 3.x

1. Initiate ventilation based on height

Start up quickly and ventilate accurately

From now on, you no longer need to spend time considering which tidal volume (Vt) and which respiratory rate (Freq.) is best suited to your patient. With MEDUVENT Standard, you can now initiate ventilation even more accurately and quickly. When you enter the patient's height and sex, your ventilator automatically calculates all the ventilation parameters via ideal body weight (IBW). IBW is an important indicator for setting ventilation parameters[1]. MEDUVENT Standard allows you to initiate ventilation more quickly and much more accurately, leaving you more time to deal with all your other key tasks.

⚠ WARNING

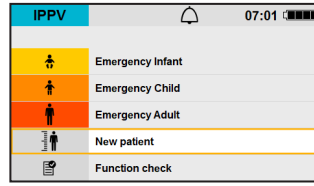
Risk of injury resulting from incorrectly set restriction of maximum airway pressure! An excessively high airway pressure may expose the patient to serious or life-threatening injury.

⇒ Always set the pressure limit pMax to suit the current patient and the current therapy.

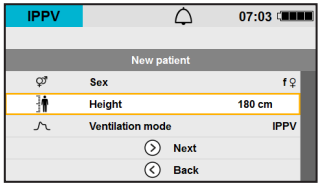
[1] Gajic, O. et al. Ventilator-associated lung injury in patients without acute lung injury at the onset of mechanical ventilation. Critical Care Medicine, 2004, No. 32, p. 1817-1824.

2. Operating steps

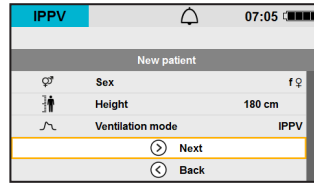
1. Switch on ventilator.



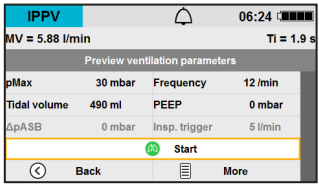
2. Select “New patient”.



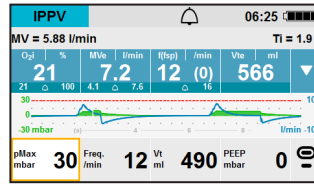
3. Set patient’s sex and height and select ventilation mode.



4. Confirm with “Next”.



5. The device shows a preview of the ventilation parameters calculated. If necessary: Adjust ventilation parameters. Select “Start”.



6. The device shows current ventilation parameters.

Use presets and work within guidelines

In the Start menu, you can set the patient's height under the "New patient" menu item. This section explains how the tidal volume for the patient is calculated from height and the setting "Vt per kg body weight" in the operator menu.

Ideal body weight (IBW) in kg is calculated from stated height in cm (x) as shown below:

- Child[1] (height ≤ 154 cm):

$$\text{IBW child} = 2.05\ \text{kg} \bullet \exp\left(\frac{x}{50\ \text{cm}}\right)$$

- Adult[2] (height > 154 cm):

$$\text{IBW (female)} = 45\ \text{kg} + 2.3\ \text{kg} \bullet \left(\frac{x}{2.54\ \text{cm}} - 60\right)$$

$$\text{IBW (male)} = 50\ \text{kg} + 2.3\ \text{kg} \bullet \left(\frac{x}{2.54\ \text{cm}} - 60\right)$$

The tidal volume for the patient is calculated and set automatically with the aid of ideal body weight and the setting "Vt per kg body weight" in ml/kg in the operator menu.

Vt = IBW • Vt per kg body weight

Example

- Patient, male, height 185 cm
- Setting for "Vt per kg body weight" = 7 ml/kg

$$\text{IBW (male)} = 50\ \text{kg} + 2.3\ \text{kg} \bullet \left(\frac{185\ \text{cm}}{2.54\ \text{cm}} - 60\right) = 79.52\ \text{kg}$$

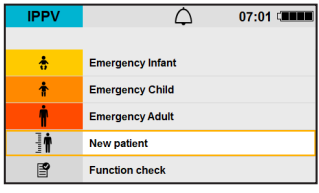
$$\text{Vt} = 79.52\ \text{kg} \bullet 7\ \frac{\text{ml}}{\text{kg}} = 557\ \text{ml} \approx 560\ \text{ml}$$

[1] Source: TRAUB, S.L.; JOHNSON, C.E.: Comparison of methods of estimating creatinine clearance in children. In: American Journal of Hospital Pharmacy 37, 1980, No. 2, p. 195–201.

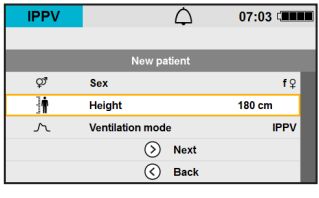
[2] Source: DEVINE, Ben J. Gentamicin therapy. The Annals of Pharmacotherapy, 1974, 8th year No. 11, p. 650-655

3. NIV therapy

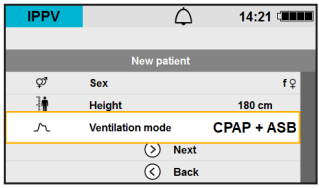
1. Switch on ventilator.



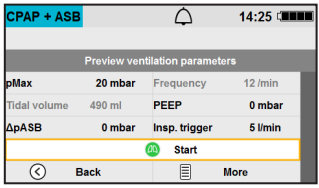
2. Select “New patient”.



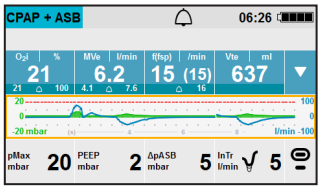
3. Set patient’s sex and height.



4. Select “CPAP” or “CPAP + ASB ” ventilation mode and confirm with “Next”.



5. Set desired PEEP and, if available, ΔpASB and select “Start”. The device starts ventilation.



6. The parameters can be adapted during ventilation with the aid of the navigation knob.
If necessary: Switch to a controlled ventilation mode via the menu button.

4. SOP

Non-invasive ventilation (NIV) in acute respiratory insufficiency (ARI)

Modified in accordance with the AGNN's 2022 treatment recommendations for emergency medicine (AGNN = Arbeitsgemeinschaft in Norddeutschland tätiger Notärzte e.V. - Working group of emergency physicians working in North Germany)

Indications

- Hypoxemic ARI with respiratory rate > 25/min (count!) and SpO_2 < 90 % despite O_2 administration; e.g., cardiac pulmonary edema.
- Hypercapnic ARI = clinical respiratory insufficiency with high respiratory rate/low tidal volume; e.g., acute exacerbated COPD (aeCOPD), bronchial asthma.

Contraindications

- Absolute: No spontaneous breathing, gasping, blocked airways, gastrointestinal hemorrhage or ileus, non-hypercapnic coma.
- Relative: Hypercapnic coma, severe hypoxemic agitation, pronounced secretion, hemodynamic instability with shock, mask leakage.

Procedure

- Ensure the logistical prerequisite: Check oxygen supply: At least one 2-l cylinder; full. Check and set ventilator.
- Monitor respiratory rate (count!), SpO_2, ECG and $etCO_2$ as soon as NIV initiates.
- Commence NIV with patient semi-seated or seated.
- Slowly adapt face mask to the patient; the patient can hold the mask initially, if appropriate. The key objective in the adaptation phase is to synchronize ventilator and patient.
- In highly agitated patients, mild sedation may be helpful and necessary. Benzodiazepines, opiates or even propofol in subanesthetic doses are suitable for this.
- Consider the fact that incorrect device settings can provoke further restlessness, particularly in patients with hypercapnic ARI.

Set ventilation mode in hypoxemic ARI

Mode: ..... CPAP + ASB (without pressure support)
Initial PEEP: ..... 5 mbar
Initial FiO_2: ..... 100 %
Target: ..... SpO_2 > 94 % (in COPD 88-92 %)

In case of elevated rise in SpO_2, reduce FiO_2 accordingly

In case of inadequate rise in SpO_2, increase PEEP:..... 7-10 mbar

In case of inadequate tidal volume (< 6 ml/kg):
Pressure support: ..... 5 mbar (increase incrementally, if appropriate)
Inspiratory trigger: ..... as low as possible

Set ventilation mode in hypercapnic ARI

Mode: ..... CPAP + ASB
Initial PEEP: ..... 5 mbar
Initial pressure support: ..... 5 mbar
Inspiratory trigger: ..... as low as possible
Expiratory trigger: ..... 50-70 %
Initial FiO_2: ..... 40 %
Aim: ..... SpO_2 88-92 %

In case of SpO_2 above the target range, reduce FiO_2 accordingly.

In case of inadequate tidal volume (< 6 ml/kg)
Pressure support: ..... increase incrementally (up to max. 20 mbar)
In pronounced respiratory insufficiency: ... if appropriate, switch to BiLevel ventilation

Success criteria

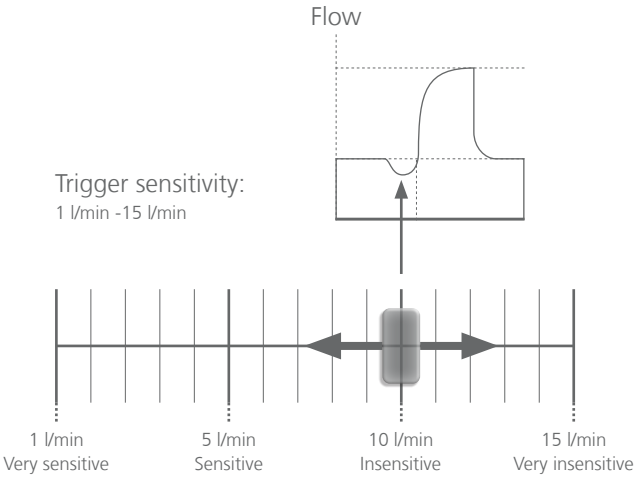
Reduced dyspnea, respiratory rate, and heart rate, increased SpO_2, improved vigilance, ideally reduced $etCO_2$.

Important note

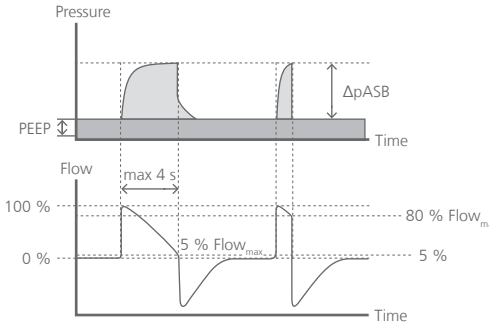
- Keep patient under close clinical observation, stop if condition deteriorates
- Do not delay pharmacological/interventional therapy
- Be ready to intubate at all times when using NIV, above all in the case of relative contraindications
- Provide advance information to the admitting hospital in good time

5. Inspiratory trigger

The inspiratory trigger initiates pressure support or a mechanical breath as soon as the patient's efforts to inhale are detected. The patient's efforts to inhale are detected by a flow trigger that triggers as soon as it determines a flow at the set level in the direction of the patient.
Please note: If the inspiratory trigger is set too low, automatic triggering may result. In this case, increase the inspiratory trigger accordingly.



6. Pressure support and expiratory trigger



Pressure support ΔpASB

Pressure support is always indicated as a value in addition to PEEP. A patient receives this additionally to the set PEEP as soon as the inspiratory trigger is detected.

Calculation example:
PEEP = 5 mbar, ΔpASB = 10 mbar → inspiratory pressure during the inspiratory phase = 15 mbar

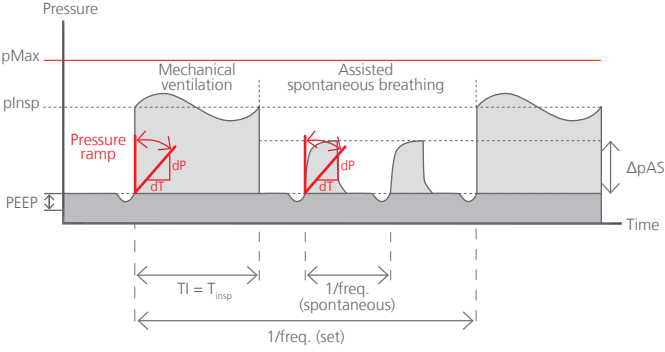
Expiratory trigger

The expiratory trigger initiates expiration as soon as the flow in the direction of the patient amounts to only the set value (in %) in relation to maximum flow. The expiratory trigger is used to set the length of pressure support.
Trigger sensitivity: 5 % - 80 % of maximum flow.
The basic rule: The lower the % value, the longer pressure support lasts.

Pressure ramp (pressure rise time)

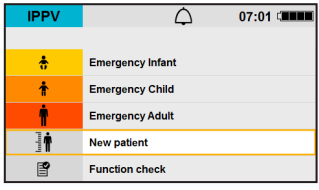
A pressure ramp (or pressure rise time) defines the time within which the pressure increases from PEEP to inspiratory pressure. This pressure rise time can be set by the shape of the ramp: flat, medium, and steep

Pressure ramps using the example of a BiLevel + ASB curve



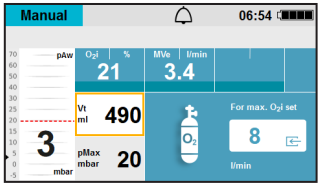
7. Resuscitation with manual mode

1. Switch on ventilator.



2. Select patient group and switch to "Manual" mode. Alternatively, select "New patient", set the patient's sex and height and select "Manual" mode.

Note: It is possible to switch to "Manual" ventilation mode from any ventilation mode at any time.

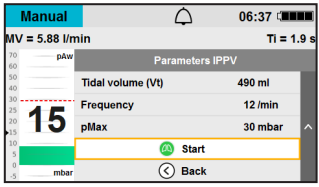


3. Check ventilation parameters. Press the mask over the patient's mouth and nose using the "double C grip". Keep the button on the MEDUtrigger depressed until two mechanical breaths have been administered.
In order to achieve maximum possible oxygen concentration, set the displayed "For max. O_2i set" value in l/min on the oxygen supply.

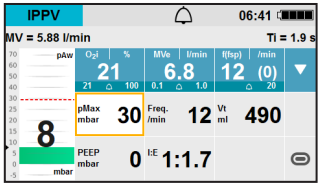
⚠ WARNING

Therapy disrupted by excessively high flow! If the flow exceeds the maximum permitted value of 15 l/min, the pressure relief valve may unintentionally open during inspiration and place the therapy at risk.

This may injure the patient.
⇒ Feed in oxygen only at a maximum flow of 15 l/min.



4. Once the airway has been secured, switch to IPPV ventilation via the menu button and “Ventilation mode”.



5. Ventilate continuously in “IPPV” mode. The device shows the parameters for IPPV ventilation.
Info: If the set pMax is reached during CPR, MEDUVENT Standard restricts inspiratory pressure.

8. Further resuscitation measures

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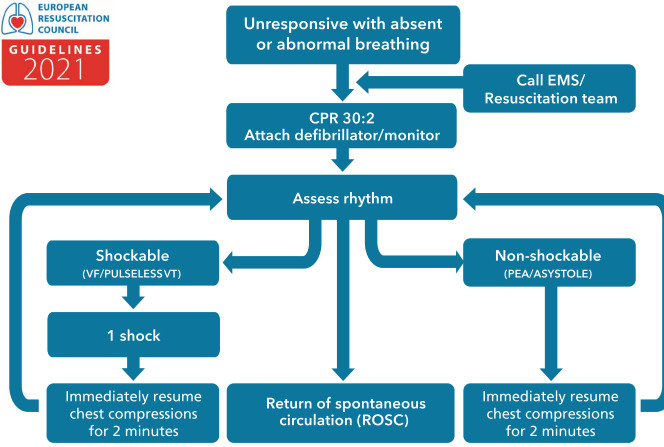

Give high-quality chest compressions and

- Give oxygen
- Use waveform capnography
- Continuous compressions if advanced airway
- Minimize interruptions to compressions
- Intravenous or intraosseous access
- Give adrenaline every 3-5 min
- Give amiodarone after 3 shocks
- Identify and treat reversible causes

Identify and treat reversible causes

- Hypoxia
- Hypovolaemia
- Hypo-/hyperkalemia/ metabolic
- Hypo-/hyperthermia
- Thrombosis - coronary or pulmonary
- Tension pneumothorax
- Tamponade-cardiac
- Toxins

Consider ultrasound imaging to identify reversible causes

Consider

- Coronary angiography/percutaneous coronary
- Mechanical chest compressions to facilitate transfer/ treatment
- Extracorporeal CPR

After ROSC

- Use an ABCDE approach
- Aim for SpO_2 of 94-98%
- 12-lead ECG
- Identify and treat cause
- Targeted temperature management


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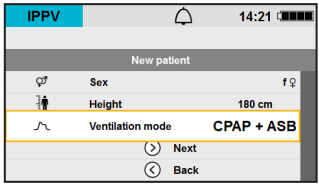
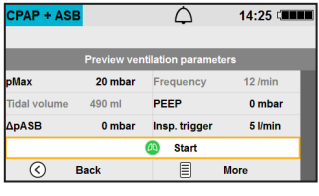
9. Anesthesia induction (RSI)

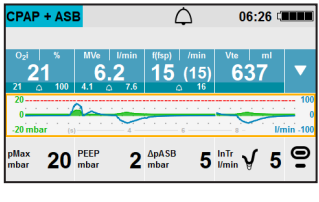
1. Switch on ventilator.



2. Set the patient's sex and height and select "CPAP" or "CPAP + ASB" ventilation mode for pre-oxygenation. Confirm with "Next".

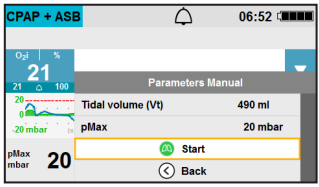


3. Select a low PEEP for pre-oxygenating a spontaneously-breathing patient; if possible, use of pressure support (ΔpASB) should be considered.

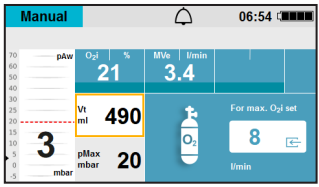


4. Pre-oxygenate at a low PEEP and, if appropriate, with adapted ΔpASB and set the flow rate on the oxygen supply.

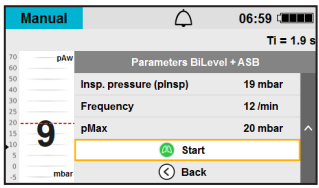
Note: If you want an oxygen concentration of 100 %, use the administered minute volume as a guide.



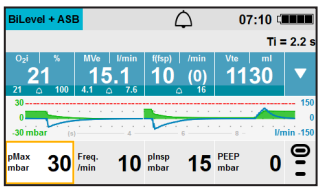
5. Following successful pre-oxygenation, switch to “Manual” mode.



6. Auscultate tube position by getting MEDUtrigger to trigger manual mechanical breaths. In an emergency, perform mask ventilation using MEDUtrigger.



7. Once the airway has been secured successfully, perform continuous mandatory ventilation. The ventilation parameters from Item 2 set at the beginning are adopted automatically.



8. Ventilate continuously in “IPPV” or “BiLevel + ASB” mode. The device shows controlled ventilation parameters.

10. Excerpt from the S1 guideline

"Prehospital Emergency Anesthesia in Adults" of the German Society for Anesthesiology and Intensive Care Medicine (DGAI)

Indications for prehospital emergency anesthesia

- Acute respiratory insufficiency (hypoxia and/or respiratory rate* < 6 or > 29/min) and non-invasive ventilation (NIV) is contraindicated or has failed
- Loss of consciousness/neurological deficit with risk of aspiration
- Multiple trauma/severe trauma with
  i) hemodynamic instability, systolic BP < 90 mmHg or
  ii) hypoxia with SpO_2 < 90 % despite = 2 l/min O_2 administration or
  iii) traumatic brain injury with GCS < 9

* in the presence of causes that cannot be rapidly reversed

Indication: factors relating to patient, session, and user, experience of the emergency medical team, situation at the scene, transport times, air and ground rescue

Communication in the team: Site of anesthesia induction, clear allocation of tasks, selection of medicines, other important notes and agreements

Optimal positioning: "Light, space, warmth" concept, ideal for upper body elevation in the ambulance (caution: not with spinal immobilization or hemodynamically unstable patients), head in "sniffing" position

Pre-oxygenation:
For a spontaneously breathing patient, at least 3-4 min
O_2 insufflation at 12-15 l/min
via a face mask with reservoir or demand valve, if applicable, NIV or mask ventilation

parallel

Standardized preparation:
Anesthesia and emergency medications, respiratory alternatives, suction, capnography

Monitoring: Pulse oximetry, ECG, blood pressure, capnography

Two peripheral venous accesses: In case of difficult puncture conditions, consider intra-osseous puncture in a time-critical manner

Rapid Sequence Induction (RSI)

Continuous monitoring: Anesthesia management and monitoring

If required
Management of complications

Rapid Sequence Induction (RSI)

- If applicable, remove the cervical spine immobilization and begin manual in-line stabilization
- Announce the anesthesia medication with active substance and dosage, administer step-by-step
- Wait for loss of consciousness and for relaxants to take effect
- Airway management without intermediate ventilation in normoxic patients*
- Tube position check (capnography, auscultation, insertion depth)
- If applicable, stop manual in-line stabilization and close the cervical spine immobilization brace again

* In individual cases, despite the increased risk of aspiration, intermediate ventilation may be necessary in order to maintain oxygenation.

Please note that these are excerpts from the S1 Guideline "Prehospital Emergency Anesthesia in adults". The complete guideline is available on the website of the Scientific Medical Society's Working Group (Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaft e.V.) at: awmf.org.

Source: Anästh Intensivmed 2015;56:317-335 Aktiv Druck & Verlag GmbH
(Translation by WEINMANN Emergency)

Please note that different standard operating procedures or guidelines may apply in your region.

11. Equivalence table

The following table is used to match the ventilation modes of the MEDUVENT Standard to the systematic codes for ventilation modes in EN ISO 19223:2021.

MEDUVENT Standard ventilation mode	Systematic code in accordance with EN ISO 19223:2021	Comments
IPPV	CMV-vtPC	–
aPCV	A/C-PC	–
PCV	CMV-PC	–
SIMV	SIMV-vtPC\PS	With MEDUVENT Standard, SIMV does not abort spontaneous breathing efforts directly before the synchronization window if the start of the synchronization window is reached.
S-IPPV	A/C-vtPC	–
CPAP	CSV	–
BiLevel + ASB	SIMV-PC\PS	In the + ASB ventilation modes, triggering is based on the higher quality proximal flow measurement.
CPAP + ASB	CSV-PS	
PRVC + ASB	SIMV-vtPC\PS	
SIMV + ASB	SIMV-vtPC\PS	
S-IPPV with the FlowCurve Pro option activated	A/C-vtPC\PS	


operation
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