MEDUMAT Standard^2

Ventilator

Instructions for use for devices from software version 4.15

Table of Contents

1 Introduction 6
1.1 About this document ... 6
1.2 Explanation of warnings ... 7

2 Safety 8
2.1 Safety information ... 8
2.2 Intended purpose ... 8
2.3 Requirements for the user ... 10
2.4 Safety information ... 11
2.5 General instructions ... 21

3 Description 23
3.1 Overview ... 23
3.2 Control panel ... 25
3.3 Display ... 27
3.4 Symbols on the display ... 31
3.5 Components ... 33
3.6 Accessories ... 40
3.7 Options ... 41
3.8 Labels and symbols ... 42

4 Preparation and operation 50
4.1 Mounting the device ... 50
4.2 Connecting to a power supply ... 50
4.3 Using the rechargeable battery ... 51
4.4 Connecting components ... 55
4.5 Switching the device on ... 68
4.6 Switching the device off ... 70
4.7 Ventilating the patient ... 70
4.8 Monitoring the patient ... 91
4.9 Audio alarm output ... 92
4.10 Transporting the device ... 93
4.11 Feeding in oxygen ... 94

WM 68011g 08/2020

4.12 After use 97
4.13 Using the SD card 98
4.14 Enabling options 100
4.15 Updating the software 102
4.16 Pairing an external data documentation system with the device for the first time (using the Bluetooth data transmission option) 105
4.17 Using the simulation mode 106

5 User menu 108
5.1 Navigating the user menu 108
5.2 Structure of the user menu 109
5.3 Settings in the user menu 110

6 Operator menu 121
6.1 Navigating the operator menu 121
6.2 Structure of the operator menu 123
6.3 Settings in the operator menu 124

7 Description of the modes 141
7.1 Classification of the ventilation modes 141
7.2 Ventilation parameters 143
7.3 Ventilation modes 145
7.4 Additional functions 163

8 Hygienic reprocessing 172
8.1 General instructions 175
8.2 Intervals 176
8.3 Preparing hygienic reprocessing 176
8.4 Disassembly of the reusable hose system 177
8.5 Cleaning parts manually 182
8.6 Wipe disinfecting parts 185
8.7 Immersion disinfecting parts 186
8.8 Reprocessing parts mechanically 188
8.9 Steam sterilizing parts (optional) 189
8.10 Preparing parts for reuse 190
8.11 Assembling reusable hose system 190

WM 68011g 08/2020

8.12 Cleaning and disinfection plan 196

9 Function check 201
9.1 Intervals 201
9.2 Preparing for the function check 201
9.3 Performing a function check 202
9.4 Failed function check 210
9.5 Testing the reusable hose system 210
9.6 Checking the system for leaks 211
9.7 Rectifying leaks in the system 211

10 Alarms and error messages 213
10.1 General instructions 213
10.2 Alarm messages 215
10.3 Faults 219

11 Maintenance 224
11.1 General instructions 224
11.2 Intervals 224
11.3 Sending in device 225
11.4 Maintaining the reusable hose system 225
11.5 Replacing the hygiene filter 226

12 Storage 228
12.1 General instructions 228
12.2 Storing the device 228
12.3 Storing patient hose systems 229
12.4 Storing the battery 230

13 Disposal 231
13.1 Electronic waste 231
13.2 Battery 231
13.3 Patient hose system 231
13.4 Hygiene filter 231

14 Appendix 232
14.1 Technical data 232
14.2 Calculation of body weight on the basis of body height 258

WM 68011g 08/2020

14.3 Exported log files 259
14.4 Scope of supply 261
14.5 Warranty 267
14.6 Declaration of Conformity 268

WM 68011g 08/2020

1 Introduction

1.1 About this document

This document describes all possible versions of the device.

Functions, accessories and other parts which are described in this document or shown in the images depend on the version purchased and are not always available.

If device functions can only be enabled through procurement of a certain option, this is marked in this document by the amendments "(optional)" and "(only with option XXXX)".

Diagrams in these instructions for use serve to improve basic understanding and may differ from the actual design. No claims can be derived from any deviations.

Texts shown in the display of the device are marked bold in this document. Example: Press the **Chrg.** function button.

Voice prompts of the device are marked italic in this document. Example: *Do not touch the patient*.

WM 68011g 08/2020

1.2 Explanation of warnings

⚠ DANGER	**Danger!** DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury.
⚠ WARNING	**Warning!** WARNING indicates a hazardous situation that, if not avoided, could result in death or serious injury.
⚠ CAUTION	**Caution!** CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.
NOTICE	**Notice!** NOTICE indicates information considered important, but not hazard-related (e.g., messages related to damage to property or the environment).
i	Designates useful tips relating to a particular action.

WM 68011g 08/2020

2 Safety

2.1 Safety information

The instructions for use form part of the device. If the instructions for use and the following safety information are not fully complied with, the treatment may fail or be compromised. This could cause severe or life-threatening injuries to the patient, user or bystanders.

⇒ Fully comply with the instructions for use.

⇒ Keep the instructions for use with the device so that they can be accessed at any time.

⇒ Only use the device as defined by the intended purpose (see "2.2 Intended purpose", page 8).

⇒ Do **not** use the device in the event of contraindications.

⇒ Follow the instructions for use for the components and accessories.

Any serious incident that has occurred in relation to the device should be reported to the manufacturer and the competent authority of the Member State.

2.2 Intended purpose

MEDUMAT Standard^2 is an emergency and transport ventilator with functions for the monitoring of respiratory values. The device can be used for invasive and non-invasive ventilation via the patient's nose, mouth or trachea. In the case of volume-controlled ventilation, tidal volumes of 50 ml or more are possible. Smaller tidal volumes are also possible in the case of pressure-controlled ventilation.

2.2.1 Patient groups

MEDUMAT Standard^2 is used in the treatment of infants, children and adults weighing 3 kg or more where spontaneous respiration has failed or is inadequate.

WM 68011g 08/2020

2.2.2 User

Qualified medical personnel (e.g., paramedics, emergency physicians).

2.2.3 Intended application areas

- Primary care at the site of the emergency, e.g., to resuscitate or induce and maintain anesthesia
- Transport between hospital rooms and departments
- Transport between the hospital and other sites in an ambulance, ship, airplane or helicopter
- Intra-hospital in the trauma or recovery room

⚠ WARNING

Risk of injury from misuse due to disregarding the information in the instructions for use!
⇒ Only use the device as defined by the intended use (see "2.2 Intended purpose", page 8).
⇒ Note the exclusions and restrictions for intended purpose (see "2.2.6 Exclusions and restrictions for intended purpose", page 10).
⇒ Observe the safety information in the instructions for use.
⇒ Observe all the chapters in the instructions for use.
Intended use includes compliance with all the specifications in these instructions for use. Any usage which goes beyond or which is in contradiction to the intended use shall be regarded as misuse. Failure to observe the information in the instructions for use can result in incorrect operation of the device and may result in serious injury or death for the patient, user or bystanders.

2.2.4 Contraindications

None currently known.

2.2.5 Possible side effects and complications

- Undesirable effects on the cardiovascular system (e.g., reduction of cardiac output, reduction of venous return flow)
- Dehydration of the respiratory tract (e.g., mucositis, sicca syndrome)

WM 68011g 08/2020

- Overinflation of the lung tissue (e.g., lung rupture)
- Overinflation of the stomach during mask ventilation (e.g., aspiration of stomach contents)

2.2.6 Exclusions and restrictions for intended purpose

The device is not approved for the following applications:

- Operation in hyperbaric chambers
- Operation in combination with magnetic resonance scanners (MRT, NMR, NMI)
- Ventilation of premature babies (born before the end of the 36th week of pregnancy)
- Use for long-term ventilation in excess of 24 hours

2.3 Requirements for the user

MEDUMAT Standard^2 must only be used by persons who possess a medical qualification and have received training in ventilation techniques.

All operators/users must familiarize themselves with the operation and use of this medical device as described in the instructions for use before using the device for the first time.

They should also receive formal instruction on the operation and use of this medical device.

Always ensure adherence to the statutory requirements for operation and use of the device (in Germany, the Medical Device Directive (MPBetreibV) in particular).

WM 68011g 08/2020

2.4 Safety information

2.4.1 How to use the device

Warning **Risk of poisoning if the device is used in a toxic atmosphere!**
If the device is used in a toxic atmosphere, it can suck in toxic gases from the ambient air. These toxic gases may reach the lungs of the patient and poison them.
⇒ Do not use the device in a toxic atmosphere.

Risk of infection if the device is used in a contaminated atmosphere!
If the device is used in a contaminated atmosphere, it may suck in contaminated or infected ambient air and harm the patient.
⇒ Only operate the device in a contaminated atmosphere with a hygiene filter.

Risk of injury if the device is used in a dusty atmosphere!
If the device is used in a dusty atmosphere, it can suck in dust and contaminants from the ambient air. Dust and contaminants may reach the lungs of the patient and harm them.
⇒ Only operate the device with a hygiene filter.
⇒ Change the hygiene filter following operation in a very dusty atmosphere.

Risk of explosion if the device is used in explosive atmospheres!
Flammable gases and anesthetics may cause spontaneous explosions and thereby bring about injury to the patient, user and bystanders.
⇒ Do not use the device in combination with flammable gases or anesthetic gases.

Risk of injury due to device or component malfunction!
A damaged device or damaged components may result in injury to the patient, user or bystanders.
⇒ Only operate the device and components if they are externally undamaged.
⇒ Only operate the device and components if the function check has been successfully completed.
⇒ Only operate the device if the display is functional.
⇒ Keep an alternative ventilation unit at the ready.

WM 68011g 08/2020

Risk of injury if the pneumatic connections within the device are closed off or blocked!

When oxygen is supplied via a central gas supply system which has not been properly cleaned or is moist, the pneumatic connections within the device may become blocked by contaminants or particles or suck in moisture.

⇒ Only operate the device from central gas connections which are clean and dry.

Risk of injury in the event of device failure resulting from blocked suction inlets on the hygiene filter!

Blocked suction inlets on the hygiene filter may cause injury to the patient in the event of device failure as a result of excessively high pressures, and may prevent the patient from breathing on his/her own.

⇒ Always keep the suction inlets on the hygiene filter clear.

Risk of injury due to sparks during defibrillation in the presence of oxygen and combustible materials!

In the event that a ventilator and defibrillator are used at the same time, defibrillation in an oxygen-enriched atmosphere and in the presence of combustible materials (e.g., textiles) combined with sparks generated by the defibrillation may cause explosions and fire, which may result in injury to the patient, user or bystanders.

⇒ During defibrillation, only use adhesive electrodes or ensure that the oxygen-air mixture coming from the patient valve flows away from the torso of the patient.

Risk of injury due to concealed alarm!

A concealed alarm light, loudspeaker and display will prevent the user from noticing any alarms and reacting to dangerous situations. This may result in injury to the patient.

⇒ Always keep the alarm (alarm light, loudspeaker and display) free.

⇒ Do not operate the device in a closed bag.

Risk of injury if an incorrect volume is applied in hyperbaric environments!

Use of the device in hyperbaric environments (pressure chambers) leads to the application of incorrect volumes and may result in an injury to the patient.

⇒ Do not use the device in hyperbaric environments.

WM 68011g 08/2020

Risk of injury from operating the device, accessories and components outside of the prescribed ambient conditions!
Use of the device, accessories and components outside of the prescribed ambient conditions may mean that tolerances are not adhered to and result in device failure and injury to the patient.
⇒ Only operate the device, accessories and components within the prescribed ambient conditions (see "14.1.1 Technical data on device", page 232).

Risk of injury due to reuse of disposable items!
Disposable items are intended for single use. Disposable items which are reused may be contaminated and/or impaired in their function and therefore cause injury to the patient.
⇒ Do not reuse disposable items.

Therapy prevented by increased oxygen consumption when using CCSV mode!
The increased ventilation rate in CCSV mode results in increased oxygen consumption during resuscitation (approx. 12-30 l/min) compared with IPPV ventilation.
⇒ Check the fill pressure in the oxygen cylinder regularly.
⇒ Keep reserve oxygen at the ready.

Risk of injury from deactivated alarm light, deactivated audio alarm output and darkened display in NVG mode!
The alarms are barely perceptible as a result of the deactivated alarm light, the deactivated audio alarm output and the darkened display in NVG mode. This can injure the patient.
⇒ Always monitor patients during ventilation.
⇒ Only use the NVG option in the military sector.

Fault or failure of the device or accessory during therapy due to high-frequency surgical devices in close proximity to the device!
High-frequency surgical devices in close proximity to the device or accessory can cause malfunctioning or failure of the device or accessory. This can result in serious or life-threatening injury to the patient.
⇒ Do not use the device and accessories in close proximity to high-frequency surgical devices.

WM 68011g 08/2020

Fault or treatment failure due to incompatibility of the device with consumables, accessories or other medical devices!
Defective and unauthorized accessories can result in malfunctions, increased electromagnetic interference emissions and reduced electromagnetic immunity of the device, incorrect output values and reduced ventilation performance. This can result in serious or life-threatening injury to the patient.
⇒ Only connect approved accessories.

Caution **Risk of injury through electric shock if the device is touched!**
Accessories which are connected to the device may cause an electrical potential in the device. This may lead to an electric shock on contact with the device and result in injury to the user.
⇒ Only use accessories from WEINMANN Emergency.

Risk of injury as a result of pressure variations during use in combination with devices from the WEINMANN Emergency MODUL range!
If the device is used together with devices from the WEINMANN Emergency MODUL range, the flow used by devices from the WEINMANN Emergency MODUL series may cause pressure variations in the device. This can injure the patient.
⇒ Only use the device and devices from the WEINMANN Emergency MODUL range in combinations approved by WEINMANN Emergency.

Prevent interference between the devices!
Electrical devices which are operated directly next to or on top of each other can cause mutual interference to functionality. Portable high-frequency communication devices in the direct vicinity of the device can also influence the functioning of the device.
⇒ Do **not** stack the device with other electrical devices.
⇒ Do **not** operate the device directly next to other electrical devices. Exception: Other WEINMANN Emergency devices which have been tested and shown to guarantee interference-free operation with the adjacent device. A list of other devices is available on request.
⇒ If stacking or operation in the immediate vicinity cannot be avoided: Closely monitor the functioning of all affected medical electrical devices and do not use if functions are disrupted.

WM 68011g 08/2020

⇒ With portable RF communication devices, maintain a minimum distance of 30 cm (approx 12 inches) to the device and accessories. Examples: Wireless device, mobile telephone.

Notice **Damage to the device caused by ingress of liquids!**
The device is rated IP54 (splash-proof). This only applies when the battery is located in the battery compartment, the SD card compartment is closed, there is a filter in the filter compartment and there is a patient hose system connected. Ingress of liquids may damage the device, components and accessories.
⇒ Do not immerse the device, components or accessories in liquids.
⇒ Clean the battery compartment carefully so that no liquids enter the device.

2.4.2 Power supply

Warning **Risk of injury due to missing, flat or defective battery!**
A missing, flat or defective battery prevents treatment.
⇒ Only operate the device with a charged battery.
⇒ Keep an alternative ventilation unit at the ready.

Treatment prevented by defective power cord or power supply!
A defective power cord or power supply prevents the battery in the device from charging and thus impairs the operational readiness of the device.
⇒ Inspect the power cord and power supply regularly.
⇒ Only operate the device with a charged battery.
⇒ Keep an alternative ventilation unit at the ready.

Risk of injury due to electric shock when connecting an incorrect power supply to the line power!
The power supply contains a safety device to prevent electric shock. The use of a non-original power supply may result in injury to the user.
⇒ Only operate the device on line power using the power supply recommended by WEINMANN Emergency.

WM 68011g 08/2020

Risk of injury due to incorrect maintenance of the Li-ion battery!
An open, non-original or damaged Li-ion battery can lead to excessive temperatures, fire or explosions. This can lead to injuries to the user, patient or third parties.
⇒ Only operate the device using the battery recommended by WEINMANN Emergency.
⇒ Only use an unopened, undamaged battery.

Caution **Risk of injury from touching the contacts in the battery compartment and the patient at the same time!**
The contacts in the battery compartment are live. Touching the contacts and the patient at the same time can injure the user or the patient.
⇒ Do not touch the contacts in the battery compartment and the patient at the same time.

Notice **Material damage due to prolonged storage of the battery without recharging!**
Storing the battery for a prolonged period of time without recharging can result in the rapid shutdown of and irreparable damage to the battery.
⇒ When the battery is stored in the device without a power connection: Charge battery every 3 months.
⇒ If the battery is not stored in the device: Charge battery with SN < 20000 every 5 months and battery with SN ≥ 20000 every 9 months.

2.4.3 How to use the patient hose system

Warning **Risk of injury due to contaminated or infected patient hose system!**
A patient hose system which is contaminated or infected as a result of hygienic reprocessing not being performed or being performed incorrectly may transmit contamination or infections to the next patient and harm them.
⇒ Do not reprocess disposable hose systems.
⇒ Perform the hygienic reprocessing of reusable hose systems correctly (see "8 Hygienic reprocessing", page 172).

WM 68011g 08/2020

Caution **Risk of injury from touching the contacts on the FlowCheck sensor connection line/FlowCheck sensor connection line with MEDUtrigger and the patient at the same time!**
The contacts on the FlowCheck sensor connection line/FlowCheck sensor connection line with MEDUtrigger are live. Touching the contacts and the patient at the same time can injure the user or the patient.
⇒ Do not touch the contacts on the FlowCheck sensor connection line/FlowCheck sensor connection line with MEDUtrigger and the patient at the same time.

2.4.4 Ventilation

Warning **Risk of injury due to lack of patient monitoring!**
If the patient is not supervised during ventilation, delayed responses of medical personnel to alarms and error messages may result in serious injuries to the patient.
⇒ Always monitor patients during ventilation.
⇒ Be sure to react immediately to alarms and error messages as well as a deterioration in the condition of the patient.

Risk of injury from condensate in the FlowCheck sensor and the patient valve at temperatures below 5°C!
With longer term ventilation of patients at temperatures below 5°C, the moisture from expiratory breath can condense in the FlowCheck sensor and patient valve. This may interfere with the functioning of the parts and injure the patient.
⇒ Quickly transfer the patient to a warmer location.
⇒ At temperatures below 5°C use a breathing system filter to extend the period of application.

Risk of poisoning due to an overly high concentration of oxygen during ventilation!
Highly concentrated oxygen can have a toxic effect on the patient if administered for too long and depending on the age of the patient.
⇒ Do not use highly concentrated oxygen on a patient for too long during ventilation.
⇒ Do not use the device for the ventilation of premature babies (born before the end of the 36th week of pregnancy).

WM 68011g 08/2020

Risk of injury due to ventilation pressures which are too high or too low!

Ventilation pressures which are too high or too low may result in injury to the patient.

⇒ Check correct ventilation on the display.

⇒ Adjust the maximum ventilation pressure (pMax) to suit the connected patient.

Risk of injury due to alarm limits which are too high or too low!

Alarm limits which are either too high or too low can prevent the device from emitting an alarm, thereby putting the patient at risk.

⇒ Always set alarm limits which have been adapted to the patient.

Risk of injury from switching on a device with activated NVG mode during daylight or without a night vision device!

A device with activated NVG mode cannot be used straight away during daylight or without a night vision device. This can injure the patient.

⇒ Keep an alternative ventilation unit at the ready.

Risk of injury if CCSV mode is used on infants!

Use of the CCSV mode can result in increased intrathoracic pressures and thus injure infants' lungs.

⇒ Do not use CCSV mode on patients weighing less than 10 kg.

Risk of injury from use of pneumatic nebulizers during volume-controlled ventilation!

The use of pneumatic nebulizers increases the minute volume administered to the patient.

⇒ Do not use pneumatic nebulizers during volume-controlled ventilation.

Caution **Risk of injury due to operation of the device with compressed air!**

During operation with compressed air, the volume delivered by the device is excessively high and the oxygen concentration of the output is too low. This may lead to volutrauma and hypoxia in the patient.

⇒ Only operate the device with medical oxygen or concentrator oxygen.

Risk of injury due to drying out of the airways!

Prolonged ventilation using the device may dry out the airways of the patient and cause them an injury.

⇒ Do not use the device for long-term ventilation.

WM 68011g 08/2020

Risk of injury due to unsuitable concentrator gas!
Unsuitable concentrator gas may distort treatment and result in injury to the patient.
⇒ Only use concentrator oxygen (90% to 96% oxygen) or medical oxygen.

Risk of injury if the patient valve is covered!
The patient valve may be covered due to the position of the patient and prevented from functioning properly.
⇒ Always keep the patient valve clear.

Risk of injury if dead space is not taken into consideration!
The patient hose systems for the device have different dead spaces. The use of additional accessories between the ventilation hose and patient (e.g.,humidifiers, nebulizers and goosenecks) increases the dead space. Failure to take dead space into consideration may lead to insufficient ventilation, especially in the ventilation of infants with very small tidal volumes.
⇒ Take dead space into consideration when choosing the ventilation parameters.
⇒ Do not use the device for the ventilation of premature babies (born before the end of the 36th week of pregnancy).

Risk of injury from autotriggering!
Automatic triggering of the inspiration trigger by artifacts (autotrigger) can result in hyperventilation of the patient.
⇒ Reduce the sensitivity of the inspiration trigger in case of autotriggers.

Risk of injury from incompatible hoses!
The use of too high ventilation pressures with incompatible hoses can result in insufflation of the stomach and cause injury to the patient.
⇒ Only use compatible hoses.

2.4.5 Safe handling of oxygen

Warning **Risk of fire if oxygen is used in combination with combustible substances!**
The combination of oxygen and combustible substances may lead to spontaneous explosions. Where ventilation is inadequate, oxygen may build up in the environment (e.g., clothing, hair, bed linen) and cause fires and thereby injuries to the patient, user and bystanders.
⇒ Do not smoke.

WM 68011g 08/2020

⇒ Do not use open flames.
⇒ Ensure adequate ventilation.
⇒ Keep the device and screwed unions free from oil and grease.
⇒ Always close the SD card cover again following the insertion and removal of the SD card.

Risk of injury if oxygen escapes from damaged oxygen cylinders or pressure reducers!

Oxygen can escape unchecked from damaged oxygen cylinders or pressure reducers. This may lead to explosions and cause injury to the patient, user and bystanders.

⇒ Tighten all screwed unions on the oxygen cylinder and on the pressure reducer by hand only.
⇒ Secure the oxygen cylinder so that it cannot fall over.

Risk of fire due to inadequate ventilation in an oxygen-enriched environment!

Where ventilation is inadequate, oxygen may build up in the environment and cause fires. This may result in injury to the patient, user and bystanders.

⇒ Make provisions for adequate ventilation.

Risk of injury due to empty oxygen cylinder!

An empty oxygen cylinder prevents ventilation and may cause injury to the patient.

⇒ Keep a full oxygen cylinder at the ready.
⇒ Keep an alternative ventilation unit at the ready.

Notice **Damage to the device due to corrosion!**

Moist ambient air may enter oxygen cylinders which have been completely emptied and cause corrosion.

⇒ Do not empty oxygen cylinders completely.

Damage to the device due to pressure hammer on fittings!

Opening the valve on the oxygen cylinder too quickly may lead to pressure hammer on the fittings.

⇒ Always open the valve of the oxygen cylinder slowly.

WM 68011g 08/2020

2.5 General instructions

- If third-party items are used, malfunctions may occur and fitness for use may be restricted. Biocompatibility requirements may also not be met. Please note that in such cases, any warranty claim and liability will be voided if neither the accessories recommended in the instructions for use nor genuine replacement parts are used. Third-party items may increase the radiation output or reduce the interference immunity.
- Repairs, servicing and maintenance should only be carried out by the manufacturer, WEINMANN Emergency, or by a technician expressly authorized by WEINMANN Emergency. The device's service and repair instructions are available to the latter; these contain all the information required.
- Only have modifications to the device carried out by the manufacturer, WEINMANN Emergency, or by a technician expressly authorized by WEINMANN Emergency.
- Any constructive changes made to the device may put the patient and the user at risk and are not permitted.
- The device is protected against unauthorized access by means of a colored security seal on the rear of the housing. Please note that any damage to the security seal voids any warranty claims.
- Please observe the section on hygienic reprocessing in order to avoid infection or bacterial contamination (see "8 Hygienic reprocessing", page 172).
- Also observe the respective instructions for use for the device, the components and the accessories.
- Always carry out a function check before using the device (see "9 Function check", page 201).
- As the user, always remain in the direct vicinity of the device and patient.
- Always have an alternative respiration option in addition to the ventilator on hand. An alternative respiration option is, for example, a resuscitator for manual ventilation.

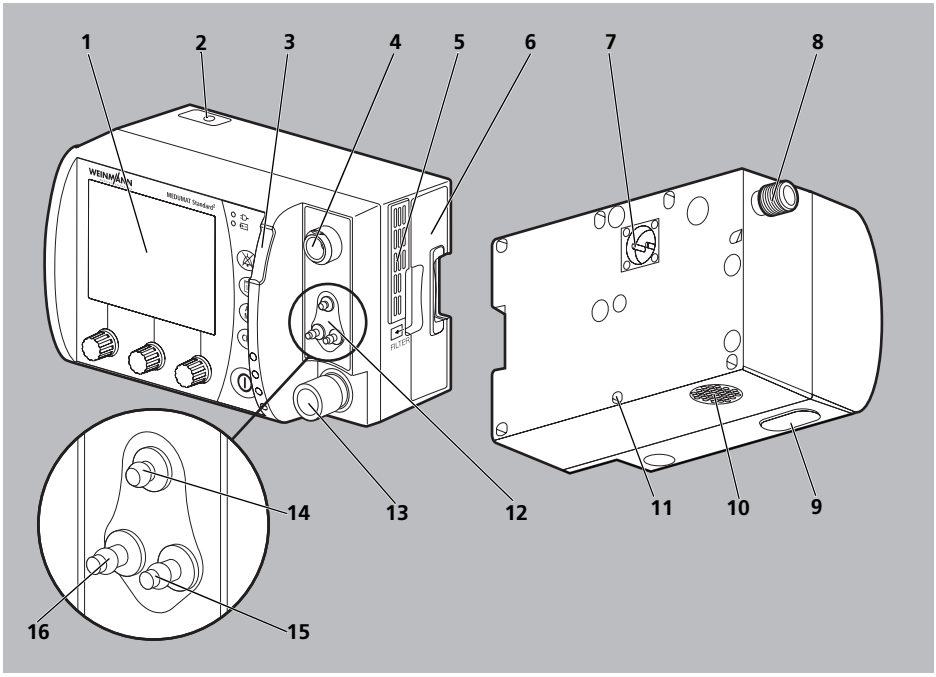
WM 68011g 08/2020

- The power supply unit/charger is not intended for use in vehicles or outdoors. Only use the power supply unit/charger in closed rooms and observe the technical data (see "14.1 Technical data", page 232).
- Risks due to software errors have been minimized by means of extensive qualification measures.
- This device's software contains code which is subject to the General Public License (GPL). You will receive the source code and the GPL upon request.
- The software for the FlowCheck sensor connection line with MEDUtrigger/FlowCheck sensor connection line was created with FreeRTOS (www.freertos.org).

WM 68011g 08/2020

3 Description

3.1 Overview



3-1 Device

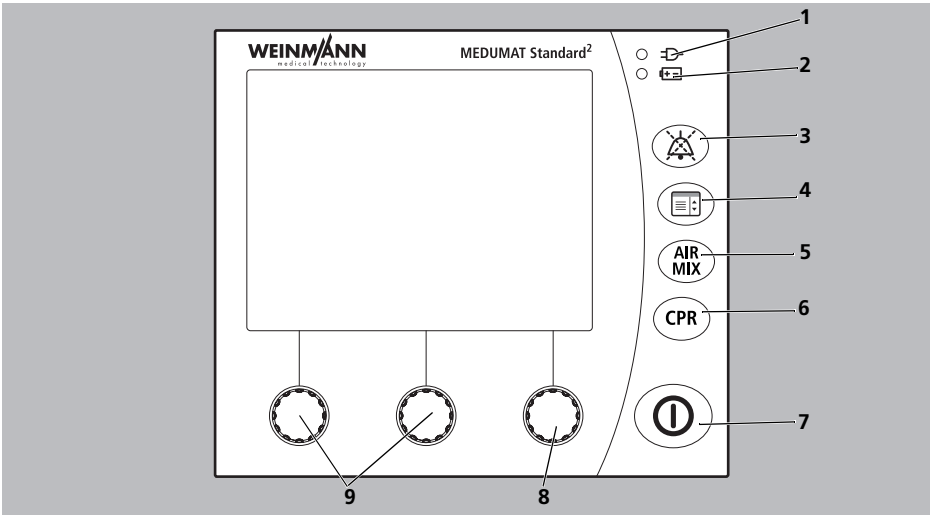
No.	Designation	Description
1	Display	Displays settings and current values (see "3.4 Symbols on the display", page 31).
2	Service cover	Used for servicing purposes. May only be opened by the manufacturer or persons authorized by the manufacturer.
3	Alarm light	Indicates high-priority alarms visually.
4	Accessory connection	• Connects the device to MEDUtrigger. • Connects the device to the FlowCheck sensor connection line. • Connects the device to the FlowCheck sensor connection line with MEDUtrigger.

WM 68011g 08/2020

No.	Designation	Description
5	Filter compartment	Houses the hygiene filter.
6	Battery compartment with battery	Houses the battery.
7	Power connection	Connects the device to the power supply.
8	Compressed gas connection	Used for connecting the oxygen supply (e.g., an oxygen cylinder).
9	SD card slot	For inserting an SD card.
10	Loudspeaker	Emits audible alarms and metronome sounds.
11	Security seal	Indicates whether the device has been opened without authorization.
12	Connection for measuring hose system	Connects the device to the measuring hose system of the patient hose system.
13	Connection for ventilation hose	Connects the device to the ventilation hose of the patient hose system.
14	Connection for CO_2 measuring hose	Connects the device to the CO_2 measuring hose (only with capnography option). This connection is included with devices without a capnography option, however it has no function.
15	Connection for pressure-measurement hose	Connects the device to the pressure-measurement hose.
16	Connection for PEEP control hose	Connects the device to the PEEP control hose.

WM 68011g 08/2020

3.2 Control panel



3-2 Controls

No.	Designation	Description
1	Line power indicator	• Steady green light: Indicates that the device is connected to line power. • Not illuminated: The device is operating on battery power and not on line power. **or** The device is in NVG mode.
2	Battery status indicator	• Steady green light: The battery is full or is not being charged because it is outside the charging temperature range. • Flashing green light: The battery is being charged. • Steady red light: The battery is defective or not in the device. • Not illuminated: The device is operating on battery power and not on line power. **or** The device is in NVG mode.

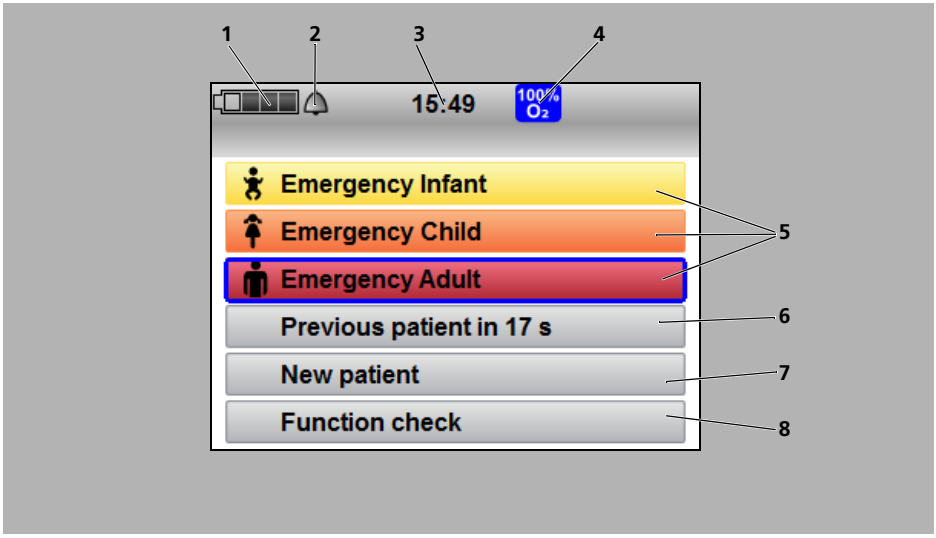
WM 68011g 08/2020

No.	Designation	Description
3	Alarm mute button	• Pressing the button briefly (< 1 s) mutes the alarm for 120 s. • Keeping the button depressed (≥ 1 s) opens the alarm limit menu.
4	Menu button	• In the start menu: Provides access to the operator menu. • With the ventilation mode set: Provides access to the user menu.
5	Air Mix button	Switches between Air Mix mode and non-Air Mix mode.
6	CPR button	Activates or deactivates the CPR mode.
7	On/Off button	Switches the device on or off.
8	Right-hand navigation knob	• Enables the selection of values for ventilation parameters. • Enables the selection and confirmation of other ventilation parameters.
9	Left/central navigation knob	• Enable the selection of values for ventilation parameters. • Enable confirmation of values selected for ventilation parameters.

WM 68011g 08/2020

3.3 Display

3.3.1 Start menu

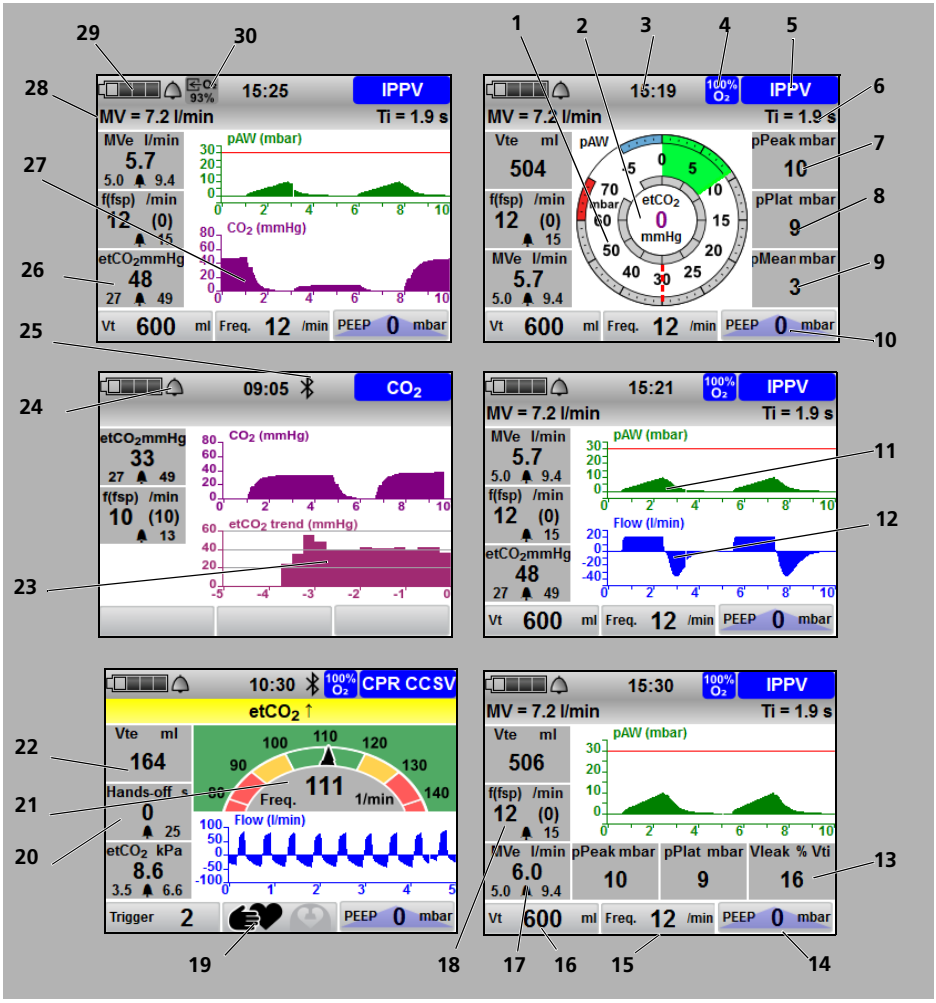


3-3 Start menu display

No.	Designation	Description
1	Battery status	Displays the charge level of the battery.
2	Alarm	Indicates whether the audio alarm output is active or has been muted.
3	Time	Displays the current time.
4	100% O_2 Air Mix	Indicates whether operation with 100% oxygen or Air Mix mode is activated.
5	Emergency modes	Provides access to the emergency modes.
6	Previous patient	Provides access to the emergency mode and the ventilation parameters set for the previous ventilated patient.
7	New patient	Provides access to the settings for a new patient.
8	Function check	Provides access to the function check.

WM 68011g 08/2020

3.3.2 Ventilation mode (example)



3-4 Display in the views
1 (pressure, CO_2 curve) (top left), 2 (pressure gauge, measurements) (top right), 3 ($etCO_2$ trend) (center left), 4 (pressure, flow curve) (center right), 5 (CPR CCSV) (bottom left), 6 (pressure curve, measurements) (bottom right)

WM 68011g 08/2020

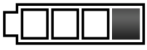
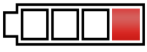
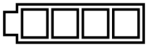
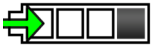
No.	Designation	Description
1	Pressure gauge	• Indicates ventilation pressure progress. • Indicates pMax as a dotted line. • Indicates the currently attuning airway pressure as a green area. • Indicates the maximum airway pressure in the middle. • Indicates the end-tidal CO_2 concentration ($etCO_2$) in the middle (only with capnography option).
2	End-tidal CO_2 concentration ($etCO_2$) (only with capnography option)	Indicates the end-tidal CO_2 concentration. If the capnography option is deactivated, the peak pressure is shown here (pPeak).
3	Time	Displays the current time.
4	100% O_2 Air Mix	Indicates whether operation with 100% oxygen or Air Mix mode is activated.
5	Ventilation mode indicator	Indicates the currently selected ventilation mode.
6	Inspiration time (Ti)	Indicates the inspiration time. If an alarm is displayed, this information is omitted.
7	Peak pressure (pPeak)	Indicates the maximum pressure.
8	Plateau pressure (pPlat)	Indicates the pressure during the plateau time.
9	Mean pressure (pMean)	Indicates the mean pressure over all measurements.
10	Blue arrow	Provides access to the application menu (turn or press the right-hand navigation knob).
11	Pressure curve (only with flow measurement + ASB option and curve display option or capnography option)	Indicates the pressure progress.
12	Flow curve (only with flow measurement + ASB option)	Indicates the flow progress.
13	Leak (Vleak) (only with flow measurement + ASB option)	Indicates leaks.
14	Positive end-expiratory pressure (PEEP)	• Indicates the positive end-expiratory pressure. • Enables the positive end-expiratory pressure to be set.
15	Frequency (Freq.)	• Indicates the ventilation rate. • Enables the ventilation rate to be set.
16	Tidal volume (Vt)	• Indicates the tidal volume. • Enables the tidal volume to be set.
17	Expiratory minute volume (MV_e) (only with flow measurement + ASB option)	Indicates the expiratory minute volume and the associated alarm limits.

WM 68011g 08/2020

No.	Designation	Description
18	Respiratory rate (f(fsp)) (only with flow measurement + ASB option)	• Indicates the total respiratory rate. • Indicates the number of spontaneous breaths per minute. • Indicates the associated upper alarm limit.
19	Manual/automatic chest compression	• Displays whether manual or automatic chest compression is set. • Allows selection between manual or automatic chest compression in CCSV mode.
20	Hands-off time (only with CCSV option)	Displays the time since the last chest compression.
21	Frequency tachometer (only with CCSV option)	Displays the current chest compression frequency.
22	Expiratory tidal volume (Vte) (with flow measurement + ASB option only)	Indicates the expiratory tidal volume.
23	$etCO_2$ trend (only with capnography option)	Displays the $etCO_2$ trend as a curve (see 4.7.8, p. 80).
24	Alarm	Indicates whether the audio alarm output is active or has been muted.
25	Bluetooth	Shows whether Bluetooth is enabled/disabled.
26	End-tidal CO_2 concentration ($etCO_2$) (only with capnography option)	Indicates the end-tidal CO_2 concentration and the associated alarm limits.
27	CO_2 curve (only with capnography option)	Indicates the CO_2 progress (capnogram).
28	Minute volume (MV)	Indicates the precalculated minute volume. If an alarm is displayed, this information is omitted.
29	Battery status	Displays the charge level of the battery.
30	93% O_2	Indicates whether the concentrator oxygen mode is activated.

WM 68011g 08/2020

3.4 Symbols on the display

Symbol	Designation	Description
	Alarm symbol	Audio alarm output active
		Audio alarm output muted for 120 s (with the exception of an alarm at a supply pressure < 2.7 bar)
		Acoustic alarm output permanently muted (NVG mode only)
	Battery status symbol	Battery status > 90%
		Battery status approx. 60%-90%
		Battery status approx. 40%-60%
		Battery status approx. 10%-40%
		Battery status < 10% • The last remaining segment in the battery status symbol is red. • The message **Battery weak** appears in the display.
		Battery almost empty The message **Battery almost empty** appears in the display. The device can still be used for approx. 15 minutes. A timer in the alarm field counts down the time until the device switches off.
		• Battery is defective. **or** • No battery. **or** • Battery not at suitable temperature.
		Green arrow: Battery is charging.

WM 68011g 08/2020

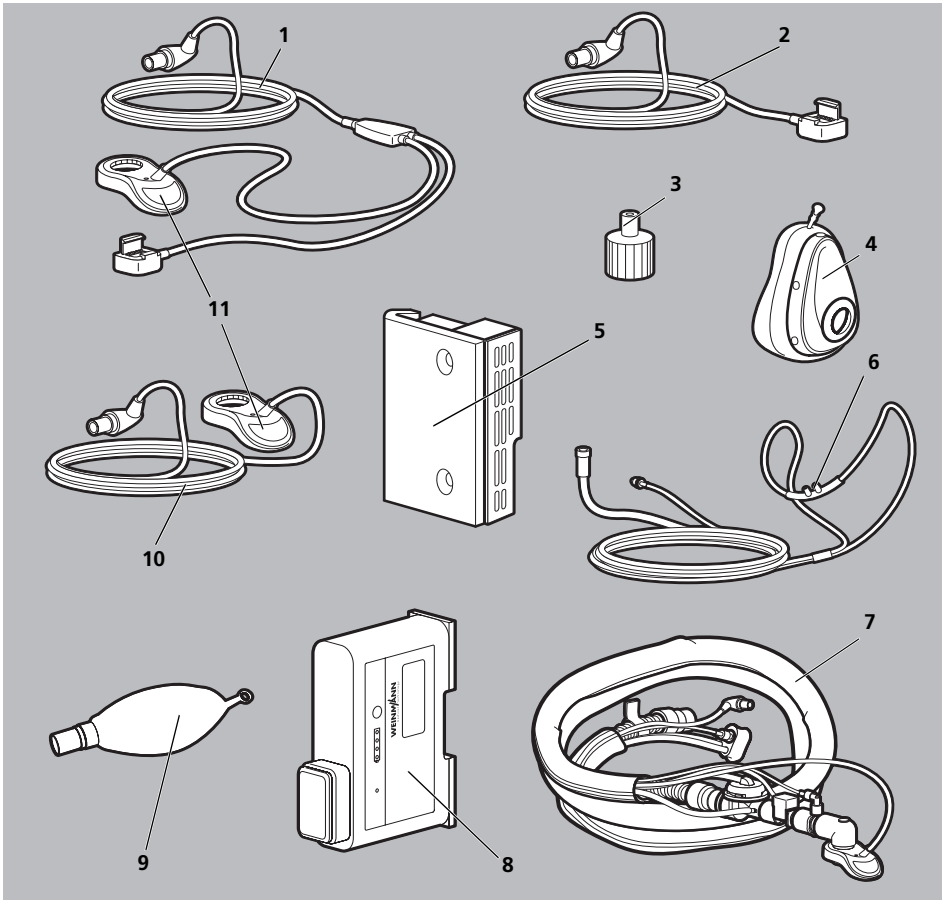
Symbol	Designation	Description
	Function check symbol	Device is ready for use
		Device is not ready for use
		Fault found during function check
		Observe the instructions for use
		Repair necessary
	Ventilation mode symbols	Metronome sound in CPR mode is switched on
		Metronome sound in CPR mode is switched off
CPR		Period during which the device is in the CPR mode
RSI		Period during which the device is in the RSI mode
		Time since last mechanical breath
		Setting for intubated patients (continuous chest compression)
	Emergency mode symbols	Emergency mode Infant (up to approx. 1 year)
		Emergency mode Child (approx. 1 year to 12 years)
		Emergency mode Adult (as of approx. 13 years)
	Supply gas symbol	Operation with concentrator oxygen
	Bluetooth® symbol	Bluetooth® connection: • When connection is activated, symbol is: Blue • When option is activated and no connection is active, symbol is: Black

WM 68011g 08/2020

Symbol	Designation	Description
	Manual chest compression	Operation with manual chest compression
	Automatic chest compression	Operation with chest compression device

3.5 Components

3.5.1 Overview

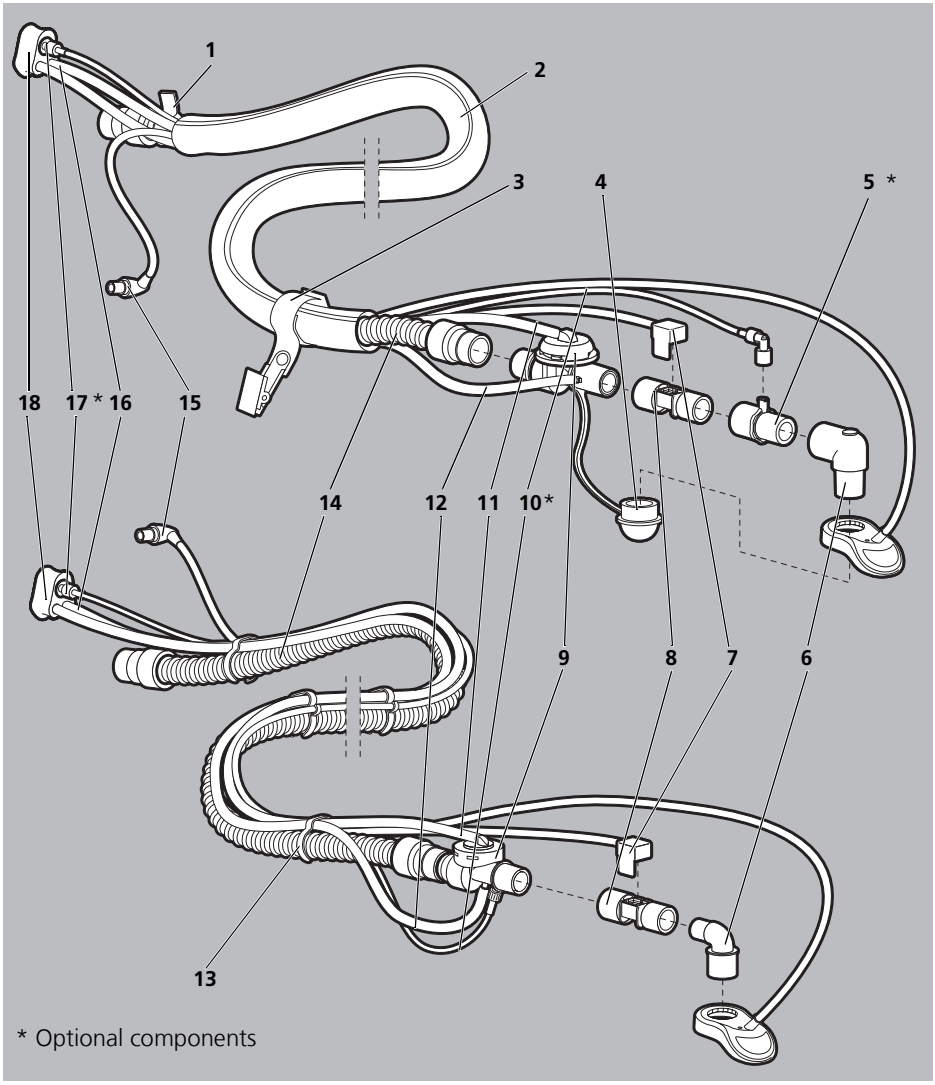


3-5 Components

No.	Designation	Description
1	FlowCheck sensor connection line with MEDUtrigger	Connects MEDUtrigger and the FlowCheck sensor to the device.
2	FlowCheck sensor connection line	Connects the FlowCheck sensor to the device.
3	Inhalation adapter	Facilitates inhalation.
4	Ventilation mask	Connects the patient hose system to the patient.
5	Hygiene filter	Protects the device from viral and bacterial contamination.
6	$etCO_2/O_2$ nasal cannula	Allows oxygen inhalation via an external flow source with simultaneous CO_2 measurement via the device (see 4.4.7, p. 66)
7	Patient hose system	Administers the gas for inspiration to the patient via a mask or tube. There are three types of patient hose systems: • Reusable hose system (see 3.5.2, p. 35) • Disposable hose system (see 3.5.2, p. 35) • Disposable hose system with reduced dead space (see 3.5.4, p. 38)
8	Battery	Facilitates mobile power supply and can be replaced if necessary.
9	Testing bag	Simulates a ventilated patient during a function check.
10	Connection line of MEDUtrigger	Connects MEDUtrigger to the device.
11	MEDUtrigger	Is used to manually trigger mechanical breaths.

WM 68011g 08/2020

3.5.2 Reusable hose system and disposable hose system



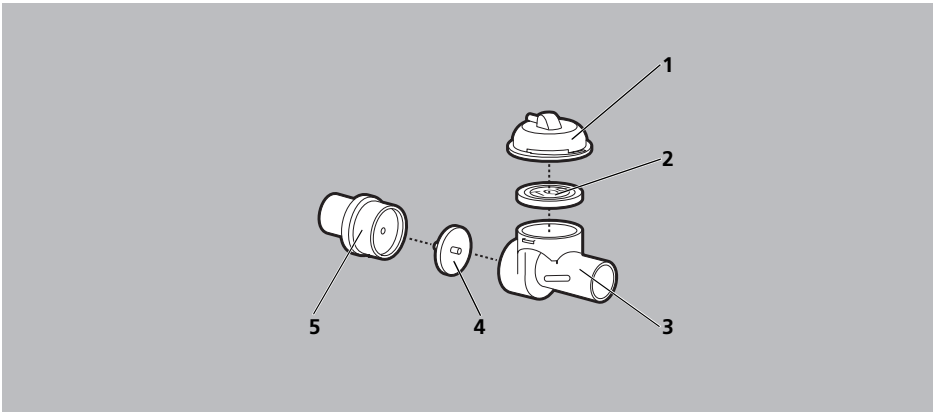
3-6 Reusable hose system (top) and disposable hose system (bottom)

No.	Designation	Description
1	Service label (only with reusable hose system)	Indicates the date when the next maintenance is due.
2	Hose protection sleeve (only with reusable hose system)	Protects the ventilation hose against soiling and damage.
3	Velcro strap with clip	• Fixes the patient hose system to the patient's clothing. • Fixes MEDUtrigger to the patient hose system when not in use (e.g., during CPAP applications).
4	Protective cap (only with reusable hose system)	Protects the end of the patient hose system closest to the patient from damage.
5	Connector with CO_2 connection (only with reusable hose system, only with capnography option)	Enables connection of the CO_2 measuring hose to the patient hose system.
6	Elbow	Connects the rest of the patient hose system to the mask or tube.
7	FlowCheck sensor connector (only with flow measurement + ASB option)	Connects one of the following connection lines to the FlowCheck sensor: • FlowCheck sensor connection line • FlowCheck sensor connection line with MEDUtrigger
8	FlowCheck sensor (only with flow measurement + ASB option)	Measures the flow to the patient and to the device.
9	Patient valve	Switches between inspiration and expiration.
10	CO_2 measuring hose (only with capnography option)	Conducts patient's respiratory gas to CO_2 measurement in the device.
11	PEEP control hose	The device controls the patient valve and the PEEP via the PEEP control hose.
12	Pressure-measurement hose	Measures the ventilation pressure at the patient.
13	Hose clip (only with disposable hose system)	Keeps the hoses and the connection line together.
14	Ventilation hose	The respiratory gas flows from the device to the patient valve through the ventilation hose.
15	FlowCheck sensor connection line with MEDUtrigger (only with flow measurement + ASB option)	Connects MEDUtrigger and the FlowCheck sensor to the device. Alternatively, you can also connect the FlowCheck sensor connection line or the connection line of MEDUtrigger here.

WM 68011g 08/2020

No.	Designation	Description
16	Measuring hose system	The device measures the patient's vital parameters via the measuring hose system. The measuring hose system comprises: • Measuring hose system connector • PEEP control hose • Pressure-measurement hose • CO_2 measuring hose (only with capnography option)
17	Water filter (only with capnography option)	The water filter protects the measuring chamber of the device against moisture and contamination from the patient's respiratory gas.
18	Measuring hose system connector	Connects the measuring hose system to the connection for the measuring hose system on the device.

3.5.3 Patient valve (reusable hose system)



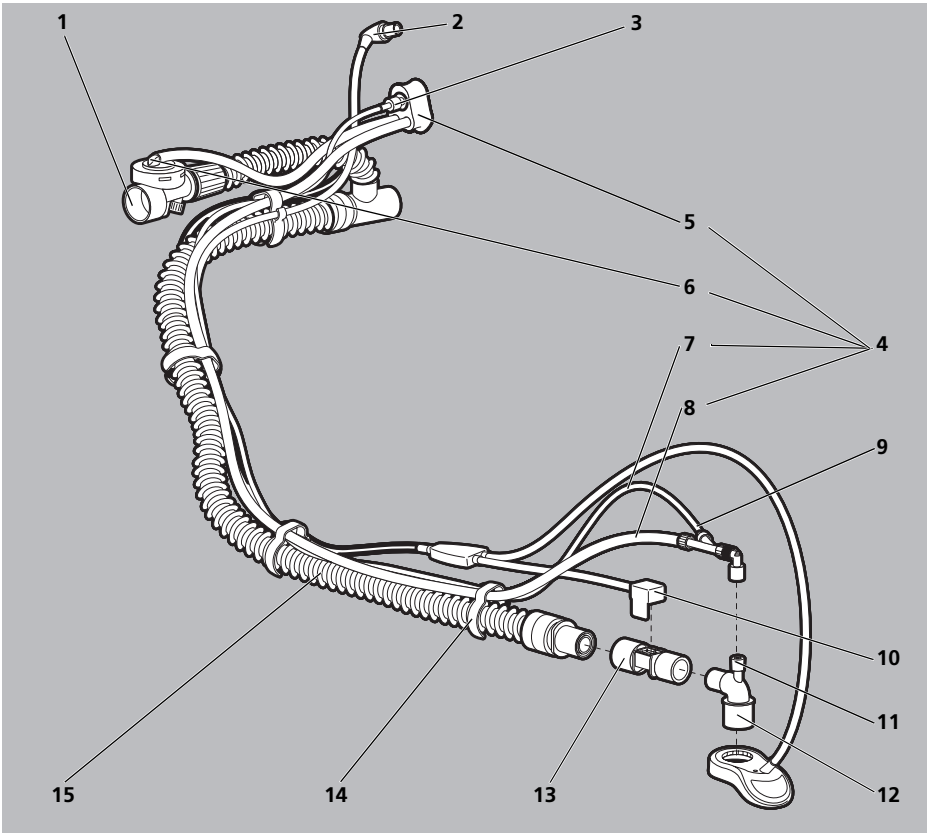
3-7 Patient valve (reusable hose system)

No.	Designation	Description
1	Control cover	Together with the PEEP control diaphragm, this creates a pressure chamber for PEEP control.
2	PEEP control diaphragm	Together with the control cover, this creates a pressure chamber for PEEP control.
3	Main body	Provides a connection for a mask, tube or the elbow.

WM 68011g 08/2020

No.	Designation	Description
4	Check valve diaphragm	Due to the check valve diaphragm, the respiratory gas only flows towards the patient. No rebreathing takes place.
5	Holder for check valve diaphragm	Connects the patient valve to the ventilation hose and contains the check valve diaphragm.

3.5.4 Disposable hose system with reduced dead space



3-8 Disposable hose system with reduced dead space

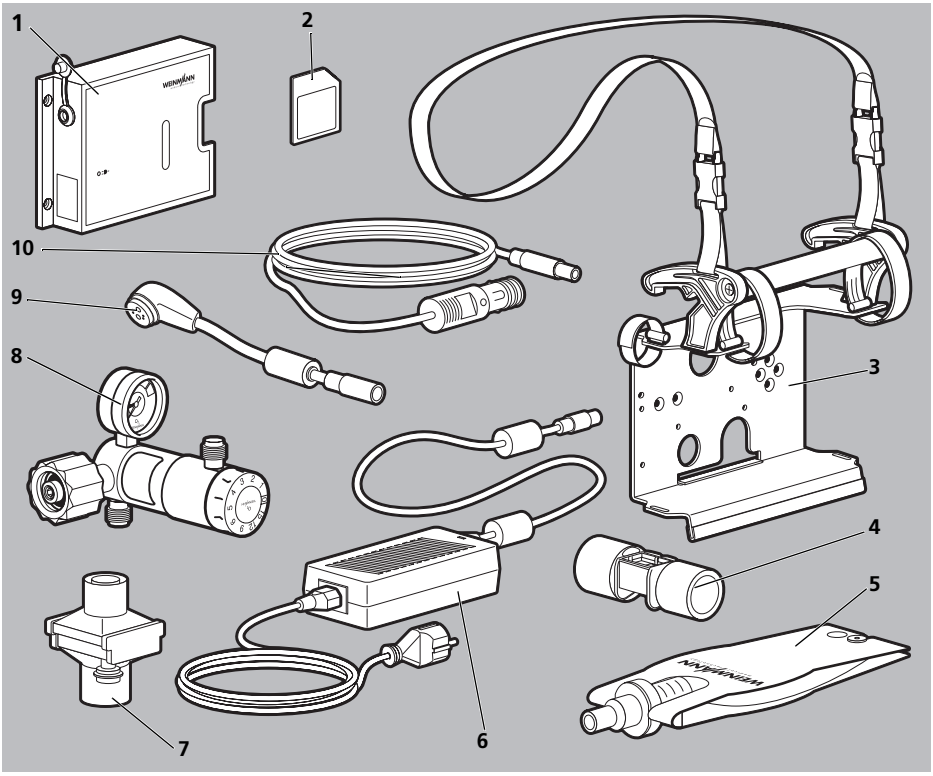
WM 68011g 08/2020

No.	Designation	Description
1	Patient valve	Switches between inspiration and expiration.
2	FlowCheck sensor connection line with MEDUtrigger (only with flow measurement + ASB option)	Connects MEDUtrigger and the FlowCheck sensor to the device. Alternatively, you can also connect the FlowCheck sensor connection line or the connection line of MEDUtrigger here.
3	Water filter (only with capnography option)	The water filter protects the measuring chamber of the device against moisture and contamination from the patient's respiratory gas.
4	Measuring hose system	The device measures the patient's vital parameters via the measuring hose system. The measuring hose system comprises: • Measuring hose system connector • PEEP control hose • Pressure-measurement hose • CO_2 measuring hose (only with capnography option)
5	Measuring hose system connector	Connects the measuring hose system to the connection for the measuring hose system on the device.
6	PEEP control hose	The device controls the patient valve and the PEEP via the PEEP control hose.
7	CO_2 measuring hose (only with capnography option)	Measures the CO_2 content in the respiratory gas of the patient.
8	Pressure-measurement hose	Measures the ventilation pressure at the patient.
9	Y-piece (only with capnography option)	Connects the pressure-measurement hose and the CO_2 measuring hose with the elbow of the patient hose system.
10	FlowCheck sensor connector (only with flow measurement + ASB option)	Connects one of the following connection lines to the FlowCheck sensor: • FlowCheck sensor connection line • FlowCheck sensor connection line with MEDUtrigger
11	Blanking plug	Closes the CO_2 connection
12	Elbow with CO_2 connection	• Connects the rest of the patient hose system to the mask or tube. • Enables the connection of the pressure-measurement hose and the CO_2 measuring hose (only with capnography option).
13	FlowCheck sensor (only with flow measurement + ASB option)	Measures the flow to the patient and to the device.

WM 68011g 08/2020

No.	Designation	Description
14	Hose clip	Keeps the hoses and the connection line together.
15	Ventilation hose	The respiratory gas flows from the device to the patient valve through the ventilation hose.

3.6 Accessories



3-9 Accessories

No.	Designation	Description
1	Charging station	Facilitates external battery charging.
2	SD card	Used for reading session data and log files and updating the device software.
3	Portable unit (example)	Serves to transport the device (see "4.10 Transporting the device", page 93).

WM 68011g 08/2020

No.	Designation	Description
4	FlowCheck sensor	Measures the flow to the patient and to the device.
5	EasyLung for WEINMANN Emergency	Simulates a ventilated patient for presentation purposes and during a function check.
6	Power supply	Supplies power to the device.
7	Breathing system filter	Serves to ensure that the respiratory air is filtered and conditioned.
8	Pressure reducer	Reduces the pressure of the oxygen from the oxygen cylinder to the operating pressure of the device.
9	Charging adapter	Connects the power supply or the 12 V cable to the device.
10	12 V cable	Supplies power to the device from the vehicle's electrical system.

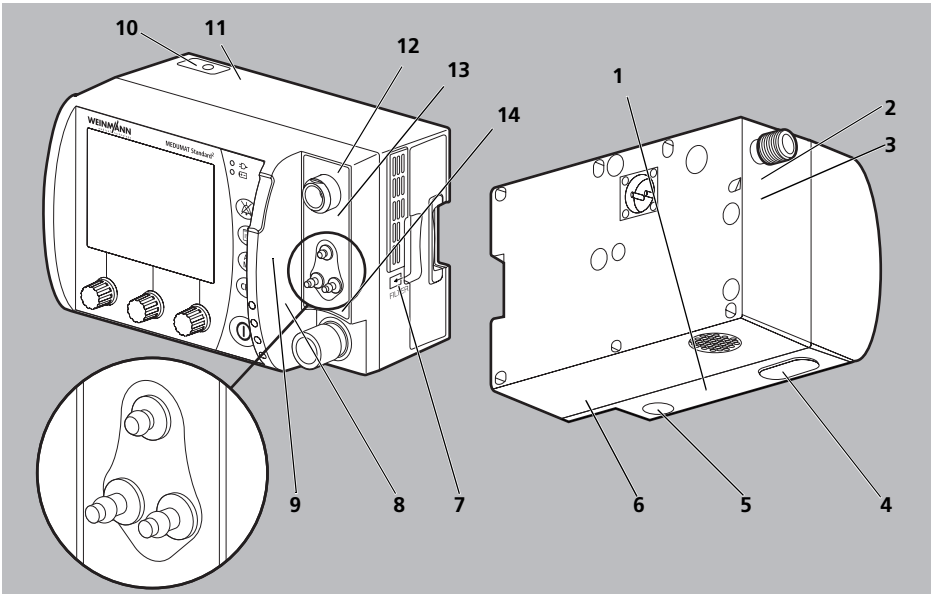
3.7 Options

You can tailor the range of functions on the device to your needs with the options (see "6.3.9 Options", page 139). Almost all the options require an access code. This can be used to enable the option (see "4.14 Enabling options", page 100).

WM 68011g 08/2020

3.8 Labels and symbols

3.8.1 Labels on the product



3-10 Labels on the product

No.	Symbol	Description
Device information label		
1	SN	Serial number
		Type BF applied part
		Input (12 V to 15 V)
		DC voltage
		Type of protection against electric shock: Protection class II device

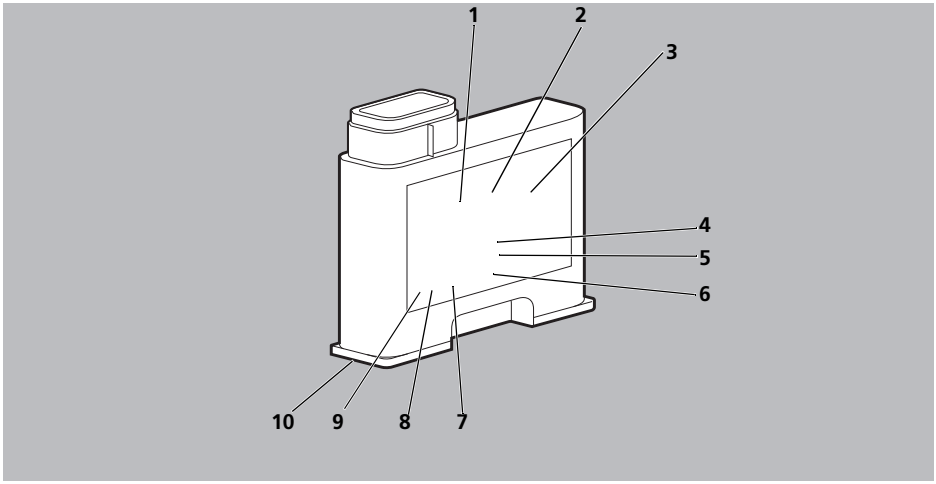
WM 68011g 08/2020

No.	Symbol	Description
1		Do not dispose of device in household waste.
		Manufacturer
	IP54	Degree of protection against: • Ingress of solid objects • Ingress of dust • Ingress of water with harmful effect
	CE 0197	CE mark (confirms that the product complies with the applicable European directives)
Other labels and symbols		
2		2.7 bar-6 bar O_2
3		Input pressure and volume flow rate
4 /10		Observe the instructions for use.
5		Follow the instructions for use.
6		Maximum pressure ≤ 100 mbar
7		Input (opening for fresh gas and emergency air)
8		STK sticker (only in the Federal Republic of Germany): Indicates when the next safety check in accordance with §11 of the MPBetreibV (German regulations governing owners/operators of medical devices) is required.
9		Service label: Indicates when the next maintenance is required.
11		Input voltage (12 V-15 V)
12		Inlet

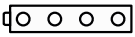
WM 68011g 08/2020

No.	Symbol	Description
13 / 14		Type BF applied part

3.8.2 Symbols on the battery



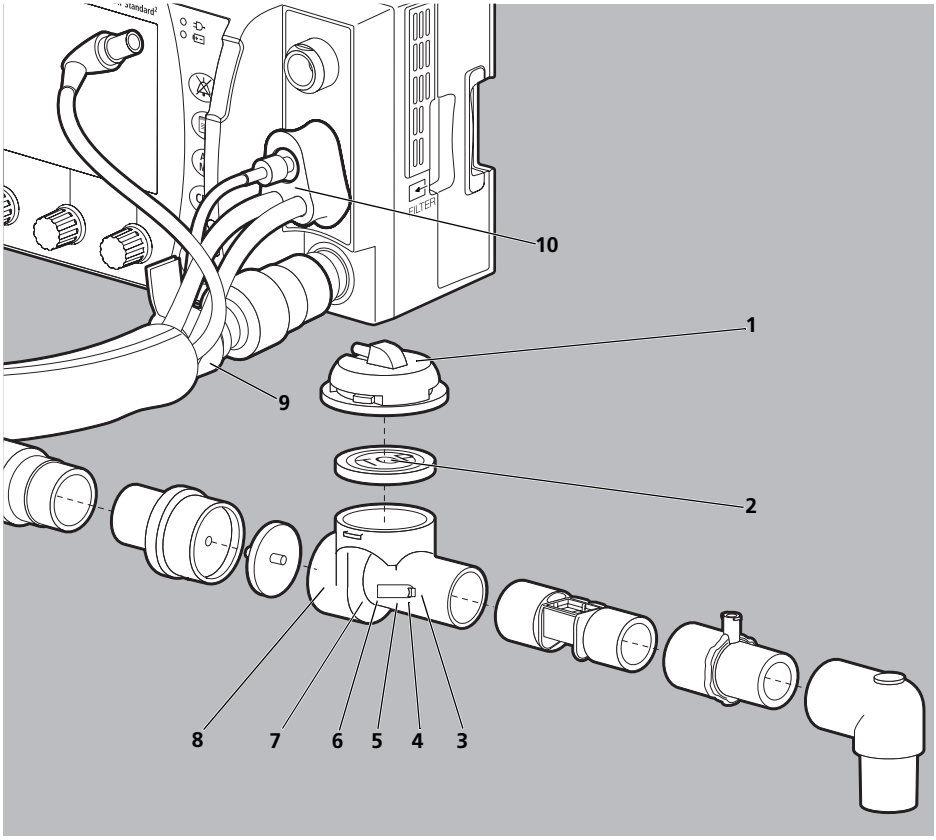
3-11 Symbols on the battery

No.	Symbol	Description
1		Battery fault, if fault indicator light is red
2		Battery status
3 / 9		Observe the instructions for use.
4		Date of manufacture
5	SN	Serial number
6		Manufacturer
7		Do not dispose of battery in household waste.

WM 68011g 08/2020

No.	Symbol	Description
8		China RoHS label (confirms that the product does not emit toxic substances for the number of years indicated)
10		Battery clicks audibly into place

3.8.3 Symbols on the patient hose system



3-12 Symbols on the patient hose system

WM 68011g 08/2020

No.	Symbol	Description
Reusable hose system and disposable hose system		
2	TOP	Indicates the correct installation direction of the PEEP control diaphragm.
3	CE 0197	CE mark (confirms that the product complies with the applicable European directives)
4		Calendar clock for year and month
5		Observe the instructions for use.
Additional symbols, for reusable hose system only		
1	INSP	Indicates the correct flow direction during inspiration.
6	**>PC<**	Material designation: Polycarbonate
7	**134°C**	Steam sterilization at 134°C
9		Indicates the date when the next maintenance is due (position: on the service label).
Additional symbols, for disposable hose system only		
1		Indicates the correct flow direction during inspiration.
6	**>PP<**	Material designation: Polypropylene
8		Disposable item, do not reuse
Additional symbols, for disposable hose system with reduced dead space only		
10		Disposable item, do not reuse

WM 68011g 08/2020

3.8.4 Symbols on the device information label of MEDUtrigger

Symbol	Description
Device information label	
	Degree of protection against electric shock: Type BF device
	Do not dispose of device in household waste.
CE 0197	CE mark (confirms that the product complies with the applicable European directives)
IP54	Degree of protection against: • Ingress of solid objects • Ingress of dust • Ingress of water with harmful effect
	Type of protection against electric shock: Protection class II device
	Date of manufacture

3.8.5 Labels on the hygiene filter

Symbol	Description
	Disposable item, do not reuse
	Manufacturer with date of manufacture

3.8.6 Labels on the packaging

Symbol	Description
Device	
	Protect the device against moisture.
	Storage temperature range limits

WM 68011g 08/2020

Symbol	Description
	Storage humidity range limits
	Fragile
SN	Serial number
CE 0197	CE mark (confirms that the product complies with the applicable European directives)
Battery	
	Article number
	Storage temperature range limits
	Keep dry
	Storage humidity range limits
	Serial number
	Manufacturer

Patient hose system (reusable hose system and disposable hose system)	
	Latex-free
	Storage temperature range limits
	Storage humidity range limits

WM 68011g 08/2020

CE 0197	CE mark (confirms that the product complies with the applicable European directives)
	Manufacturer
Additional symbols, for disposable hose system only	
	Disposable item, do not reuse
	Expiration date
Hygiene filter	
REF	Article number
	Observe the instructions for use
	Storage humidity range limits
	Disposable item, do not reuse
	Manufacturer
	Storage temperature range limits
	Expiration date

WM 68011g 08/2020

4 Preparation and operation

4.1 Mounting the device

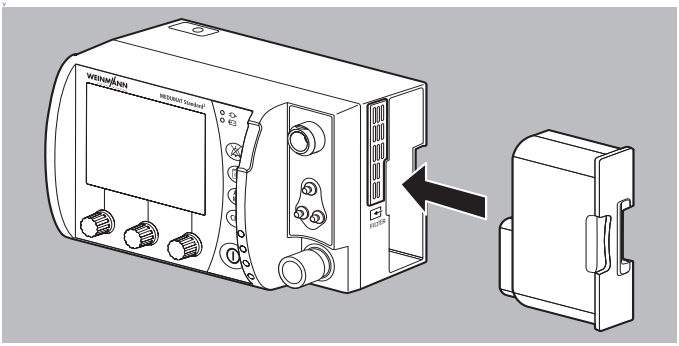
The device is mounted on a portable unit as standard and is ready for use. Observe the instructions for use of the portable units.

4.2 Connecting to a power supply

NOTICE

Loss of power due to combination of the device with an incorrect power supply!
If you use a portable unit which combines MEDUMAT Standard^2 and MEDUCORE Standard or MEDUCORE Standard^2 devices, a loss of power may occur in the devices in the event that these are used with a 50 W power supply.
⇒ Use only the more powerful 100 W power supply when combining the devices MEDUMAT Standard^2 and MEDUCORE Standard.

1. Check battery status (see "4.3 Using the rechargeable battery", page 51).
2. If necessary: Charge battery (see "4.3.2 Charging the battery in the device", page 51).



3. Slide full battery into the battery compartment until it clicks into place.

WM 68011g 08/2020

4. If necessary:
   If operating on the portable unit, mount the portable unit on a wall mounting with charging interface.

   or

   Connect the device to the power supply using the charging adapter (WM 28979) and the 100 W power supply.

   or

   Connect the device up to the vehicle's electrical system with the charging adapter (WM 28979) and 12 V cable.

Result The device is ready for use.

4.3 Using the rechargeable battery

4.3.1 General instructions

- Always operate the device with the rechargeable battery WM 45045.
- Note the methods of storing the battery and the charging intervals for prolonged storage (see "12.4 Storing the battery", page 230).
- The expected life of the battery is 6 years. Recommendation: Replace the battery after 6 years. If battery life has substantially dropped before then, replace the battery earlier.
- If you receive a replacement battery, you need to fully charge it before the first use.

4.3.2 Charging the battery in the device

Requirement

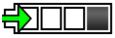
- The portable unit is mounted on a wall mounting with charging interface.

  or

- The device is connected to the line power via the power supply.

1. Insert battery into the battery compartment.
   Charging starts automatically if the following conditions are met:
   - External supply of at least 10 V is connected

- Battery is not yet fully charged (< 95% charge level)
- Battery temperature between 0°C and 45°C

If the device is switched on, the green arrow appears in the battery status symbol on the display (example: ) and the battery status indicator on the device flashes green.
If the device is switched off, only the battery status indicator flashes green.

If the battery is deeply discharged and you charge it in the device, the alarm light will light up red for a short period of time. It goes out again when the battery status progresses.

If the battery temperature is not within the designated charging temperature range (see "14.1.2 Technical data for battery", page 237), the green arrow on the battery status symbol disappears and the charging process is interrupted. The charging procedure is continued once the battery temperature is within the designated charging temperature range again.

When the battery status indicator lights up green and/or the symbol  appears on the display:
The device can be disconnected from the charging interface or from the power supply.

Result The battery is fully charged.

4.3.3 Charging the battery with the charging station

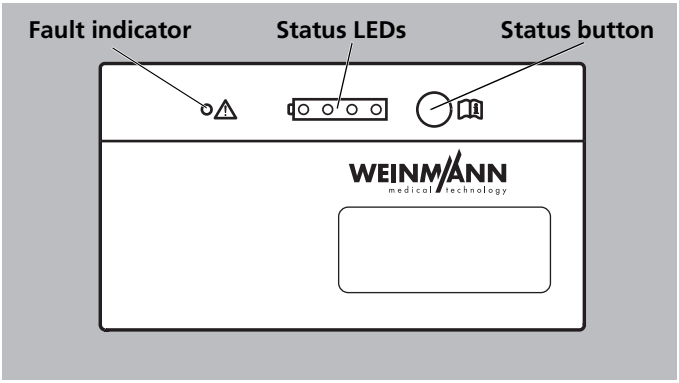
You can also charge the battery with the charging station WM 45190. Observe the instructions for use of the charging station.

4.3.4 Battery status indicator

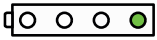
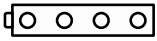
Battery

You can see the battery status on the battery itself.
The battery status is indicated by 4 green status LEDs. Simply press the status button on the battery.

WM 68011g 08/2020



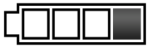
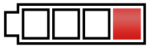
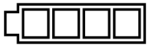
4-1 Status indicator on the battery

Status indicator	Explanation	Meaning
	4 LEDs are lit	Battery status > 90%
	3 LEDs are lit	Battery status approx. 60%-90%
	2 LEDs are lit	Battery status approx. 40%-60%
	1 LED is lit	Battery status approx. 10%-40%
	1 LED is flashing	Battery status < 10%
	No LEDs are lit	Battery is deeply discharged. Charge battery in the device for 24 hours. After 24 hours: • Green LED is lit: Battery fully charged and ready for use. • Red LED or no LED is lit: Battery defective. Replace battery.
	Red fault indicator is lit	Battery defective. Replace battery.

WM 68011g 08/2020

Device

If the device is switched on, you can see the battery status on the display:

Status indicator	Meaning
	Battery status > 90%
	Battery status approx. 60%-90%
	Battery status approx. 40%-60%
	Battery status approx. 10%-40%
	Battery status < 10% • The last remaining segment in the battery status symbol is red. • The message **Battery weak** appears in the display.
	Battery almost empty The message **Battery almost empty** appears in the display. The device can still be used for approx. 15 minutes. A timer in the alarm field counts down the time until the device switches off.
	• Battery is defective. **or** • No battery. **or** • Battery not at suitable temperature.
	Green arrow: Battery is charging.

WM 68011g 08/2020

4.3.5 Changing the battery

Requirement The replacement battery is fully charged.

1. Switch off the device (see "4.6 Switching the device off", page 70).

   or

   Connect the device to the line power.

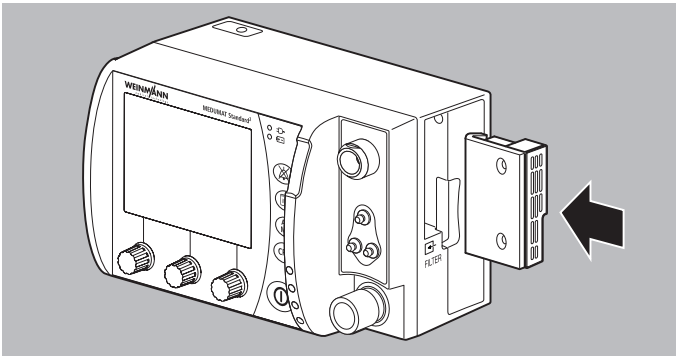
2. Take battery out of the battery compartment.
3. Slide the replacement battery into the battery compartment until it audibly clicks into place.
4. Switch on the device (see "4.5 Switching the device on", page 68).
   The symbol  appears on the display.

Result The device is operated with a fully charged battery.

4.4 Connecting components

4.4.1 Inserting the hygiene filter

1. Check the hygiene filter for external damage. If necessary: Replace the hygiene filter.



2. With the filter side facing forwards, slide the hygiene filter into the device's filter compartment until the hygiene filter is flush with the device.

WM 68011g 08/2020

3. Perform a function check (see "9.3 Performing a function check", page 202).

Result The hygiene filter has been inserted.

4.4.2 Connecting the patient hose system

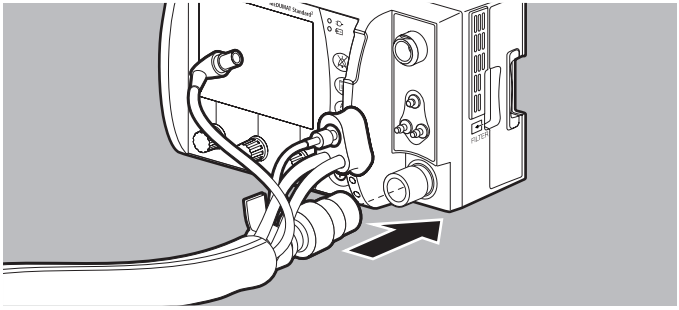
⚠ CAUTION

Risk of injury posed by ventilation with inhalation mask, tube or nasal cannula!

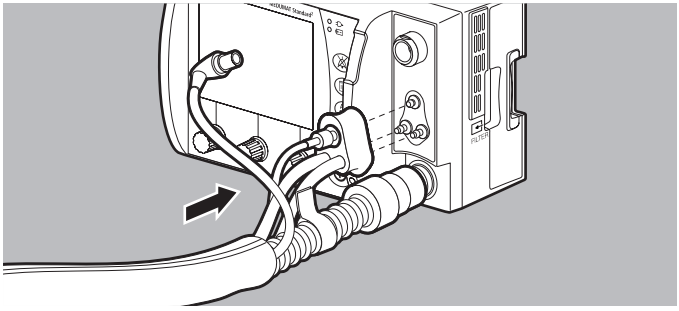
Ventilation with an inhalation mask, tube or nasal cannula connected may cause an injury to the patient.

⇒ Do not use an inhalation mask, tube or nasal cannula for ventilation.

Recommendation: Always use a breathing system filter for ventilation.



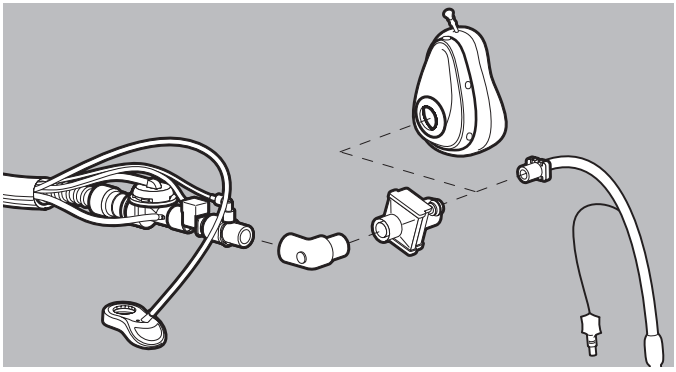
1. Connect the ventilation hose to the ventilation hose connection.



2. Connect the measuring hose system connector to the connection for the measuring hose system.

WM 68011g 08/2020

3. If necessary: Connect the FlowCheck sensor (see "4.4.3 Connecting the FlowCheck sensor", page 58).
4. If necessary: Connect MEDUtrigger (see "4.4.5 Connecting MEDUtrigger", page 62).
5. If necessary: Connect the CO_2 measuring hose (see "4.4.4 Connecting the CO_2 measuring hose", page 60).

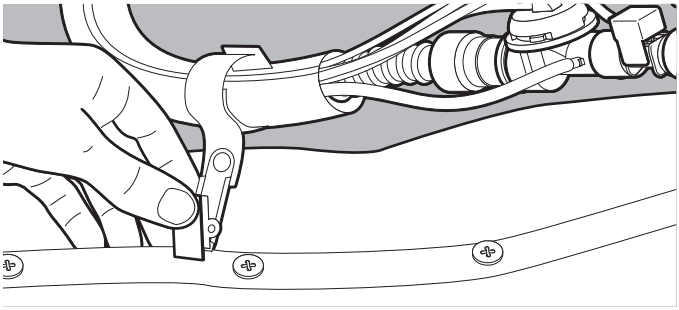


6. In case of tube ventilation: Following intubation, attach the patient valve of the patient hose system to the tube:
   - with/without elbow
   - with/without breathing system filter

   or

   In the case of mask ventilation: Attach the ventilation mask to the patient valve of the patient hose system:
   - with/without elbow
   - with/without breathing system filter

WM 68011g 08/2020

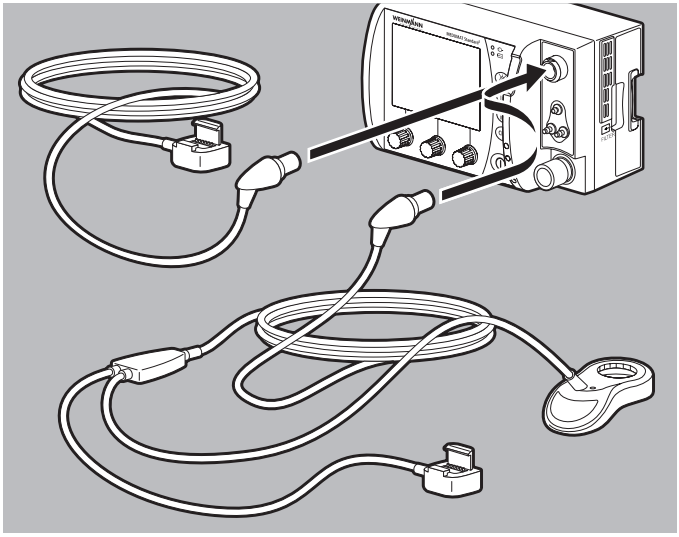


7. If necessary: Attach the patient hose system with Velcro strap with clip to the patient's clothing.

Result The patient hose system is connected and ready for use.

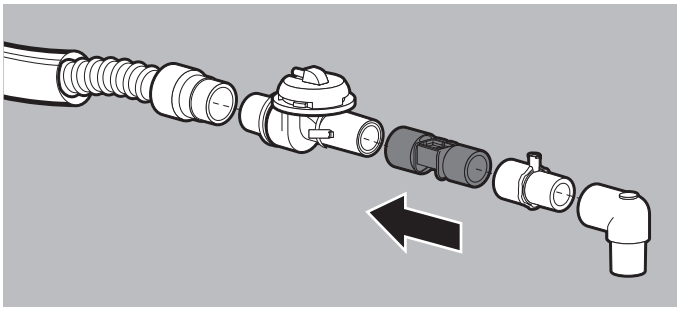
4.4.3 Connecting the FlowCheck sensor

The FlowCheck sensor enables flow measurement (only with flow measurement + ASB option).



1. Connect the connector of one of the following connection lines to the accessory connection on the device:
   - FlowCheck sensor connection line
   - FlowCheck sensor connection line with MEDUtrigger

WM 68011g 08/2020



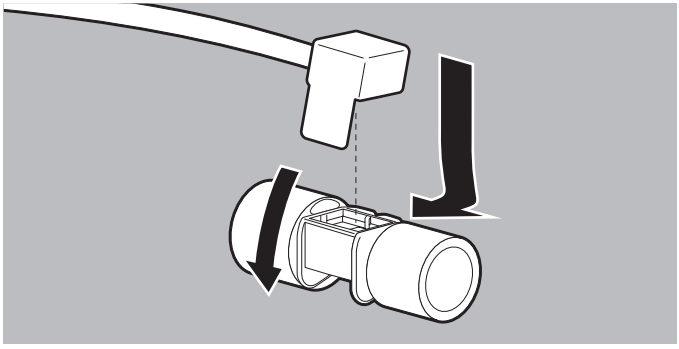
2. Connect the FlowCheck sensor to the patient valve.

⚠ CAUTION

Risk of injury from touching the contacts on the FlowCheck sensor connection line/FlowCheck sensor connection line with MEDUtrigger and the patient at the same time!

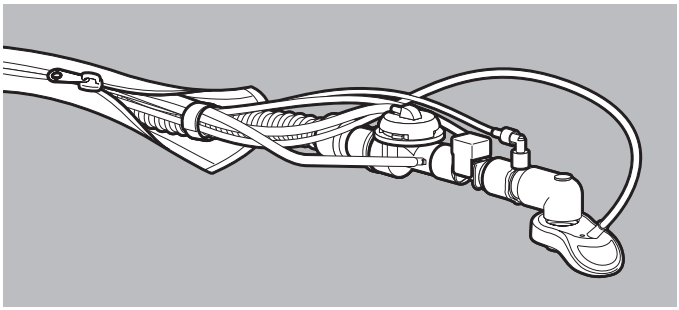
The contacts on the FlowCheck sensor connection line/FlowCheck sensor connection line with MEDUtrigger are live. Touching the contacts and the patient at the same time can injure the user or the patient.

⇒ Do not touch the contacts on the FlowCheck sensor connection line/FlowCheck sensor connection line with MEDUtrigger and the patient at the same time.



3. Hook the FlowCheck sensor connector onto the FlowCheck sensor and push down until it audibly clicks into place.

WM 68011g 08/2020



4. With the reusable hose system: Guide the connection line with measuring hose system and ventilation hose into the hose protection sleeve of the patient hose system.
5. If necessary: Activate flow measurement + ASB option (see "6.3.9 Options", page 139).
6. If necessary: On connecting one of the two connection lines to the device, perform a function check (see "9.3 Performing a function check", page 202) to update the connection line software.

Result The FlowCheck sensor is connected to the device and is ready for use.

4.4.4 Connecting the CO_2 measuring hose

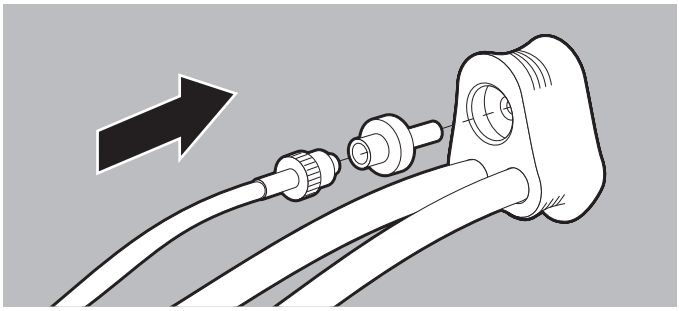
NOTICE

Material damage due to lack of a water filter!
If CO_2 is measured without a water filter, the device can suck in dirt and become damaged.
⇒ Always use a water filter for CO_2 measurement.

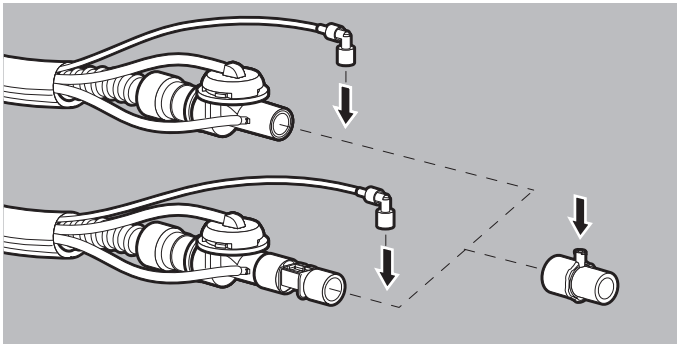
The water filter loses efficiency after approx. 8 hours of continuous operation, depending on the temperature, humidity and any coarse particles such as mucus. If the effectiveness of the water filter declines, the device displays the alarm **CO_2 occlusion** and issues a medium priority audible alarm. Replace the water filter after a maximum of 8 hours of continuous operation.

Requirement
- The ventilation hose is connected to the device.
- The measuring hose system connector is connected to the device.

WM 68011g 08/2020



1. Connect the water filter to the CO_2 measuring hose.
2. Connect the CO_2 measuring hose with water filter to the measuring hose system connector.

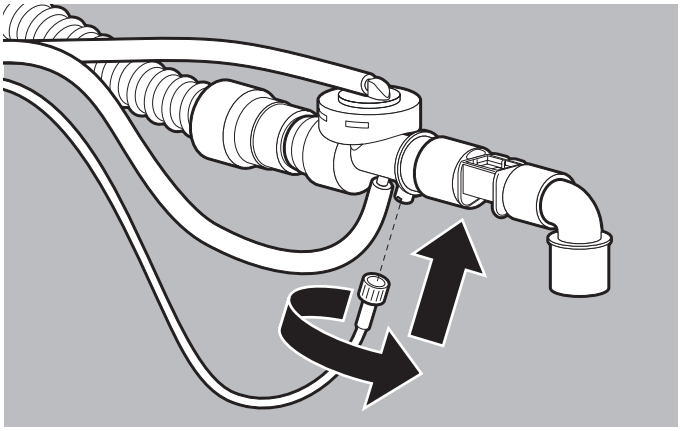


3. With the reusable hose system: Connect the connector with CO_2 connection:
   - to the patient valve

   or

   - to the FlowCheck sensor
4. With the reusable hose system: Connect the CO_2 measuring hose to the connector with CO_2 connection.

WM 68011g 08/2020



5. With disposable hose systems: Detach the blanking plug on the CO_2 connection and connect the CO_2 measuring hose to the CO_2 connection.
   When doing so, note: Tighten the screw connection by hand.

To minimize the dead space, you can also connect the CO_2 measuring hose to a breathing system filter with gas connection (e.g., WM 22162).

6. With the reusable hose system: Guide the CO_2 measuring hose with the rest of the measuring hose system and ventilation hose into the hose protection sleeve of the patient hose system.

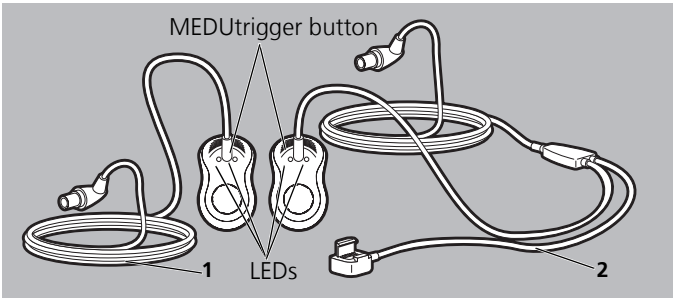
7. If necessary: Activate the capnography option (see "6.3.9 Options", page 139).

Result The CO_2 measuring hose is connected to the patient hose system.

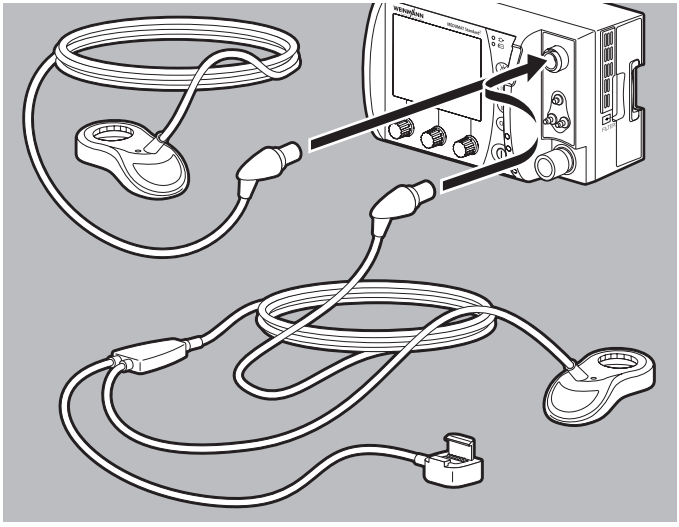
4.4.5 Connecting MEDUtrigger

The operational readiness of MEDUtrigger is indicated by 2 green LEDs on MEDUtrigger. If MEDUtrigger is connected to the device and the green LEDs on MEDUtrigger are lit, you can trigger mechanical breaths manually by pressing the MEDUtrigger button.

WM 68011g 08/2020

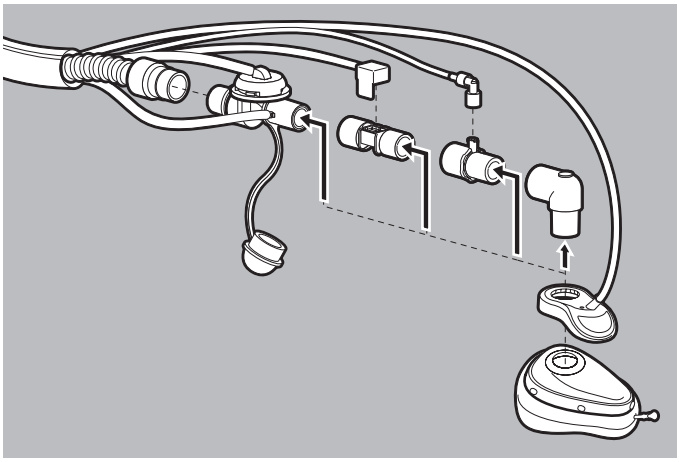


*4-2 Connection line of MEDUtrigger (**1**) and FlowCheck sensor connection line with MEDUtrigger (**2**)*



1. Connect the connector of one of the following connection lines to the accessory connection on the device:
   - Connection line of MEDUtrigger
   - FlowCheck sensor connection line with MEDUtrigger
2. If necessary: Connect the FlowCheck sensor connector of the FlowCheck sensor connection line with MEDUtrigger to the FlowCheck sensor (see "4.4.3 Connecting the FlowCheck sensor", page 58).

WM 68011g 08/2020



3. Place MEDUtrigger between the mask and the following end of the patient hose system closest to the patient:

   - Patient valve

   or

   - FlowCheck sensor

   or

   - Connector with CO_2 connection

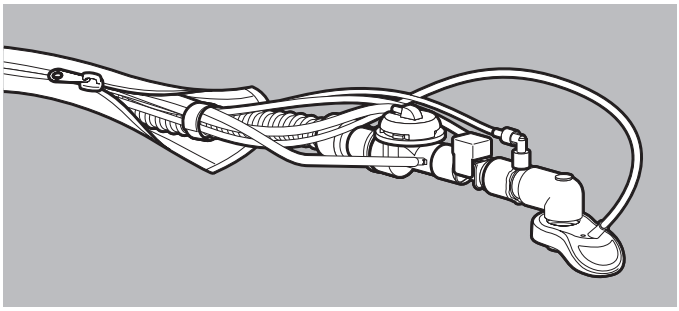
   or

   - Elbow

If you use a breathing system filter, always place MEDUtrigger between the mask and the breathing system filter.

If you are not using MEDUtrigger (e.g., with CPAP applications), release it from the patient hose system and fix to the patient hose system with the Velcro strap with clip.

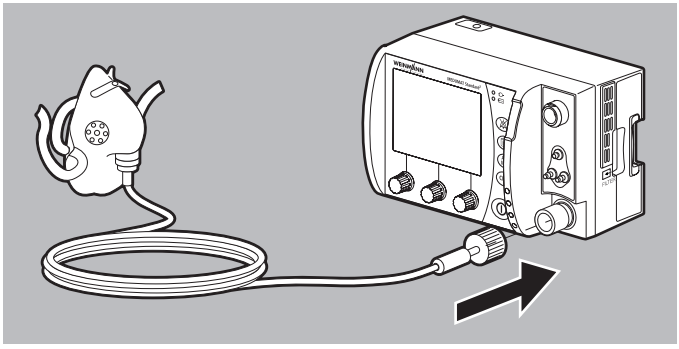
WM 68011g 08/2020



4. With the reusable hose system: Guide the connection line with measuring hose system and ventilation hose into the hose protection sleeve of the patient hose system.
5. If necessary: Activate MEDUtrigger option (see "6.3.9 Options", page 139).

Result MEDUtrigger is connected to the device and is ready for use.

4.4.6 Connecting the inhalation adapter



1. Connect the inhalation adapter to the connection for the ventilation hose on the device.
2. Connect the inhalation mask to the inhalation adapter

   or

   Connect the tube to the inhalation adapter

   or

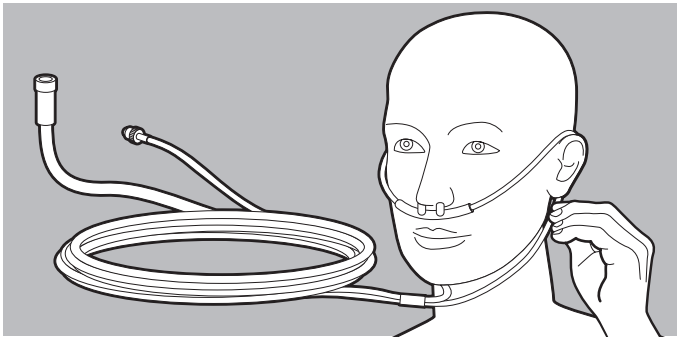
   Connect the nasal cannula to the inhalation adapter.

WM 68011g 08/2020

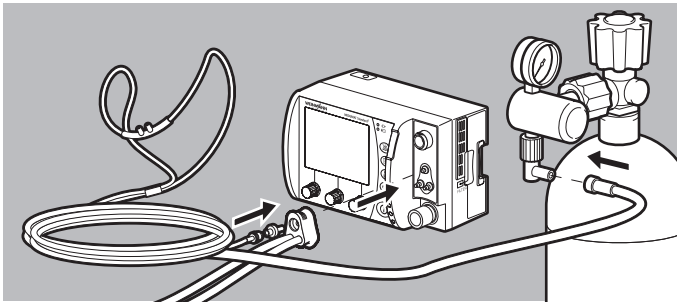
3. Perform inhalation (see "4.7.7 Performing inhalation (only with Inhalation option)", page 79).

Result Inhalation via the inhalation adapter is prepared.

4.4.7 Connecting the etCO$_2$/O$_2$ nasal cannula



1. Position the etCO$_2$/O$_2$ nasal cannula.
2. If necessary: Fix the tubes of the etCO$_2$/O$_2$ nasal cannula to the face using adhesive plasters.



3. Connect the inhalation inlet of the etCO$_2$/O$_2$ nasal cannula to the inhalation outlet of the pressure reducer.
4. Connect the CO$_2$ inlet of the etCO$_2$/O$_2$ nasal cannula with water filter to the measuring hose system connector.

As an alternative to the etCO$_2$/O$_2$ nasal cannula, you can also connect the CO$_2$ measuring hose to the measuring hose system connector and couple with the CO$_2$ connector of a breathing system filter or a resuscitator.

Result CO$_2$ monitoring is prepared via an external interface.

WM 68011g 08/2020

4.4.8 Connecting the nebulizer

Only use the device in combination with the following nebulizer:

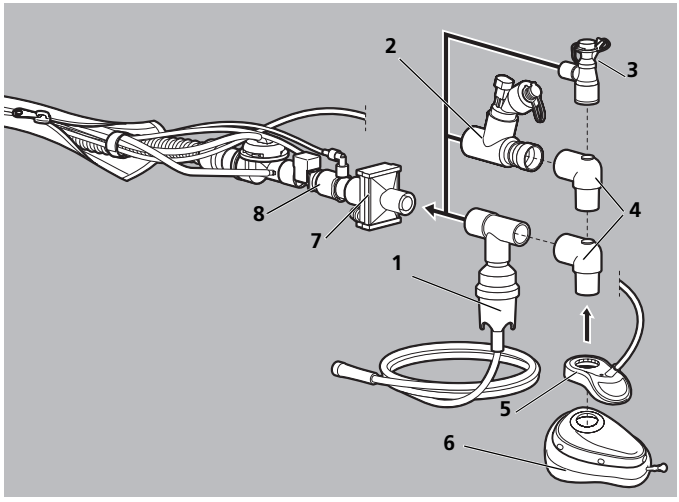
- Pneumatic drug nebulizer WM 15827 **1**
- Aerogen® Solo (Fa. Aerogen Ltd.) **2**
- Tube Inhaler (VBM Medizintechnik GmbH) **3**

⚠ CAUTION

Risk of injury due to erroneous readings!
If the filter is installed incorrectly or no filter is used, the membrane may stick in the patient valve or the FlowCheck sensor could return erroneous readings, which can cause injury to the patient.
⇒ Observe the correct order of the individual components.
⇒ Install the filter (breathing system filter, bacteria filter or a combined breathing system/bacteria filter) between the FlowCheck sensor and nebulizer.

⚠ CAUTION

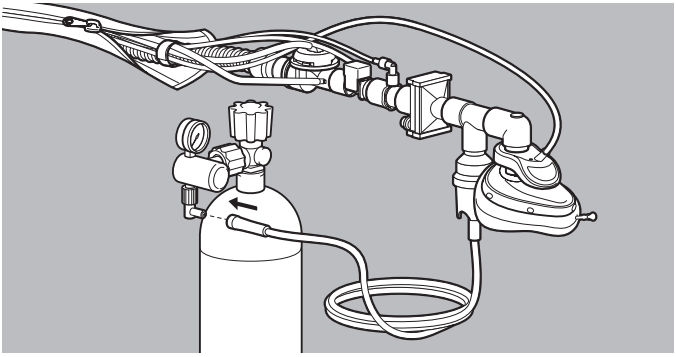
Risk of injury from use of pneumatic nebulizers during volume-controlled ventilation!
The use of pneumatic nebulizers increases the minute volume administered to the patient. This can injure the patient.
⇒ Do not use pneumatic nebulizers during volume-controlled ventilation.



1. Place the mask/tube **6** (optionally with elbow **4** and/or MEDUtrigger **5**) on the nebulizer **1**, **2** or **3**.

WM 68011g 08/2020

2. Connect the open end of the nebulizer **1**, **2** or **3** with the filter **7** (breathing system filter, bacteria filter or a combined breathing system/bacteria filter).
3. Place the filter **7** (breathing system filter, bacteria filter or a combined breathing system/bacteria filter) on the patient hose system's FlowCheck sensor **8**.



4. When using the pneumatic drug nebulizer WM 15827: Connect the oxygen tube to the inhalation outlet

   of the pressure reducer. When doing so, note: The nebulizer must be in a horizontal position for sufficient nebulization to occur.

Result A nebulizer is connected.

4.5 Switching the device on

Requirement
- The device is disconnected from the patient.
- A fully charged battery is inserted in the device.
- The device is connected to the oxygen supply.

1. Briefly press the On/Off button ⏻.

   An automatic self-test starts, which runs through the following sequence:

   - The alarm light flashes twice and two short test tones are emitted
   - The start screen appears

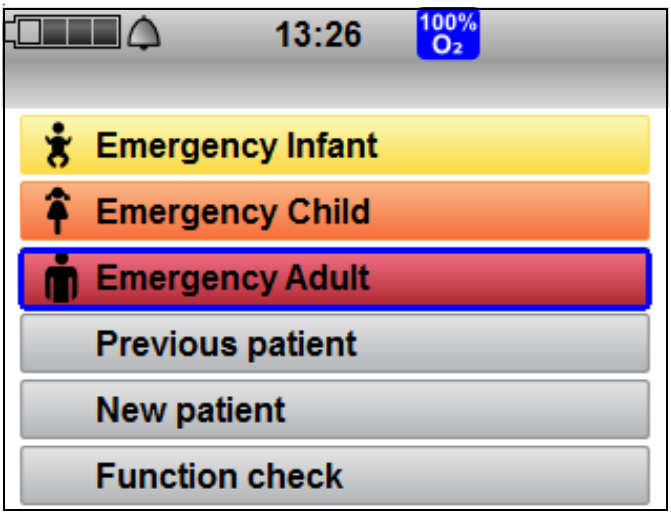
WM 68011g 08/2020

If you switch the device on in NVG mode, the following displays are deactivated:

- Alarm light
- Line power indicator
- Battery status indicator
- Audio alarm output

The start screen with the selected NVG brightness appears (see "6.3.7 Device configuration", page 130).

The self-test is successful when all of the steps have been completed.
After the self-test, the device displays the start menu:



2. If one or more steps were not completed: Do not operate the device.
3. Perform a function check (see "9.3 Performing a function check", page 202).

Result The device is ready for use.

WM 68011g 08/2020

4.6 Switching the device off

1. Press and hold the On/Off button ⏻ for at least 2 seconds.
2. Shut off the oxygen supply.

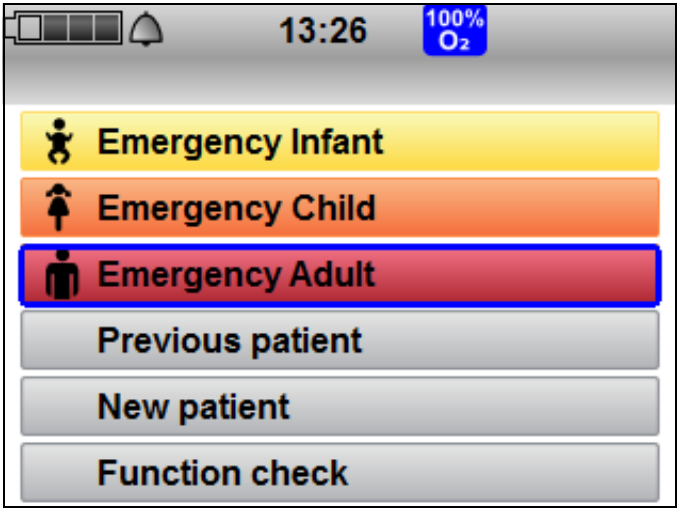
Result The device is completely switched off.

4.7 Ventilating the patient

4.7.1 Selecting the emergency mode from the start menu

Requirement The device is switched off.

1. Switch on the device.
   After the self-test, the device displays the start menu:



If the device was switched off for < 30 seconds (e.g., for a battery change), a countdown in the **Previous patient** field counts down 20 seconds.

If the device was switched off for > 30 seconds, the countdown for the last patient is deactivated.

WM 68011g 08/2020

2. Select emergency mode:
   - Emergency Infant
   - Emergency Child
   - Emergency Adult

   Depending on the preset in the operator menu, the device switches to one of the following modes with the ventilation parameters preset for the patient group (see "14.1.10 Factory settings for emergency modes and ventilation modes", page 257) and shows a pressure gauge view:

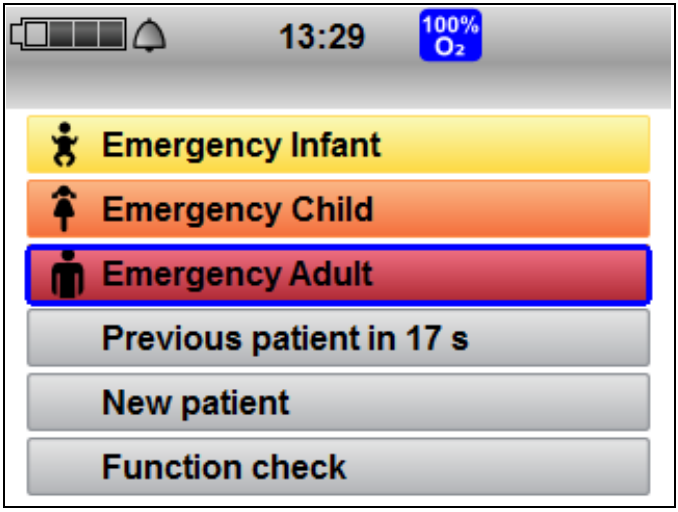
   - IPPV
   - BiLevel + ASB (only if the BiLevel + ASB option is activated)

Result An emergency mode for a particular patient group is activated.

4.7.2 Calling up the parameters of the patient last ventilated

Requirement The device is switched off.

1. Switch on the device.
   After the self-test, the device displays the start menu:



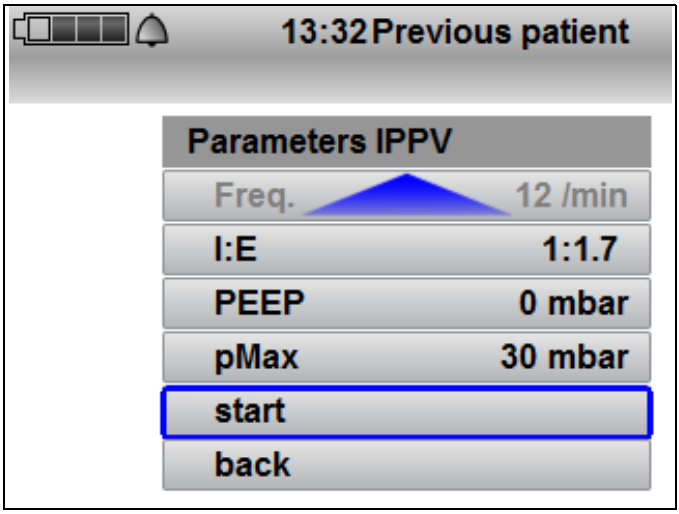
   If the device was switched off for < 30 seconds (e.g., for a battery change), a countdown in the **Previous patient** field counts down 20 seconds.

If the device was switched off for > 30 seconds, the countdown for the last patient is deactivated.

2. Select **Previous patient** field.

   or

   Allow the countdown to run.



3. If necessary: Adjust the settings of the last patient and confirm.

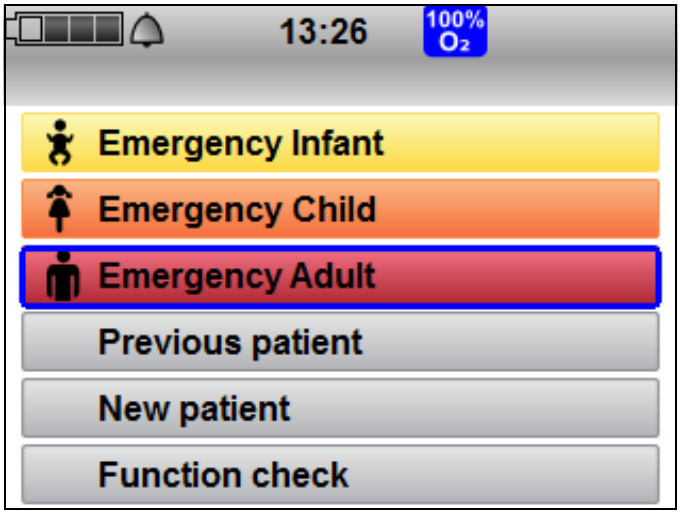
Result The ventilation mode, ventilation parameters and the view of the last ventilated patient are loaded.

WM 68011g 08/2020

4.7.3 Selecting a ventilation mode for a new patient

Requirement The device is switched off.

1. Switch on the device.
   After the self-test, the device displays the start menu:

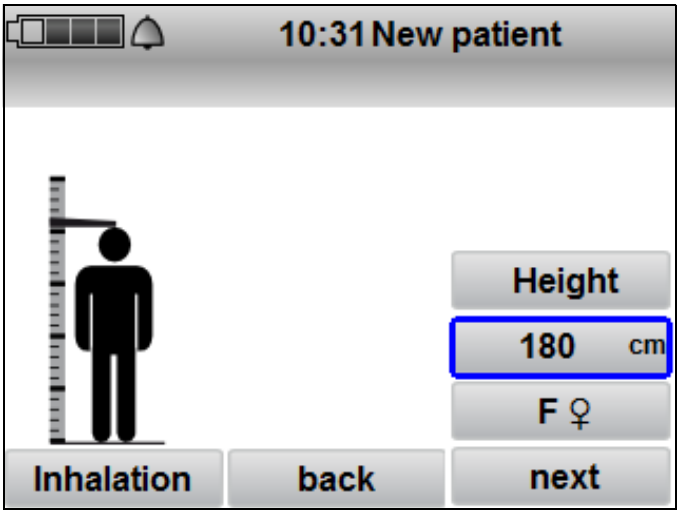


   If the device was switched off for < 30 seconds (e.g., for a battery change), a countdown in the **Previous patient** field counts down 20 seconds.

   If the device was switched off for > 30 seconds, the countdown for the last patient is deactivated.

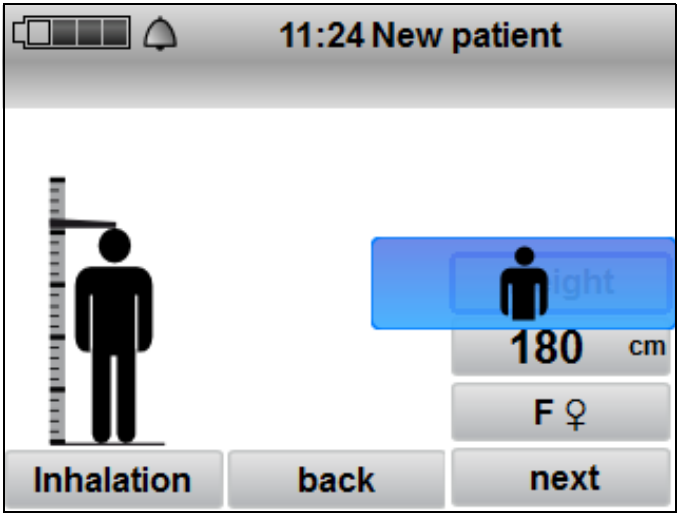
2. Select the field **New patient**.

WM 68011g 08/2020



3. Select the height and gender: The height is given in 5 cm increments between 50 cm and 250 cm.
(see "14.2 Calculation of body weight on the basis of body height", page 258).

or



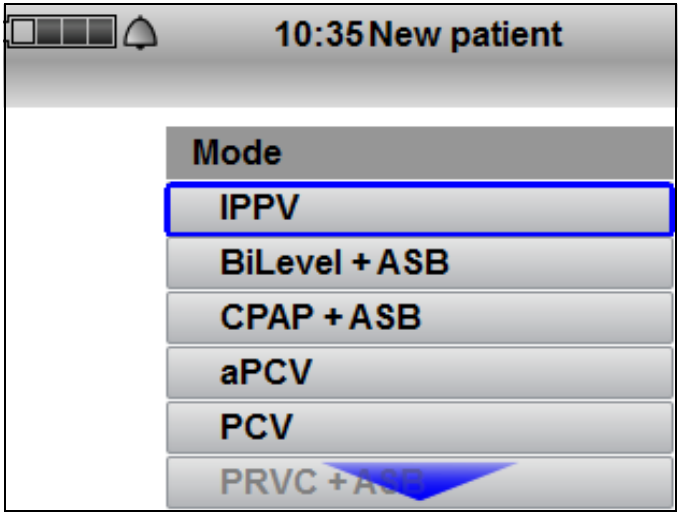
Navigate to the field **Height** and turn the navigation knob further to select the desired patient group:

- Adult

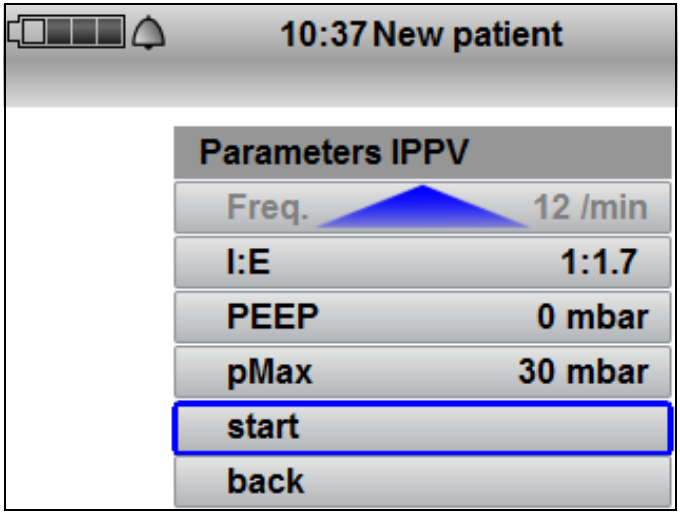
WM 68011g 08/2020

- Child
- Infant

4. Press the navigation knob **next**.



5. Select a ventilation mode.



6. If necessary: Set the parameters of the ventilation mode.

WM 68011g 08/2020

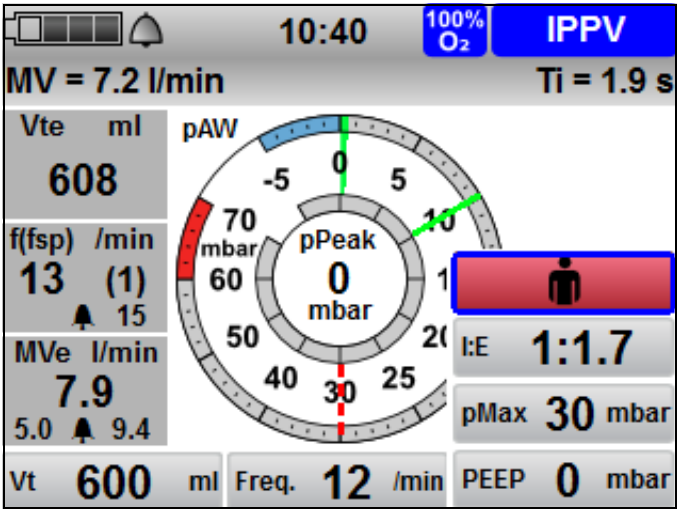
7. Select the **start** field.

Result A ventilation mode for a new patient has been set. If the curve display option is activated, the device shows a curve view.

4.7.4 Selecting an emergency mode from a ventilation mode

Requirement

- The device is switched on.
- A ventilation mode is set (exception: CPR, Inhalation, CO_2 monitoring).



1. Select the field for the emergency mode using the right-hand navigation knob.
2. Select emergency mode:
   - Emergency Infant
   - Emergency Child
   - Emergency Adult

WM 68011g 08/2020

Depending on the preset in the operator menu, the device switches to one of the following modes with the ventilation parameters preset for the patient group (see "14.1.10 Factory settings for emergency modes and ventilation modes", page 257) and shows a pressure gauge view:

- IPPV
- BiLevel + ASB (only if the BiLevel + ASB option is activated)

You can adjust the preset ventilation parameters for the emergency modes in the operator menu: Operator menu | Presets patient.

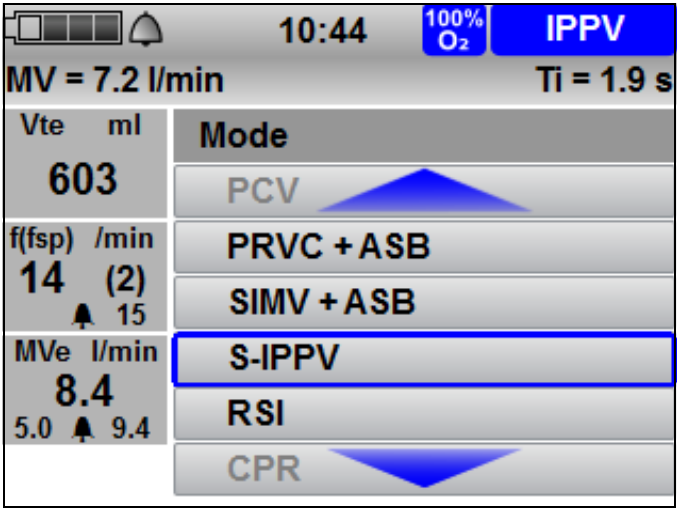
Result An emergency mode for a particular patient group is activated.

4.7.5 Changing the ventilation mode

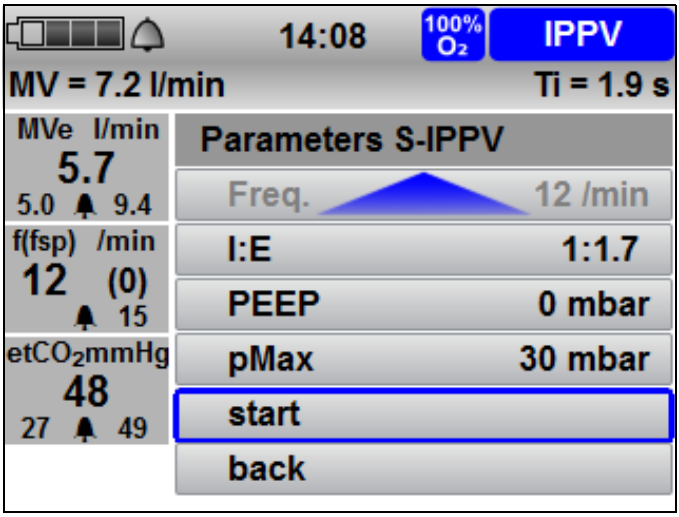
Requirement

- The device is switched on.
- A ventilation mode is set.

1. Briefly press the menu button .
   The user menu opens.
2. Select the **Mode** field using the right-hand navigation knob.



3. Select a ventilation mode.



4. If necessary: Set the parameters of the ventilation mode.
5. Select the **start** field.

Result The ventilation mode is changed.

4.7.6 Operating the device in oxygen or Air Mix mode

Requirement

- The device is switched on.
- A ventilation mode is set.

1. Briefly press the Air Mix button (AIR MIX).
   Air Mix appears in the status line and the device is operated in Air Mix mode.
2. Briefly press the Air Mix button (AIR MIX):
   - If **100% O_2** is set as the supply gas (see "6.3.7 Device configuration", page 130): **100% O_2** appears in the status line and the device is operated with 100% oxygen.

   or

   - If **93% O_2** is set as the supply gas (see "6.3.7 Device configuration", page 130): O_2 93% appears in the status line and the device is operated with concentrator oxygen.

WM 68011g 08/2020

Oxygen mode is activated as standard for all emergency modes.

Result The device is operated in oxygen or Air Mix mode.

4.7.7 Performing inhalation (only with Inhalation option)

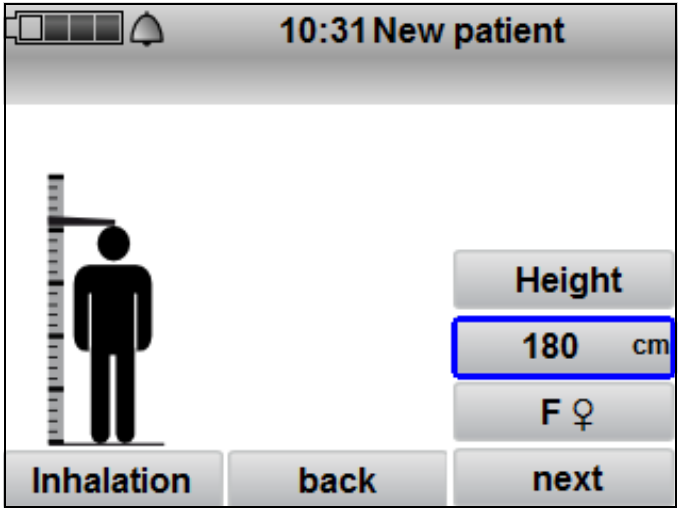
NOTICE

Using a nebulizer prevents treatment in Inhalation mode!
The device is not suitable for nebulizers in inhalation mode. The device does not create sufficient pressure for this function.
⇒ Do not use nebulizers in inhalation mode with this device.

Requirement

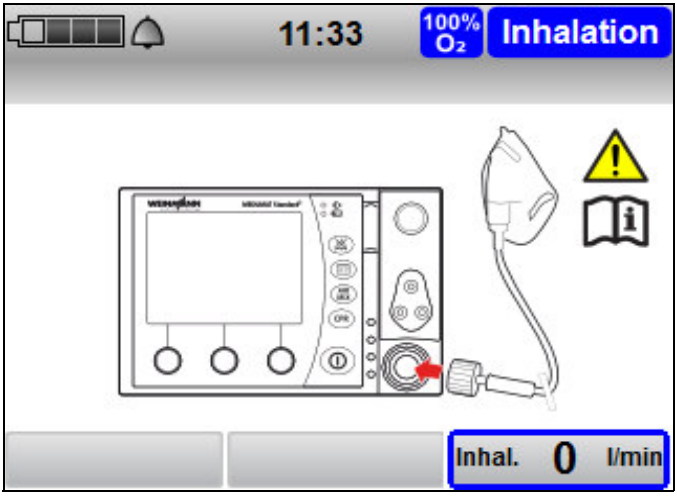
- The patient is not connected via a tube.
- An inhalation adapter is connected (see "4.4.6 Connecting the inhalation adapter", page 65).
- The device is switched on.
- The start menu is on the display.

1. Select the field **New patient**.
2. Select the height and gender (see "14.2 Calculation of body weight on the basis of body height", page 258).



WM 68011g 08/2020

3. Select the field **Inhalation** using the left-hand navigation knob.
   The device switches to Inhalation mode.



4. Select flow for inhalation using the right-hand navigation knob.

Result The inhalation is performed.

4.7.8 Performing CO_2 monitoring (only with capnography option)

Requirement

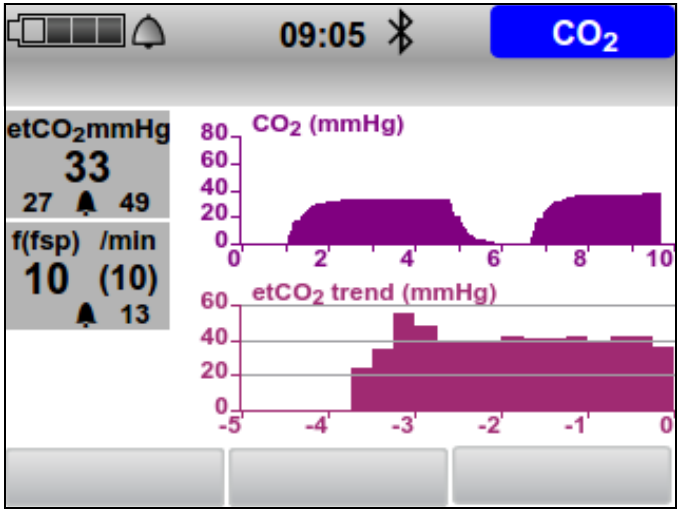
- The device is switched on.
- **CO_2 monitoring** was set as the ventilation mode for a new patient (see "4.7.3 Selecting a ventilation mode for a new patient", page 73).
- An $etCO_2/O_2$ nasal cannula is connected (see "4.4.7 Connecting the $etCO_2/O_2$ nasal cannula", page 66)

  or

- The CO_2 measuring hose is connected to an external interface (e.g., resuscitator with breathing system filter).

WM 68011g 08/2020

When using an $etCO_2/O_2$ nasal cannula, the CO_2 measurement may be distorted by the intake of additional air. Only the CO_2 trend can be assessed.



1. Assess CO_2 measurements diagnostically.
2. If necessary: Configure $etCO_2$ Trend (see "5.3.6 $etCO_2$ trend (only with capnography option)", page 116).

Result The CO_2 measurements and the respiratory rate of the patient are monitored.

4.7.9 Performing ventilation in CPR Manual mode

In CPR Manual mode, you determine the respiratory rate administered yourself. Using MEDUtrigger, you manually trigger individual mechanical breaths with the set tidal volume.

WM 68011g 08/2020

⚠ CAUTION

Delay in treatment due to simultaneous metronome outputs from the ventilator and the defibrillator!
If the ventilator is used together with a defibrillator (MEDUCORE Standard or MEDUCORE Standard^2) which can also emit a metronome sound, the simultaneous metronome outputs from the defibrillator and the ventilator may confuse the user and cause delays in treatment.
⇒ If the ventilator and defibrillator are being used at the same time, switch off the metronome sound of MEDUMAT Standard^2.
⇒ Do not perform resuscitation without a metronome.

Requirement

- The device is switched on.
- MEDUtrigger is connected to the device.
- MEDUtrigger is activated in the operator menu (Operator menu | Options | MEDUtrigger).
- **Manual** was set in the operator menu (Operator menu | Presets patient | CPR mode | Start mode).

1. Briefly press the CPR button (CPR).
   The device switches to the mode **CPR Man.** The green LEDs on MEDUtrigger light up.
   If you have activated the metronome, the metronome emits signals at a rate of 30:2 (Patient group adult) or 15:2 (Patient group infant and child).
2. Press and hold the MEDUtrigger button during the ventilation interval until two mechanical breaths are performed.

   or

   If the green LEDs on MEDUtrigger are lit, briefly press the MEDUtrigger button twice and trigger the mechanical breaths manually.
3. If necessary: Cancel CPR Manual mode using the CPR button (CPR).

   or

   Use the right-hand navigation knob to switch to **CCSV** or **IPPV** (see "4.7.12 Changing the ventilation mode in CPR mode", page 88).

WM 68011g 08/2020

The device always switches to IPPV mode upon exiting CPR mode.

Result Ventilation is performed in CPR Manual mode.

4.7.10 Performing ventilation in CPR IPPV mode

⚠ CAUTION

Delay in treatment due to simultaneous metronome outputs from the ventilator and the defibrillator!
If the ventilator is used together with a defibrillator (MEDUCORE Standard or MEDUCORE Standard^2) which can also emit a metronome sound, the simultaneous metronome outputs from the defibrillator and the ventilator may confuse the user and cause delays in treatment.
⇒ If the ventilator and defibrillator are being used at the same time, switch off the metronome sound of MEDUMAT Standard^2.
⇒ Do not perform resuscitation without a metronome.

Requirement
- The device is switched on.
- CCSV option is deactivated.

1. Briefly press the CPR button (CPR).
   Depending on the preset in the operator menu, the device switches to **CPR IPPV** mode or **CPR Manual** mode (Operator menu | Presets patient | CPR mode | Start mode).
2. If  is already set in the operator menu: Continue ventilation in CPR IPPV mode.

   or

   If **Manual** is already set in the operator menu: Use the right-hand navigation knob to switch to  **IPPV**
   (see "4.7.12 Changing the ventilation mode in CPR mode", page 88).
3. If the patient experiences spontaneous circulation again: Cancel **CPR IPPV** mode using the CPR button (CPR).

The device always switches to IPPV mode upon exiting CPR mode.

Result Ventilation is performed in CPR IPPV mode.

WM 68011g 08/2020

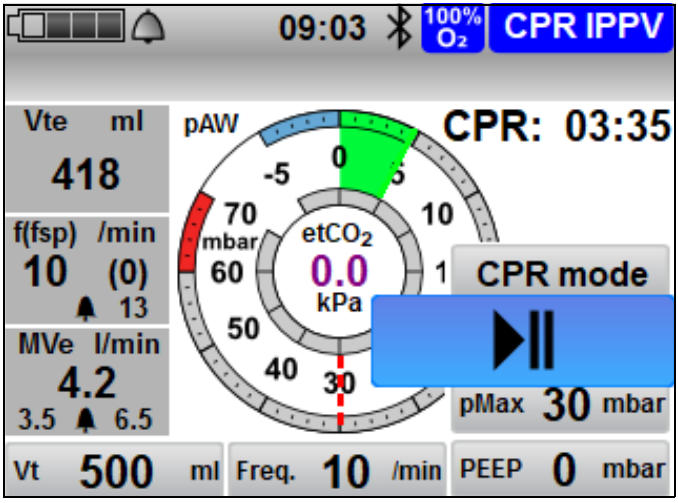
Pausing ventilation in CPR IPPV mode

During the analysis of the defibrillator, you can pause ventilation in order to avoid artifacts in the analysis.

Requirement

- The device is switched on.
- The CPR mode is set.
- Continuous ventilation **IPPV** is activated (**CPR IPPV**).

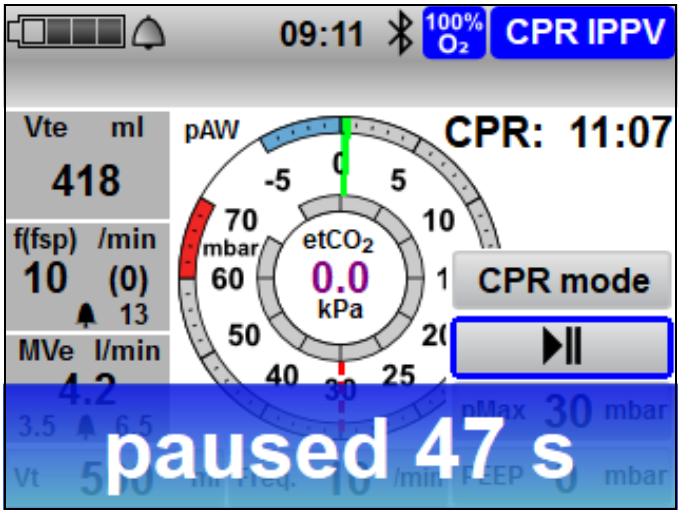
1. Turn or press the right-hand navigation knob.



2. Select the field.

   The ventilation is paused for the interval time set in the operator menu (max. 60 seconds). A countdown indicates the remaining time.

WM 68011g 08/2020



3. To start continuous ventilation again: Press the ▶‖ field twice.

Result Ventilation pauses.
When the countdown reaches zero, ventilation automatically restarts.

4.7.11 Performing ventilation in CPR CCSV mode

⚠ WARNING

Delay in treatment due to simultaneous metronome outputs from the ventilator and the defibrillator!
If the ventilator is used together with a defibrillator (MEDUCORE Standard or MEDUCORE Standard^2), which can also emit a metronome sound, the simultaneous metronome outputs from both devices may confuse the user and cause delays in treatment.
⇒ Where the ventilator and defibrillator are used at the same time, switch off the metronome sound of MEDUMAT Standard^2.
⇒ Do not perform resuscitation without a metronome.

WM 68011g 08/2020

⚠ WARNING

Treatment delays due to triggered alarms for spontaneously breathing patients which do not apply in the this application scenario!
In CPR CCSV mode, triggered $etCO_2$ alarms can confuse the user and result in delays in treatment.
⇒ Switch off $etCO_2$ alarms for CPR CCSV mode in the operator menu.

⚠ WARNING

Treatment delay due to impaired detection of chest compressions due to obstructed airways!
In CPR CCSV mode, chest compressions are detected as a result of pressure changes in the airways. If the airways are obstructed, this detection is impaired, which can lead to delays in treatment.
⇒ Check the setting of the PEEP and the trigger in CPR CCSV mode and adjust if required.

Requirement

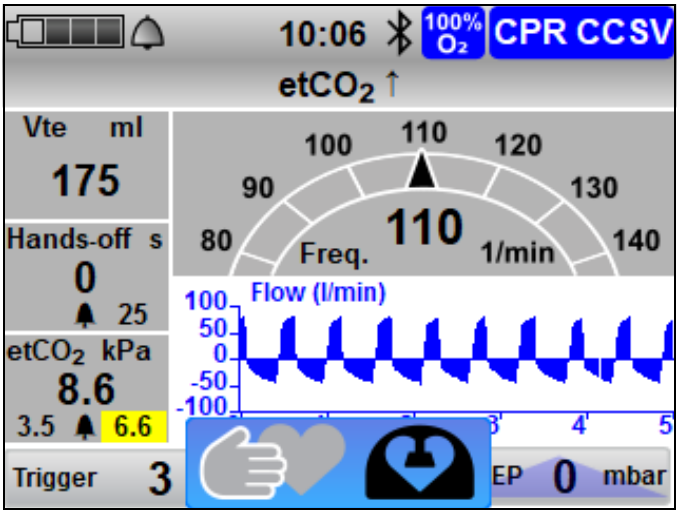
- The device is switched on.
- The CCSV option is activated.

1. Briefly press the CPR button (CPR).
   Depending on the preset in the operator menu, the device switches to **CPR CCSV** mode or **CPR Manual** mode (Operator menu | Presets patient | CPR mode | Start mode).
2. If  is already set in the operator menu: Continue ventilation via chest compressions in **CPR CCSV** mode:

   or

   If **Manual** is already set in the operator menu: Use the right-hand navigation knob to switch to  **CCSV**
   (see "4.7.12 Changing the ventilation mode in CPR mode", page 88).

WM 68011g 08/2020



3. If you want chest compressions to be carried out automatically: Switch to using the middle navigation knob.

   or

   If you want chest compressions to be carried out manually: Switch to using the middle navigation knob.

4. If you want mechanical breaths to be triggered in the phase during which no chest compression is performed: Increase the trigger level and/or reduce PEEP.

   or

   If the trigger is not activated or activated too infrequently and no compressions are detected: Reduce the trigger level and/or increase PEEP.

5. If the patient experiences spontaneous circulation again: Stop chest compressions.

   or

   Cancel **CPR CCSV** mode with the CPR button (CPR).

Result Ventilation is performed in **CPR CCSV** mode.

WM 68011g 08/2020

If the trigger is still not functioning properly in **CPR CCSV** mode in spite of reducing the trigger and increasing the PEEP, you can switch from **CPR CCSV** mode to **CPR IPPV** mode (see "4.7.12 Changing the ventilation mode in CPR mode", page 88).

Interrupting ventilation in CPR CCSV mode

During the analysis of the defibrillator, you can pause ventilation in order to avoid ventilation artifacts in the analysis.

Requirement

- The device is switched on
- The CPR CCSV mode is set.

1. Pause chest compressions.

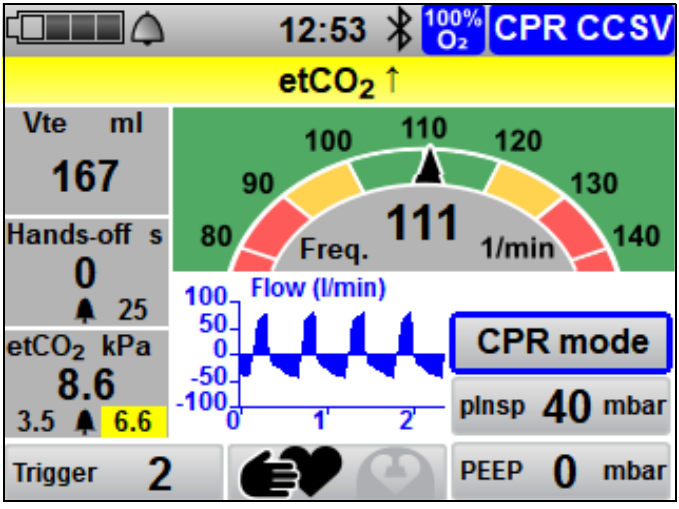
Result The ventilation is paused for as long as the chest compressions are continued (up to the set back-up ventilation time at most).

4.7.12 Changing the ventilation mode in CPR mode

This chapter describes how you can switch between CPR Manual, CPR IPPV and CPR CCSV when in CPR mode.

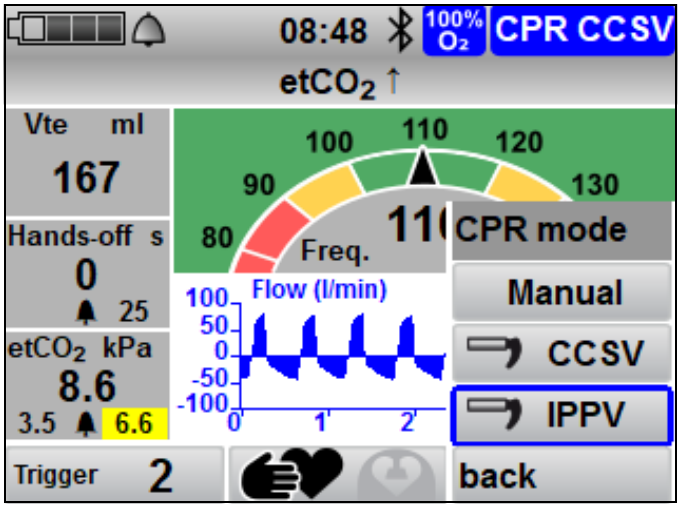
Requirement

- The device is switched on.
- A CPR mode is set.



1. Select **CPR mode** field using the right-hand navigation knob.

WM 68011g 08/2020



2. Switch between the **Manual**, **CCSV** and **IPPV** fields using the right-hand navigation knob to change the mode.

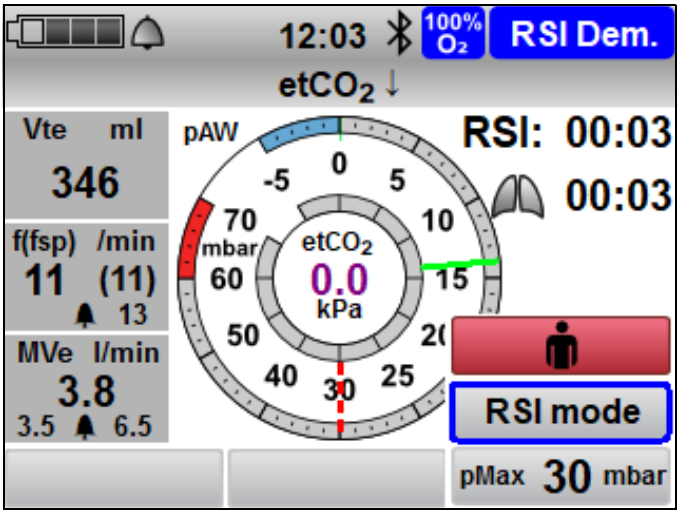
Result The required CPR mode is set.

4.7.13 Performing ventilation in RSI mode

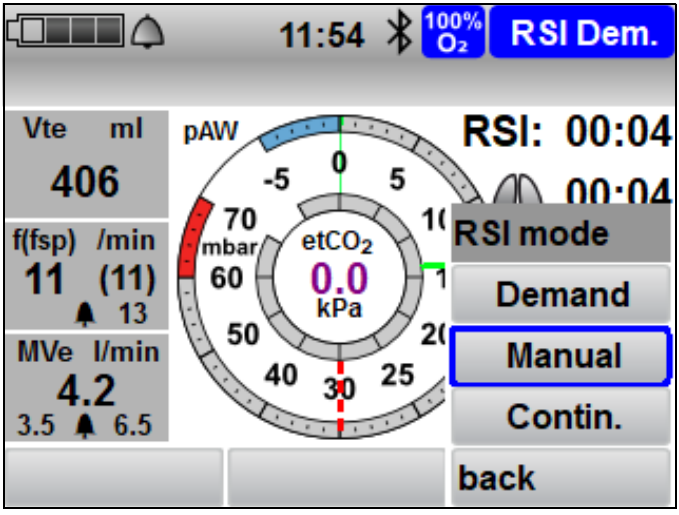
Requirement

- The device is switched on.
- MEDUtrigger is connected to the device.
- **RSI** was set as the ventilation mode for a new patient (see "4.7.3 Selecting a ventilation mode for a new patient", page 73). The Demand function is automatically activated.

WM 68011g 08/2020



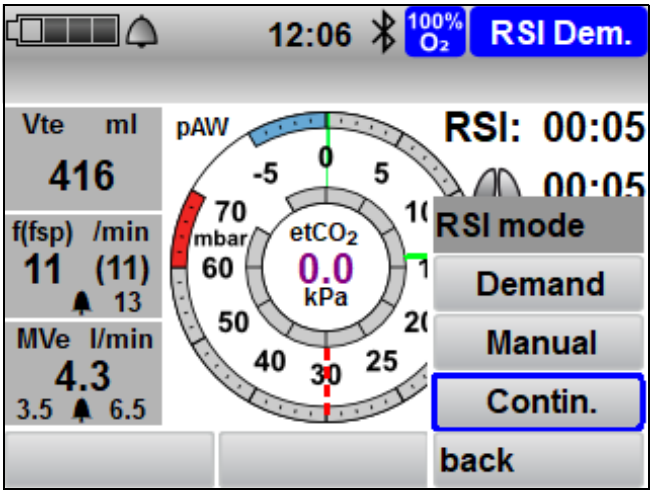
1. Select **RSI mode** field using the right-hand navigation knob.



2. To select the **Manual** function, switch to the **Manual** field using the right-hand navigation knob.

To enable the selection of the **Manual** function, a MEDUtrigger must be connected and activated in the operator menu. Otherwise, this function will not be displayed.

WM 68011g 08/2020



3. To perform continuous ventilation following successful airway management, select the **Contin.** field.

   Depending on the preset in the operator menu, the device switches to one of the following modes with the ventilation parameters preset for the patient group (see "14.1.10 Factory settings for emergency modes and ventilation modes", page 257):

   - IPPV
   - BiLevel + ASB (only if the BiLevel + ASB option is activated)

   If the capnography option is activated, the device shows a pressure gauge view or a curve view depending on the preset in the operator menu (see "6.3.8 Presets patient", page 133).

Result Ventilation is performed in RSI mode.

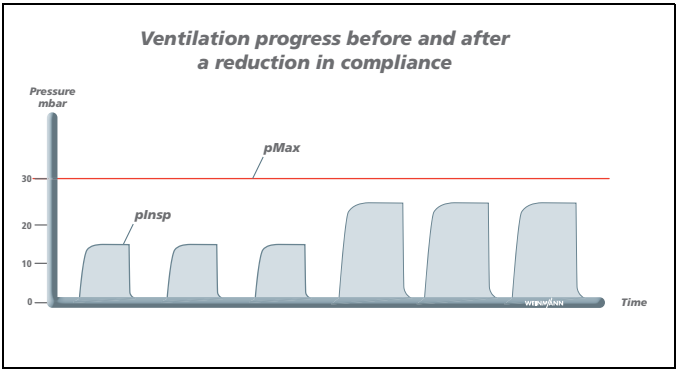
4.8 Monitoring the patient

During ventilation, you must monitor the patient continuously.You can see the ventilation progress on the gauge, on the ventilation curves and on the measurements shown on the display of the device (see "3.3.2 Ventilation mode (example)", page 28).

All the measurements shown for flow, tidal volume and minute volume relate to standard body temperature and ambient pressure (BTPS (Body Temperature and Pressure, saturated): Volume at current ambient pressure and 37°C, with 100% saturated gas).

High airway resistances, e.g., due to obstructions of the airways or during external chest compression, may change the respiratory minute volume, depending on the ventilation mode.

In the event that the compliance of the lungs is reduced, during volume-controlled ventilation the device reacts by increasing the ventilation pressure to the set pressure limit whilst the ventilation volume remains constant. Then the applied volume drops.



4-3 Ventilation progress before and after a reduction in compliance (during volume-controlled ventilation)

4.9 Audio alarm output

4.9.1 Muting the audio alarm output

Requirement An alarm is active and is audible.

1. Briefly (< 1 s) press the alarm mute button .

The acoustic alarm output is permanently muted in NVG mode.

Result The audio alarm output is muted for 120 s. The symbol appears on the display.

WM 68011g 08/2020

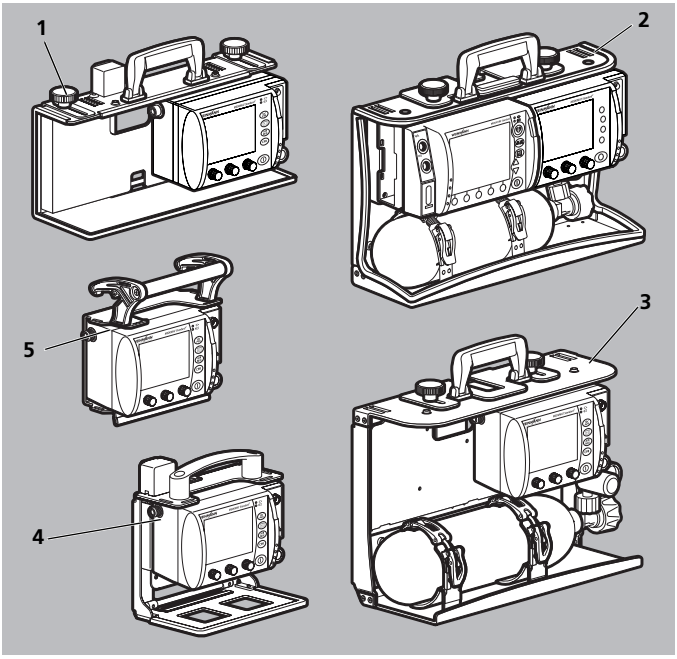
4.9.2 Canceling the muting of the audio alarm output

Requirement An alarm is active and is muted.

1. Briefly (< 1 s) press the alarm mute button .

Result The muting of the audio alarm output is canceled. The symbol appears on the display.

4.10 Transporting the device



4-4 Transport on a portable unit

You can transport the device in the following ways:

- On the portable unit LIFE-BASE 1 NG XL (**1**)
- On the portable unit LIFE-BASE 3 NG (**2**)
- On the portable unit LIFE-BASE 4 NG (**3**)
- On the portable unit LIFE-BASE 1 NG XS (**4**)
- On the portable unit LIFE-BASE *light* XS (**5**)

WM 68011g 08/2020

4.11 Feeding in oxygen

4.11.1 Connecting an oxygen supply

⚠ WARNING

Risk of injury posed by the combination of highly compressed oxygen and hydrocarbon compounds!

When combined with highly compressed oxygen, hydrocarbon compounds (e.g., oil, grease, cleaning alcohols, hand cream or adhesive plasters) can cause explosions and injuries to the patient, user and bystanders.

⇒ Wash hands thoroughly and remove adhesive plasters before using highly compressed oxygen.

⚠ WARNING

Risk of injury if oxygen escapes from damaged oxygen cylinders or pressure reducers!

Oxygen can escape unchecked from damaged oxygen cylinders or pressure reducers. This may lead to explosions and cause injury to the patient, user and bystanders.

⇒ Tighten all screwed unions on the oxygen cylinder and on the pressure reducer by hand only.

⇒ Secure the oxygen cylinder so that it cannot fall over.

⚠ CAUTION

Risk of injury due to particles of dust which have been blown away!

When you open the oxygen cylinder, particles of dust which are blown away by the high pressure may injure the user or bystanders.

⇒ Hold the valve opening so that it points away from the body.

⇒ Hold the valve opening so that no bystanders can be affected.

NOTICE

Connecting several devices to the same oxygen supply may result in loss of performance!

If you connect several devices to the same oxygen supply, the performance of the device and of the individual components may be reduced.

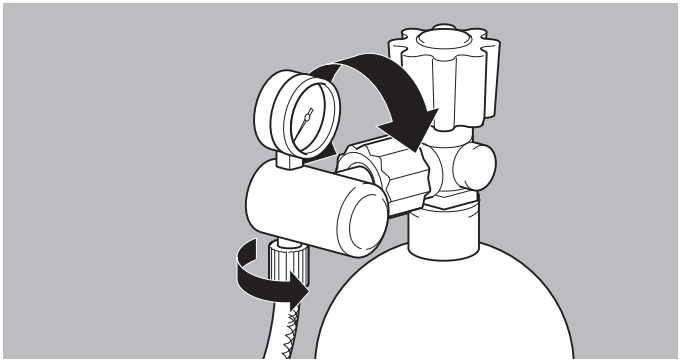
⇒ Do not operate MEDUMAT Standard^2 simultaneously with other devices sharing the same oxygen supply.

WM 68011g 08/2020

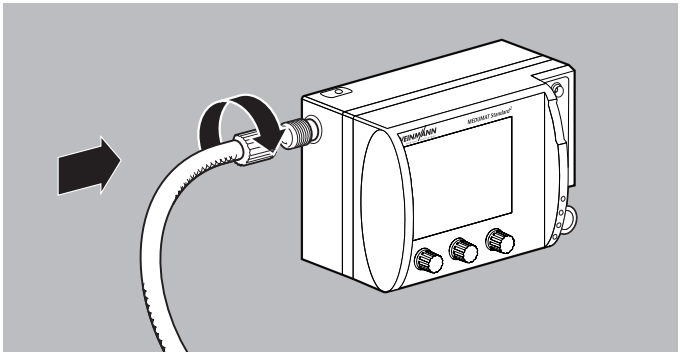
Requirement

- The patient is not connected to the device.
- The oxygen cylinder is full.

1. Briefly open and then close the valve of the oxygen cylinder in order to blow away any particles of dust.



2. Connect a pressure reducer to the valve of the oxygen cylinder with a knurled union nut and tighten it by hand.
3. If necessary: Connect a low-pressure hose to the outlet of the pressure reducer using the union nut.



4. If necessary: Connect a low-pressure hose to the compressed gas connection of the device.

Result The device is connected to the oxygen supply.

WM 68011g 08/2020

4.11.2 Removing the oxygen supply

1. Close the valve on the oxygen cylinder.
2. Briefly press the On/Off button ⏻ and operate the device without an oxygen supply.
   The remaining oxygen is flushed out of the device.
3. Press and hold the On/Off button ⏻ for at least 2 seconds to switch off the device.
4. Disconnect the low-pressure hose from the compressed gas connection of the device.
5. If necessary: Replace the empty oxygen cylinder.

Result The device is disconnected from the oxygen supply.

4.11.3 Calculating the operating time

1. Calculating the oxygen level in the cylinder (oxygen supply):

Oxygen supply = Volume of the oxygen cylinder x Pressure in the oxygen cylinder		
Example		
Volume of the oxygen cylinder	10 l	2 l
Pressure in the oxygen cylinder	200 bar	200 bar
Oxygen level in the cylinder (oxygen supply)	**2000 l**	**400 l**

2. Calculating the operating time:

100% oxygen mode:

Time (min)= $\frac{\text{Oxygen supply (l)}}{\text{Vt (l) x f (min}^{-1}\text{)} + 0.3\ \text{l/min}}$	
Example	
Oxygen supply	2000 l
Vt	500 ml
f	12 min^{-1}
Time	**317 min = 5 h 17 min** or 31 min per liter of cylinder volume

WM 68011g 08/2020

Air Mix mode:

Time (min)= $\frac{\text{Oxygen supply (l) x 2}}{\text{Vt (l) x f (min}^{-1}\text{) + 0.3 l/min}}$	
Example	
Oxygen supply	2000 l
Vt	500 ml
f	12 min^{-1}
Time	**634 min = 10 h 34 min** or 63 min per liter of cylinder volume

Result The operating time has been calculated.

4.12 After use

1. Detach the patient hose system from the ventilation mask or tube.
2. If necessary: Dispose of the ventilation mask or tube.
3. If necessary: Disconnect the patient hose system from the device.
4. If necessary: Dispose of the disposable hose system.
5. If necessary: Take a new disposable hose system.
6. If necessary: Change hygiene filter.
7. Hygienically reprocess the device, components and accessories (see "8 Hygienic reprocessing", page 172).
8. If necessary: Take a new ventilation mask or new tube.
9. If necessary: Stow the components and accessories away on the portable unit.
10. If necessary: Store the device, components and accessories (see "12 Storage", page 228).

WM 68011g 08/2020

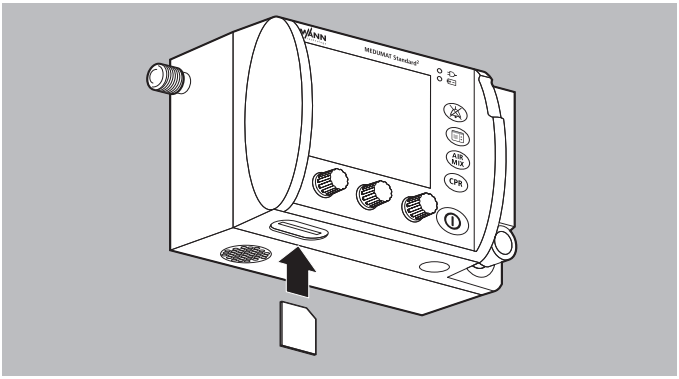
4.13 Using the SD card

4.13.1 Inserting an SD card

NOTICE

Loss of data due to incorrect SD card!
SD cards not purchased from WEINMANN Emergency may have reduced functionality or result in the loss of data.
⇒ Only use SD cards from WEINMANN Emergency.
⇒ Do not use the SD card for third-party files.

1. Open the splash guard of the SD card slot.



2. Slide the SD card into the SD card slot until it audibly clicks into place.
   When doing so, note: The beveled corner of the SD card must be at the front on the right during insertion.
3. Close the splash guard.

Result The SD card is inserted in the device and ready for use.

WM 68011g 08/2020

4.13.2 Removing the SD card

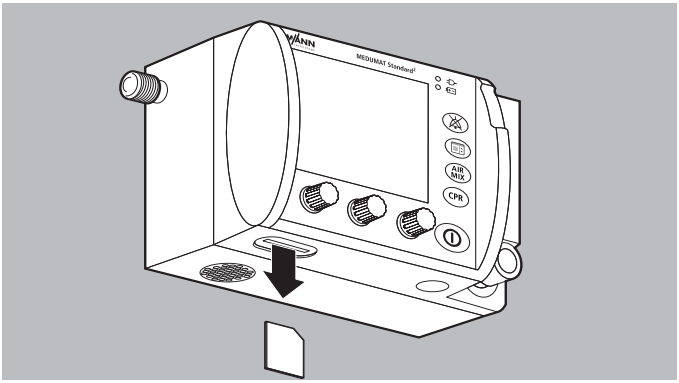
Requirement An SD card is in the SD card slot.

1. Open the splash guard of the SD card slot.

NOTICE

Incorrect use may result in loss of data or damage to the device!
If you remove the SD card whilst exporting log files or updating the software of the device, data may be lost or the device may be damaged.
⇒ Only remove the SD card after ensuring that no log file exports or updates to the device software are in progress.

2. Briefly press in the SD card.
   The SD card is ejected slightly.



3. Remove the SD card.
4. Close the splash guard to protect the device from the ingress of moisture.

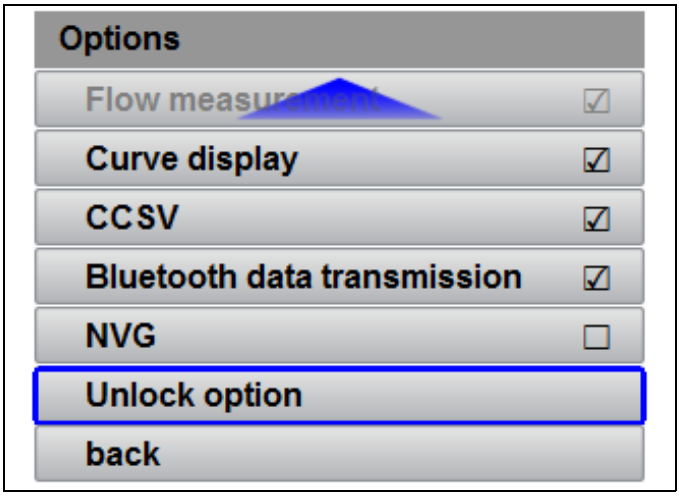
Result The SD card is removed.

4.14 Enabling options

Requirement

- The operator menu has been called up (see "6.1 Navigating the operator menu", page 121).
- The latest software version is installed on the device (see "4.15 Updating the software", page 102).

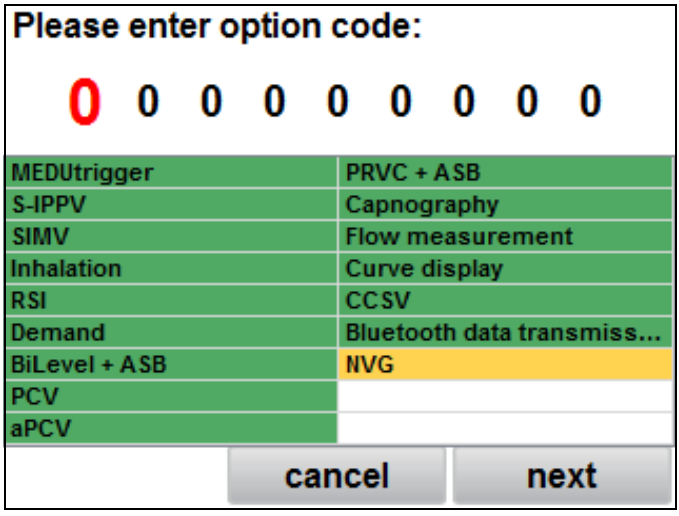
1. Select the menu item **Options**.



2. Select the menu item **Unlock option**.
   The device shows which options have already been unlocked using the following color scale:

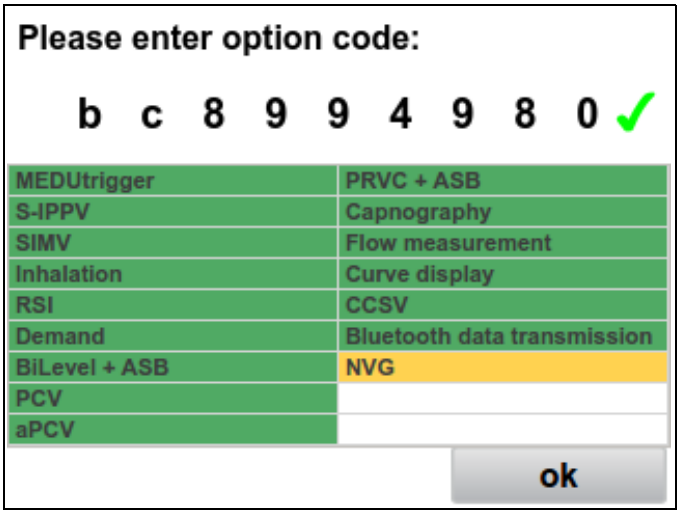
Color scale	Description
Gray	Option is not unlocked.
Yellow	Option is unlocked, but not activated.
Red	Option is unlocked, but cannot be activated (because, for example, another required option has not yet been unlocked).
Green	Option is unlocked and activated.

WM 68011g 08/2020



3. Turn the right-hand navigation knob to enter the first digit of the option code.
4. Press the navigation knob **next** to confirm the first digit of the option code.
5. Enter the other digits of the option code in the same way.
6. Press the navigation knob **ok** to confirm the option code.

WM 68011g 08/2020



The device uses a green checkmark to display whether the input option code is correct and changes the color of the option as per the color scale shown above.
When doing so, note:

- Prerequisite for the unlocking of the curve display option: Flow measurement + ASB option is enabled.
- Prerequisite for the unlocking of the pressure-controlled ventilation modes option: Flow measurement + ASB option and curve display option are enabled.

7. Press the navigation knob **ok** to leave the code input menu.
8. Activate or deactivate the option using the right-hand navigation knob.
9. To leave the operator menu, press the navigation knob **back**.

Result An option is unlocked for use and activated.

4.15 Updating the software

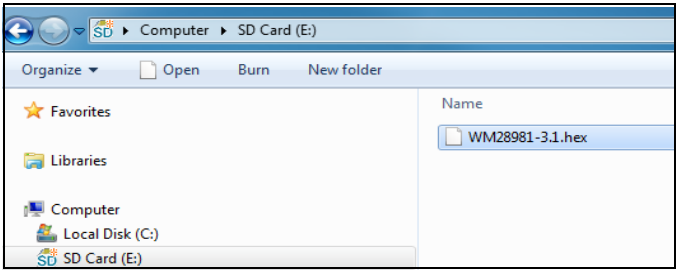
Requirement

- The device is connected to the line power.
- A fully charged battery is inserted in the device.

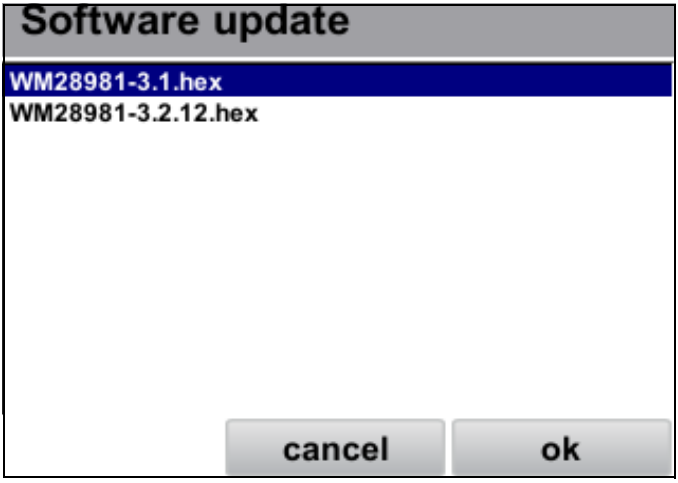
WM 68011g 08/2020

- The operator menu has been called up (see "6.1 Navigating the operator menu", page 121).

1. If necessary: Download the software from the Login area of the WEINMANN Emergency website to the SD card.
2. If the software is available as a ZIP file: Unzip the software. The software is available in the folder as a file named **WM28981-x.x.hex**.



3. Place the file in the SD card's root directory.
   When doing so, note: The file for the software update must not be in a sub-folder.
4. Select the menu item **Software update**.



5. Select Software update.

NOTICE

Damage to the device caused by moving the device and/or pressing buttons during the update!
Moving the device and/or pressing buttons during the update may cancel the update and damage the device.
⇒ Do not move the device.
⇒ Do not press any buttons on the device.

6. Press the navigation knob **ok** to update the software.
   The device updates the software.
7. After the end of the update: Press the navigation knob **reboot** to restart the device.
   The device restarts and the start menu appears on the display.
8. Press and hold the On/Off button ⏻ for at least 2 seconds to switch off the device and save the settings.
9. Disconnect the device from the line power.
10. Switch on the device (see "4.5 Switching the device on", page 68).
11. Perform a function check (see "9.3 Performing a function check", page 202).
12. Switch off the device (see "4.6 Switching the device off", page 70).

Result The software has been updated.

The **update.txt** file is saved to the SD card in the device as soon as the software update is complete. The file contains information on the software update just performed. This helps you with documentation within the scope of your quality management process. You can open the file with a text editing program, print it and sign it. The following information can be found in the file:

```
Softwareupdate durchgeführt / software update performed:
Datum / date: 2013-07-10 18:20:10
Seriennummer / serial number: 109
Updatedatei / update file: xxxxx.hex


Unterschrift / signature:
```

WM 68011g 08/2020

4.16 Pairing an external data documentation system with the device for the first time (using the Bluetooth data transmission option)

4.16.1 Pairing in the operator menu

Requirement

- The external data documentation system supports the device's communication protocol.
- The **Bluetooth data transmission** option is enabled and activated in the operator menu of the device (see "4.14 Enabling options", page 100).
- The operator menu has been opened.

1. Select the **Device information** field.
   The device's Bluetooth® name is displayed.
2. Search for the device's Bluetooth® name via the external data documentation system.
3. Send a pairing request to the device via the external data documentation system.
4. If necessary: Enter the device's Bluetooth® PIN in the external data documentation system.

Information on the Bluetooth® PIN can be found in the operator menu | device information (see "6.3.1 Device information", page 124).

Result The device is paired with an external data documentation system via Bluetooth data transmission.

4.16.2 Pairing during ventilation

Requirement

- The external data documentation system supports the device's communication protocol.
- The **Bluetooth data transmission** option is enabled and activated in the operator menu of the device (see "4.14 Enabling options", page 100).

WM 68011g 08/2020

- The **Allow bluetooth pairing** option, located under **Device configuration** in the operator menu, is activated.

1. Start ventilation (see "4.7 Ventilating the patient", page 70).
2. Activate **Bluetooth** in the user menu (see "5.3.7 Bluetooth (only with Bluetooth data transmission option)", page 117).
3. Enter the device's MAC address in the external data documentation system.
4. Send a pairing request to the device via the external data documentation system.
5. If necessary: Enter the device's Bluetooth® PIN in the external data documentation system.

Information on the Bluetooth® PIN can be found in the operator menu | device information (see "6.3.1 Device information", page 124).

Result The device is paired with an external data documentation system via Bluetooth data transmission.

4.17 Using the simulation mode

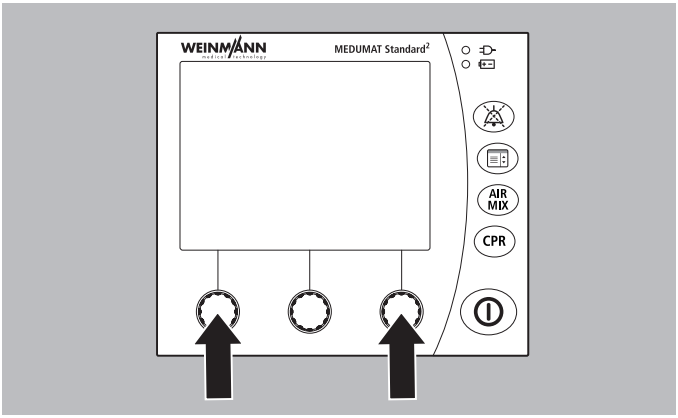
The device features a simulation mode with which settings can be simulated.

⚠ WARNING

Risk of injury from confusing simulation mode with the device's normal mode!
The only difference between the two modes are the words **Simulation Mode!** on the display, so it is easy to confuse the two if overlooked. This can put the patient at risk.
⇒ Do not use the simulation mode when the device is in use.
⇒ Always switch off and restart the device after using the simulation mode.

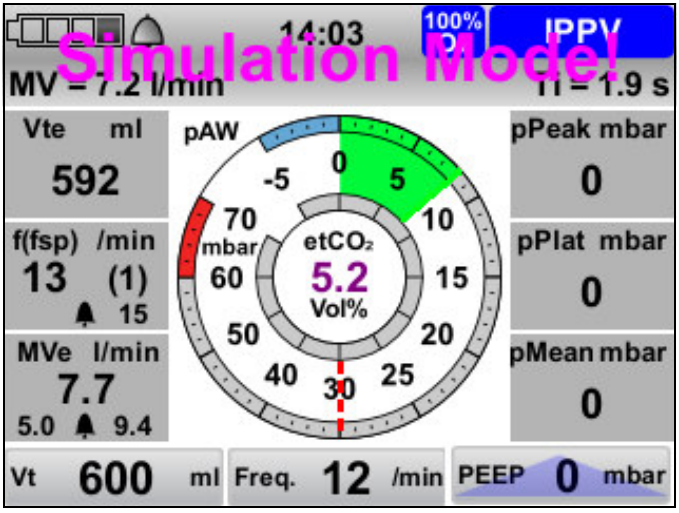
Requirement The device is switched off.

WM 68011g 08/2020



1. Switch on the device and during start-up press the right-hand and left-hand navigation knobs at the same time.

   The device switches to simulation mode. The words **Simulation Mode!** flash in the display.



2. Simulate settings.
3. To end the simulation mode: Switch the device off and restart.

Result Simulation mode is used.

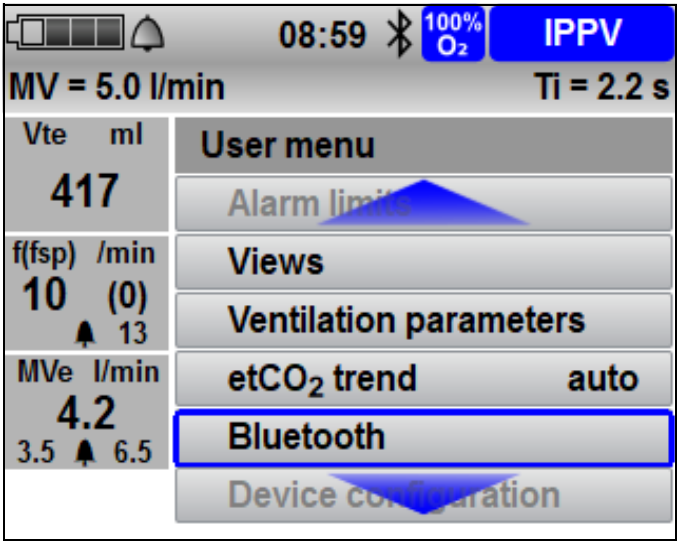
WM 68011g 08/2020

5 User menu

5.1 Navigating the user menu

Requirement A ventilation mode is set.

1. Briefly press the menu button (📖).

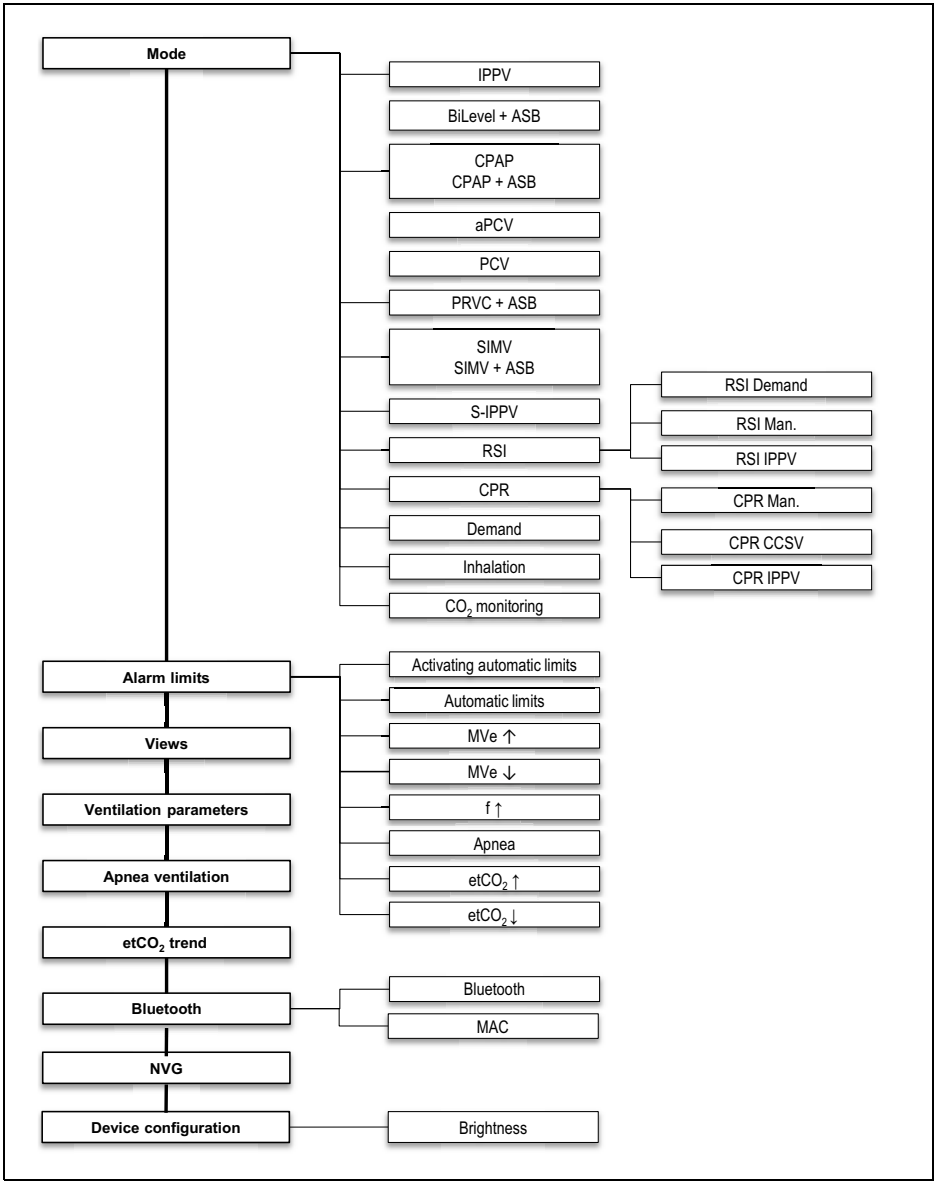


2. To select a submenu, turn one of the three navigation knobs.
3. To confirm the settings, press one of the three navigation knobs.

Result You know how to navigate the user menu.

WM 68011g 08/2020

5.2 Structure of the user menu

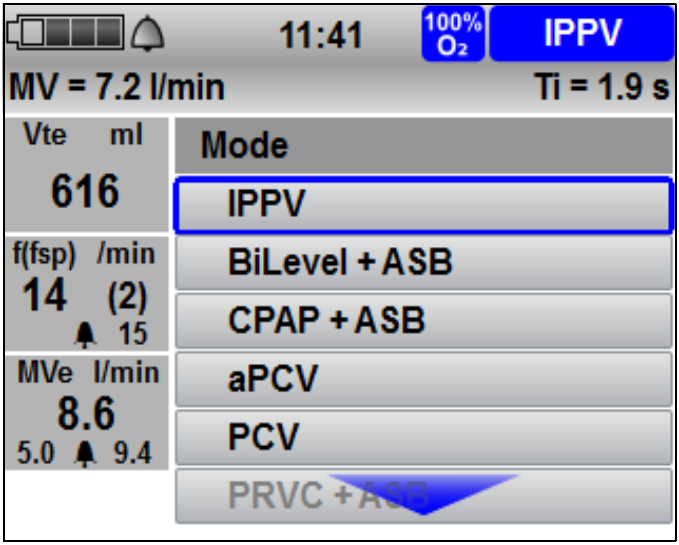


5-1 User menu structure

WM 68011g 08/2020

5.3 Settings in the user menu

5.3.1 Mode



5-2 Mode submenu

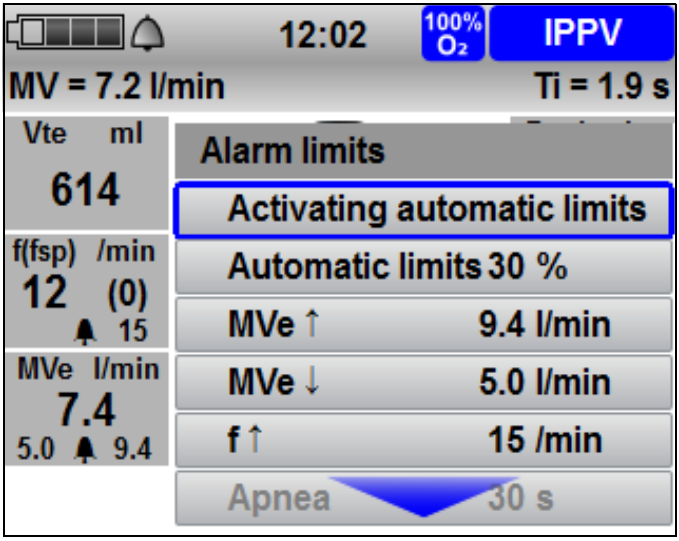
WM 68011g 08/2020

You can select the following ventilation modes and additional functions here (see "7 Description of the modes", page 141):

Mode submenu	
Ventilation modes	IPPV
	BiLevel + ASB (only if the pressure-controlled ventilation modes option is activated)
	CPAP
	CPAP + ASB (only with flow measurement + ASB option)
	aPCV (only if the pressure-controlled ventilation modes option is activated)
	PCV (only if the pressure-controlled ventilation modes option is activated)
	PRVC + ASB (only if the pressure-controlled ventilation modes option is activated)
	SIMV (only with SIMV option)
	SIMV + ASB (only if the SIMV and flow measurement + ASB options are activated)
	S-IPPV (only with S-IPPV option)
Additional functions	RSI
	CPR
	Demand
	Inhalation
	CO_2 monitoring (only with capnography option)

WM 68011g 08/2020

5.3.2 Alarm limits



5-3 Alarm limits submenu

Here you can set the alarm limits.

You can also open the alarm limit menu by keeping the alarm mute button depressed.

⚠ WARNING

Risk of injury due to alarm limits which are too high or too low!

Alarm limits which are either too high or too low can prevent the device from emitting an alarm, thereby putting the patient at risk.

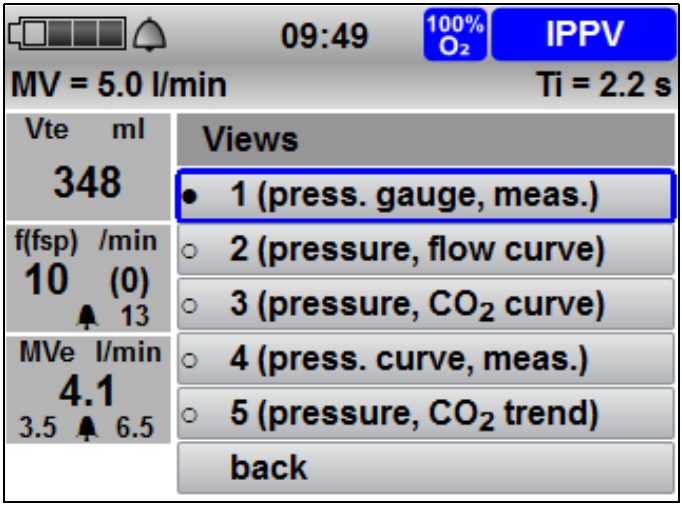
⇒ Always set alarm limits which have been adapted to the patient.

WM 68011g 08/2020

Alarm	Setting range
Activating automatic limits	The device sets the alarm limits for the alarms relating to respiratory physiology automatically. The deviation is 10%, 20% or 30% from the ventilation values at the time of activation. The automatic alarm limits are set to ± 30% on delivery.
Automatic limits	
MVe ↑ (only with flow measurement + ASB option)	1 l to 160 l
MVe ↓ (only with flow measurement + ASB option)	0.1 l to 110 l
f ↑ (only with flow measurement + ASB option)	1/min to 150/min
Apnea (only in CPAP, CPAP + ASB and Demand modes)	4 s to 60 s When the time elapses, the device automatically switches to an apnea ventilation mode.
$etCO_2$ ↑ (only with capnography option)	20 mmHG to 75 mmHG 2.6 vol% to 9.9 vol% 2.6 kPa to 10 kPa
$etCO_2$ ↓ (only with capnography option)	0 mmHG to 40 mmHG 0 vol% to 5.3 vol% 0 kPa to 5.4 kPa

WM 68011g 08/2020

5.3.3 Views

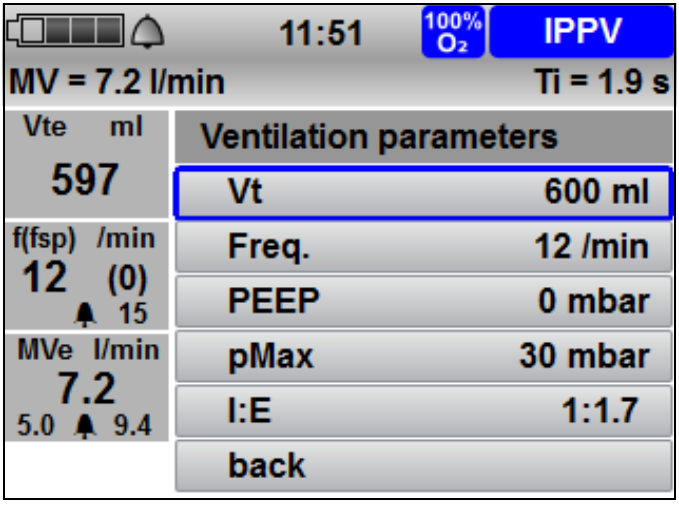


5-4 Views submenu (example)

You can select preconfigured views of measurements here. The views depend on the activated options and the ventilation mode selected.

WM 68011g 08/2020

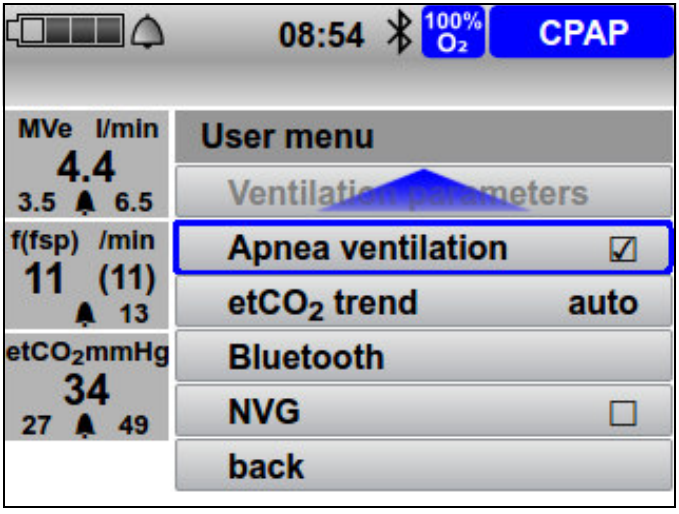
5.3.4 Ventilation parameters



5-5 Ventilation parameters submenu (example)

You can change the ventilation parameters of the selected ventilation mode here.

5.3.5 Apnea ventilation

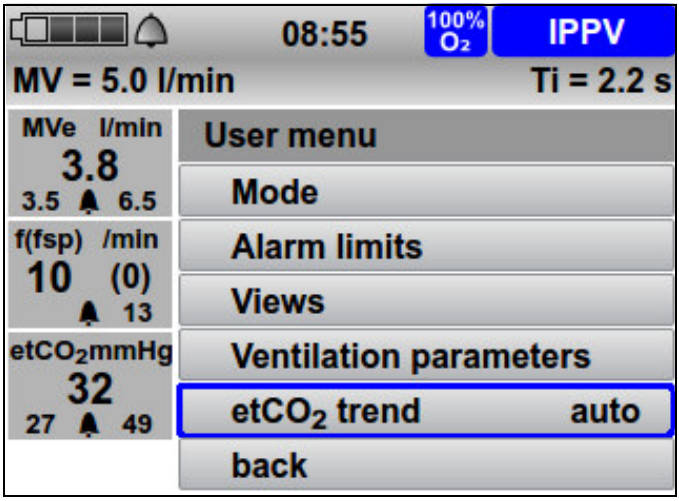


5-6 Apnea ventilation submenu

WM 68011g 08/2020

In this menu you can activate or deactivate apnea ventilation in the CPAP, CPAP + ASB and Demand ventilation modes.
When apnea ventilation is activated, the device automatically switches to IPPV mode once the set apnea time has elapsed.
If the BiLevel + ASB mode is unlocked in the operator menu and activated, you can choose between the IPPV mode and the BiLevel + ASB mode as the apnea ventilation mode in the operator menu.

5.3.6 $etCO_2$ trend (only with capnography option)



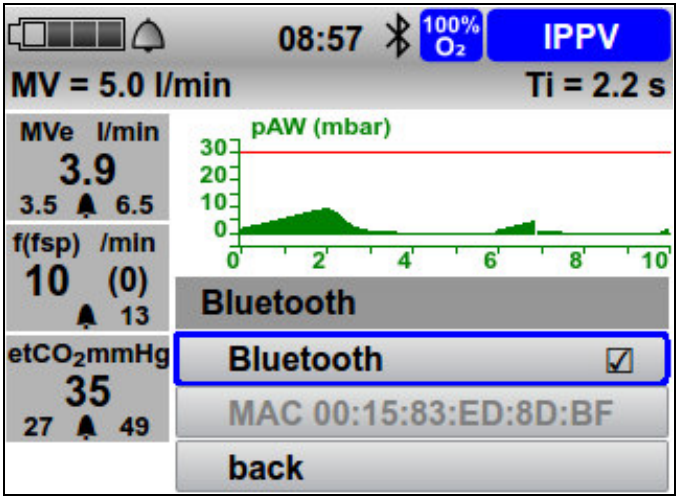
5-7 $etCO_2$ *trend submenu*

If the capnography option is activated, the device offers the possibility of a visualization of the $etCO_2$ value. The trend curve can be selected via the Views item in the user menu and shown on the device's display.
The trend curve shows the patient's ventilation as a graphic. The last value recorded appears on the far right of the trend curve.

WM 68011g 08/2020

In this menu you can set the scale for the time axis of the $etCO_2$ trend. The following settings are possible: auto, 5 min., 10 min., 30 min., 60 min.,120 min. At a time setting of 5 minutes or 10 minutes, the device records the determined value every 15 seconds. At a setting of 30, 60 or 120 minutes, an average value is recorded every 30 seconds.
In the "auto" setting, the x axis is scaled automatically depending on the duration of the application.
The unit of the $etCO_2$ trend is based on the CO_2 unit. This can be selected in the operator menu under the menu item Device Configuration (see "6.3.7 Device configuration", page 130).

5.3.7 Bluetooth (only with Bluetooth data transmission option)



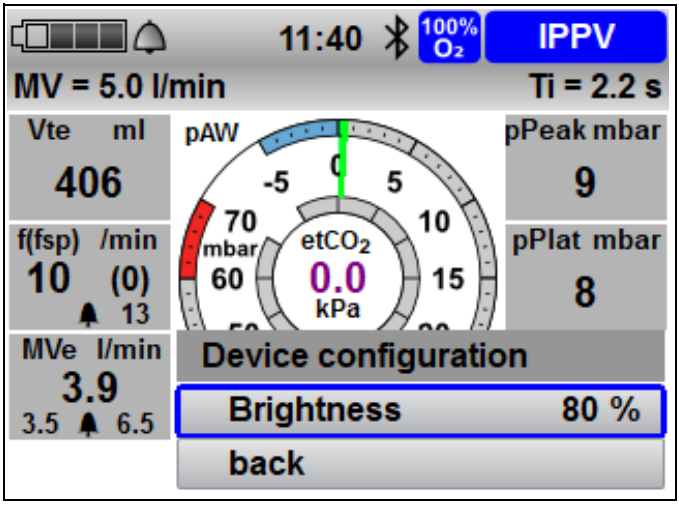
5-8 Bluetooth submenu

If the **Bluetooth data transmission** option is enabled and activated in the operator menu (see "4.14 Enabling options", page 100), you can enable and disable the Bluetooth® connection here. If the Bluetooth® connection is activated, an operation documentation system can connect to the device to retrieve operating data.

WM 68011g 08/2020

If you have activated the **Allow bluetooth pairing** function in the operator menu (see "6.3.7 Device configuration", page 130), the MAC address of the device will also be displayed in this menu. You can then pair MEDUMAT Standard^2 with an external data documentation system during the application.

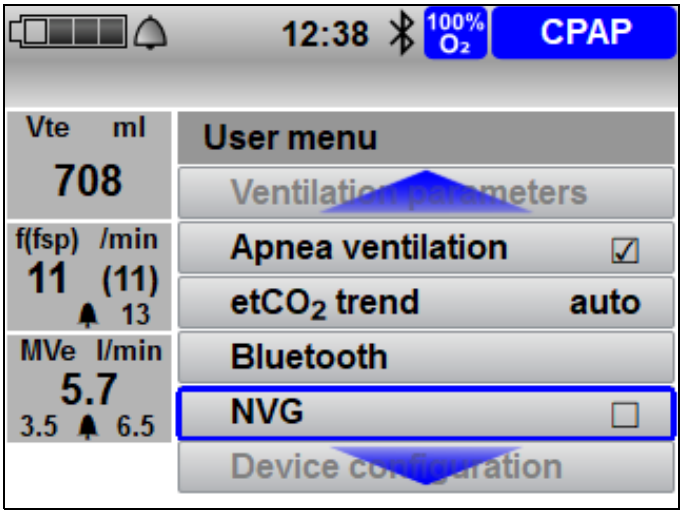
5.3.8 Device configuration



Here you can change the brightness of the screen. Settings between 5 and 100% are possible. The selected setting is retained after switching off and on again.

WM 68011g 08/2020

5.3.9 NVG (Night Vision Goggles)



5-9 NVG submenu

⚠ WARNING

Risk of injury from deactivated alarm light, deactivated audio alarm output and darkened display in NVG mode!
The alarms are barely perceptible as a result of the deactivated alarm light, the deactivated audio alarm output and the darkened display in NVG mode. This can injure the patient.
⇒ Always monitor patients during ventilation.
⇒ Only use the NVG option in the military sector.

You can activate the NVG mode here. When the NVG mode is activated, the device behaves as follows:

- Alarm light deactivated
- Acoustic alarm output for all alarms permanently deactivated
- Line power and battery status indicators deactivated
- Coloring of the display optimized for night vision devices
- Display brightness reduced as per preset (see "6.3.7 Device configuration", page 130)

WM 68011g 08/2020

This submenu only appears if you activate the NVG option in the operator menu (see "6.3.9 Options", page 139). This option is only permitted for use in the military sector.

A device in NVG mode does not comply with the following standards with respect to alarm output:

- EN 60601-1-8
- EN 794-3/EN 10651-3.

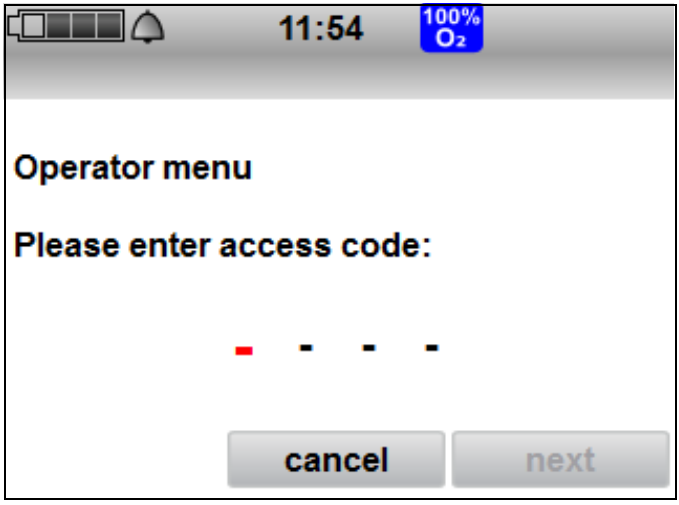
The operator assumes the resulting risk for operation.

WM 68011g 08/2020

6 Operator menu

6.1 Navigating the operator menu

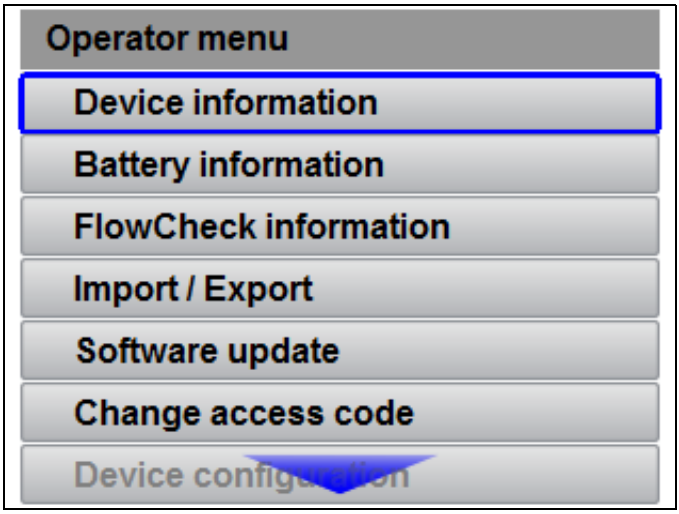
1. Switch on the device.
   The start menu appears.
2. Briefly press the menu button .



3. Turn the right-hand navigation knob to enter the first digit of the access code.
4. Press the navigation knob **next** to confirm the first digit of the access code.
5. Enter the other digits of the access code in the same way.

On delivery, the access code for the operator menu is 0000. We recommend changing the access code so as to protect the device from undesired modification. Operator menu | Change access code.

6. Press the navigation knob **ok** to confirm the access code.
   The operator menu appears on the display.

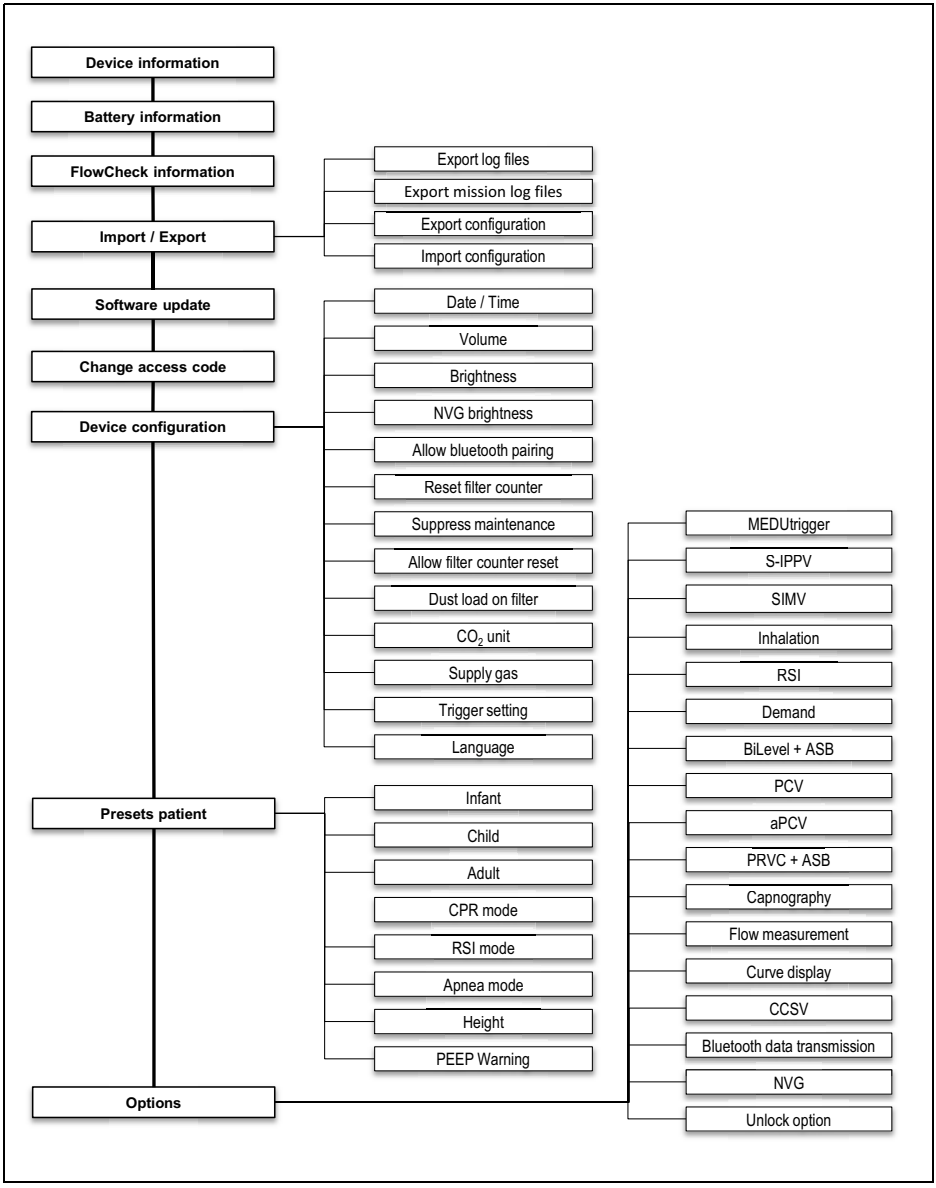


7. To select a submenu, turn one of the three navigation knobs.
8. To call up a submenu, press one of the three navigation knobs.
9. To select a desired value, turn one of the three navigation knobs.
10. To confirm a value, press one of the three navigation knobs.
11. To reset values to their original state, press the menu item **Reset**.
12. To leave the menu, press the menu item **back** until the menu closes.

Result You know how to navigate the operator menu.

WM 68011g 08/2020

6.2 Structure of the operator menu

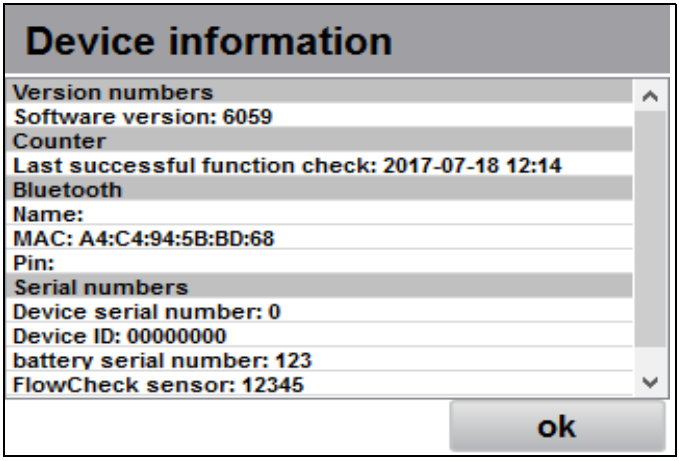


6-1 Structure of the operator menu

WM 68011g 08/2020

6.3 Settings in the operator menu

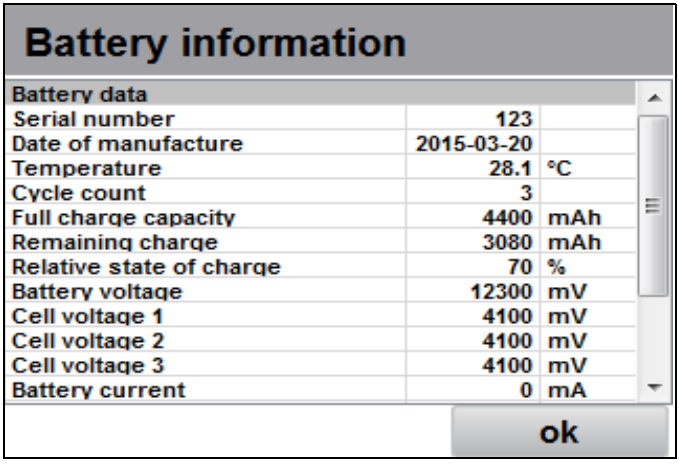
6.3.1 Device information



6-2 Device information submenu

You will find all the information on the device in this submenu.

6.3.2 Battery information

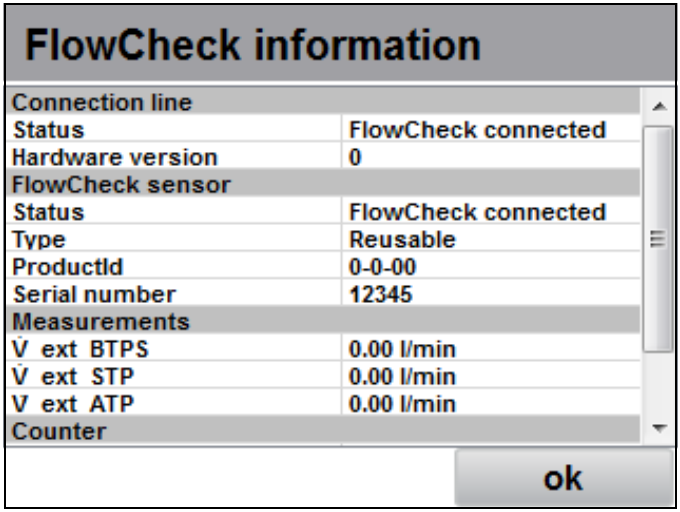


6-3 Battery information submenu

You will find all the information on the battery in this submenu.

WM 68011g 08/2020

6.3.3 FlowCheck information (only with flow measurement + ASB option)



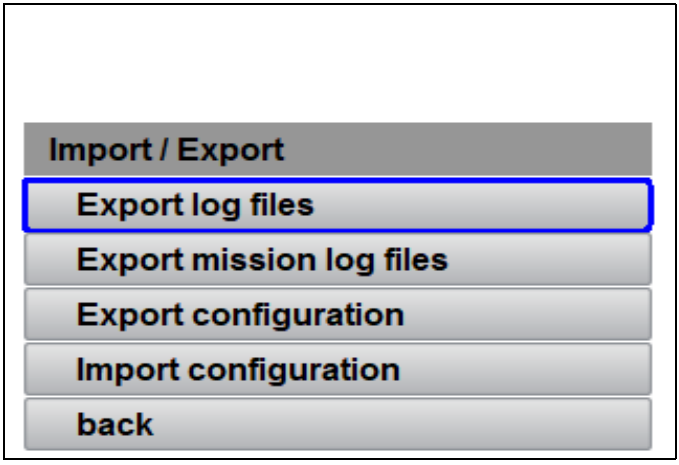
6-4 FlowCheck information submenu

You will find all the information on the FlowCheck sensor and the following connection lines in this submenu:

- FlowCheck sensor connection line
- FlowCheck sensor connection line with MEDUtrigger

WM 68011g 08/2020

6.3.4 Import / Export



6-5 Import / Export submenu

Export log files

The device always saves the log files in its internal memory.
You can export data to an SD card in order to analyze it.

Detailed information on exported log files can be found in the appendix (see "14.3 Exported log files", page 259).

Export mission log files

The mission log files contain detailed session data from up to 100 applications. The number of saved applications may vary depending on the session duration.
The device stores the session data in its internal memory.
You can export them to an SD card to analyze the data.

Detailed information on exported log files can be found in the appendix (see "14.3 Exported log files", page 259).

WM 68011g 08/2020

Export configuration

The **Export configuration** function allows you to export all the configuration settings made on the device to an SD card.

When exporting, all the configuration settings (including the options) are transferred with the exception of the following configuration settings:

- Date and time
- Serial number
- Device runtime
- Filter runtime
- Date of last function check
- Date of last maintenance
- Number of start-ups

Import configuration

The **Import configuration** function allows you to import the configuration settings exported to an SD card from one device onto a second device.

Following the import, the second device is configured in exactly the same way as the original device. The access code for the operator menu is also adopted.

If you do not wish to adopt the customer-specific password for the operator menu, you have two options:

- Before the export: Reset the password to **0000** and export the configuration.
- Prior to import: Set the password to **0000** before exiting the operator menu.

Configuration imports are saved in the log files. Configurations can only be transferred between devices with the same software version. Options subject to a charge are only imported if these options are already activated.

WM 68011g 08/2020

Exporting data to an SD card

Requirement

- An SD card is in the SD card slot.
- The operator menu has been called up (see "6.1 Navigating the operator menu", page 121).

1. Select the menu item **Import / Export**.
2. Select the submenu item **Export log files**.

   or

   Select the submenu item **Export configuration**.

   The device automatically begins to export the desired data to the SD card.
3. Once the export has concluded: Press the navigation knob **ok** to confirm that all of the data has been correctly exported.
4. To leave the operator menu, press the navigation knob **back**.
5. Remove the SD card (see "4.13.2 Removing the SD card", page 99).

Result The desired data are on the SD card.

Importing a configuration onto a device

Requirement

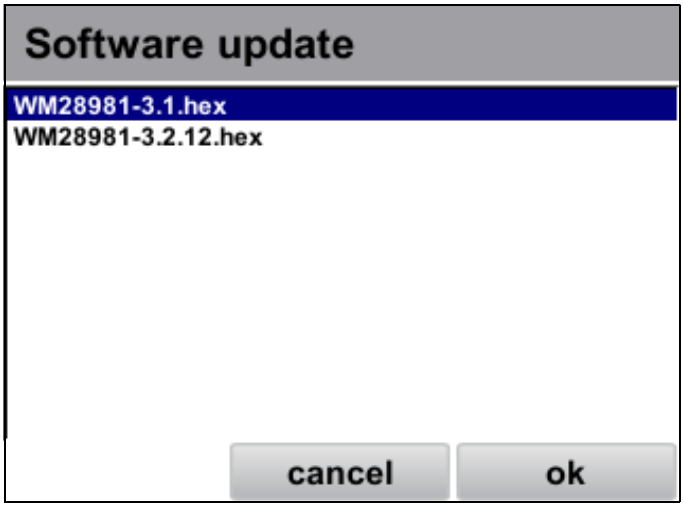
- There must be an SD card with the desired configuration in the SD card slot.
- The operator menu has been called up (see "6.1 Navigating the operator menu", page 121).

1. Select the menu item **Import / Export**.
2. Select the submenu item **Import configuration**.
   The device automatically begins to import the configuration from the SD card.
3. Once the import has concluded: Press the navigation knob **ok** to confirm that the configuration has been correctly imported.
4. To leave the operator menu, press the navigation knob **back**.
5. Remove the SD card (see "4.13.2 Removing the SD card", page 99).

Result The desired configuration is now on the device.

WM 68011g 08/2020

6.3.5 Software update



6-6 Software update submenu

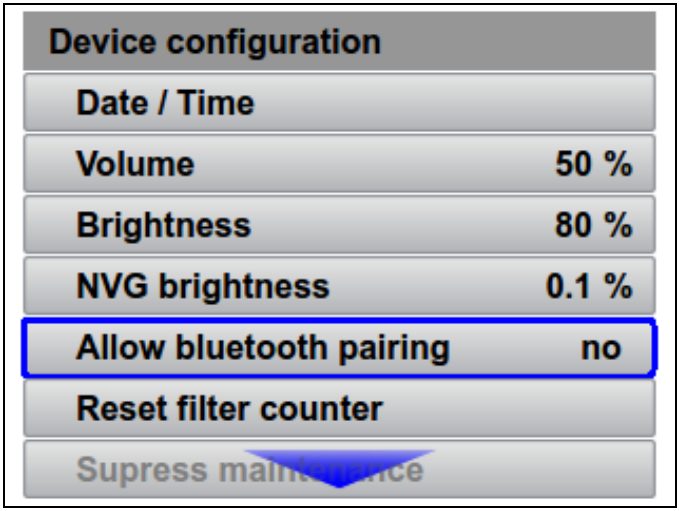
You can update your software here (see "4.15 Updating the software", page 102).

6.3.6 Change access code

6-7 Submenu for changing the access code

Here you can change the access code for the operator menu.
On delivery, the access code for the operator menu is 0000.

6.3.7 Device configuration



6-8 Device configuration submenu

WM 68011g 08/2020

In the submenu **Device configuration**, you can set the following parameters for the device:

Parameter	Possible values	Description
Date/Time	Year Month Day Hour Minute	Here you can set the current date and time.
Volume	50% 100%	Here you can set the volume of the acoustic signals.
Brightness	5% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%	Here you can set the brightness of the display.
NVG brightness (only with NVG option)	0.1% to 3% in 0.1% increments 3% to 5% in 0.5% increments 5% to 10% in 1% increments 10% to 100% in 10% increments	You can set the brightness here to which the device switches when the NVG mode is activated.
Allow bluetooth pairing	Yes No	Here you can set whether the device can be paired with an external data communication system during ventilation. If this is not allowed, the device can only be paired in the operator menu.
Reset filter counter	-	Here you can reset the counter for the hygiene filter.

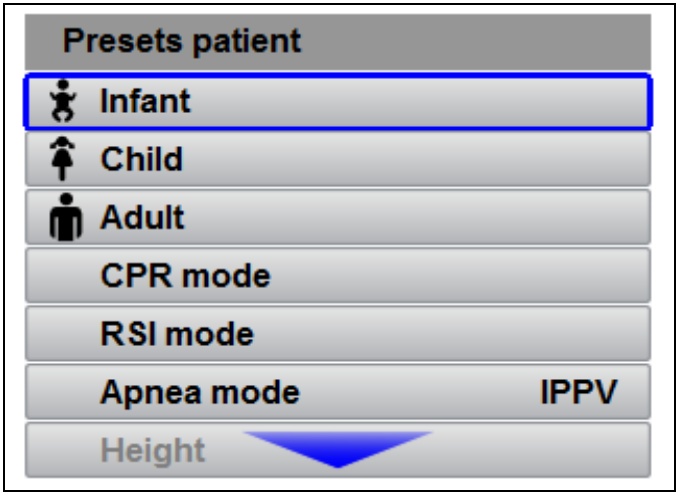
WM 68011g 08/2020

Parameter	Possible values	Description
Suppress maintenance	Activated Deactivated	When maintenance becomes due, you can suppress the maintenance notice within a maintenance cycle one time for a maximum of 180 days from the date maintenance is due. The device then behaves as if the maintenance were not due in terms of the reminders. It is not possible to reverse the suppression of the maintenance notice within a maintenance cycle. After the 180 days have elapsed, the maintenance notice becomes active again until the next service is performed and cannot be deactivated again. Even when the maintenance notice has been suppressed, maintenance is still required (see "11.2 Intervals", page 224).
Allow filter counter reset	Yes No	Here you can determine whether the user is allowed to reset the hygiene filter at any time during the function check.
Dust load on filter	100% 150% 200%	Here you can set the load caused by environmental factors (e.g., dust) for the hygiene filter. With an average load (**100%**) the hygiene filter filter is able to function for approx. 24 hours of ventilation in Air Mix mode, or for 6 months.
CO_2 unit (only with capnography option)	vol% kPa mmHG	Here you can select which unit of measurement the CO_2values should be displayed in.
Supply gas	93% O_2 100% O_2	Here you can set the type of supply gas.
Trigger setting	3 levels Units	Here you can set the inspiration and expiration trigger: • Simple three-level setting • Normal multi-level setting (in units)

WM 68011g 08/2020

Parameter	Possible values	Description
Language	German (de DE) English (en US) French (fr FR) Dutch (nl NL) Spanish (es ES) Brazilian Portuguese (pt BR) Polish (pl PL) Russian (ru RU) Czech (cs CZ) Portuguese (pt PT) Korean (ko KR) Italian (it IT) Thai (th TH) Farsi (fa IR) Chinese (zh CN) Danish (da DK) Romanian (ro RO) Slovak (sk SK) Croatian (hr HR) Turkish (tr TR)	Here you can set the language of the display texts. Depending on the status of the device software, additional languages may be available. The device shows the languages in your respective language.

6.3.8 Presets patient



6-9 Presets patient submenu

In the **Presets patient** submenu, you can determine which presets are assigned to the ventilation parameters of the different patient groups:

⚠ WARNING

Risk of injury from different alarm presets in the same or similar devices!
Different alarm presets in the same or similar devices in different application areas can confuse the user and result in injury to the patient.
⇒ Select the same alarm presets in the same or similar devices.

⚠ WARNING

Risk of injury from deactivated alarms in the additional functions CPR and RSI!
Through deactivation in the operator menu, no alarms for flow and CO_2 monitoring are output in the additional functions CPR and RSI. This can injure the patient.
⇒ Notify the user if the alarms in the additional functions CPR and RSI have been deactivated.
⇒ Observe the alarm limits during ventilation in the additional functions CPR and RSI.

Parameter	Possible values	Description
Infant/Child/Adult		
Emergency mode (only if the pressure-controlled ventilation modes option is activated)	IPPV BiLevel + ASB	Here you can choose between IPPV mode or BiLevel + ASB as the emergency ventilation mode per patient group.
Vt	50 ml - 2000 ml, in 50 ml increments	Here you can set the tidal volume.
pInsp (only if the pressure-controlled ventilation modes option is activated)	3 mbar - 60 mbar	Here you can set the inspiratory pressure.
Freq.	5/min - 50/min	Here you can set the frequency.
I:E	1:4 to 4:1	You can specify the inspiration to expiration ratio here.
PEEP	0 mbar - 30 mbar	Here you can set the positive end-expiratory pressure.
Δ pASB (only with activated flow measurement + ASB option)	0 mbar - 30 mbar	Here you can set the pressure support.

WM 68011g 08/2020

Parameter	Possible values	Description
pMax	10 mbar - 65 mbar	Here you can set the maximum ventilation pressure.
pMax CPR	10 mbar - 65 mbar	Here you can set the maximum ventilation pressure in CPR mode.
CPR mode		
Start mode	Manual 	Here you can set with which submenu the CPR mode should be started. If the CCSV option is enabled, once the patient group Child or Adult is selected, the device always starts in continuous mode with CPR CCSV.
Metronome		Here you can activate or deactivate the audio output of the metronome.
Metronome freq.	100/min - 120/min	Here you can set the frequency of the metronome tone.
$etCO_2$ ↑ / ↓ (only with capnography option)	☑ ☐	Here you can determine whether an alarm should be output in the event of rising or dropping end-expiratory CO_2.

WM 68011g 08/2020

Parameter	Possible values		Description
CPR Manual/IPPV	View (only with activated capnography option)	Pressure gauge Pressure/CO_2 curve Pressure/etCO_2 trend	Here you can choose between a pressure gauge view and a curve view for the CPR mode.
	Airway pressure ↑	☑ ☐	Here you can determine whether or not an alarm should be emitted when airway pressure increases.
	CPR Manual		
	Ventilation pause	2 s - 6 s	Here you can set the time interval for ventilation between the chest compressions.
	CPR IPPV		
	MVe ↑ / ↓ / (only with flow measurement + ASB option)	☑ ☐	Here you can determine whether an alarm should be output in CPR IPPV mode in the event of rising or falling expiratory minute volume. In the CPR 30:2 and CPR 15:2 modes this alarm is deactivated as a rule.
	f ↑ / (only with flow measurement + ASB option)	☑ ☐	Here you can determine whether an alarm should be output in CPR IPPV mode in the event of a rising respiratory rate. In the CPR 30:2 and CPR 15:2 modes this alarm is deactivated as a rule.
	Interval cont.	20 s - 60 s	Here you can set the maximum duration of the ventilation interval for the analysis phase of the defibrillator during the continuous ventilation.

WM 68011g 08/2020

Parameter	Possible values		Description
CPR CCSV	pInsp	40 mbar or 60 mbar	Here you can set the inspiratory pressure.
	PEEP	0 mbar - 5 mbar	Here you can set the positive end-expiratory pressure.
	Hands-off time ↑	5 s - 55 s	Here you can set when the hands-off time alarm ↑ should appear.
	Time until backup ventilation	10 s - 60 s	Here you can set when the back-up ventilation should be initiated. The hands-off time is always less than the time until back-up ventilation.
	f CCSV ↑ / ↓	80/140 90/130 100/120	You can set the alarm limit for the chest compression rate here.
	f CCSV ↑ / ↓ alarm	☑ ☐	Here you can determine whether or not an alarm should be emitted if the compression rate is too slow or too fast.
	Airway pressure ↓	☑ ☐	Here you can determine whether or not an alarm should be emitted when airway pressure decreases.
RSI mode (only with flow measurement + ASB option or capnography option)			
View (only with activated capnography option)	Pressure gauge Pressure/CO_2 curve		Here you can choose between a pressure gauge view and a curve view for the RSI mode.
Contin. mode (only if the pressure-controlled ventilation modes option is activated)	IPPV BiLevel + ASB		Here you can determine whether the device switches to IPPV mode or BiLevel + ASB mode after RSI Manual.
MVe ↑ / ↓ (only with flow measurement + ASB option)	☑ ☐		Here you can determine whether an alarm should be output in RSI Demand mode in the event of rising or falling expiratory minute volume. In the RSI Manual mode this alarm is deactivated as a rule.
f ↑ (only with flow measurement + ASB option)	☑ ☐		Here you can determine whether an alarm should be output in RSI Demand mode in the event of a rising respiratory rate. In the RSI Manual mode this alarm is deactivated as a rule.

WM 68011g 08/2020

Parameter	Possible values	Description
$etCO_2$ ↑ / ↓ (only with capnography option)	☑ ☐	Here you can determine whether an alarm should be output in the event of rising or dropping end-expiratory CO_2.
Apnea mode (only if the pressure-controlled ventilation modes option is activated)		
	IPPV BiLevel + ASB	Here you can set the apnea ventilation mode for the CPAP and CPAP + ASB modes.
Height		
Vt per kg bodyweight	4 ml/kg - 10 ml/kg	Here you can set the tidal volume in milliliters per kilogram body weight. In the process, a variable is used to convert the height to a tidal volume (see "14.2 Calculation of body weight on the basis of body height", page 258).
PEEP Warning		
	1 mbar - 21 mbar	Here you can set a limit value for the positive end-expiratory pressure. A warning is then given on the display if this value is reached or exceeded. In this case, the **PEEP** field in the bottom right of the display turns red.

Setting height*

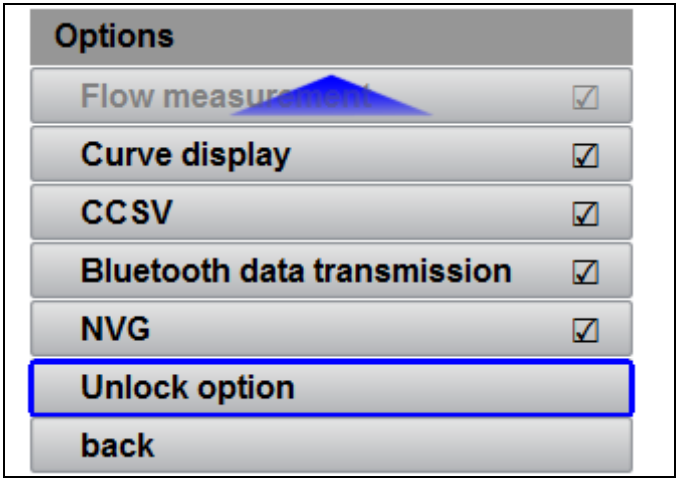
Depending on the height selected (tidal volume Vt in ml per kg bodyweight) the height which can be set is restricted to the following minimum values:

Tidal volume Vt in ml per kg bodyweight	Minimum height which can be set in cm
4	90
5	80
6	70
7	65
8	60
9	55
10	50

WM 68011g 08/2020

For the smallest height which can be set, the tidal volume is always at least 50 ml.

6.3.9 Options



6-10 Options submenu

As the operator, you can unlock new options for the user in the menu item **Unlock option** (see "4.14 Enabling options", page 100) and activate or deactivate the unlocked options.

Options	Description
MEDUtrigger	Enables connection of MEDUtrigger to the device and use of MEDUtrigger in CPR mode.
S-IPPV	Enables the S-IPPV ventilation mode.
SIMV	Enables the SIMV ventilation mode.
Inhalation	Enables the additional function Inhalation.
RSI	Enables the additional function RSI.
Demand	Enables the additional function Demand.
BiLevel + ASB	Enables the BiLevel + ASB pressure-controlled ventilation mode.
PCV	Enables the PCV pressure-controlled ventilation mode.

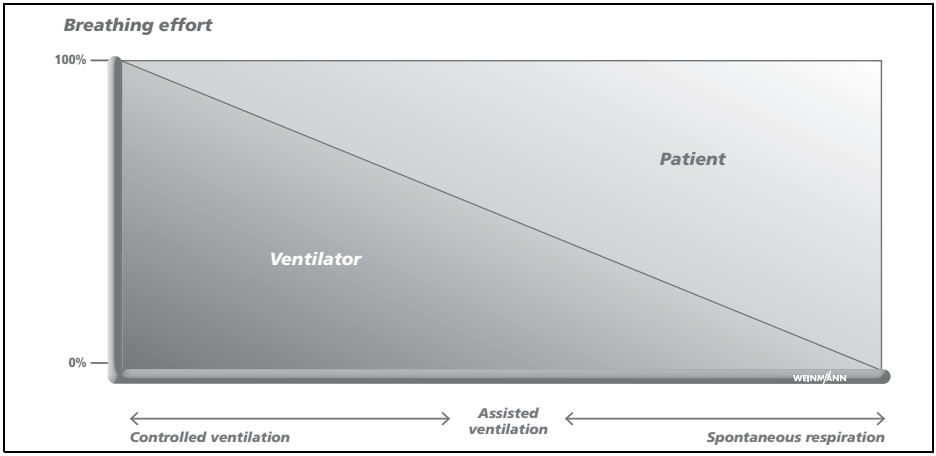
WM 68011g 08/2020

Options	Description
aPCV	Enables the aPCV pressure-controlled ventilation mode.
PRVC + ASB	Enables the PRVC + ASB pressure-controlled ventilation mode.
Capnography	Enables CO_2 measurement and display of the CO_2 curve. For CO_2 measurement you require a device with CO_2 measuring.
Flow measurement	Enables flow measurement with the FlowCheck sensor and the following ventilation modes: • CPAP + ASB • SIMV + ASB
Curve display (only with simultaneously activated flow measurement + ASB option)	Enables display of the following curves: • Pressure • Flow
CCSV	Enables the CCSV pressure-controlled ventilation mode.
Bluetooth data transmission	Allows communication of ventilation data to an external documentation system using Bluetooth®.
NVG	Enables use of the device with night vision devices. This option is only permitted for use in the military sector (see "5.3.9 NVG (Night Vision Goggles)", page 119).
Unlock option	You can unlock the software options here using an option code (see "4.14 Enabling options", page 100).

WM 68011g 08/2020

7 Description of the modes

7.1 Classification of the ventilation modes



The following ventilation modes are possible with this device:

Control parameter	Controlled ventilation	Assisted ventilation	Spontaneous respiration
Pressure	CCSV PCV	aPCV BiLevel + ASB PRVC + ASB	CPAP CPAP + ASB Demand
Volume	IPPV	S-IPPV SIMV SIMV + ASB	

Depending on the options activated in the operator menu, there are different ventilation modes available in the device.

WM 68011g 08/2020

There are the following trigger options in the individual ventilation modes:

Ventilation mode	Inspiration trigger	Expiration trigger	Trigger time slot for mandatory breaths	ASB breath
IPPV	No	No	No	No
BiLevel + ASB	Yes	Yes	20% of Te	Yes
CPAP	No	No	No	No
CPAP + ASB	Yes	Yes	No	Yes
aPCV	Yes	No	Can be set from 0%-100% of Te	No
PCV	No	No	No	No
PRVC + ASB	Yes	Yes	20% of Te	Yes
SIMV	Yes, permanently set	No	20% of Te	No
SIMV + ASB	Yes	Yes	20% of Te	Yes
S-IPPV	Yes (can be set with flow measurement + ASB option)	No	100% of Te	No
Demand	Yes, permanently set	Yes, permanently set	No	No
CCSV	Yes	No	No	No

WM 68011g 08/2020

7.2 Ventilation parameters

Ventilation parameters	Unit	Description
Vt	ml	Tidal volume (breath volume)
Freq.	1/min	Respiratory rate
pMax	mbar	Maximum ventilation pressure
PEEP	mbar	Positive end-expiratory pressure (CPAP)
Air Mix	-	Ventilation through the addition of ambient air
93% oxygen	-	Ventilation with concentrator oxygen
100% oxygen	-	Ventilation with 100% oxygen
Δ pASB (only with flow measurement + ASB option)	mbar	Pressure support (relative to the set PEEP)
InTr level (only if the flow measurement + ASB option is activated)	-	Inspiratory trigger (three-level setting)
ExTr level (only if the flow measurement + ASB option is activated)	-	Expiratory trigger (three-level setting)
InTr (only if the flow measurement + ASB option is activated)	l/min	Inspiratory trigger (setting with units)
ExTr (only if the flow measurement + ASB option is activated)	% Flow max	Expiratory trigger (setting with units)
I:E	-	Inspiration to expiration ratio
 (only if the flow measurement + ASB option is activated)	-	Pressure increase time
Trigger time slot (only in aPCV mode if the pressure-controlled ventilation modes option is activated)	% Te	Trigger time slot

WM 68011g 08/2020

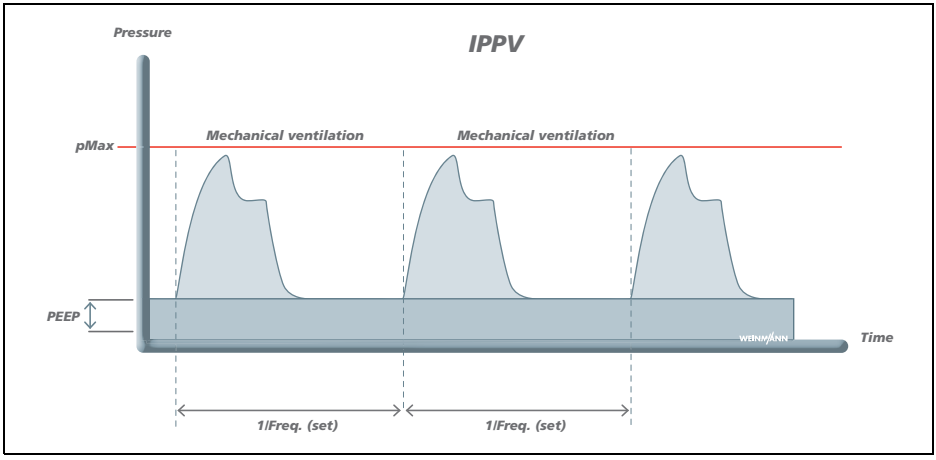
- If the flow measurement + ASB option is not activated: With a set PEEP value > 0 mbar, the patient must create an underpressure of at least -1.3 mbar below the set PEEP value through his/her spontaneous respiratory effort in order to initiate an inspiratory trigger in the device.
- If the flow measurement + ASB option is not activated: If no PEEP value has been set (PEEP value = 0), the patient must create an underpressure of at least -0.8 mbar in order to initiate an inspiratory trigger. When using assisted ventilation modes, ensure that the patient shows sufficient respiratory effort. If this is not the case, the trigger sensitivity can be increased by setting a PEEP value > 2 mbar. If the patient is still not able to initiate a trigger, the mandatory rate must be set accordingly high to ensure adequate ventilation of the patient.
- If the flow measurement + ASB option is activated, you can set the inspiratory trigger independently of the PEEP.
- When the device switches to CPR mode, the PEEP value is automatically set to 0 mbar.
- When the device switches from CPR mode to another ventilation mode, it automatically changes from the preset pMax value for CPR to the preset pMax value for all other ventilation modes (see "6.3.8 Presets patient", page 133).
- The ventilation parameters are interdependent. Example: pMax is always larger than the PEEP value.

WM 68011g 08/2020

7.3 Ventilation modes

7.3.1 IPPV mode

Description	
Abbreviation	IPPV
Long form	Intermittent Positive Pressure Ventilation
Type	Volume-controlled
Requirement	None
Ventilation parameters	
Left-hand navigation knob	Vt
Central navigation knob	Freq.
Right-hand navigation knob	• PEEP • pMax • I:E • Emergency mode



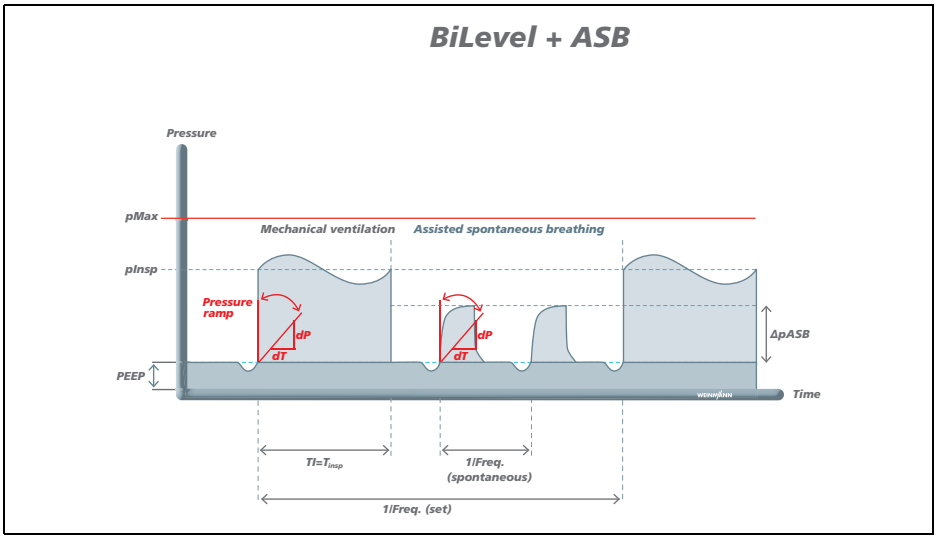
The IPPV mode is used for mandatory volume-controlled ventilation with a fixed tidal volume and fixed frequency. This mode is used on patients who have no spontaneous respiration. However, a spontaneously breathing patient can breathe deeply and freely during expiration.

When the maximum ventilation pressure (pMax) is achieved, the device maintains the pMax up until the end of the inspiration time and then switches to expiration. As such, the set tidal volume is possibly not fully applied if the maximum ventilation pressure (pMax) is not achieved during inspiration.

7.3.2 BiLevel + ASB mode

Description	
Abbreviation	BiLevel + ASB
Long form	Ventilation at two pressure levels + Assisted Spontaneous Breathing
Type	Pressure-controlled
Requirement	• Flow measurement + ASB option is activated • Pressure-controlled ventilation modes option is activated • Curve display option is activated
Ventilation parameters	
Left-hand navigation knob	pInsp
Central navigation knob	Freq.
Right-hand navigation knob	PEEP pMax Δ pASB InTr I:E Emergency mode

WM 68011g 08/2020

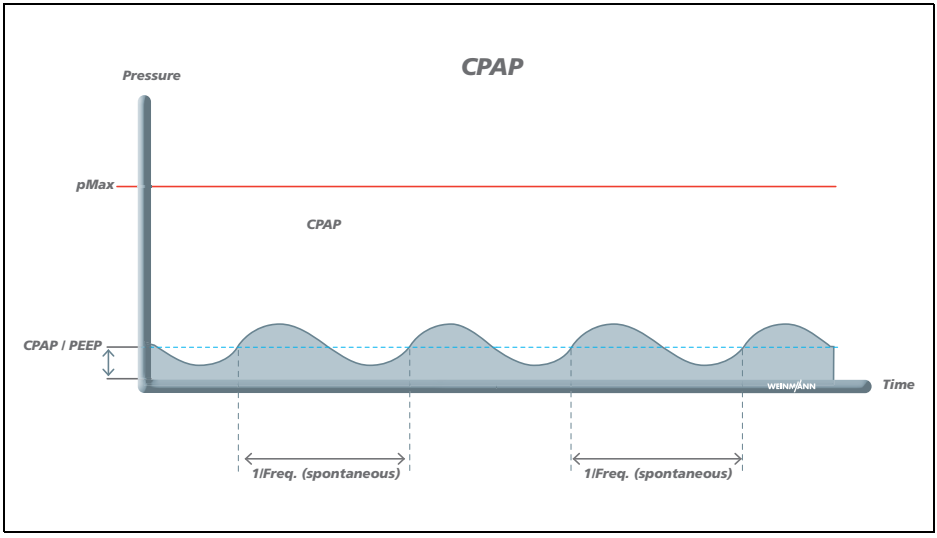


The BiLevel + ASB mode is used for pressure-controlled ventilation combined with free spontaneous respiration at pressure levels pInsp and PEEP during the entire breathing cycle and for adjustable pressure support at PEEP level. This mode is used on patients who have no spontaneous respiration or on spontaneously breathing patients. The patient can trigger a mandatory, pressure-controlled mechanical breath during a predetermined trigger time slot. The trigger time slot is 20% of the expiration time Te before the anticipated mandatory mechanical breath. For the rest of the time, the patient can breathe spontaneously or with the aid of pressure support. Tidal volume and minute volume are determined by the set pInsp, lung compliance and the set inspiration time T_i.

WM 68011g 08/2020

7.3.3 CPAP mode

Description	
Abbreviation	CPAP
Long form	Continuous Positive Airway Pressure
Type	Pressure-controlled
Requirement	None
Ventilation parameters	
Left-hand navigation knob	-
Central navigation knob	-
Right-hand navigation knob	• PEEP • pMax • Emergency mode



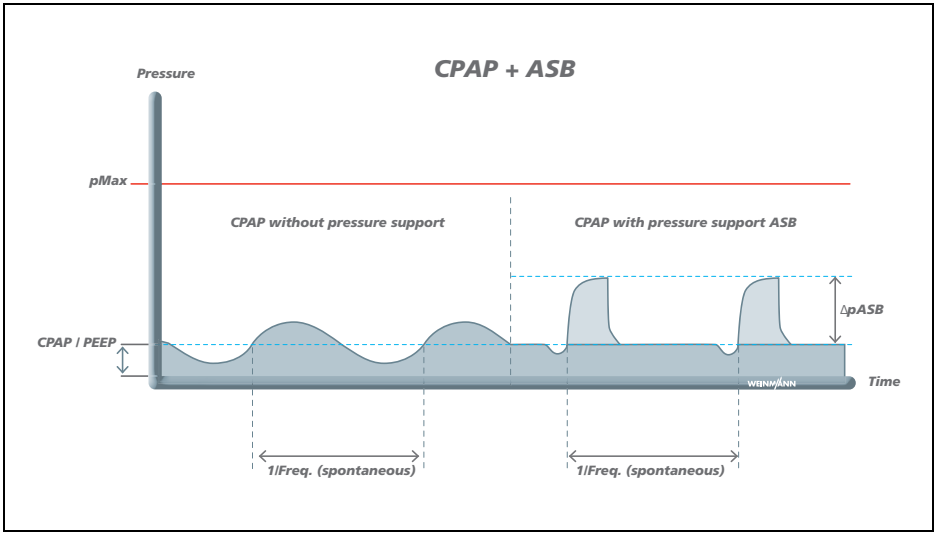
The set value CPAP/PEEP is used to increase the pressure level of respiration in order to raise the functional residual capacity (FRC) of a spontaneously breathing patient. The patient is able to breathe spontaneously without any restriction at the set pressure level. The CPAP mode is used exclusively on patients with adequate spontaneous respiration.

In principle, the pressure is set at the end of expiration (PEEP). The set maximum ventilation pressure (pMax) ensures the safety of the patient.

WM 68011g 08/2020

7.3.4 CPAP + ASB mode

Description	
Abbreviation	CPAP + ASB
Long form	Continuous Positive Airway Pressure + Assisted Spontaneous Breathing
Type	Pressure-controlled
Requirement	Flow measurement + ASB option is activated
Ventilation parameters	
Left-hand navigation knob	InTr
Central navigation knob	Δ pASB
Right-hand navigation knob	• PEEP • pMax • ExTr • Emergency mode



The CPAP + ASB mode can be separated into its individual elements:

- The set value CPAP/PEEP is used to increase the pressure level of respiration in order to raise the functional residual capacity (FRC) of a spontaneously breathing patient.

- The ASB function is used for pressure support of insufficient or exhausted spontaneous respiration. The patient is able to breathe spontaneously without any restriction, but is supported in his breathing effort by the device.

The CPAP + ASB mode is used exclusively on patients with adequate spontaneous respiration.

In principle, the pressure is set at the end of expiration (PEEP). If necessary, the pressure support (Δ pASB) can be switched on. Ventilation can be individually adjusted to suit the patient with the aid of the inspiratory and expiratory triggers. The inspiratory trigger indicates a sensitivity for triggering pressure support. The expiratory trigger determines when the device interrupts pressure support. This allows the administered volume and the inspiration time to be set indirectly.

The set maximum ventilation pressure (pMax) ensures the safety of the patient.

7.3.5 aPCV mode

⚠ WARNING

Risk of hyperventilation!
When using the aPCV mode, the CO_2 concentration in the patient's blood can drop and injure the patient.
⇒ Monitor the patient continuously.

⚠ WARNING

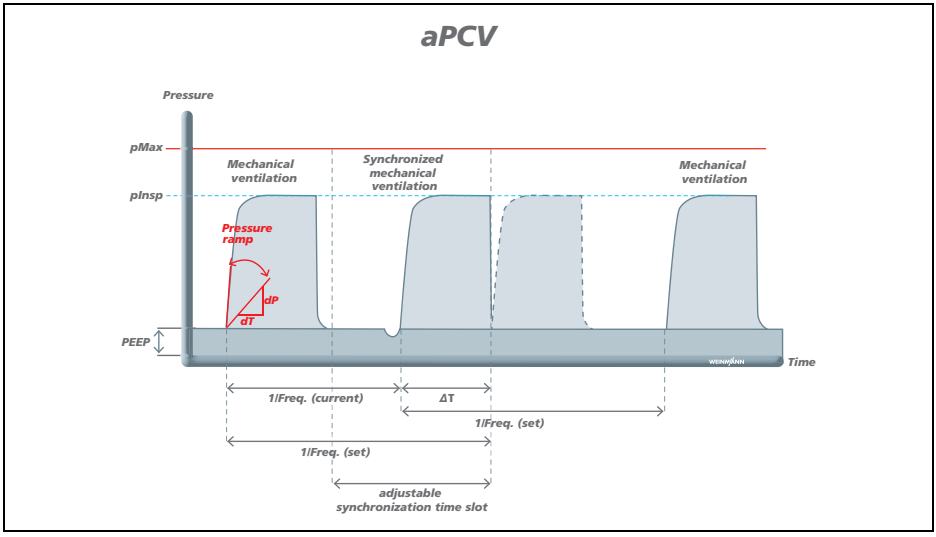
Risk of air trapping!
When using the aPCV mode, air can become trapped in the patient's lung. This results in a reduced gas exchange and can injure the patient.
⇒ Monitor the airway pressure continuously.

⚠ WARNING

Risk of intrinsic PEEP!
An expiration that is too short can cause the pressure to increase slowly at the end of the expiration and injure the patient.
⇒ Set the pressure limitation correctly.
⇒ Monitor the patient continuously.

WM 68011g 08/2020

Description	
Abbreviation	aPCV
Long form	Assisted Pressure Controlled Ventilation
Type	Pressure-controlled
Requirement	• Flow measurement + ASB option is activated • Pressure-controlled ventilation modes option is activated • Curve display option is activated
Ventilation parameters	
Left-hand navigation knob	pInsp
Central navigation knob	Freq.
Right-hand navigation knob	PEEP pMax InTr I:E Emergency mode

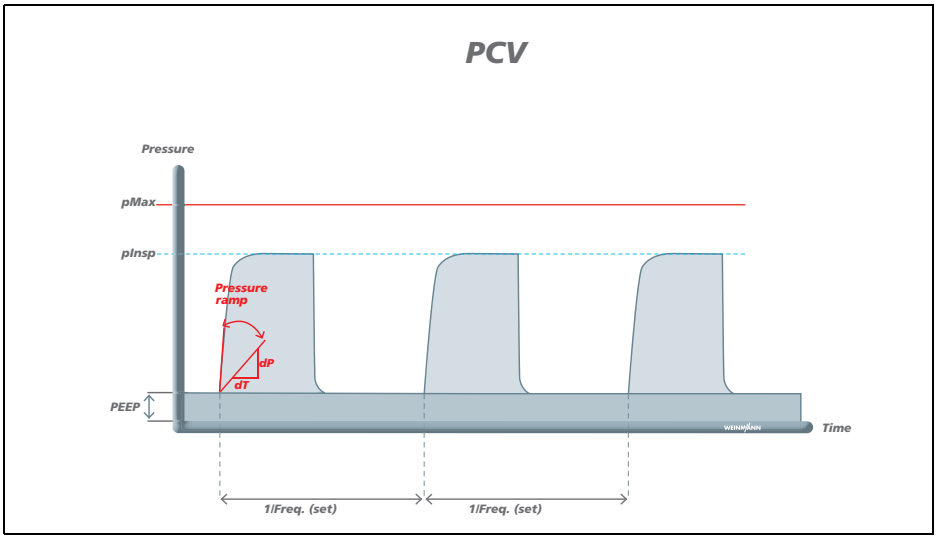


The aPCV mode is used for pressure-controlled, assisted ventilation at a fixed mandatory ventilation rate. In case of spontaneous respiration, the patient has the possibility of increasing the rate and consequently the minute volume. If the patient displays a spontaneous respiratory effort within a specified time slot of the expiration, the mandatory mechanical breath is synchronized with the patient's respiration. The time slot or trigger time slot can be set in % of T_e before the next expected mandatory mechanical breath. If the patient displays a spontaneous respiratory effort outside of the set trigger time slot, no mandatory mechanical breath is triggered.

7.3.6 PCV mode

Description	
Abbreviation	PCV
Long form	Pressure Controlled Ventilation
Type	Pressure-controlled
Requirement	• Flow measurement + ASB option is activated • Pressure-controlled ventilation modes option is activated • Curve display option is activated
Ventilation parameters	
Left-hand navigation knob	pInsp
Central navigation knob	Freq.
Right-hand navigation knob	PEEP pMax I:E Emergency mode

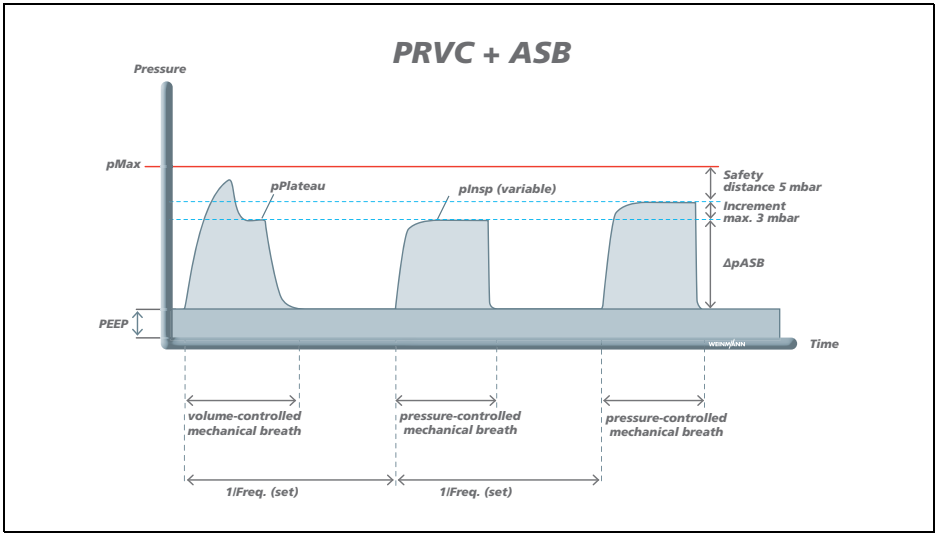
WM 68011g 08/2020



The PCV mode is used for mandatory pressure-controlled ventilation with fixed pressure levels with a fixed set ventilation rate. This mode is used on patients who have no spontaneous respiration. However, a spontaneously breathing patient can breathe deeply and freely during expiration. The set maximum ventilation pressure (pMax) ensures the safety of the patient.

7.3.7 PRVC + ASB mode

Description	
Abbreviation	PRVC + ASB
Long form	Pressure Regulated Volume Controlled Ventilation + Assisted Spontaneous Breathing
Type	Pressure-controlled
Requirement	• Flow measurement + ASB option is activated • Pressure-controlled ventilation modes option is activated • Curve display option is activated
Ventilation parameters	
Left-hand navigation knob	Vt
Central navigation knob	Freq.
Right-hand navigation knob	PEEP pMax Δ pASB InTr I:E Emergency mode



WM 68011g 08/2020

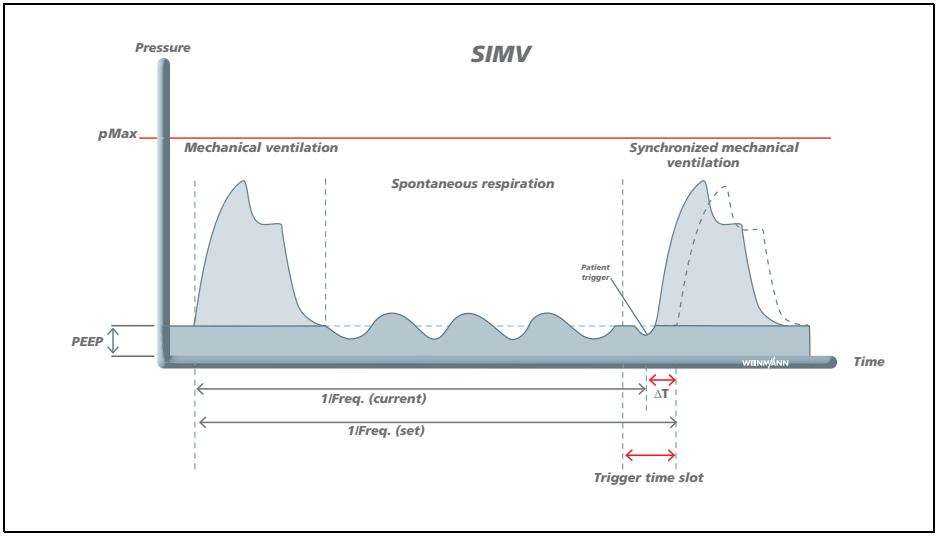
The controlled PRVC + ASB mode combines the advantages of both pressure-controlled ventilation and volume-controlled ventilation. The set tidal volume is applied with the minimum ventilation pressure possible. Ventilation begins with three volume-controlled breaths with the set tidal volume and decreasing flow. The volume-controlled breaths have a plateau time of 50% of the configured inspiration time T_i. The device selects the measured plateau pressure as the starting value for the inspiratory pressure pInsp of the following pressure-controlled ventilation. It measures the administered volumes and adjusts the ventilation pressure accordingly. If the lung parameters change during ventilation, the device alters the inspiratory pressure pInsp in increments of a maximum of 3 mbar in order to achieve the set tidal volume again and thereby automatically compensate for changes in the patient. Measuring the applied volume is improved by compensating hose compliance. This enables precise control of the required tidal volume, in particular of small tidal volumes under high airway pressures. The set maximum ventilation pressure (pMax) ensures the safety of the patient. For safety reasons, the inspiratory pressure (pInsp) is at least 5 mbar below the set maximum ventilation pressure (pMax).

If this inspiratory pressure is achieved (pInsp = pMax - 5 mbar), the device administers as much volume as possible. If this volume deviates from the set tidal volume, the device triggers the medium-priority alarm "Vt not achievable".

WM 68011g 08/2020

7.3.8 SIMV mode

Description	
Abbreviation	SIMV
Long form	Synchronized Intermittent Mandatory Ventilation
Type	Volume-controlled
Requirement	SIMV option is activated
Ventilation parameters	
Left-hand navigation knob	Vt
Central navigation knob	Freq.
Right-hand navigation knob	• PEEP • pMax • I:E • Emergency mode



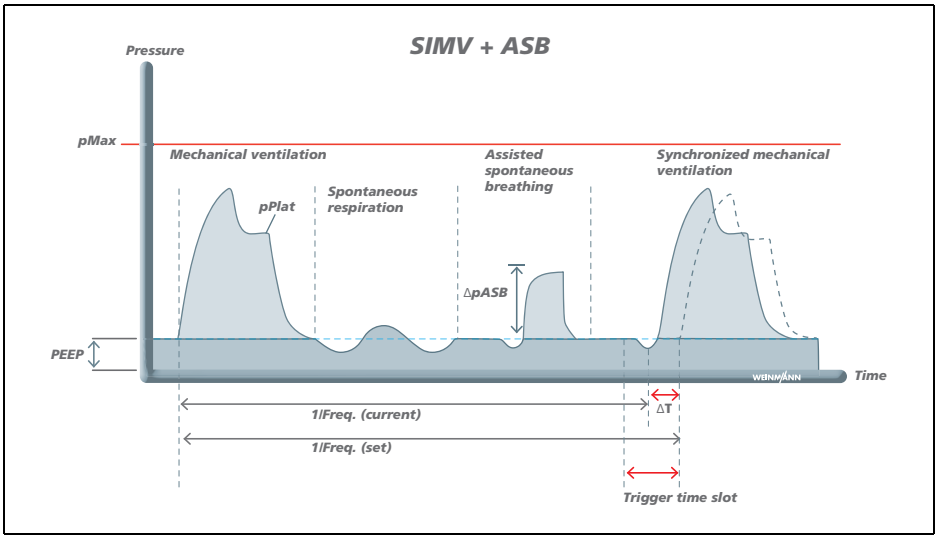
WM 68011g 08/2020

The SIMV mode is used for volume-controlled ventilation with a fixed mandatory minute volume. The patient can breathe spontaneously between the mandatory mechanical breaths and thereby increase the minute volume. During spontaneous respiration, the mandatory mechanical breath is synchronized with the patient's breathing. The mandatory minute volume and the mandatory respiration rate remain unchanged. When the maximum ventilation pressure (pMax) is achieved, the device maintains the pMax up until the end of the inspiration time and then switches to expiration. As such, the set tidal volume is possibly not fully applied if the maximum ventilation pressure (pMax) is not achieved during inspiration.

7.3.9 SIMV + ASB mode

Description	
Abbreviation	SIMV + ASB
Long form	Synchronized Intermittent Mandatory Ventilation + Assisted Spontaneous Breathing
Type	Volume-controlled
Requirement	• SIMV option is activated • Flow measurement + ASB option is activated
Ventilation parameters	
Left-hand navigation knob	Vt
Central navigation knob	Freq.
Right-hand navigation knob	• PEEP • pMax • Δ pASB • InTr • ExTr (does not appear if at least one pressure-controlled ventilation mode is activated) • I:E • Emergency mode

WM 68011g 08/2020



The SIMV + ASB mode is used for volume-controlled ventilation with a fixed mandatory minute volume. The patient can breathe spontaneously between the mandatory mechanical breaths and thereby increase the minute volume. During spontaneous respiration, the mandatory mechanical breath is synchronized with the patient's breathing. The mandatory minute volume and the mandatory respiration rate remain unchanged. When the maximum ventilation pressure (pMax) is achieved, the device maintains the pMax up until the end of the inspiration time and then switches to expiration. As such, the set tidal volume is possibly not fully applied if the maximum ventilation pressure (pMax) is not achieved during inspiration. The patient can trigger a mandatory, pressure-controlled mechanical breath during a predetermined trigger time slot. The trigger time slot is available in the final 20% of expiration time Te. For the rest of the time, the patient can breathe spontaneously or with the aid of pressure support (see "7.3.4 CPAP + ASB mode", page 149).

WM 68011g 08/2020

7.3.10 S-IPPV mode

⚠ WARNING

Risk of hyperventilation!
When using the S-IPPV mode, the CO_2 concentration in the patient's blood can drop and injure the patient.
⇒ Monitor the patient continuously.

⚠ WARNING

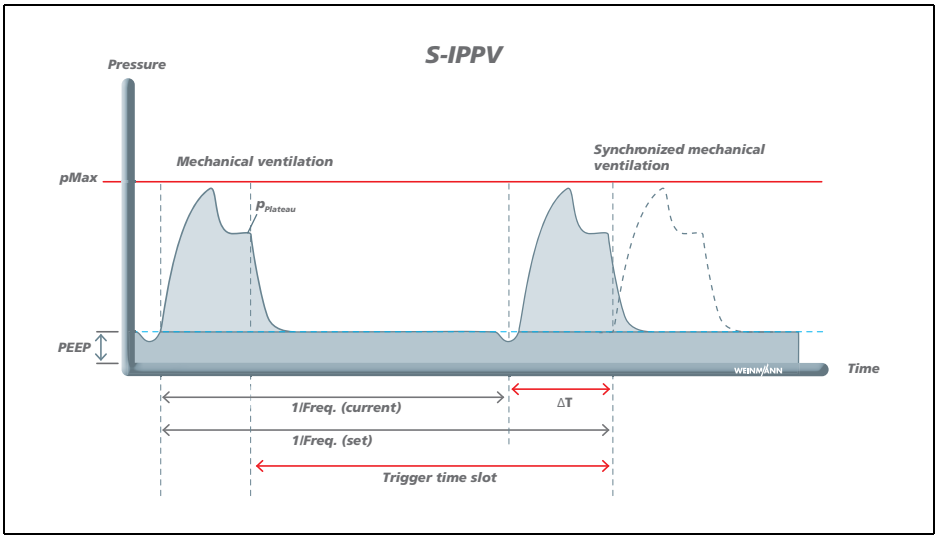
Risk of air trapping!
When using the S-IPPV mode, air can become trapped in the patient's lung. This results in a reduced gas exchange and can injure the patient.
⇒ Monitor the airway pressure continuously.

⚠ WARNING

Risk of intrinsic PEEP!
An expiration that is too short can cause the pressure to increase slowly at the end of the expiration and injure the patient.
⇒ Set the pressure limitation correctly.
⇒ Monitor the patient continuously.

Description	
Abbreviation	S-IPPV
Long form	Synchronized Intermittent Positive Pressure Ventilation
Type	Volume-controlled
Requirement	S-IPPV option is activated
Ventilation parameters	
Left-hand navigation knob	Vt
Central navigation knob	Freq.
Right-hand navigation knob	• PEEP • pMax • InTr (only if the flow measurement + ASB option is activated) • I:E • Emergency mode

WM 68011g 08/2020



The S-IPPV mode is used for volume-controlled ventilation with a variable mandatory minute volume. Throughout the entire expiration phase, a trigger is active which enables the patient to trigger a new breath. This means the patient has the option of increasing the respiratory rate and therefore the minute volume and adapting these to his/her needs. As a rule this mode is used on patients who have inadequate spontaneous respiration.

Ventilation in the S-IPPV mode corresponds to ventilation in the IPPV mode with the difference that it is possible to synchronize ventilation with the patient's efforts to inhale. Since the setting for the respiratory rate is lower, the patient can trigger mandatory mechanical breaths spontaneously. A trigger time slot extending throughout the expiration time is available for this synchronization. When the maximum ventilation pressure (pMax) is achieved, the device maintains the pMax up until the end of the inspiration time and then switches to expiration. As such, the set tidal volume is possibly not fully applied if the maximum ventilation pressure (pMax) is not achieved during inspiration.

WM 68011g 08/2020

7.3.11 CCSV mode

⚠ WARNING

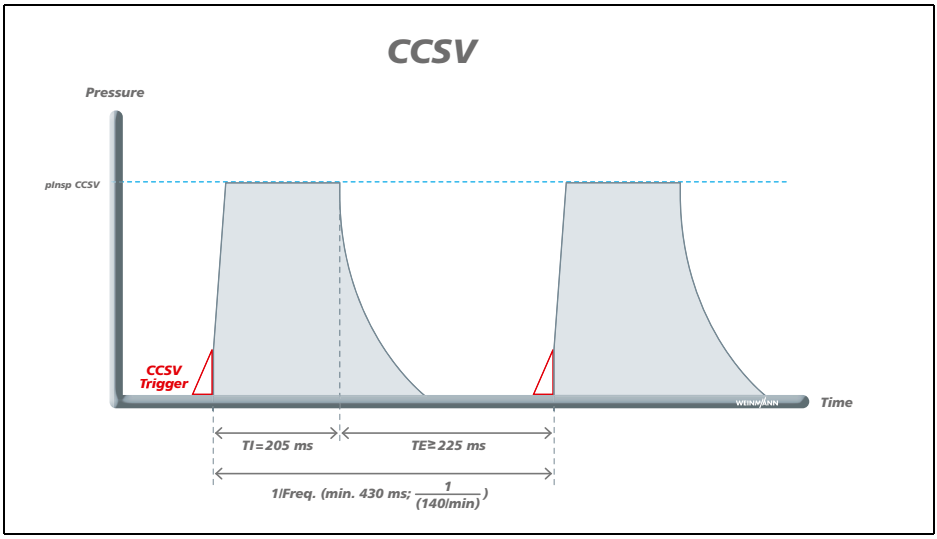
Risk of injury due to unsecured airway!
If the CCSV mode is used, an unsecured airway can result in insufflation of the stomach and cause injury to the patient.
⇒ Only use CCSV mode with an endotracheal tube or with pressure-tight (blocked) tracheostomy hoses.

⚠ CAUTION

Risk of injury if using a hose system not approved for CCSV mode!
Do not use a hose system with reduced dead space or a 3 m hose system in CCSV mode, as the device will be unable to correctly detect chest compressions. This may cause a fault or treatment failure. This can injure the patient.
⇒ Only use a standard 2 m hose system in CCSV mode.

Description	
Abbreviation	CCSV
Long form	Chest Compression Synchronized Ventilation
Type	Pressure-controlled
Requirement	• Flow measurement + ASB option is activated. • CCSV option is activated
Ventilation parameters	
Left-hand navigation knob	Trigger
Central navigation knob	•  • 
Right-hand navigation knob	• CPR mode • pInsp • PEEP

WM 68011g 08/2020



The CCSV mode is a pressure-controlled ventilation mode employed specially and exclusively for resuscitation ventilation during continuing chest compression. The ventilation mode offers you support during cardiopulmonary resuscitation (in accordance with the resuscitation guidelines) by applying a defined pressure into the lungs in time with every chest compression and switches to expiration during the chest decompression phase.
The set inspiratory pressure corresponds to the maximum pressure limit at the same time.
The device detects the beginning of a chest compression via a pressure trigger (CCSV trigger) and outputs a mechanical breath with the set inspiratory pressure within a few milliseconds.

WM 68011g 08/2020

7.4 Additional functions

7.4.1 CPR mode

⚠ WARNING

Risk of injury from deactivated alarms in the additional functions CPR and RSI!

Through deactivation in the operator menu, no alarms for flow and CO_2 monitoring are output in the additional functions CPR and RSI. This can injure the patient.

⇒ Notify the user if the alarms in the additional functions CPR and RSI have been deactivated.

⇒ Observe the alarm limits during ventilation in the additional functions CPR and RSI.

Description			
Abbreviation	CPR manual	CPR IPPV	CPR CCSV
Long form	Cardiopulmonary Resuscitation		
Type	Volume-controlled		Pressure-controlled
Requirement	None	None	• Flow measurement + ASB option is activated • CCSV option is activated
Ventilation parameters			
Left-hand navigation knob	Vt	Vt	Trigger
Central navigation knob	-	Freq.	•  • 
Right-hand navigation knob	• CPR mode • pMax	• CPR mode • Interval • pMax • PEEP	• CPR mode • pInsp • PEEP

The CPR mode supports you during cardiopulmonary resuscitation according to the Resuscitation Guidelines (see "4.7 Ventilating the patient", page 70). The CPR mode differentiates between a CPR Manual mode for 30:2 and 15:2 ventilation and a continuous CPR IPPV mode for continuous chest compression. If the CCSV option is enabled, the continuous CPR CCSV mode is also available. You can switch between the different CPR modes as follows (see "4.7.12 Changing the ventilation mode in CPR mode", page 88):

MEDUMAT Standard^2 emits a metronome sound which dictates the frequency of the chest compressions according to a 15:2 or 30:2 algorithm or continuously. When the Infant or Child patient group is selected, the metronome automatically emits the tone in the rate 15:2 in CPR Manual mode. When the Adult patient group is selected, a rate of 30:2 is emitted in CPR Manual mode. The metronome can be deactivated in the operator menu. Whilst the metronome is activated, the alarms in CPR mode are emitted via an alternative alarm transmitter.

At the start of the CPR mode, Air Mix switches off automatically, in order to ensure ventilation with 100% oxygen. You cannot activate Air Mix in the CPR Manual and CPR CCSV modes. You can activate Air Mix in CPR IPPV mode. The Air Mix setting is retained upon exiting CPR mode.

The device always switches to IPPV mode upon exiting CPR mode. If the capnography option is activated, you can set a pressure gauge view or curve view in CPR mode (see "6.3.8 Presets patient", page 133).

WM 68011g 08/2020

In **CPR Manual** mode, individual breaths can be manually applied via MEDUtrigger. This mode is applied at the start of a resuscitation if the airway is not secured. Algorithms 15:2 and 30:2 are supported in CPR Manual mode. With these algorithms, 15 or 30 metronome beats are emitted in each case, of which the last 5 sounds have a rising tone frequency and thus announce the imminent ventilation phase. In the ventilation phase, you administer the mechanical breaths manually via MEDUtrigger. The I:E ratio is always 1:1. The set maximum ventilation pressure (pMax) ensures the safety of the patient.

The continuous **CPR IPPV** mode is designed for ventilation during chest compression after the airway is secured and corresponds to an adjusted IPPV ventilation.
During the analysis of the defibrillator, you can pause continuous ventilation in order to avoid artifacts in the analysis of the defibrillator.

The **CPR CCSV** ventilation mode delivers continuous ventilation synchronized with the chest compression for an intubated patient (see "7.3.11 CCSV mode", page 161).
To ensure effective treatment in CPR CCSV mode, the trigger and the PEEP must be set to suit the patient. You can set the trigger from Level 1 (very sensitive) to Level 5 (insensitive to autotrigger), which means that reducing the trigger level ensures that the chest compression can be detected more easily by the device. In CPR CCSV mode, the PEEP can be preset by the operator. The default setting is 3 mbar. In CPR CCSV mode, the PEEP serves to improve triggering in the case of patients with a low functional residual capacity (e.g. due to obesity).

Chest compressions during cardiopulmonary resuscitation can be performed manually in CPR CCSV mode or by automatic chest compression devices. By default, CCSV starts with Trigger Level 2 for manual chest compression. When switching to automatic chest compression, the trigger and the alarm behavior are adjusted accordingly and the colored assessment in the frequency display is disabled. The trigger level is set to 3.
If you do not perform chest compressions for an extended period of time in CPR CCSV mode, the device returns to IPPV back-up ventilation after the time preset in the operator menu. As soon as you recommence chest compressions, the device automatically returns to CSSV ventilation.

WM 68011g 08/2020

7.4.2 RSI mode

⚠ WARNING

Risk of injury from deactivated alarms in the additional functions CPR and RSI!

Through deactivation in the operator menu, no alarms for flow and CO_2 monitoring are output in the additional functions CPR and RSI. This can injure the patient.

⇒ Notify the user if the alarms in the additional functions CPR and RSI have been deactivated.

⇒ Observe the alarm limits during ventilation in the additional functions CPR and RSI.

Description	
Abbreviation	RSI
Long form	Rapid Sequence Induction
Type	Volume-controlled
Requirement	None
Ventilation parameters	
Left-hand navigation knob	Vt (only with RSI manual)
Central navigation knob	-
Right-hand navigation knob	• Emergency mode • RSI mode • pMax

The RSI mode supports you in the induction of anesthesia (TIVA). It is used on all patients with an increased risk of a pulmonary aspiration.

Following the selection of the RSI mode, the device launches the oxygen demand function immediately for the preoxygenation of a spontaneously breathing patient.

For intubation, switch to the **Manual** function. The I:E ratio is always 1:1. With the supplied MEDUtrigger, this function now enables manual ventilation with a defined volume and a defined pressure limitation. The **Manual** function can be used for checking the position of the tube or as a fallback option should it prove difficult to secure the airway.

WM 68011g 08/2020

Air Mix cannot be activated in the Demand and Manual functions.

Following successful airway management, switch to continuous ventilation mode with the **Contin.** function. The device automatically switches to one of the following modes with the ventilation parameters preset for the patient group (see "14.1.10 Factory settings for emergency modes and ventilation modes", page 257):

- IPPV
- BiLevel + ASB (only if the BiLevel + ASB option is activated).

If the capnography option is activated, you can set a pressure gauge view or curve view in CPR mode (see "6.3.8 Presets patient", page 133)

7.4.3 Demand mode

Description	
Abbreviation	-
Long form	Demand
Type	Pressure-controlled
Requirement	Demand option is activated
Ventilation parameters	
Left-hand navigation knob	-
Central navigation knob	-
Right-hand navigation knob	• pMax • Emergency mode

The Demand mode serves to (pre)oxygenate spontaneously breathing patients via a ventilation mask. The patient must trigger inspiration himself in Demand mode. If there is a FlowCheck sensor this recognizes the respiratory effort, otherwise the underpressure created is used. You can select the following operation in Demand mode:

- Concentrator oxygen mode
- 100% oxygen mode

Air Mix cannot be activated in Demand mode.

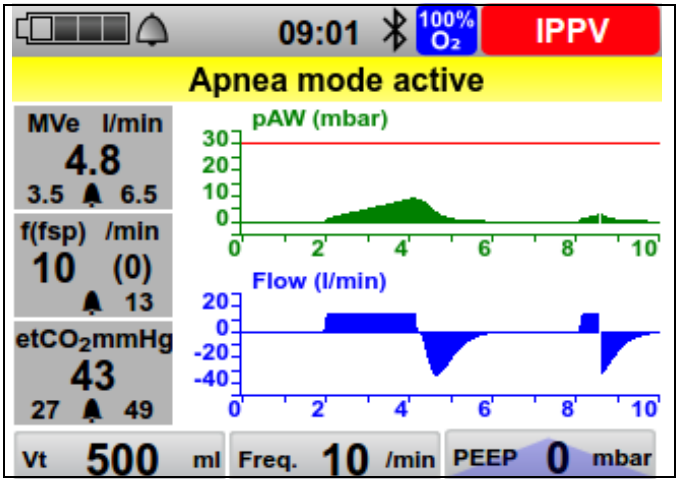
WM 68011g 08/2020

7.4.4 Apnea ventilation

Description	
Abbreviation	• IPPV **or** • BiLevel + ASB (if pressure-controlled ventilation option is activated)
Long form	• Intermittent Positive Pressure Ventilation **or** • BiLevel ventilation at two pressure levels
Type	• Volume-controlled **or** • Pressure-controlled
Requirement	Apnea ventilation is activated in the user menu
Ventilation parameters	
Left-hand navigation knob	• Vt • pInsp
Central navigation knob	Freq
Right-hand navigation knob	• PEEP • pMax • Δ pASB (in BiLevel + ASB mode only) • InTr (in BiLevel + ASB mode only) • I:E • Emergency mode

WM 68011g 08/2020

Apnea ventilation is a safety function which causes the device to take over and continue ventilation in the CPAP, CPAP + ASB and Demand modes if the patient stops breathing (apnea). If the patient is no longer breathing spontaneously and the set Apnea time in the "Alarm Limits" menu has elapsed, the device will automatically change to mandatory IPPV ventilation. If the BiLevel + ASB ventilation mode is activated, you can choose between IPPV and BiLevel + ASB as the apnea ventilation mode in the operator menu. The device uses the settings preconfigured in the operator menu for the Infant, Child and Adult patient groups or the settings defined via the height for the ventilation parameters in the respective apnea ventilation mode.



7-1 Apnea mode active

During apnea ventilation, the device emits a medium-priority alarm and the ventilation mode display turns red. The apnea ventilation mode can only be exited if the ventilation mode is changed actively.

7.4.5 Inhalation mode

Description	
Abbreviation	-
Long form	Inhalation
Type	-
Requirement	Inhalation option is activated
Ventilation parameters	
Left-hand navigation knob	-
Central navigation knob	-
Right-hand navigation knob	Inhalation flow

The Inhalation mode is used for the application of a defined oxygen flow of 1-10 l/min via a corresponding interface. To connect the interface, an inhalation adapter is required, which is attached to the connection for the ventilation hose on the device. On delivery, the inhalation adapter is secured to the connection for the ventilation hose by a retaining band.

7.4.6 CO_2 monitoring mode

Description	
Abbreviation	-
Long form	CO_2 monitoring
Type	-
Requirement	Capnography option is activated
Ventilation parameters	
Left-hand navigation knob	-
Central navigation knob	-
Right-hand navigation knob	-

WM 68011g 08/2020

CO_2 monitoring is used for the sidestream CO_2 measurement during oxygen inhalation or bag-valve-mask ventilation (see "4.7.8 Performing CO_2 monitoring (only with capnography option)", page 80). To use the CO_2 measurement during oxygen inhalation, you require an interface with a male Luer lock connector for CO_2 measurement (see "4.4.7 Connecting the $etCO_2/O_2$ nasal cannula", page 66). To use the CO_2 measurement during bag-valve-mask ventilation, connect the device's CO_2 measuring hose to, for example, a breathing system filter or a resuscitator.
In CO_2 monitoring mode, a CO_2 curve (capnography option) and an $etCO_2$ trend are displayed. In order to display the trend, the mean value of the $etCO_2$ is determined every minute and displayed in a diagram, whereby the time axis of the trend can be set by the user in the user menu (see "5.3.6 $etCO_2$ trend (only with capnography option)", page 116).

The CO_2 unit can be selected in the operator menu under the menu item Device Configuration (see "6.3.7 Device configuration", page 130).

WM 68011g 08/2020

8 Hygienic reprocessing

The following sections describe the activities required for hygienic reprocessing. The chapter is divided into the following areas:

- Device
- Accessories
- Patient hose system

Read this section in full before starting hygienic reprocessing. If you have any queries on hygienic reprocessing, please contact the manufacturer WEINMANN Emergency or a technician who has been expressly authorized by WEINMANN Emergency.

⚠ WARNING

Malfunction or failure of treatment due to the incorrect use of disposable items!
The repeated use and reprocessing of disposable items may lead to unforeseeable reactions as a result of ageing, embrittlement, wear, thermal load, and the effects of chemical processes. This can compromise the functionality and safety of the device and result in severe or life-threatening injury to the patient and user.
⇒ Do not reuse disposable items.
⇒ Do not subject disposable items to hygienic reprocessing.

⚠ WARNING

Infection of the user or subsequent patients due to the incorrect handling of contaminated hygiene filters!
A contaminated hygiene filter can result in severe or life-threatening injury to the patient and user.
⇒ Only use suitable protective equipment to remove contaminated hygiene filters.
⇒ Dispose of contaminated hygiene filters within the scope of hygienic reprocessing and do not reuse.

WM 68011g 08/2020

⚠ WARNING

Disruption or failure of therapy due to unsuitable cleaning agents and disinfectants!

The use of incorrect cleaning agents and disinfectants can cause the device to malfunction. This can result in serious or life-threatening injury to the patient.

⇒ Never clean the device and accessories with bleach, bleach solutions or phenolic compounds.

⇒ Only use the cleaning agents and disinfectants recommended in these instructions for use (see "8.12 Cleaning and disinfection plan", page 196).

⚠ WARNING

Loss of mechanical or electrical safety resulting from reprocessing of the device and accessories with unsuitable cleaning agents and disinfectants!

Using incorrect cleaning agents and disinfectants might cause damage to the surface of the device and/or accessories, as well as impairing electrical and insulating properties. This can result in severe or life-threatening injury to the user and patient.

⇒ Only use the cleaning agents and disinfectants recommended in these instructions for use (see "8.12 Cleaning and disinfection plan", page 196).

⚠ WARNING

Disruption or failure of therapy due to liquid in the hose system after hygienic reprocessing!

Drips in the reusable measuring hose system or FlowCheck sensor can distort the measurement results. This can result in serious or life-threatening injury to the patient.

⇒ Following hygienic reprocessing of the hose system, allow all hose system components to dry thoroughly.

WM 68011g 08/2020

⚠ CAUTION

Risk of infection resulting from insufficient hygienic reprocessing!

The use of a device and accessories which have not been subjected to hygienic reprocessing may lead to infections if they come into contact with the skin of the patient or user or the patient's airways. This can result in severe or life-threatening injury to the patient and user.

⇒ Carry out hygienic reprocessing of the device and accessories after every use.

⇒ Perform hygienic reprocessing according to the cleaning and disinfection plan (see "8.12 Cleaning and disinfection plan", page 196).

⇒ When hygienically reprocessing the device and accessories, use only the recommended cleaning agents and disinfectants.

⇒ Follow the instructions for use of the cleaning agents and disinfectants used.

⇒ Follow the instructions for use of the accessories.

⇒ Wear suitable protective equipment.

⇒ Always immersion disinfect (see "8.7.1 Immerse disinfecting the reusable measuring hose system", page 187) or steam sterilize the reusable measuring hose system (without the CO_2 measuring hose) to reduce the germs.

⚠ CAUTION

Risk of infection when using a contaminated device for subsequent ventilation!

If the device is used in a contaminated atmosphere, it can suck in contaminated ambient air. This can result in serious or life-threatening injury to the patient.

⇒ If it is suspected that the inside of the device is contaminated, take the device out of use and contact the manufacturer.

⚠ CAUTION

Risk of infection from contaminated disposable items!

Reused disposable items can cause infections if they come into contact with the airways. This can result in severe or life-threatening injury to the patient and user.

⇒ Do not reuse disposable items.

⇒ Do not subject disposable items to hygienic reprocessing.

WM 68011g 08/2020

⚠ CAUTION

Risk of injury and damage to property due to residues of disinfectants and cleaning agents in the device or hose system.

Disinfectant or cleaning agent residues can get into the patient's lung. This can result in severe or life-threatening injury to the patient and cause material damage to the device.

⇒ All parts of the hose system must be rinsed thoroughly with water and allowed to dry completely following the hygienic reprocessing.

⇒ After hygienic reprocessing, check the device and hose system visually for residues of cleaning agents or disinfectants and, if necessary, remove any residues.

⇒ Perform a full check after every hygienic reprocessing.

⇒ Do not immerse the device in liquids.

⇒ Only reprocess the device hygienically with the hygiene filter inserted.

⇒ Only clean/disinfect the filter compartment when changing the filter.

⇒ Only clean/disinfect the filter compartment when moist and not wet.

NOTICE

Damage to the device caused by ingress of liquids!

The device is rated IP54 (splash-proof). This only takes effect when the battery is located in the battery compartment. Ingress of liquids may damage the device, components and accessories.

⇒ Do not immerse the device, components or accessories in liquids.

⇒ Clean the battery compartment carefully so that no liquids enter the device.

8.1 General instructions

- The service life of the components of the reusable hose system is at least 30 reprocessing cycles (exception FlowCheck sensor: typically 50 reprocessing cycles).
- The components and accessories are not sterile on delivery.

WM 68011g 08/2020

8.2 Intervals

Part	Interval		
	After each use	**At least 1 x weekly**	**After transportation of an infected patient or upon expiry of the filter's service life (at least every 6 months)**
All parts (except the hygiene filter)	x	x	-
Hygiene filter	-	-	x

8.3 Preparing hygienic reprocessing

Requirement

- The device is switched off (see "4.6 Switching the device off", page 70).
- The device is disconnected from the patient.

1. Disconnect the device from the power supply.
2. Remove accessories from the device.
3. Dismantle the reusable hose system into its individual parts (see "8.4 Disassembly of the reusable hose system", page 177).
4. If necessary: Dismantle the accessories into individual parts.
5. Dispose of all disposable items correctly (see "13 Disposal", page 231).

Result All parts have been prepared for hygienic reprocessing.

WM 68011g 08/2020

8.4 Disassembly of the reusable hose system

The images in this subchapter show all the possible components of the reusable hose system. Depending on the system type, your reusable hose system may not include certain components (see "3.5.2 Reusable hose system and disposable hose system", page 35).

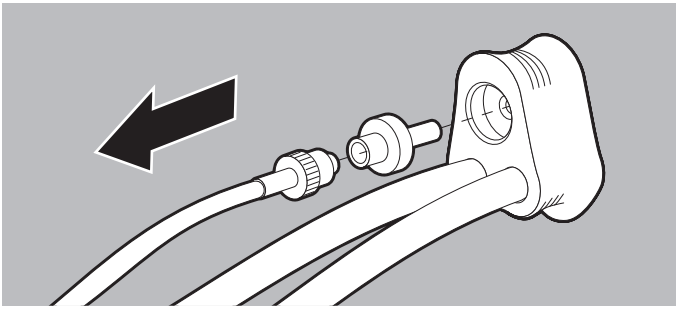
Requirement

- The device is disconnected from the patient hose system.
- The patient is disconnected from the patient hose system.

NOTICE

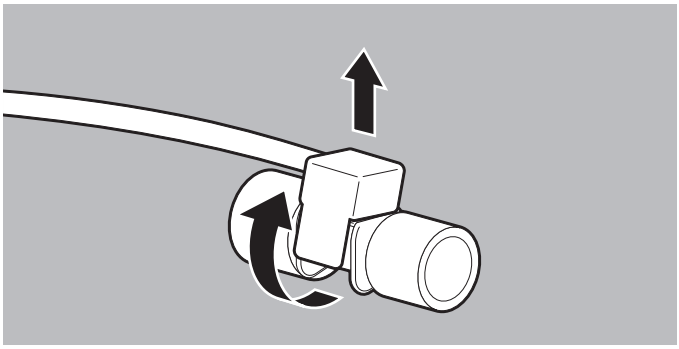
Material damage from pulling out the hoses incorrectly!
The hoses may be damaged if pulled out incorrectly.
⇒ Hold the end of the hose when pulling out!

1. Open the hose protection sleeve.
2. Open the Velcro fasteners in the hose protection sleeve.

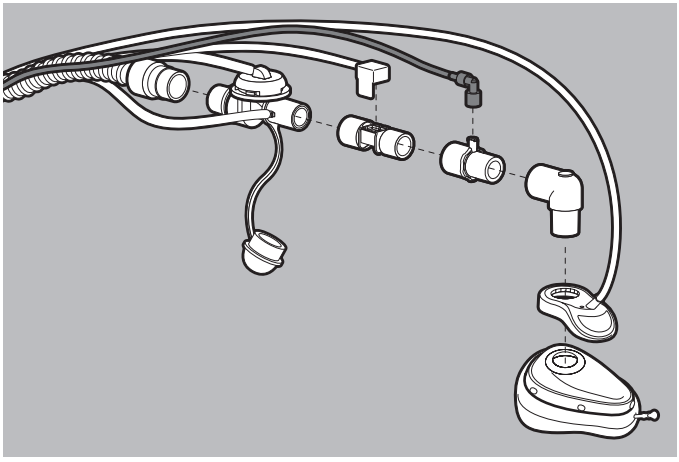


3. If available: Detach the water filter from the measuring hose system connector.
4. If available: Detach the water filter from the CO_2 measuring hose.

WM 68011g 08/2020

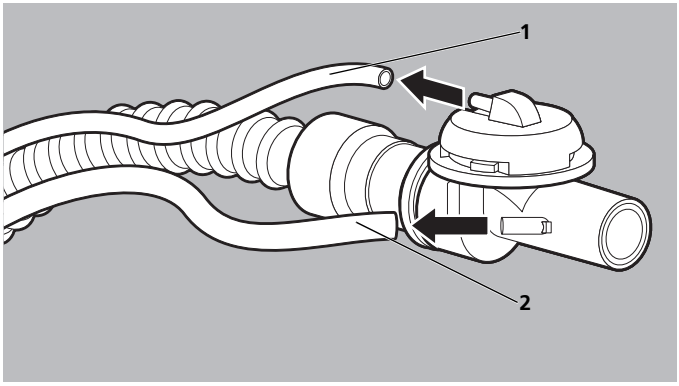


5. If available: Detach one of the following connection lines from the FlowCheck sensor:
   - FlowCheck sensor connection line
   - FlowCheck sensor connection line with MEDUtrigger

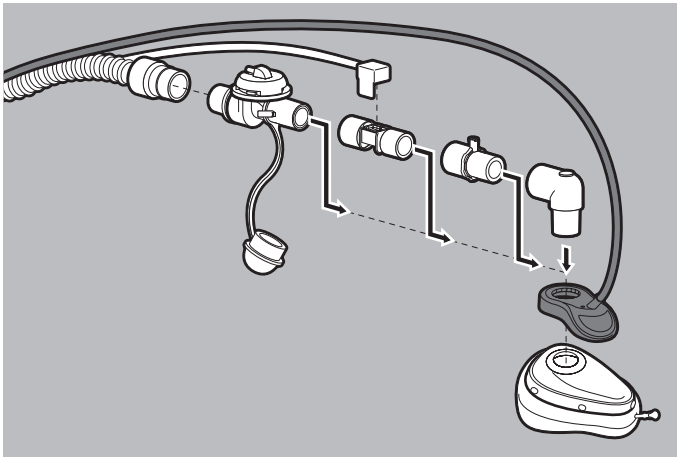


6. If available: Detach the CO_2 measuring hose from the connector with CO_2 connection.

WM 68011g 08/2020

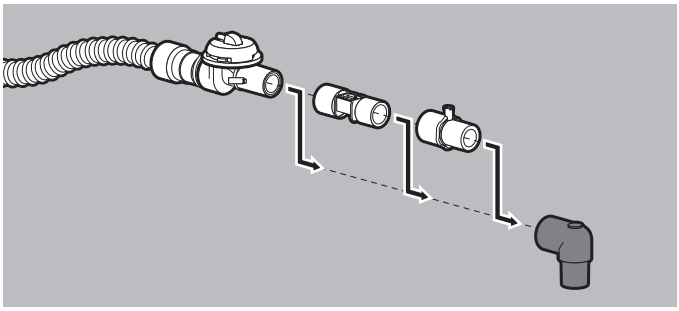


7. Detach the pressure-measurement hose (**2**) and PEEP control hose (**1**) from the patient valve.
8. If available: Remove the protective cap from the end of the reusable hose system closest to the patient.

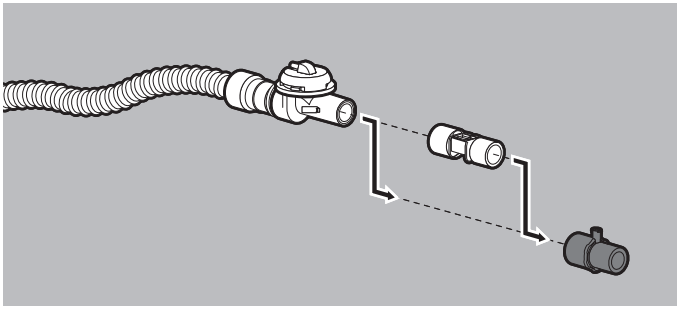


9. If available: Detach MEDUtrigger.

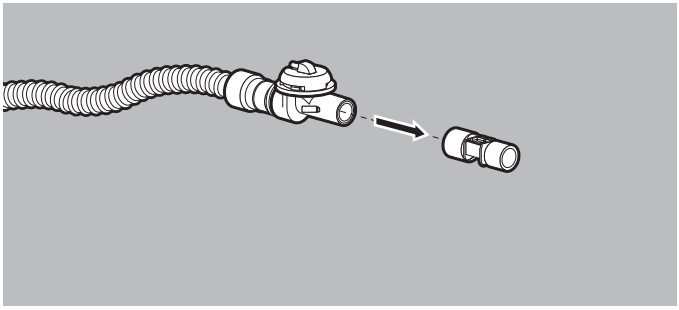
WM 68011g 08/2020



10. If available: Detach the elbow.



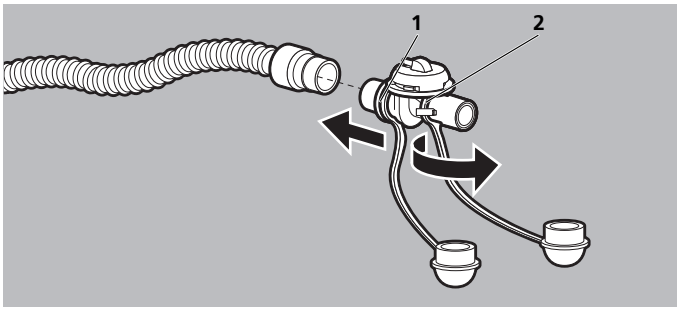
11. If available: Detach the connector with CO_2 connection.



12. If available: Detach the FlowCheck sensor from the patient valve.

13. Disconnect the patient valve from the ventilation hose.

WM 68011g 08/2020

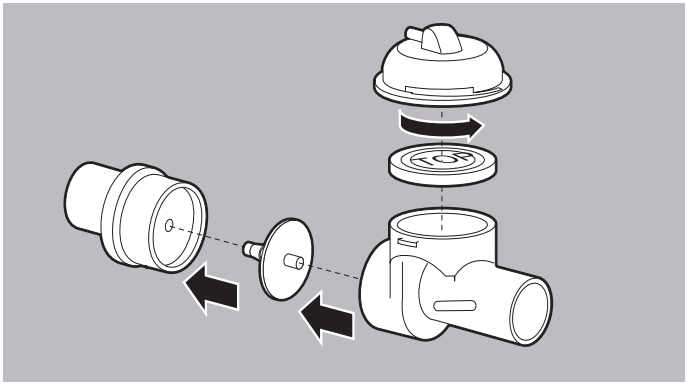


14. If available: Remove the protective cap strap from the patient valve:

    - Position **1**

    or

    - Position **2** (only with reusable hose systems with flow measurement **and** CO_2 measurement)



15. Disassemble the patient valve.

Result The reusable hose system is disassembled.

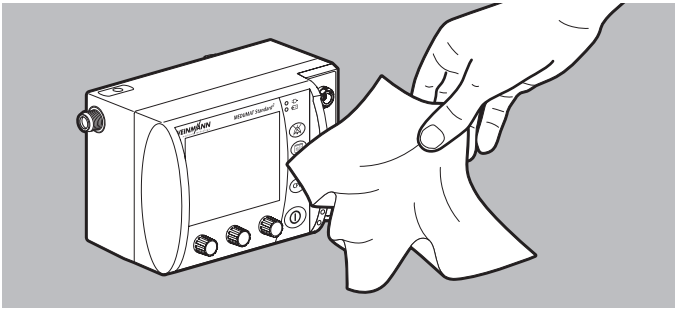
WM 68011g 08/2020

8.5 Cleaning parts manually

Requirement

- The parts are visibly soiled.
- The hygienic reprocessing is prepared (see "8.3 Preparing hygienic reprocessing", page 176).

1. The parts approved for manual cleaning can be found in the cleaning and disinfection plan (see "8.12 Cleaning and disinfection plan", page 196).
2. The cleaning agents, doses, and exposure time for the individual parts can be found in the cleaning and disinfection plan (see "8.12 Cleaning and disinfection plan", page 196).
3. Prepare the cleaning solution in accordance with the specifications of the cleaning agent manufacturer.
4. To remove all visible soiling: Thoroughly brush down parts on the inside and outside using a standard soft brush that is suitable for use on plastics and that has been wetted with the cleaning agent.
   When doing so, note:
   - Keep uneven surfaces and grooves (e.g., top and bottom of MEDUtrigger, adjusting knob, connection for ventilation hose) moist for the duration of the exposure time and brush them off particularly thoroughly.
   - Brush off the hoses with a special lumen brush.



5. If the parts need to be wiped down acc. to the cleaning and disinfection plan: Wipe parts down with a clean, lint-free cloth that has been moistened with cleaning solution.
   When doing so, note:

WM 68011g 08/2020

- Use a new cloth for each cleaning procedure.
- Carefully wipe down all the surfaces.
- All surfaces must be wetted with cleaning solution.
- Ensure compliance with the exposure time specified in the cleaning and disinfection plan.
- Rewipe uneven surfaces and grooves in particular.

6. If the parts need to be immersed acc. to the cleaning and disinfection plan: Immerse parts in the cleaning solution. When doing so, note:
   - Swirl the parts in the cleaning solution to coat all surfaces and any cavities completely.
   - Ensure compliance with the exposure time specified in the cleaning and disinfection plan.
7. If visible soiling remains: Repeat the manual cleaning.
8. Rinse parts that have been immersed in the cleaning solution thoroughly with water of drinking-water quality.
9. Wipe down the remaining parts with a damp cloth in order to remove cleaning agent residue.
10. Wipe MEDUtrigger with a dry cloth.
11. Allow all parts to dry fully at room temperature.

Result The parts are manually cleaned.

8.5.1 Cleaning the reusable measuring hose system manually

Requirement The reusable measuring hose system is disconnected from the patient valve and the device.

1. The cleaning agents, doses, and exposure time can be found in the cleaning and disinfection plan (see "8.12 Cleaning and disinfection plan", page 196).
2. Prepare the cleaning solution in accordance with the specifications of the cleaning agent manufacturer.
3. Clean the pressure-measurement hose and PEEP control hose:

WM 68011g 08/2020

- Wet the lumen brush (e.g., article number 26024, Interlock Medizintechnik GmbH) with cleaning solution.
- Clean the hose on the inside with the lumen brush until the hose is visibly clean.
- Connect a sterile disposable syringe (20 ml) to a free end of the hose.
- Draw the cleaning solution up through the hose into the disposable syringe by means of suction until both are completely full.
- Disconnect the disposable syringe from the hose.

4. Immerse the reusable measuring hose system in cleaning solution.
   When doing so, note:
   - All surfaces and lumens must be completely wetted.
   - Ensure compliance with the exposure time specified in the cleaning and disinfection plan.
5. Rinse the reusable measuring hose system with drinking-water quality from the outside.
6. Rinse the pressure-measurement hose and PEEP control hose with drinking-water quality from the inside at least eight times with a disposable syringe.
   When doing so, note: Only rinse in one direction.
7. Allow the reusable measuring hose system to dry out completely.
8. Check the reusable measuring hose system for residue and any remaining soiling.
9. If visible soiling remains: Repeat the manual cleaning.

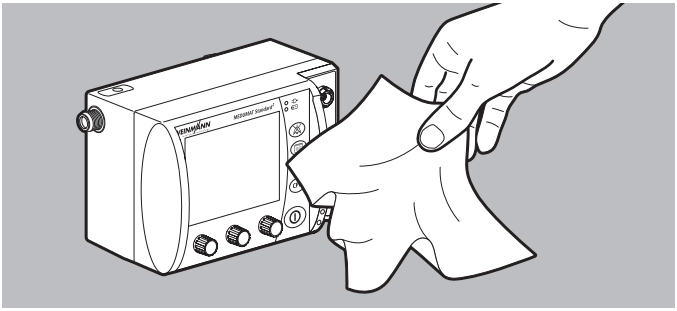
Result The reusable measuring hose system has been cleaned manually.

WM 68011g 08/2020

8.6 Wipe disinfecting parts

Requirement The parts have been manually cleaned and are visibly clean (see "8.5 Cleaning parts manually", page 182).

1. The parts approved for wipe disinfection can be found in the cleaning and disinfection plan (see "8.12 Cleaning and disinfection plan", page 196).
2. The cleaning agents, doses, and exposure time for the individual parts can be found in the cleaning and disinfection plan (see "8.12 Cleaning and disinfection plan", page 196).
3. Wipe-disinfect the parts with one of the agents listed (see "8.12 Cleaning and disinfection plan", page 196). When doing so, note:



   - Wet any uneven surfaces and grooves (e.g., adjusting knob, connection for ventilation hose) sufficiently with the disinfectant.
   - With a change of filter: Wipe disinfect the filter compartment.
4. Allow the parts to dry fully.
5. Check the parts for residue and any remaining soiling.
6. If visible soiling remains: Repeat wipe disinfection.

Depending on the disinfectant, rewiping with a neutralizing agent may be necessary.

Result The parts are wipe disinfected.

8.7 Immersion disinfecting parts

Requirement The parts intended for immersion disinfection have been manually cleaned (see "8.12 Cleaning and disinfection plan", page 196).

1. The parts approved for immersion disinfection can be found in the cleaning and disinfection plan (see "8.12 Cleaning and disinfection plan", page 196).
2. The disinfectants, doses, and exposure time for the individual parts can be found in the cleaning and disinfection plan (see "8.12 Cleaning and disinfection plan", page 196).
3. Prepare the immersion disinfection solution in accordance with the specifications of the disinfectant agent manufacturer.
4. Immerse the parts in the immersion disinfection solution. When doing so, note:
   - All cavities must be filled.
   - There must not be any air bubbles.
   - All surfaces must be wetted.
   - Swirl the parts in the immersion disinfection solution to coat all surfaces and any cavities completely.
   - Ensure compliance with the exposure time specified in the cleaning and disinfection plan.
5. After the specified exposure time, rinse the parts in water of drinking-water quality for 5 minutes in order to remove all of the disinfectant residue.
6. Allow the parts to dry fully.
7. Check the parts for residue and any remaining soiling.
8. If soiling is visible: Repeat the cleaning and disinfection.

Result The parts are immersion disinfected.

WM 68011g 08/2020

8.7.1 Immerse disinfecting the reusable measuring hose system

⚠ CAUTION

Risk of infection and contamination due to insufficient hygienic reprocessing of the measuring hose system!
Rinsing the measuring hose system in alternating directions does not guarantee any bacteria reduction and may injure the patient.
⇒ Only rinse measuring hoses in one direction.

The principle described only applies to the following parts of the reusable measuring hose system:

- Pressure-measurement hose
- PEEP control hose
- Measuring hose system connector

Requirement

- The reusable measuring hose system is disconnected from the reusable hose system (see "8.4 Disassembly of the reusable hose system", page 177).
- The reusable measuring hose system has been cleaned manually.

1. The disinfectants, doses, and exposure time for the individual parts can be found in the cleaning and disinfection plan (see "8.12 Cleaning and disinfection plan", page 196).
2. Prepare the immersion disinfection solution in accordance with the specifications of the disinfectant agent manufacturer.
3. Connect a sterile disposable syringe (20 ml) to one end of a hose.
4. Draw the immersion disinfection solution up through the hose into the disposable syringe by means of suction until both are completely full.
5. Disconnect the disposable syringe from the hose.
6. Immerse the hose in the disinfection solution.
   When doing so, note:
   - All surfaces and lumens must be completely wetted.
   - Ensure compliance with the exposure time specified in the cleaning and disinfection plan.

WM 68011g 08/2020

7. After the exposure time: Rinse the hose with drinking-water quality at least eight times with a syringe.
   When doing so, note: Only rinse in one direction.
8. Repeat the process based on this principle for each hose.
9. Allow the hoses to dry out completely.
10. If necessary: Dry hoses with sterile compressed air or medical oxygen.
11. Check the hoses for residue and any remaining soiling.
12. If visible soiling remains: Repeat immersion disinfection.

Result The reusable measuring hose system has been immersion disinfected.

8.8 Reprocessing parts mechanically

Alternatively to manual cleaning and disinfection, certain parts can also be machine cleaned and disinfected.

Requirement The parts have been prepared for mechanical reprocessing (see "8.3 Preparing hygienic reprocessing", page 176).

1. The parts approved for machine cleaning and disinfection can be found in the cleaning and disinfection plan (see "8.12 Cleaning and disinfection plan", page 196).
2. Place the parts in a washer and disinfector. When doing so, note:
   - Ensure compliance with the exposure time specified in the cleaning and disinfection plan.
   - Connect the hoses with the washer and disinfector.
   - All parts and lumens must be completely flushed.
   - The water must be able to run away.
3. Add cleaning agents as per the instructions for use for the washer and disinfector.
4. If necessary: Add neutralizing agent as per the instructions for use for the washer and disinfector.

WM 68011g 08/2020

5. Start the manual reprocessing program.
6. Allow parts to dry fully at room temperature.
7. Check the parts for residue and any remaining soiling.
8. If visible soiling remains: Repeat the machine cleaning and disinfection.

Result The parts are machine cleaned and disinfected.

8.8.1 Reprocessing the hose protection sleeve mechanically

1. Open the hose protection sleeve completely.
2. Wash the hose protection sleeve in the domestic or industrial washing machine at 60°C adding the cleaning agent specified in the cleaning and disinfection plan (see "8.12 Cleaning and disinfection plan", page 196).
   When doing so, note: Compliance with the manufacturer's specifications must be assured.
3. Allow the hose protection sleeve to dry completely.

Result The hose protection sleeve has been disinfected.

8.9 Steam sterilizing parts (optional)

If steam sterilization is to be performed, do so in accordance with the internal processes in place at your facility.

Requirement
- The parts intended for steam sterilization are visibly clean.
- The parts intended for steam sterilization have been disinfected.

1. The parts approved for steam sterilization can be found in the cleaning and disinfection plan (see "8.12 Cleaning and disinfection plan", page 196).
2. Steam sterilize parts with a device corresponding to EN 285.
   When doing so, note:
   - At 134°C with a hold time of 5 min.

   or

WM 68011g 08/2020

- At 132°C with a hold time of 4 min.
- The sterilizer manufacturer's instructions must be observed and followed.

Result The parts are steam sterilized.

8.10 Preparing parts for reuse

Requirement The parts have been subjected to hygienic reprocessing according to the cleaning and disinfection plan.

1. Check all parts for damage due to use (e.g., tension cracks and cable breakage).
2. Replace damaged parts.
3. Assemble reusable hose system (see "8.11 Assembling reusable hose system", page 190).
4. Mount the accessories.
5. Reconnect the power supply (see "4.2 Connecting to a power supply", page 50).
6. Perform a function check (see "9 Function check", page 201).
7. Place parts in storage in accordance with the storage conditions (see "14.1 Technical data", page 232).

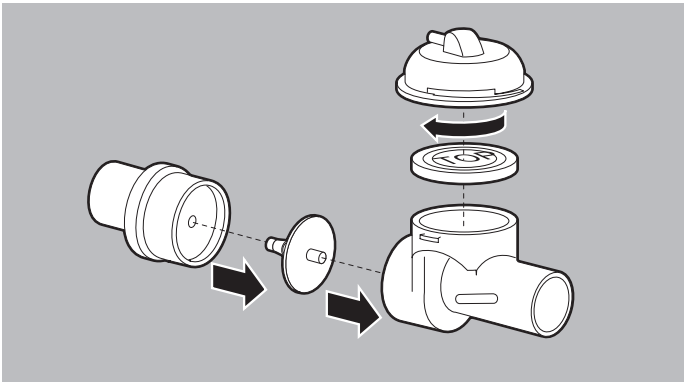
Result The parts are ready for use again.

8.11 Assembling reusable hose system

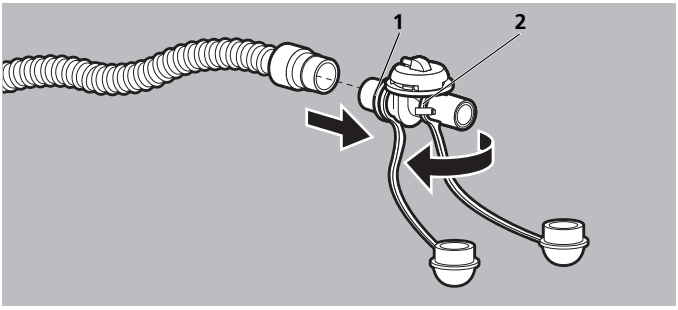
The images in this subchapter show all the possible components of the reusable hose system. Depending on the system type, your reusable hose system may not include certain components (see "3.5.2 Reusable hose system and disposable hose system", page 35).

Requirement The reusable hose system is disassembled.

WM 68011g 08/2020



1. Assemble the patient valve.
   When doing so, note:
   - the side of the PEEP control diaphragm labeled "TOP" must face upward toward the control cover.
   - the arrow on the control cover must point toward the patient.

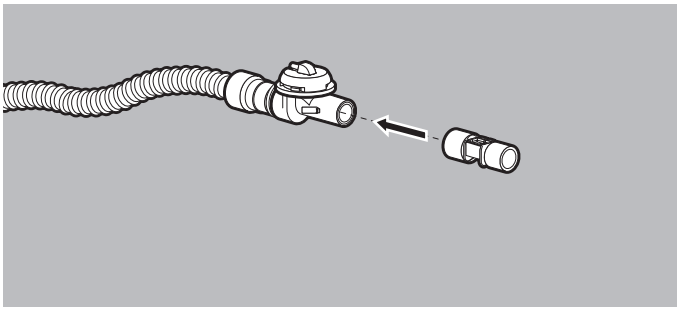


2. If available: Secure the protective cap strap on the patient valve:
   - Position **1**

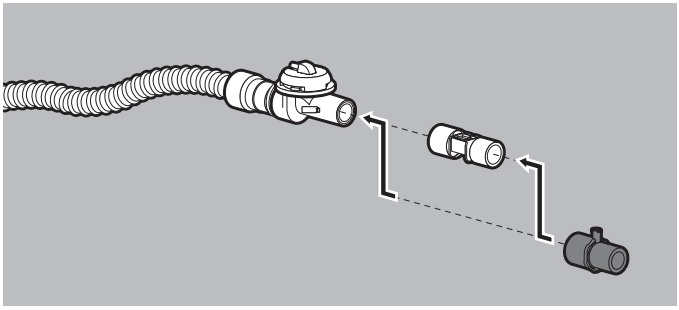
   or

   - Position **2** (only with reusable hose systems with flow measurement **and** CO_2 measurement)
3. Connect the patient valve to the ventilation hose.

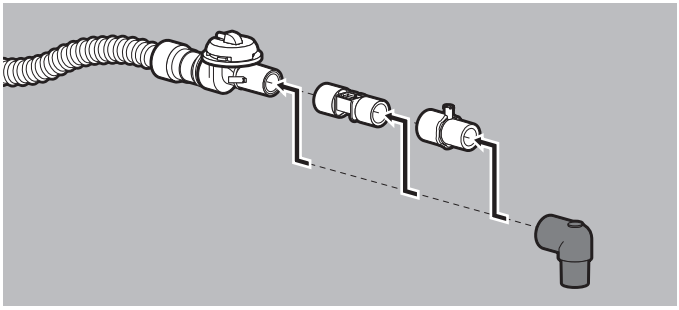
WM 68011g 08/2020



4. If available: Connect the FlowCheck sensor.

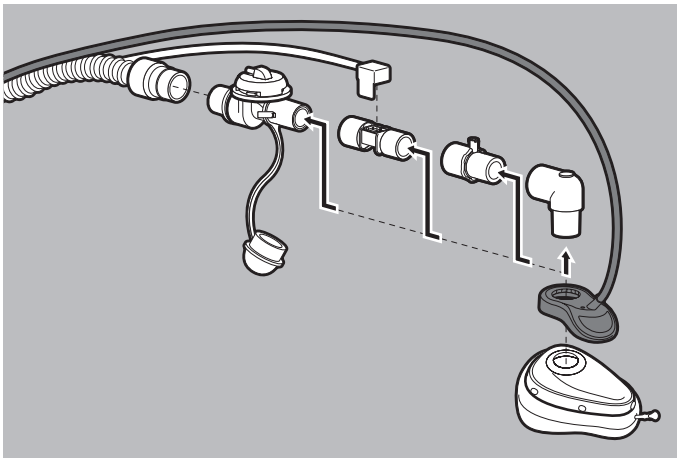


5. If available: Connect the connector with CO_2 connection.

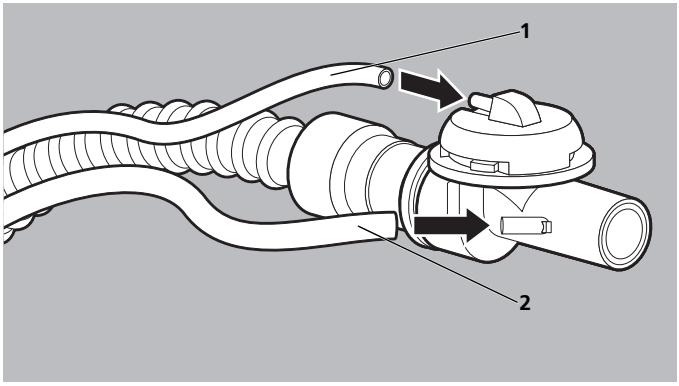


6. If available: Connect the elbow.

WM 68011g 08/2020

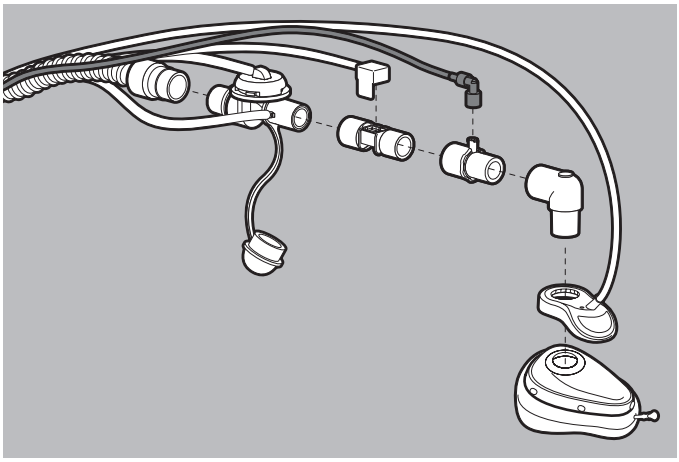


7. If available: Connect MEDUtrigger

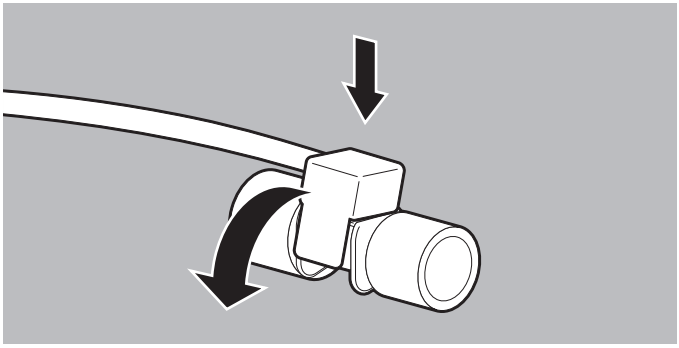


8. Connect the pressure-measurement hose (**2**) and PEEP control hose (**1**) to the patient valve.
   When doing so, note: The hoses must be firmly attached to the patient valve.

WM 68011g 08/2020

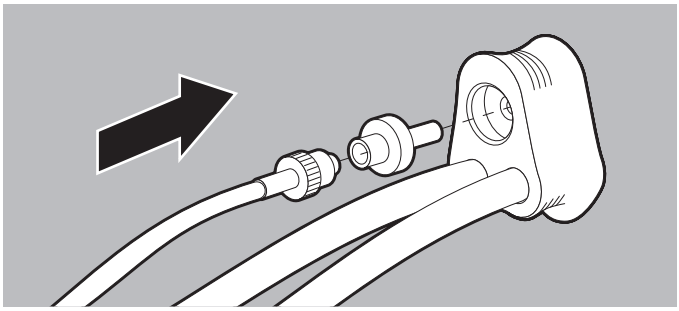


9. If available: Connect the CO_2 measuring hose to the connector with CO_2 connection.



10. If available: Connect one of the following connection lines to the FlowCheck sensor:
    - FlowCheck sensor connection line
    - FlowCheck sensor connection line with MEDUtrigger

WM 68011g 08/2020



11. If available: Connect the CO_2 measuring hose with water filter to the measuring hose system connector.
12. If available: Seal the end of the reusable hose system closest to the patient with a protective cap.
13. Place all the hoses and one of the connection lines in the hose protection sleeve.
14. Close the Velcro fasteners in the hose protection sleeve around the hoses and connection line.
15. Close the hose protection sleeve zipper.

Result The reusable hose system is assembled.

WM 68011g 08/2020

8.12 Cleaning and disinfection plan

Carry out hygienic reprocessing according to the following table after **every** use:

8.12.1 Device and accessories

Part	Manual cleaning (only necessary with visible soiling)	Wipe disinfection	Immersion disinfection	Mechanical reprocessing	Sterilization
Device 12 V cable Charging adapter Battery Power supply	Wipe down with neodisher® MediClean forte (Dr. Weigert). Dosage: 10 ml/l, Duration: treat all surfaces at least twice until visibly clean	Wipe down with Incidin™ Oxywipe S (Ecolab)	Not permitted	Not permitted	Not permitted
Testing bag	Not permitted	Wipe down with Incidin™ Oxywipe S (Ecolab)			
Velcro strap with clip	Wipe down with neodisher® MediClean forte (Dr. Weigert).	Not permitted	Immerse in gigasept® FF neu (Schülke) Dosage: 5 ml/l Exposure time: 15 min	Wash at up to 70°C with Derval SOLO and Ottalin PERACET	Not permitted
Hygiene filter (after infection transport or expiry of the filter service life (see 11.2, p. 224))	Disposable item, do not reuse. Dispose of correctly (see 13, p. 231).				

WM 68011g 08/2020

Part	Manual cleaning (only necessary with visible soiling)	Wipe disinfection	Immersion disinfection	Mechanical reprocessing	Sterilization
Inhalation adapter	Disposable item, do not reuse. Dispose of correctly (see 13, p. 231).				
Portable unit	Observe the instructions for use from the manufacturer.				
Ventilation mask					
Tube					
Breathing system filter					

WM 68011g 08/2020

8.12.2 Patient hose systems

Part	Manual cleaning (only necessary with visible soiling)	Wipe disinfection	Immersion disinfection	Mechanical reprocessing	Sterilization
Reusable hose system					
Ventilation hose	Immerse in and clean with neodisher® MediClean forte (Dr. Weigert). Dosage: 10 ml/l, Duration: treat all surfaces at least twice until visibly clean	Not permitted	Immerse in gigasept® FF neu (Schülke) Dosage: 5 ml/l Exposure time: 15 min	Cleaning: neodisher® MediClean forte (Dr. Weigert): 0.5%, 55°C, 10 min Thermal disinfection: 90°C, 5 min. (corresponding to A0 value 3000)	Optionally permissible: steam sterilization* **following disinfection:** 5 min. at 134°C or 4 min. at 132°C
Patient valve					
Elbow					
Protective cap					
Reusable measuring hose system					
FlowCheck sensor (reusable)	Not permitted				
Connector with CO_2 connection					
CO_2 measuring hose (only with capnography option)	Disposable item, do not reuse. Dispose of correctly (see 13, p. 231).				
Water filter (only with capnography option)	Disposable item, do not reuse. Dispose of correctly (see 13, p. 231).				

WM 68011g 08/2020

Part	Manual cleaning (only necessary with visible soiling)	Wipe disinfection	Immersion disinfection	Mechanical reprocessing	Sterilization
Hose protection sleeve	Not permitted	Not permitted	Not permitted	Wash at 60°C in industrial washing machine Cleaning agent: Derval SOLO (RKI) (Kreussler) Dosage: 2 ml/l Disinfectant: Ottalin PERACET (Kreussler) Dosage: 2 ml/l Exposure time: 10 min., type AB	Not permitted
FlowCheck sensor connection line	Wipe down with neodisher® MediClean forte (Dr. Weigert). Dosage: 10 ml/l, Duration: treat all surfaces at least twice until visibly clean	Wipe down with Incidin™ Oxywipe S (Ecolab)	Not permitted	Not permitted	Not permitted
FlowCheck sensor connection line with MEDUtrigger					
MEDUtrigger with connection line					

WM 68011g 08/2020

Part	Manual cleaning (only necessary with visible soiling)	Wipe disinfection	Immersion disinfection	Mechanical reprocessing	Sterilization
Disposable hose system					
Disposable hose system	Disposable item, do not reuse. Dispose of correctly (see 13, p. 231).				
Disposable measuring hose system					
Hose clips					
FlowCheck sensor (disposable)					
Water filter					
CO_2 measuring hose (only with capnography option)					
FlowCheck sensor connection line	Wipe down with neodisher® MediClean forte (Dr. Weigert). Dosage: 10 ml/l, Duration: treat all surfaces at least twice until visibly clean	Wipe down with Incidin™ Oxywipe S (Ecolab)	Not permitted	Not permitted	Not permitted
FlowCheck sensor connection line with MEDUtrigger					
MEDUtrigger with connection line					

The applicable instructions are those in the instructions for use from the manufacturers of the individual components or parts. Observe these instructions for use.

WM 68011g 08/2020

9 Function check

9.1 Intervals

Carry out a function check at regular intervals:

Part concerned	Interval
Device	• Before each use • After each hygienic reprocessing • After each repair
Patient hose system (reusable hose system)	• Before each use • After each hygienic reprocessing • After each disassembly • At least every 6 months

9.2 Preparing for the function check

1. Check battery status: The battery must be fully charged.
   If necessary: Charge or replace the battery.
2. Check the following parts for external damage:
   - Device
   - Plug and cable
   - Patient hose system
   - Accessories

   If necessary: Replace parts.
3. Check the patient valve of the patient hose system
   (see "9.5 Testing the reusable hose system", page 210).
   If necessary: Replace the patient hose system.
4. Check the oxygen level in the oxygen cylinder.
   If necessary: Change the oxygen cylinder.

WM 68011g 08/2020

5. Check the system for leaks (see "9.6 Checking the system for leaks", page 211).
   If necessary: Rectify any leaks in the system (see "9.7 Rectifying leaks in the system", page 211).

Result The function check is ready.

9.3 Performing a function check

You can perform the function check with the following test lungs:

- Testing bag WM 1454
- EasyLung for WEINMANN Emergency WM 28625

⚠ WARNING

Risk of injury from incorrect test lungs!
Test lungs other than those named here may not reliably detect errors and thus distort the result of a function check. This can injure the patient.
⇒ Only use the test lungs named here.

⚠ WARNING

Risk of injury due to a connection between the device and the patient during the function check!
A connection between the device and the patient during the function check can result in barotrauma and injury to the patient.
⇒ Always disconnect any connection between the device and the patient for the function check.

NOTICE

Material damage from touching the contacts in the battery compartment!
Touching the contacts and the ingress of liquids can damage the device.
⇒ Only operate the device with the battery inserted.
⇒ Do not touch the contacts in the battery compartment.
⇒ Clean the battery compartment carefully so that no liquids enter the device.

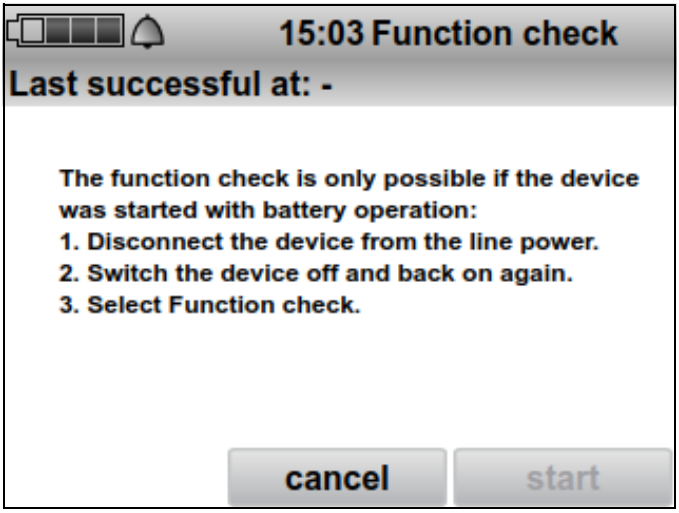
Requirement

- The device is disconnected from the patient.
- A fully charged battery is inserted in the device.
- The hygiene filter is inserted in the device.
- The protective cap has been removed from the end of the patient hose system.

WM 68011g 08/2020

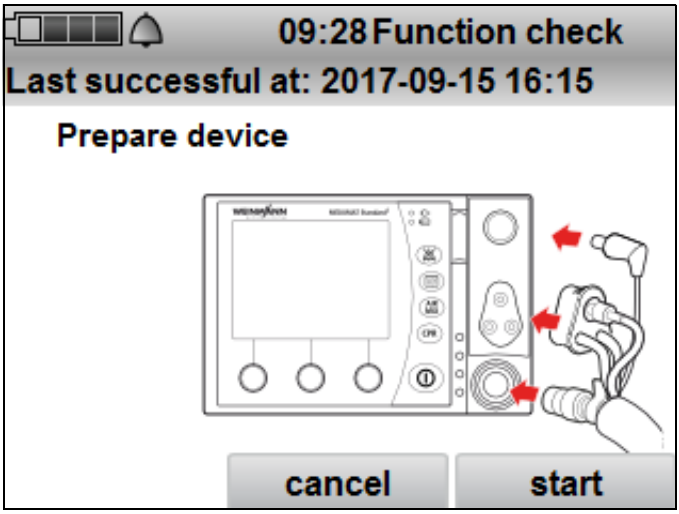
- The function check is ready (see "9.2 Preparing for the function check", page 201).

1. Disconnect the device from the line power.
   When doing so, note: If the device is switched on with the line power connected, the function check cannot be started. The following notice appears on the device display:



2. Switch on the device (see "4.5 Switching the device on", page 68).
3. Select the menu item **Function check**.

WM 68011g 08/2020



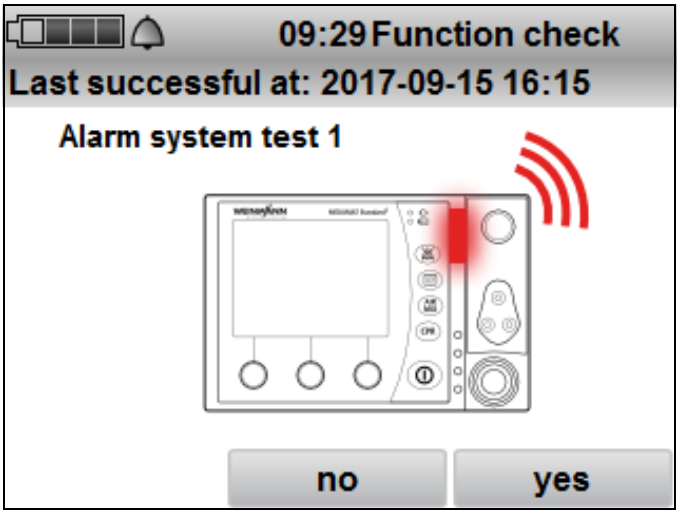
4. Prepare the device:
   - Connect and open the oxygen cylinder.
   - Connect the patient hose system up to the device.
   - Connect the test lung up to the patient hose system.

Do not touch the patient hose system and the test lung during the function check. Touching could distort the results of the function check.

5. Press the navigation knob **start**.

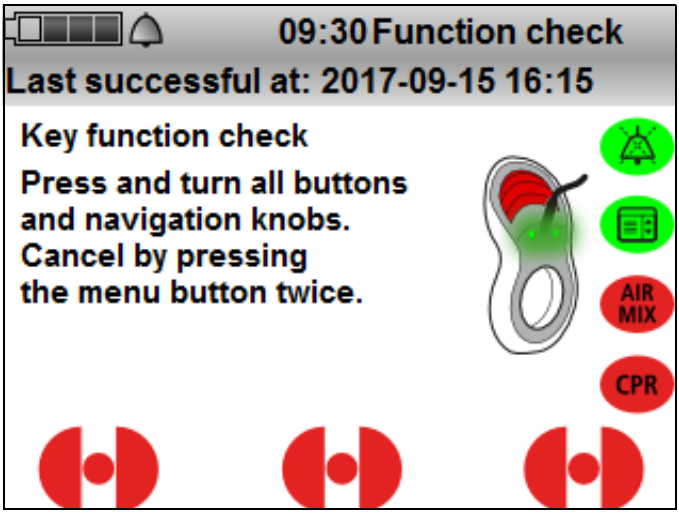
The alarm system test is not necessary if the NVG option is activated (see "6.3.9 Options", page 139).

WM 68011g 08/2020



6. Check the alarm system:
   - The alarm light must flash red.
   - The device must emit at least one audible alarm in alarm system test 1 and alarm system test 2.
7. If the alarm system is functioning: Press the navigation knob **yes** each time.
8. If the alarm system is not functioning: Press the navigation knob **no**.

If the software of the FlowCheck sensor connection line/ FlowCheck sensor connection line with MEDUtrigger is not up-to-date, the device updates the software before the key function check starts.

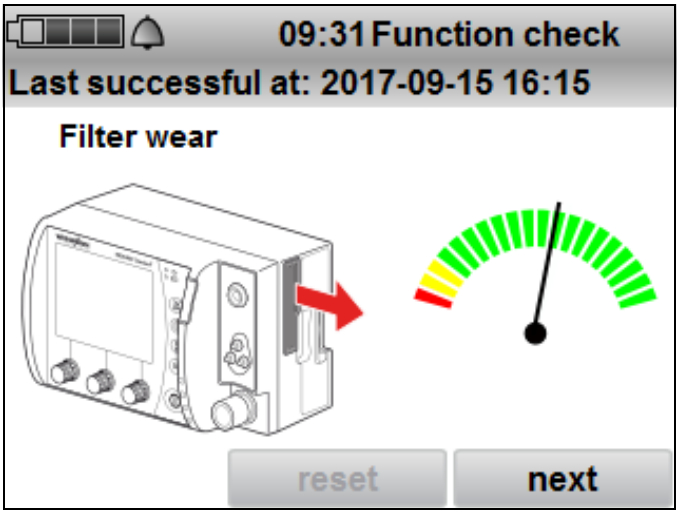


9. In the key function check, press all of the controls one after the other except for the On/Off button (ⓘ).

If MEDUtrigger is not displayed in the function check, activate it in the operator menu and repeat the function check.

10. If necessary: Press the menu button (▤) twice to cancel the key function check.

WM 68011g 08/2020



11. Proceed with the hygiene filter according to the following table:

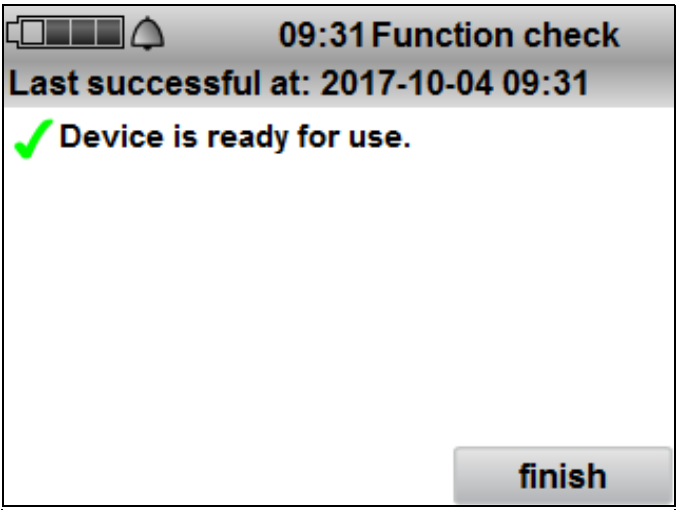
Color	Action
Green	Continue to use the hygiene filter.
Yellow	• Keep the hygiene filter at the ready. **or** • Order the hygiene filter.
Red	Replace the hygiene filter.

12. When the hygiene filter has been replaced: Reset the filter change indicator using the **reset** navigation knob.

Depending on the preset in the operator menu (see 6.3.7, p. 130), you can reset the hygiene filter at any time or never during the function check.

13. Press the navigation knob **next**.
The status report appears.

WM 68011g 08/2020



⚠ WARNING

Device malfunction or device failure if maintenance is either not performed or not performed in good time!
Wearing parts which are either not replaced or not replaced in good time as part of maintenance can result in device malfunction or device failure and injury to the patient.
⇒ Always observe the maintenance intervals.

14. Proceed with the device according to the following table:

Display		Meaning	Action
✓	Device is ready for use	Function check passed.	Use device without restriction.
✓	• Device is ready for use • Maintenance required in xx days.	• Function check passed • ≤ 60 days until expiry of the maintenance interval	• Device can be used without restrictions until expiry of the maintenance interval. • To continue using the device without restrictions: Contact WEINMANN Emergency or a technician authorized by WEINMANN Emergency in good time for maintenance.

WM 68011g 08/2020

Display		Meaning	Action
	• Device is ready for use • Maintenance required • Maintenance symbol is flashing in the display (only in the start menu)	• Function check passed • Maintenance interval expired	To continue using the device without restrictions: Contact WEINMANN Emergency or a technician authorized by WEINMANN Emergency for maintenance.
	• Device is ready for use • Check or replace the FlowCheck sensor • Maintenance symbol is flashing in the display (only in the start menu)	• Function check passed • Total useful life of the FlowCheck sensor has been exceeded	To continue using the device without restrictions: Check or replace the FlowCheck sensor.
	Device is not ready for use	Function check failed.	Take action (see "9.4 Failed function check", page 210).

The message **Check or replace the FlowCheck sensor** can also appear with a reminder that maintenance is required.

15. Press the navigation knob **finish**.
16. Switch off the device.
17. Close the oxygen cylinder.

⚠ WARNING

Risk of injury from improperly removed testing bag!
If the testing bag is removed improperly, the connector of the testing bag may remain on the patient hose system. The resulting increase in inspiratory airway resistance can injure the patient.
⇒ When disassembling always pull the testing bag off at the connector.

18. Pull the test lung from the patient hose system.

Result The function check is complete.

WM 68011g 08/2020

9.4 Failed function check

⚠ CAUTION

Risk of injury due to inoperational device!
Operation of the device after a failed function check may result in injury to the patient.
⇒ Only operate the device after it passes the function check.

Requirement The function check ended with **Device is not ready for use**.

Precise information on the individual tests in the function check can be found in the file **fcheck** (see "14.3.1 Recorded function checks", page 259).

1. Check the components named in the instructions on the display and replace if necessary.
2. Repeat the function check.
3. If the function check ends with **Device is not ready for use** again: Contact your authorized dealer or WEINMANN Emergency.

9.5 Testing the reusable hose system

Requirement The patient valve of the reusable hose system is dismounted (see "8.4 Disassembly of the reusable hose system", page 177).

1. Check all parts of the patient valve for external damage.
   If necessary: Replace damaged parts.
2. Check the PEEP control diaphragm and inspect the check valve diaphragm:
   If the diaphragm is torn, wavy, distorted or sticky: Replace the diaphragm.
3. Assemble reusable hose system (see "8.11 Assembling reusable hose system", page 190).

Result The patient valve of the reusable hose system has been checked and is ready for use.

WM 68011g 08/2020

9.6 Checking the system for leaks

Requirement The device is connected to the oxygen supply.

1. Open the valve of the oxygen cylinder slowly.
   The contents gauge on the pressure reducer indicates the pressure in the oxygen cylinder.
2. Close the valve on the oxygen cylinder.
3. Observe the contents gauge on the pressure reducer for approx. 1 min:
   - If the position of the needle remains constant: the system is free from leaks
   - If the needle falls, there is a leak in the system
4. If necessary: Rectify the leak (see "9.7 Rectifying leaks in the system", page 211).

Result The system has been checked for leaks.

9.7 Rectifying leaks in the system

Requirement
- All screw connections are tightened.
- All hoses are securely connected.
- There is a leak in the system.

1. Prepare a soapy solution using unperfumed soap.

NOTICE

Damage to the device caused by ingress of liquids!
Ingress of liquids may damage the device, components and accessories.
⇒ Do not immerse the device, components or accessories in liquids.

2. Wet all screw connections and hoses with the soapy solution. Bubbles will form if a leak is present.
3. In the event of a leakage: Close the valve on the oxygen cylinder.

WM 68011g 08/2020

4. Briefly press the On/Off button ⏻ and operate the device without an oxygen supply.
   The remaining oxygen is flushed out of the device.
5. Press and hold the On/Off button ⏻ for at least 2 seconds to switch off the device.
6. Replace leaky components.
7. Check the system for leaks once more (see "9.6 Checking the system for leaks", page 211).
8. If necessary: Look for other leaks and replace leaky components.
9. If the leak cannot be rectified, have the device repaired.

Result The leak in the system has been rectified.

WM 68011g 08/2020

10 Alarms and error messages

10.1 General instructions

The device's alarm system is based on the concept of self-preserving alarms. The device emits an alarm for as long as the cause continues to exist. Once the cause of the alarm no longer exists, the device no longer emits the alarm.

The device emits physiological and technical alarms. Every alarm has a certain priority.

Priority	Color in the alarm line	Meaning
High priority	Red	High-priority alarms warn of imminent fatal or irreversible patient injuries or of device faults.
Medium priority	Yellow	Medium-priority alarms warn of immediate reversible patient injuries or of minor device faults.
Low priority	Turquoise	Low-priority alarms warn of delayed minor injuries or inconvenience to the patient or minor restrictions on the device.

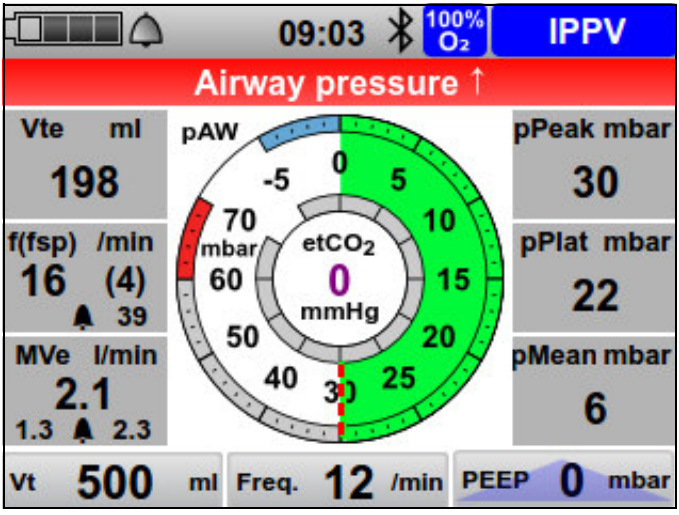
If more than one alarm is active, the device handles this as follows:

- Multiple alarms of different priorities: The device displays the alarm with the highest priority. Alarms with a lower priority do not appear until the higher-priority alarm is no longer active.
- Multiple alarms of identical priorities: The device displays the alarms alternately.
- Technical alarms dominate and cannot be muted. Technical alarms occur if ventilation is not possible with the device (e.g., in the event of a device fault, a supply pressure < 2.7 bar).

WM 68011g 08/2020

The device displays alarms as follows:

- As text in the alarm line on the display
- Acoustically as an audible alarm (via the loudspeaker on the underside of the device)
- With the alarm light (in the top right-hand corner on the front of the device)



10-1 Alarm line with airway pressure alarm

The device additionally displays physiological alarms through the flashing of the respective parameter field.

WM 68011g 08/2020

10.2 Alarm messages

10.2.1 High-priority alarm (red)

Alarm	Cause	Remedy
Airway pressure ↑	Obstruction of the patient's airways	Free the patient's airways of obstructions.
	Tube wrongly positioned	Position tube correctly.
	pMax set too low	Adjust pMax.
	Hoses kinked or pinched	Route hoses so that they are not kinked or pinched.
Airway pressure ↓	Patient hose system leaking	Replace the patient hose system.
	Patient hose system not connected correctly	Connect patient hose system correctly.
	Tube wrongly positioned	Position tube correctly.
	Hoses kinked or pinched	Route hoses so that they are not kinked or pinched.
	Ventilation settings incorrectly set	Adjust ventilation settings.
	Mask is not sitting correctly or is leaking	Place the mask on tightly or replace it.
Apnea	No inspiration since the set apnea alarm time, exception: in manual CPR mode (no inspiration in the last 59 s)	Check the condition of the patient. Select mandatory ventilation. In CPR CCSV mode: Restart chest compression.
Battery almost empty	Very low battery status	Replace battery (see 4.3.5, p. 55).
		Connect device to the line power (see 4.2, p. 50) and charge battery (see 4.3.2, p. 51).
Battery temperature critical	Battery temperature > 80°C	Operate battery within the permitted temperature range (see 14.1.2, p. 237).
Device fault	Temporary device malfunction	• Switch device off (see 4.6, p. 70) and back on again (see 4.5, p. 68). • Perform a function check.
	Device defective	Have the device repaired.
Device temperature ↓	Device temperature < -20°C	Operate device within permitted temperature range (see 14.1.1, p. 232).

WM 68011g 08/2020

Alarm	Cause	Remedy
Device temperature critical	Device temperature > 75°C	Operate device within permitted temperature range (see 14.1.1, p. 232).
MVe ↑ (only with flow measurement + ASB option)	Upper limit value exceeded	• Check the condition of the patient. • Check the set limit values for plausibility.
MVe ↓ (only with flow measurement + ASB option)	Lower limit value not reached	
PEEP ↑	Obstruction of the patient's airways	Free the patient's airways of obstructions.
	Tube wrongly positioned	Position tube correctly.
	Hoses kinked or pinched	Route hoses so that they are not kinked or pinched.
	Patient valve defective	Replace patient valve.
	Ventilation settings incorrectly set	Adjust ventilation settings.
Supply pressure < 2.7 bar	Oxygen cylinder not opened	Open oxygen cylinder.
	Oxygen cylinder almost empty	Replace oxygen cylinder.
	Compressed gas source not connected correctly	Connect compressed gas source correctly.
	Compressed gas source defective	Replace compressed gas source.
	Route the low-pressure hose so that it is not kinked or pinched.	Route the low-pressure hose so that it is not kinked or pinched.
	Pressure reducer defective	Replace pressure reducer.
Supply pressure > 6 bar	Pressure of compressed gas too high	Use compressed gas source < 6 bar.
		Switch off the device (see 4.6, p. 70) and disconnect it from compressed gas source.

The following alarms are only emitted once the respective condition is satisfied in two consequent breathing cycles.

- Airway pressure ↑ /Airway pressure ↓
- PEEP ↑
- MVe ↑ /MVe ↓ (only with flow measurement + ASB option)
- f ↑ (only with flow measurement + ASB option)

WM 68011g 08/2020

10.2.2 Medium-priority alarm (yellow)

Alarm	Cause	Remedy
Apnea mode active	No inspiration since the set apnea alarm time	• Check the condition of the patient. • Select mandatory ventilation mode.
Battery defective	Battery defective	Let the device run on battery power without line power until it switches off. Fully recharge battery (see 4.3.2, p. 51). If the device continues to display the alarm: Replace battery (see 4.3.5, p. 55).
Battery weak	Low battery status	Replace battery (see 4.3.5, p. 55).
		Connect device to the line power (see 4.2, p. 50) and charge the battery (see 4.3.5, p. 55).
Check the FlowCheck connection line (only with flow measurement + ASB option)	FlowCheck sensor connection line/ FlowCheck sensor connection line with MEDUtrigger not connected correctly	Connect the FlowCheck sensor connection line/FlowCheck sensor connection line with MEDUtrigger correctly.
	FlowCheck sensor connection line/ FlowCheck sensor connection line with MEDUtrigger defective	Replace the FlowCheck sensor connection line/FlowCheck sensor connection line with MEDUtrigger
	Software version of the FlowCheck sensor connection line/FlowCheck sensor connection line with MEDUtrigger not compatible with device	Perform a function check. The device updates the software version during the function check.
Check the FlowCheck sensor (only with flow measurement + ASB option)	FlowCheck sensor not connected correctly	Connect the FlowCheck sensor correctly.
	FlowCheck sensor defective	Replace the FlowCheck sensor.
CO_2 occlusion (only with capnography option)	Water filter blocked	Replace water filter.
	CO_2 measuring hose blocked	Replace CO_2 measuring hose.
Compression frequency ↑ (only with CCSV option)	Chest compression too fast	Perform chest compression slower.
	Automatic chest compression device generating too many trigger signals	Switch to automatic chest compression setting.

WM 68011g 08/2020

Alarm	Cause	Remedy
Compression frequency ↓ (only with CCSV option)	Chest compression too slow	Perform chest compression faster.
	No oscillating volume in the airways	Increase PEEP setting.
	Not all trigger signals are detected	Reduce trigger level.
Disconnection MEDUtrigger	MEDUtrigger removed from the device during manual ventilation	Reconnect MEDUtrigger to the device.
$etCO_2$ ↑ (only with capnography option)	Upper limit value exceeded	• Check the condition of the patient. • Check the set limit values for plausibility.
$etCO_2$ ↓ (only with capnography option)	Lower limit value not reached	
f ↑ (only with flow measurement + ASB option)	Upper limit value exceeded	• Check the condition of the patient. • Check the set limit values for plausibility.
Hands-off time ↑ (only with CCSV option)	Hands-off time too high	Continue chest compression.
Insert battery	Battery not inserted or incorrectly inserted	Insert battery correctly (see 4.2, p. 50).
Vt not achievable	The administered tidal volume deviates from the set tidal volume in PRVC + ASB mode.	Adjust pMax or Vt.
	Compressed gas supply inadequate	Adjust compressed gas supply.
	Sintered filter blocked	Have the device repaired.

WM 68011g 08/2020

10.2.3 Low-priority alarm (turquoise)

Alarm	Cause	Remedy
Battery operation	Line power too weak or power failure	The alarm appears: • If you remove the portable unit from the wall mounting. • If you operate the device using the power supply and a power failure occurs. In both cases, the alarm stops after 10 s.
CO_2 module defective (only with capnography option)	No communication with the CO_2 module or error message from the CO_2 module	Continue ventilation without CO_2 measurement. Have the device repaired.
	CO_2 module defective	
CO_2 temperature ↓ (only with capnography option)	Temperature in the device below 0°C	• If necessary: Continue ventilation without CO_2 measurement. • Move device to a warmer environment.
Device temperature ↑	Device temperature > 65°C	Operate device within permitted temperature range (see 14.1.1, p. 232).

10.3 Faults

If you are not able to clear an error message with the aid of the table, you should contact the manufacturer WEINMANN Emergency or your authorized dealer to have the device repaired. To avoid serious damage, do not continue using the device.

WM 68011g 08/2020

10.3.1 Device

Fault	Cause	Remedy
Alarm output too quiet	Volume set to 50%	Set the volume to 100% in the operator menu (see 6.3.7, p. 130).
No acoustic alarm output	NVG mode activated	Deactivate NVG (see 5.3.9, p. 119).
Alarm light does not light up		
Display too dark	Brightness of the display set too low	Increase brightness of the display (see 5.3.7, p. 117).
	NVG mode activated	Adjust NVG brightness (see 6.3.7, p. 130).
		Deactivate NVG (see 5.3.9, p. 119).
Device cannot be switched on	Battery not correctly inserted in device, or battery empty	Check battery.
	Battery empty and device not connected to the line power	Check power supply.
	Device defective	Have the device repaired.
Device cannot be switched off	Operating error	Press and hold the On/Off button ⏻ for at least 2 seconds.
Red cross in function check status report	Non-functioning component	See "9.4 Failed function check", page 210.
Software update is not functioning	Update file or SD card defective	Perform software update with another SD card. If the update still cannot be performed successfully, have the device repaired.
Battery status indicator flickers between red and green	Battery deeply discharged	Charge battery in the device for 24 hours (see 4.3.2, p. 51).
Battery status indicator and the line power indicator are not lit up	NVG mode activated	Deactivate NVG (see 5.3.9, p. 119).
The functionality of an option is not available	Option is deactivated in the operator menu	Activate the option in the operator menu (see 6.3.9, p. 139).
	Option is not enabled in the operator menu	Enable the option in the operator menu with the option code (see 4.14, p. 100).
Power failure/device failure: • Black screen • Alarm LED flashes • Audio alarm output	Battery empty and device not connected to the line power	Check power supply.
	Device defective	Switch off the device and have it repaired.

WM 68011g 08/2020

Fault	Cause	Remedy
The device switches off in NVG mode	Battery empty and device not connected to the line power	Check power supply.
	Device defective	Switch off the device and have it repaired.
Not possible to establish Bluetooth® connection during ventilation	Bluetooth® deactivated in user menu	Activate Bluetooth® in user menu (see "5.3.7 Bluetooth (only with Bluetooth data transmission option)", page 117).
	Distance between two devices too far	Reduce distance and move any objects which might interfere.
	Bluetooth® module of device or external data communication device is defective	Repair Bluetooth® module of device or external data communication device.
	Devices are not paired	Pair devices in user or operator menu (see "6.3.7 Device configuration", page 130).
Unable to export files to SD card	SD card not formatted correctly	Use SD card WM 29791
		Format SD card with FAT32 file system

10.3.2 Battery

Fault	Cause	Remedy
Red fault indicator lights up when status button on battery is pressed or red battery status indicator on device lights up	Battery defective	Replace battery.
	Battery temperature outside the permitted range (> 70°C)	Use battery within permitted temperature range (see 14.1.2, p. 237).
Battery does not respond when status button is pressed	Battery has run down completely and has shut down to prevent deep discharge.	Charge battery in the device for 24 hours (see 4.3.2, p. 51). After 24 hours: • Green LED is lit: Battery fully charged and ready for use. • Red LED or no LED is lit: Battery defective. Replace battery.
Device runtime with battery operation too short	Battery has reached end of its service life.	Replace battery.

WM 68011g 08/2020

Fault	Cause	Remedy
Battery not charging although it is not full	Battery temperature < 0°C or > 45°C	Charge battery within permitted temperature range (see 14.1.2, p. 237).
	Battery defective	Replace battery.

10.3.3 Ventilation

Fault	Cause	Remedy
Unusually high oxygen consumption	Leak in oxygen feed line	Locate and rectify leak (see 9.7, p. 211).
	Patient valve does not close completely	Check the hose system (PEEP control hose and patient valve).
	Leakage during mask ventilation	Place mask as tightly as possible on the patient.
MEDUtrigger is not functioning	MEDUtrigger option is deactivated in the operator menu	Activate the MEDUtrigger option in the operator menu(see 6.3.9, p. 139).
	MEDUtrigger/MEDUtrigger connection line/FlowCheck sensor connection line with MEDUtrigger defective	Replace MEDUtrigger.
Flow measurement is not functioning	Flow measurement + ASB option deactivated in the operator menu	Activate flow measurement + ASB in the operator menu (see 6.3.9, p. 139).
	FlowCheck sensor connection line/ FlowCheck sensor connection line with MEDUtrigger defective	Replace the FlowCheck sensor connection line/FlowCheck sensor connection line with MEDUtrigger.
CO_2 measurement is not functioning	Capnography option is deactivated in the operator menu	Activate the MEDUtrigger option in the operator menu (see 6.3.9, p. 139).
	Esophagus intubation	Check correct intubation.
	CO_2 measuring hose not connected correctly	Check CO_2 measuring hose.
	Ongoing occlusion	Eliminate the occlusion.

WM 68011g 08/2020

Fault	Cause	Remedy
No ventilation in CCSV	Tube not sufficiently blocked	Check cuff pressure.
	Esophagus intubation	Check correct intubation.
	Chest compression is not being performed.	Restart chest compression.
	Use hose system with reduced dead space or the 3 m hose system under CCSV	• Use standard 2 m hose system. • Switch to IPPV mode.

WM 68011g 08/2020

11 Maintenance

11.1 General instructions

Maintenance, safety checks, inspections and repairs must only be carried out by the manufacturer or a technician specifically authorized by the manufacturer.

11.2 Intervals

Part concerned	Interval	Maintenance by
Device	Maintenance and safety check every 2 years	Manufacturer or a technician specifically authorized by the manufacturer
Battery	Maintenance-free When stored in the device: Charge every 3 months. If stored outside the device: Charge battery with SN < 20000 every 5 months and battery with SN ≥ 20000 every 9 months. Recommendation: Replace battery after 6 years.	
Disposable hose system	Maintenance-free	
Reusable hose system	Maintenance every 2 years	User/operator (see "11.4 Maintaining the reusable hose system", page 225)
FlowCheck sensor	Following a prompt during the function check Recommendation: Replace FlowCheck sensor after 2 years.	User/operator
Hygiene filter	Following a prompt during the function check (every 6 months or after 24 ventilation hours in Air Mix mode) **or** after each transportation of an infected and ventilated patient	User/operator (see "11.5 Replacing the hygiene filter", page 226)

WM 68011g 08/2020

Part concerned	Interval	Maintenance by
Accessories (e.g., charging station)	There are individual intervals for the different accessories. Please refer to the instructions for use supplied with the accessories. In addition, the following applies for the Federal Republic of Germany: In accordance with the safety check (STK) regulation in Section 11 of the German regulations governing owners/operators of medical devices (MPBetreibV) as applicable in countries governed by German legislation, we as the manufacturer recommend that the patient hose system connected to MEDUMAT Standard^2 for use of the latter be subjected to a safety check every two years.	

11.3 Sending in device

⚠ WARNING

Risk of infection due to contaminated parts during maintenance work!
The device, components and accessories may be contaminated, and infect the technicians with bacteria or viruses.
⇒ Clean and disinfect the device, components and accessories.
⇒ Do not send in parts which are potentially contaminated.

1. Remove components and accessories.
2. Clean and disinfect the device, components and accessories (see "8.3 Preparing hygienic reprocessing", page 176).
3. Send in the device and, if necessary, components and accessories to WEINMANN Emergency or a technician specifically authorized by WEINMANN Emergency.

If you send in parts which are visibly contaminated, they will be disposed of by WEINMANN Emergency or a technician specifically authorized by WEINMANN Emergency at your expense.

11.4 Maintaining the reusable hose system

Requirement The reusable hose system has been disassembled (see "8.4 Disassembly of the reusable hose system", page 177).

1. Check all parts of the reusable hose system for external damage and complete labeling.
   If necessary: Replace damaged or incorrectly labeled parts.

WM 68011g 08/2020

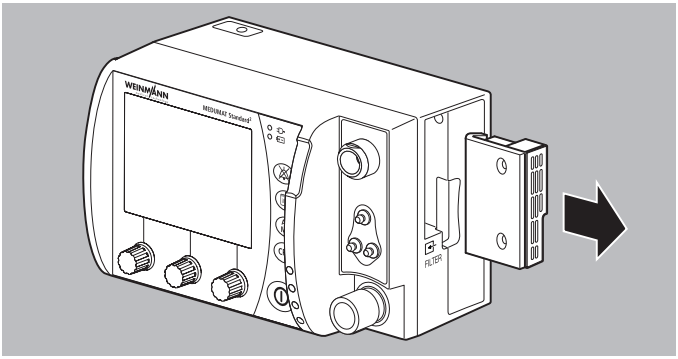
2. Replace the PEEP control diaphragm and check valve diaphragm (maintenance set WM 15779).
3. Assemble reusable hose system (see "8.11 Assembling reusable hose system", page 190).
4. Punch out the date at which the next maintenance is due on the service label (maintenance set WM 15779).
5. Attach the service label to the end of the ventilation hose which is closest to the device.
6. Perform a function check (see "9.3 Performing a function check", page 202).

Result The reusable hose system has been maintained and is ready for use.

11.5 Replacing the hygiene filter

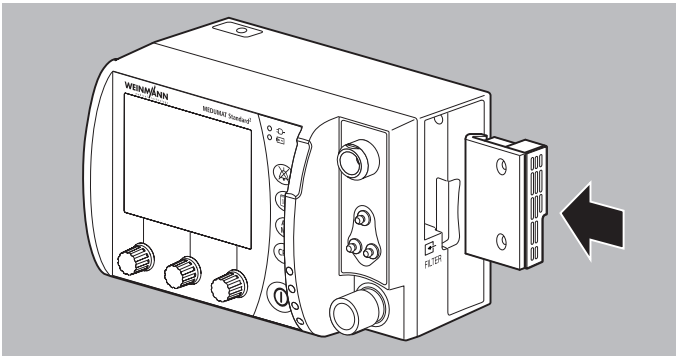
Requirement The device is switched off.

1. Wipe-disinfect the outside of the hygiene filter and the device.



2. Pull the hygiene filter out of the filter compartment of the device.
3. Dispose of the hygiene filter along with the filter cassette (see "13.4 Hygiene filter", page 231).

WM 68011g 08/2020



4. With the filter side facing forwards, slide the hygiene filter into the device's filter compartment until the hygiene filter is flush with the device.
5. Perform a function check (see "9.3 Performing a function check", page 202).

Result The hygiene filter has been replaced.

WM 68011g 08/2020

12 Storage

12.1 General instructions

- Store the device and accessories under the prescribed ambient conditions (see "14.1.1 Technical data on device", page 232).
- Following storage in extreme ambient conditions (outside of the ambient operating conditions, (see "14.1.1 Technical data on device", page 232):
  Store the device at room temperature for at least 12 hours before putting it into operation once more.

12.2 Storing the device

1. Switch off the device (see "4.6 Switching the device off", page 70).
2. If necessary: Disconnect the device from the line power.
3. Remove the battery.
4. Clean and disinfect the device (see "8.3 Preparing hygienic reprocessing", page 176).
5. Store the device in a dry place.

Result The device is stored in a dry place.

WM 68011g 08/2020

12.3 Storing patient hose systems

NOTICE

Material damage due to incorrectly stored patient hose system!

Material changes can result from incorrect storage of the patient hose system.

⇒ In the case of reusable hose systems: Also observe storage periods and maintenance intervals for patient hose systems in storage.

⇒ In the case of disposable hose systems: Only store until the expiry date.

⇒ Store patient hose systems in a dry place.

⇒ Protect silicone and rubber parts from UV light and direct sunlight.

Storing reusable hose systems

Requirement

- The reusable hose system has been cleaned and disinfected (see "8.4 Disassembly of the reusable hose system", page 177).

1. Connect the reusable hose system to the device and store in the protective bag

   or

   Store the reusable hose system in dry, sealed packaging.

Result The reusable hose system is kept dry during storage.

Storing disposable hose systems

1. Store the reusable hose system and disposable components in dry, sealed packaging

Result The disposable hose system is kept dry during storage.

12.4 Storing the battery

Requirement

- The device and the battery have been cleaned and disinfected (see "8.3 Preparing hygienic reprocessing", page 176).
- The battery is fully charged.
- If available: The replacement battery is fully charged.

1. Insert the battery in the battery compartment and store the device in a dry place.

   or

   Store the battery in a dry place outside of the device.

NOTICE

Material damage due to prolonged storage of the battery without recharging!
Storing the battery for a prolonged period of time without recharging can result in the rapid shutdown of and irreparable damage to the battery.
⇒ When the battery is stored in the device without a power connection: Charge battery every 3 months.
⇒ If the battery is not stored in the device: Charge battery with SN < 20000 every 5 months and battery with SN ≥ 20000 every 9 months.

2. Charge battery at regular intervals:

Type of storage	Charging interval
In device without power connection	Every 3 months
Not in device	• Battery with SN < 20000 every 5 months • Battery with SN ≥ 20000 every 9 months

Result The battery is stored in a dry place and is ready for use.

WM 68011g 08/2020

13 Disposal

13.1 Electronic waste

Do not dispose of the product in the household waste. Consult an authorized, certified electronic waste recycling company for proper disposal. You can find out their address from your environmental officer or from your local council.
The device packaging (cardboard box and inserts) can be disposed of as waste paper.

The following products are categorized as electronic waste:

- Device
- Power supply
- MEDUtrigger
- FlowCheck sensor
- Connection lines

13.2 Battery

Do not dispose of used batteries in the household waste. Contact WEINMANN Emergency or a public waste disposal authority.

13.3 Patient hose system

After use, dispose of the patient hose system in the correct manner for plastics.

13.4 Hygiene filter

Dispose of the hygiene filter correctly.

WM 68011g 08/2020

14 Appendix

14.1 Technical data

14.1.1 Technical data on device

Specification	Device
Product class according to Directive 93/42/EEC	IIb
Dimensions (W x H x D)	206 mm x 138 mm x 130 mm
Weight: Without battery With battery	 Approx. 2 kg Approx. 2.5 kg
Weight with capnography option: Without battery With battery	 Approx. 2.15 kg Approx. 2.65 kg
Operation: Temperature range Humidity Air pressure Height above sea level	 -20°C to +50°C 0% RH to 95% RH without condensation 540 hPa to 1100 hPa -500 m to 5000 m
Storage (device)/transport: Temperature range Humidity Air pressure Height above sea level	 -40°C to +70°C 0% RH to 95% RH without condensation 540 hPa to 1100 hPa -500 m to 5000 m
Electrical connection (rated voltage)	12 V
Permitted operating voltage	10.2 V to 15.1 V
Max. power consumption	30 W
Disconnection from line power	Pulling out the power plug disconnects the device from line power on all poles.
Current consumption	0.1 to 3 A
Input voltage (external power supply)	100 V-240 V~/50 Hz-60 Hz
Operating time with battery without CO_2 measurement with activated CO_2 measurement	 Approx. 10 h Approx. 9 h The specified battery runtime applies under the following conditions: Ambient temperature = 21°C, ventilation: Emergency Adult, new battery

WM 68011g 08/2020

Specification	Device
Vehicle electrical system operation: Rated voltage Max. internal resistance of vehicle electrical system	 12 V 500 mΩ
Operating mode	Continuous operation
Classification acc. to EN 60601-1: • Type of protection against electric shock • Degree of protection against electric shock	 Protection class II BF-type protection
Degree of protection against: • Ingress of solid objects • Ingress of dust • Ingress of water with harmful effect	IP54 (housing category II): Protected against dust and splash water
Applied parts acc. to EN 60601-1	• Ventilation mask • etCO_2/O_2 nasal cannula • Patient hose system • MEDUtrigger / connection cable to FlowCheck sensor • FlowCheck sensor
Electromagnetic compatibility (EMC) acc. to EN 60601-1-2: Radio interference suppression Radio interference immunity	Test parameters and limit values can be requested from the manufacturer if required. EN 55011 RTCA DO 160 G ISO 7637-2 EN 61000-4 (parts 2 to 6, 8 and 11)
Radio waves (only with Bluetooth data transmission option)	Frequency range: 2.4 Ghz to 2.57 Ghz Signal power: Max. 12 dBm Modulation types: • 1 Mbps: GFSK (BDR) • 2 Mbps: π/4-DQPSK (EDR) • 3 Mbps: 8-DPSK (EDR)

WM 68011g 08/2020

Specification	Device
Resistance to shock and vibration	• EN 1789 • EN 60601-1-12 (Categories: Secured in a rescue vehicle, secured in an aeroplane, secured in a helicopter, portable at the site of the emergency) • EUROCAE ED-14G (RTCA DO 160 G) (Section 8 - Vibration Aeroplanes Cat. S and Helicopter Cat. U2) • MIL-STD 810 G (Cat 12, 13, 14, 20)
Type of rescue vehicle	Secured in rescue vehicle, ship, aeroplane and helicopter as well as portable at the site of the emergency
Display	5" TFT color display Resolution: 320 pixels x 240 pixels
Alarm volume	60 dbA to 95 dbA for all alarm priorities and alarms
Standards used	EN 60601-1;-1-2; -1-6; -1-8; -1-12 EN 1789 EN 794-3 ISO 10651-3 RTCA DO-160 G MIL-STD 810 G EN ISO 80601-2-55 (only with capnography option) With Bluetooth data transmission option: EN 62311 EN 301489-1 EN 300328
Volume-controlled ventilation modes	IPPV, CPR, RSI Optional: SIMV (only with SIMV option), SIMV + ASB (only with SIMV option and flow measurement + ASB option), S-IPPV (only with S-IPPV option)
Pressure-controlled ventilation modes	CPAP, Demand Optional: CPAP + ASB (only with flow measurement + ASB option) PCV (only with pressure-controlled ventilation modes option) aPCV (only with pressure-controlled ventilation modes option) BiLevel + ASB (only with pressure-controlled ventilation modes option) PRVC + ASB (only with pressure-controlled ventilation modes option) CCSV (only with CCSV option)
Inhalation flow (only with inhalation option)(1)	0 l/min to 10 l/min, in increments of 1 l/min

WM 68011g 08/2020

Specification	Device
Monitoring	Pressure gauge: Airway pressure Frequency tachometer (only with CCSV option) Curves: • Airway pressure (only with flow measurement + ASB option and curve display option or capnography option) • Flow (only with flow measurement + ASB option and curve display option) • CO_2 (only with capnography option) • $etCO_2$ trend (only with capnography option)
Monitoring parameters	pPeak, pPlat, pMean Vte, MVe, f, fsp, Vleak (only with flow measurement + ASB option) $etCO_2$ (only with capnography option)
Operating gas	Medical oxygen (100% oxygen) **or** Concentrator oxygen as per the European Pharmacopeia (90% to 96% oxygen)
Operating pressure range	2.7 bar to 6 bar
Recommended gas supply	4.5 bar at ≥ 150 l/min
Required gas supply	min. 2.7 bar at ≥ 80 l/min
Maximum outlet flow	80 l/min with an input pressure of 4.5 bar in Air Mix and non-Air Mix mode
Mechanical pressure relief/emergency air valve	Pressure limitation to a maximum of 100 mbar
I:E	1:1 in CPR 30:2, 15:2 and RSI Manual 1:4 to 4:1* * The setting options of I:E in volume-controlled ventilation modes depend on the combination of ventilation rate and tidal volume.
Respiratory rate	5 min^{-1} to 50 min^{-1} (±1 min^{-1})
Inspiration time	0.2 s to 9.6 s
Tidal volume(1)	50 ml to 2000 ml (±40 ml or ±20%)
Respiratory minute volume(1)	At least 0.25 l Max. 20 l
Gas composition	Air, oxygen, CO_2 mix. Oxygen percentage 21% to 100%, CO_2 percentage 0% to 10%
Inspiratory pressure (pInsp) (only with pressure-controlled ventilation modes option)	3 mbar to 60 mbar (±3 mbar or ±15%)
Maximum ventilation pressure (pMax)	10 mbar to 65 mbar (±3 mbar or ±15%)
Minimum working pressure	3 mbar. Cannot be set.
Minimum limiting pressure (pLim, min)	10 mbar. The device does not generate active negative pressure.

WM 68011g 08/2020

Specification	Device
Maximum limiting pressure (pLim, max.)	65 mbar
Means for limiting pressure	Pressure control
Means for ensuring the minimum value	Pressure control
PEEP	0 mbar to 30 mbar (±3 mbar or ±15%)
PEEP CCSV (only with CCSV option)	0 mbar to 5 mbar (±3 mbar or ±15%)
Pressure support Δ pASB (only with flow measurement + ASB option)	0 mbar to 30 mbar (±3 mbar or ±15%) above PEEP
Pressure ramp (only with flow measurement + ASB option)	Steep Averaging Flat
Trigger (permanently set)(1)	Inspiratory trigger: -1.3 mbar at PEEP > 0 -0.8 mbar at PEEP = 0 Expiratory trigger: 30% of the maximal flow Triggering via internal sensors
Trigger can be set (only with flow measurement + ASB option)(1)	Triggering via FlowCheck sensor Inspiratory trigger (three levels): • Level 1: Sensitive, corresponds to approx. 3 l/min • Level 2: Medium sensitivity, corresponds to approx. 6 l/min • Level 3: Insensitive, corresponds to approx. 10 l/min Expiratory trigger (three levels): • Level 1: Long ASB breath, corresponds to approx. 10% of the inspiratory maximum flow • Level 2: Medium ASB breath, corresponds to approx. 35% of the inspiratory maximum flow • Level 3: Short ASB breath, corresponds to approx. 70% of the inspiratory maximum flow Inspiratory trigger (units): 1 l/min to 15 l/min Expiratory trigger (units) 5% flow max. to 80% flow max.
Trigger can be set (only with CCSV option)	Inspiratory trigger (5 levels): • Level 1: Very sensitive (only slight pressure on the chest is necessary to trigger a ventilation stroke) to • Level 5: Insensitive (firm pressure on the chest is necessary to trigger a ventilation stroke)

WM 68011g 08/2020

Specification	Device
Trigger time slot for mandatory breaths	20% of Te (SIMV, SIMV + ASB, BiLevel + ASB and PRVC + ASB) 0% to 100% of Te (S-IPPV)
Trigger time slot for ASB breaths	0% to 100% Te
aPCV trigger time slot (only with pressure-controlled ventilation modes option)	0% to 100% Te (adjustable)
Volume monitoring(1)	Measurement range: 40 ml to 8000 ml Tolerance: ± 15%
Airway pressure monitoring	Measurement range: -5 mbar to +80 mbar Tolerance: ± 3 mbar
Oxygen concentration: • Air Mix mode • Non-Air Mix mode	 See "14.1.8 Oxygen concentration in Air Mix mode", page 251. 100% oxygen Concentrator oxygen (90% to 96% oxygen)
Pressurized gas thread	External thread G 3/8
Connection for ventilation hose	WEINMANN Emergency-specific
Patient valve connections	WEINMANN Emergency-specific
Service life of hygiene filter	24 h in Air Mix mode or 6 months
Efficiency of hygiene filter	> 99% for viruses and bacteria (particle size > 27 nm)

(1) BTPS (Body Temperature and Pressure, saturated): Volume at current ambient pressure and 37°C, with 100% saturated gas

CE 0197 Subject to alterations in design.

14.1.2 Technical data for battery

Specification	Battery
Type	Li-ion
Dimensions (W x H x D)	97 mm x 127 mm x 33 mm
Weight	450 g
Nominal capacity	4.2 Ah (≥ 46.4 Wh)
Rated voltage	10.8 V
Charging time (0%-95%)	3.5 h
Charging temperature	0°C to +45°C
Operating temperature range	-20°C to +50°C

WM 68011g 08/2020

Specification	Battery
Transport/storage: Temperature range Humidity	 -40°C to +70°C (max. one week at more than +60°C) 0% RH to 95% RH without condensation
Service life	At least 300 charging cycles*
Charging intervals	When stored in the device without a power connection: Every 3 months If stored outside the device: • Battery with SN < 20000 every 5 months • Battery with SN ≥ 20000 every 9 months

* One charging cycle corresponds to one instance of the battery being charged by 100%, regardless of the current battery status. Example: If you charge the battery to 100% from a status of 50% twice, the device counts this as one charging cycle.

14.1.3 Technical data for power supply

Specification	Power supply
Power supply operation 100 W (WM 28937): Temperature range Humidity Air pressure Height above sea level	 0°C to +40°C 5% RH to 95% RH without condensation 700 hPa to 1060 hPa -382 m to 3000 m
Input voltage (external power supply)	100 V-240 V~/50 Hz-60 Hz
Rated voltage output	15 V
Disconnection from line power	Pulling out the power plug disconnects the device from line power on all poles.

WM 68011g 08/2020

14.1.4 Technical data for patient hose system

Specification	**Patient hose system Length 2 m**	**Patient hose system Length 3 m**
Operation: • Temperature range • Relative humidity	 -20°C to +50°C 15% to 95%	
Storage/Transport: Temperature range up to 48 h • Reusable hose system and disposable hose system • Disposable hose system with reduced dead space Temperature range longer than 48 h Relative humidity (according to EN 60601-1-12)	 -30°C to +70°C -30°C to +60°C -20°C to +40°C 15% to 95%	
Patient valve: Patient connection for mask/ endotracheal tube	15 mm internal taper 22 mm external taper EN ISO 5356-1	
Patient valve: Expiration opening	Non-connectable expiration opening	
Compliance: • Reusable hose system • Disposable hose system • Disposable hose system with reduced dead space	 0.62 ml/hPa (ml/cmH_2O) 0.63 ml/hPa (ml/cmH_2O) 1.18 ml/hPa (ml/cmH_2O)	 0.89 ml/hPa (ml/cmH_2O) 0.92 ml/hPa (ml/cmH_2O) -

WM 68011g 08/2020

Specification	Patient hose system Length 2 m	Patient hose system Length 3 m
Internal volume of the complete respiratory system: • Reusable hose system • Disposable hose system • Disposable hose system with reduced dead space	 Approx. 582 ml Approx. 588 ml Approx. 1030 ml	 Approx. 874 ml Approx. 885 ml -
Internal volume of the complete respiratory system with FlowCheck sensor and CO_2 measurement: • Reusable hose system • Disposable hose system • Disposable hose system with reduced dead space	 Approx. 600 ml Approx. 593 ml Approx. 1039 ml	 Approx. 890 ml Approx. 892 ml -
Materials used	PC, silicone, TPE, PA, PP, TPR, PE, PU, polyisoprene	

Internal volumes of respiration accessories		
Part	**Article number**	**Volume**
Ventilation mask with self-inflating silicone cushion for infants, size 1	WM 5086	Approx. 40 ml
Ventilation mask with self-inflating silicone cushion for children and young adults, size 3	WM 5082	Approx. 120 ml
Ventilation mask with self-inflating silicone cushion for adults, size 5	WM 5074	Approx. 190 ml
Disposable NIV mask, size S	WM 20703	Approx. 130 ml
Disposable NIV mask, size M	WM 20704	Approx. 200 ml
Disposable NIV mask, size L	WM 20705	Approx. 270 ml
Eagle 1 Premium disposable NIV mask, size S	WM 20717	Approx. 135 ml
Eagle 1 Premium disposable NIV mask, size M	WM 20718	Approx. 165 ml
Eagle 1 Premium Disposable NIV mask, size L	WM 20719	Approx. 185 ml
Breathing system filter for MEDUMAT ventilators	WM 22162	Approx. 15 ml
Inhalation adapter	WM 28263	Approx. 10 ml
Nasal cannula for adults, double lumen, with 2.1 m connection hose	WM 1925	Approx. 35 ml
$etCO_2/O_2$ nasal cannula	WM 1928	Approx. 35 ml
Pneumatic drug nebulizer set	WM 15827	Approx. 25 ml
Aerogen® Solo, t-piece for adults	-	Approx. 35 ml
Aerogen® Solo, t-piece for children	-	Approx. 20 ml
Tube inhaler	-	Approx. 10 ml
CapnoDura CO_2 detector	WM 20775	Approx. 15 ml

WM 68011g 08/2020

Dead space in the patient hose systems (2 m and 3 m)		
	Without elbow	**With elbow**
Reusable patient valve	Approx. 16 ml	Approx. 28 ml
Disposable patient valve	Approx. 19 ml	Approx. 27 ml
Disposable patient valve with reduced dead space	Approx. 5 ml	Approx. 14 ml
Reusable patient valve with FlowCheck sensor	Approx. 21 ml	Approx. 33 ml
Disposable patient valve with FlowCheck sensor	Approx. 25 ml	Approx. 33 ml
Disposable patient valve with reduced dead space with FlowCheck sensor	Approx. 12 ml	Approx. 21 ml
Reusable patient valve with CO_2 connection	Approx. 27 ml	Approx. 39 ml
Disposable patient valve with CO_2 connection	-	Approx. 27 ml
Disposable patient valve with reduced dead space with CO_2 connection	-	Approx. 14 ml
Reusable patient valve with FlowCheck sensor and CO_2 connection	Approx. 34 ml	Approx. 46 ml
Disposable patient valve with FlowCheck sensor and CO_2 connection	-	Approx. 33 ml
Disposable patient valve with reduced dead space with FlowCheck sensor and CO_2 connection	-	Approx. 21 ml

⚠ CAUTION

Risk of injury from use of other accessories!

Other accessories can increase the pressure drop and injure the patient.

⇒ When using other accessories, observe the requirements from ISO 10651-3 as regards the maximum pressure drop.

WM 68011g 08/2020

Pressure drop [hPa] over the inspiratory and expiratory flow path at different flow rates [l/min] acc. to EN 794-3 (in combination with MEDUMAT Standard^2, measuring point 1: Patient connection opening)						
Patient hose systems (2 m) without FlowCheck sensor and without CO_2 measurement						
	Flow [l/min]	**Patient hose system (reusable), 2 m WM 28860**		**Patient hose system (disposable), 2 m WM 28865**		**Patient hose system (disposable), 2 m, with reduced dead space WM 28867**
		With elbow	**Without elbow**	**With elbow**	**Without elbow**	**With elbow**
Spontaneous respiration in the event of power failure, inspiratory (STP)(1)	2.5	0.35	0.26	0.82	0.61	0.30
	15	1.35	1.08	1.84	1.59	1.59
	30	2.82	2.72	3.35	3.83	4.08
Spontaneous respiration in the event of power failure, expiratory (BTPS)(2)	2.5	0.62	0.66	0.87	0.87	0.87
	15	1.52	1.53	1.40	1.48	1.79
	30	2.05	2.00	1.93	1.98	3.17
Normal operation, inspiratory (STP)(1)	5	0.00	0.00	0.42	0.37	0.00
	30	0.13	0.00	1.22	1.15	1.31
	60	0.34	0.14	2.65	2.52	4.84
Normal operation, expiratory (BTPS)(2)	5	0.85	0.92	1.00	1.04	1.06
	30	2.01	2.01	1.93	1.98	3.17
	60	2.80	2.59	3.01	2.90	7.32

WM 68011g 08/2020

Pressure drop [hPa] over the inspiratory and expiratory flow path at different flow rates [l/min] acc. to EN 794-3 (in combination with MEDUMAT Standard^2, measuring point 1: Patient connection opening)						
Patient hose systems (2 m) with FlowCheck sensor and with CO_2 measurement						
	Flow [l/min]	**Patient hose system (reusable), 2 m WM 29190**		**Patient hose system (disposable), 2 m WM 29192**		**Patient hose system (disposable), 2 m, with reduced dead space WM 29199**
		With elbow	**Without elbow**	**With elbow**	**Without elbow**	**With elbow**
Spontaneous respiration in the event of power failure, inspiratory (STP)(1)	2.5	1.25	1.03	0.52	-	0.33
	15	2.64	2.45	2.10	-	1.43
	30	3.77	3.39	4.29	-	3.93
Spontaneous respiration in the event of power failure, expiratory (BTPS)(2)	2.5	0.43	0.41	0.95	-	0.88
	15	1.68	1.66	1.63	-	1.94
	30	2.68	2.56	2.34	-	3.40
Normal operation, inspiratory (STP)(1)	5	0.18	0.18	0.43	-	0.08
	30	1.11	1.05	1.60	-	1.28
	60	2.83	2.55	3.94	-	5.90
Normal operation, expiratory (BTPS)(2)	5	0.94	1.01	1.24	-	1.09
	30	2.85	2.79	2.34	-	3.40
	60	4.53	4.09	3.89	-	8.11

WM 68011g 08/2020

Pressure drop [hPa] over the inspiratory and expiratory flow path at different flow rates [l/min] acc. to EN 794-3 (in combination with MEDUMAT Standard^2, measuring point 1: Patient connection opening)					
Patient hose systems (3 m) without FlowCheck sensor and without CO_2 measurement					
	Flow [l/min]	**Patient hose system (reusable), 3 m WM 28861**		**Patient hose system (disposable), 3 m WM 28866**	
		With elbow	**Without elbow**	**With elbow**	**Without elbow**
Spontaneous breathing in the event of power failure, inspiratory (STP)(1)	2.5	0.35	0.32	035	0.18
	15	1.25	1.19	1.64	1.52
	30	2.75	2.68	3.78	3.46
Spontaneous breathing in the event of power failure, expiratory (BTPS)(2)	2.5	0.54	0.83	0.48	0.45
	15	1.29	1.35	1.18	1.04
	30	1.75	1.75	1.65	1.49
Normal operation, inspiratory (STP)(1)	5	0.00	0.00	0.20	0.13
	30	0.15	0.12	1.21	0.81
	60	0.40	0.15	3.07	2.04
Normal operation, expiratory (BTPS)(2)	5	0.80	1.05	0.71	0.63
	30	1.75	1.72	1.65	1.49
	60	2.39	2.29	2.65	2.08

WM 68011g 08/2020

Pressure drop [hPa] over the inspiratory and expiratory flow path at different flow rates [l/min] acc. to EN 794-3 (in combination with MEDUMAT Standard^2, measuring point 1: Patient connection opening)					
Patient hose systems (3 m) with FlowCheck sensor and with CO_2 measurement					
	Flow [l/min]	**Patient hose system (reusable), 3 m WM 29191**		**Patient hose system (disposable), 3 m WM 29193**	
		With elbow	**Without elbow**	**With elbow**	**Without elbow**
Spontaneous breathing in the event of power failure, inspiratory (STP)(1)	2.5	1.65	1.46	0.27	-
	15	3.21	3.01	1.73	-
	30	4.08	3.81	4.08	-
Spontaneous breathing in the event of power failure, expiratory (BTPS)(2)	2.5	0.52	0.43	0.53	-
	15	2.02	1.95	1.30	-
	30	2.93	2.82	2.05	-
Normal operation, inspiratory (STP)(1)	5	0.58	0.57	0.22	-
	30	1.37	1.34	1.21	-
	60	2.97	2.86	3.94	-
Normal operation, expiratory (BTPS)(2)	5	1.44	1.02	0.73	-
	30	3.00	2.83	2.05	-
	60	4.68	4.39	3.66	-

Pressure drop [hPa] over the inspiratory and expiratory flow path at different flow rates [l/min]				
Part	**Article number**	**Flow [l/min]**	**Inspiratory (STP)(1)**	**Exspiratory (BTPS)(2)**
Breathing system filter for MEDUMAT ventilators	WM 22162	5	0.23	0.2
		30	1.47	1.39
		60	3.16	3.09
Pneumatic drug nebulizer set	WM 15827	5	0	0.01
		30	0.06	0.03
		60	0.08	0.09

WM 68011g 08/2020

Pressure drop [hPa] over the inspiratory and expiratory flow path at different flow rates [l/min]				
Part	**Article number**	**Flow [l/min]**	**Inspiratory (STP)(1)**	**Exspiratory (BTPS)(2)**
Aerogen® Solo, t-piece for adults	-	5	0.01	0.01
		30	0.02	0.03
		60	0.05	0.06
Aerogen® Solo, t-piece for children	-	5	0.01	0
		30	0.12	0.03
		60	0.44	0.09
Tube inhaler	-	5	0.02	0.01
		30	0.27	0.28
		60	1.06	1
CapnoDura CO_2 detector	WM 20775	5	0.03	0.04
		30	0.54	0.5
		60	1.87	1.68

(1) STP (Standard Temperature and Pressure): Volume at 21°C and 1013 hPa

(2) BTPS (Body Temperature and Pressure, saturated): Volume at current ambient pressure and 37°C, with 100% saturated gas

14.1.5 Technical data CO_2 monitoring (only with capnography option)

Specification	**Device**
Operating range CO_2 measurement • Temperature range • Air pressure	 • 0°C to 65°C • 650 hPa to 1100 hPa If you operate the device outside of the given pressure range, the measured value tolerances may be exceeded:
Removal rate for gas sample	80 ml/min (± 20 ml/min)
Measurement range	0 vol% to 10 vol% 0 mmHG to 76 mmHG/ 0 kPa to 10.1 kPa
Tolerance	± (0.43 vol% + 8% of the CO_2 concentration)
Operating range for respiratory rate	5 min-1 to 50 min-1 If the respiratory rate is higher, e.g., with CCSV, the etCO_2 measurement may be compromised.

WM 68011g 08/2020

Specification	Device
Maximum drift of measuring accuracy	< 0.4 vol% in 6 h
Start-up time of the CO_2 module	10 s
Response time of the complete system • 2 m hose systems • 3m hose systems	 • 4.5 s • 6 s
Data sampling rate	40 Hz
Service life of the water filter	8 h

Functioning of CO_2 monitoring

CO_2 monitoring is performed using the side-stream method by removing a small amount of gas (80 ml/min) close to the patient connection of the hose system. The measurement principle is based on nondispersive infrared technology (NDIR). The CO_2 module provides a time-resolved measurement of the CO_2 concentration (capnogram) and the end-tidal CO_2 ($etCO_2$). This physiological parameter is determined by an internal algorithm based on the analysis of the capnogram in the time range. The inspiration and expiration cycles are distinguished by comparing the differentiated capnogram with dynamically adjusted threshold values. The $etCO_2$ values are determined on the basis of this. No deterioration in the measurement accuracy of the gas measurement at the end of the ventilation cycle is expected and the given measurement tolerance applies within the stated limits of the respiratory rate and I:E ratio.

Measurement range for the respiratory rate

The measurement range for the respiratory rate and the possible impact of the respiratory rate on the accuracy of the gas measurement at the end of the ventilation cycle were evaluated by feeding CO_2 testing gas and compressed air alternatively through a switch valve at a set rate. The gas was removed by suction via the CO_2 module and the measurements were evaluated. The frequency of gas switching was then increased until the measurement deviations exceeded the set tolerance.

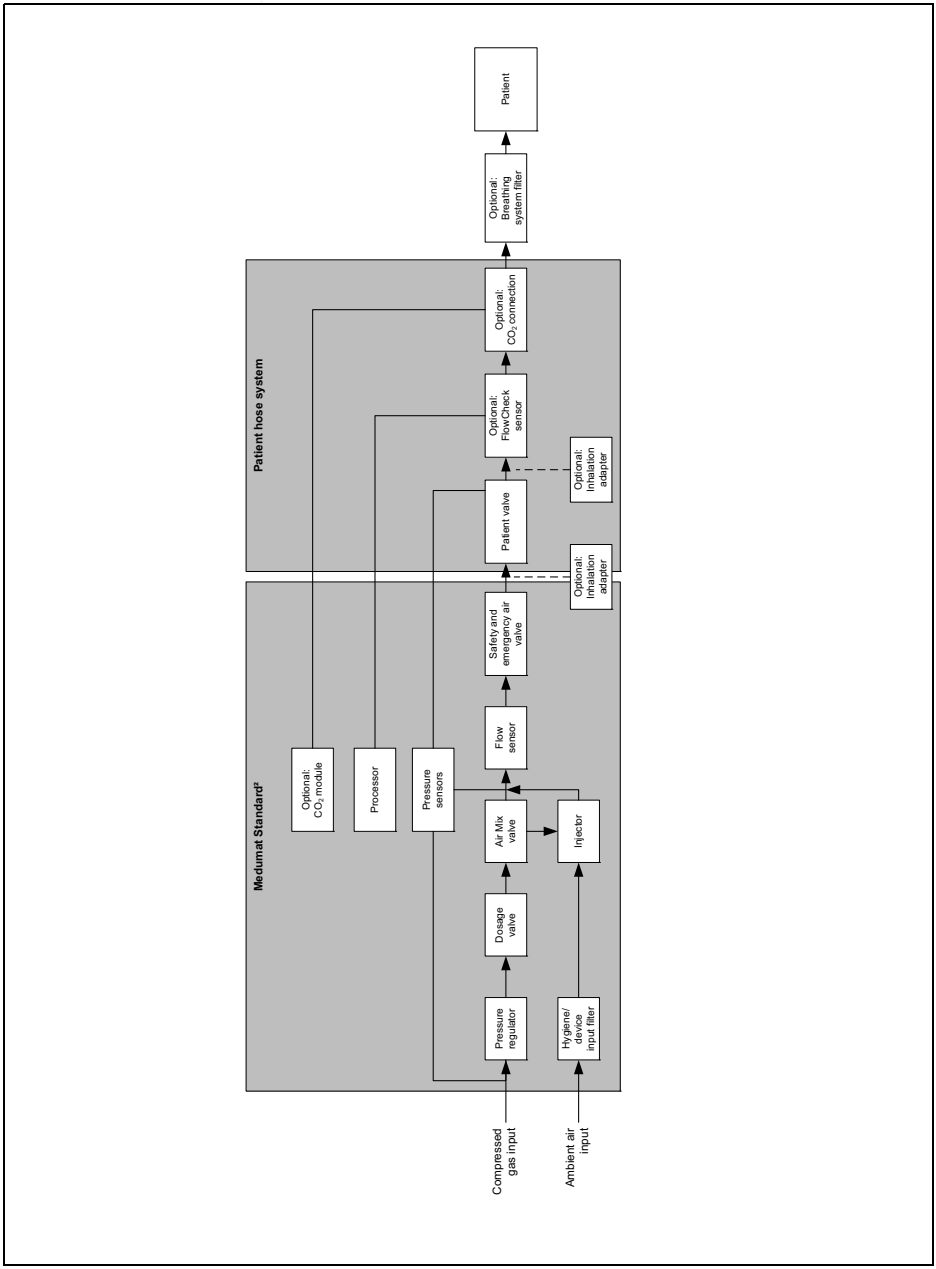
WM 68011g 08/2020

Calibration of the CO_2 module

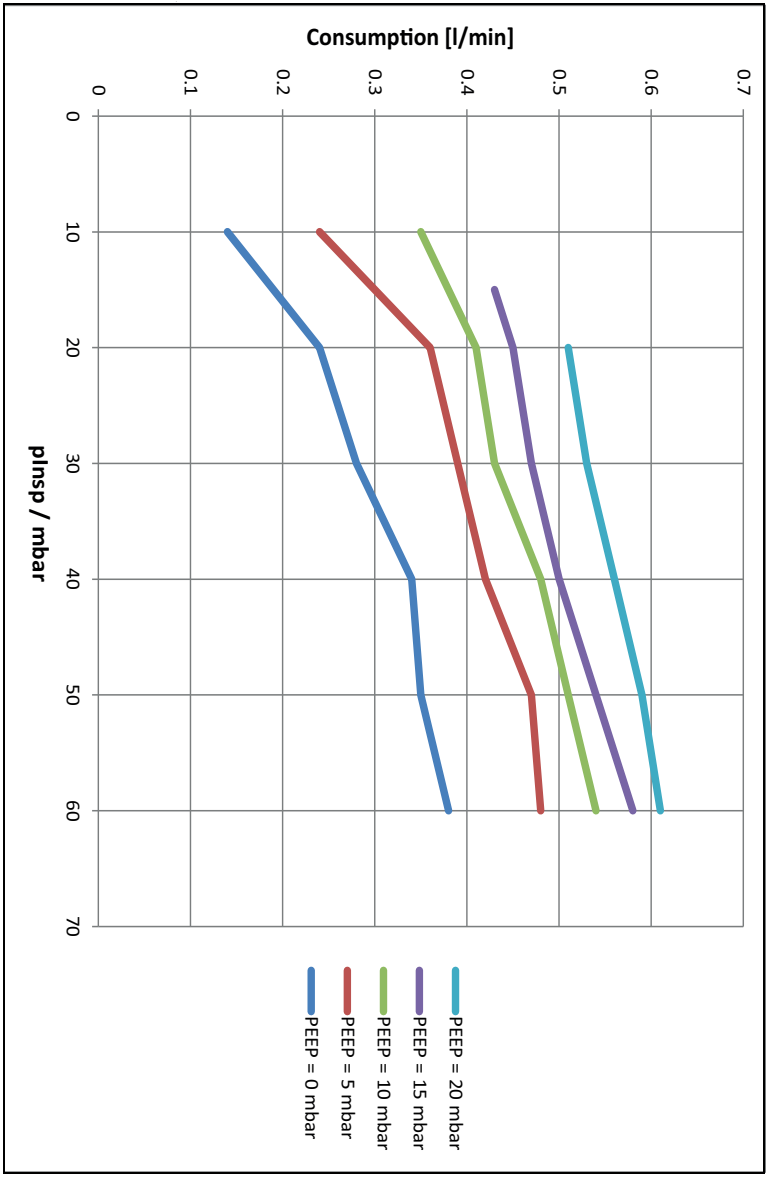
The CO_2 module is only calibrated within the scope of the 2-year maintenance intervals and does not have to be calibrated by the user. Neither calibration nor zero-point adjustment are performed during operation. The CO_2 module features automatic adjustment for barometric pressure. When used as intended, no specific unwanted gases are emitted at the sampling point which would have an influence on the gas measurement.

WM 68011g 08/2020

14.1.6 Block diagram



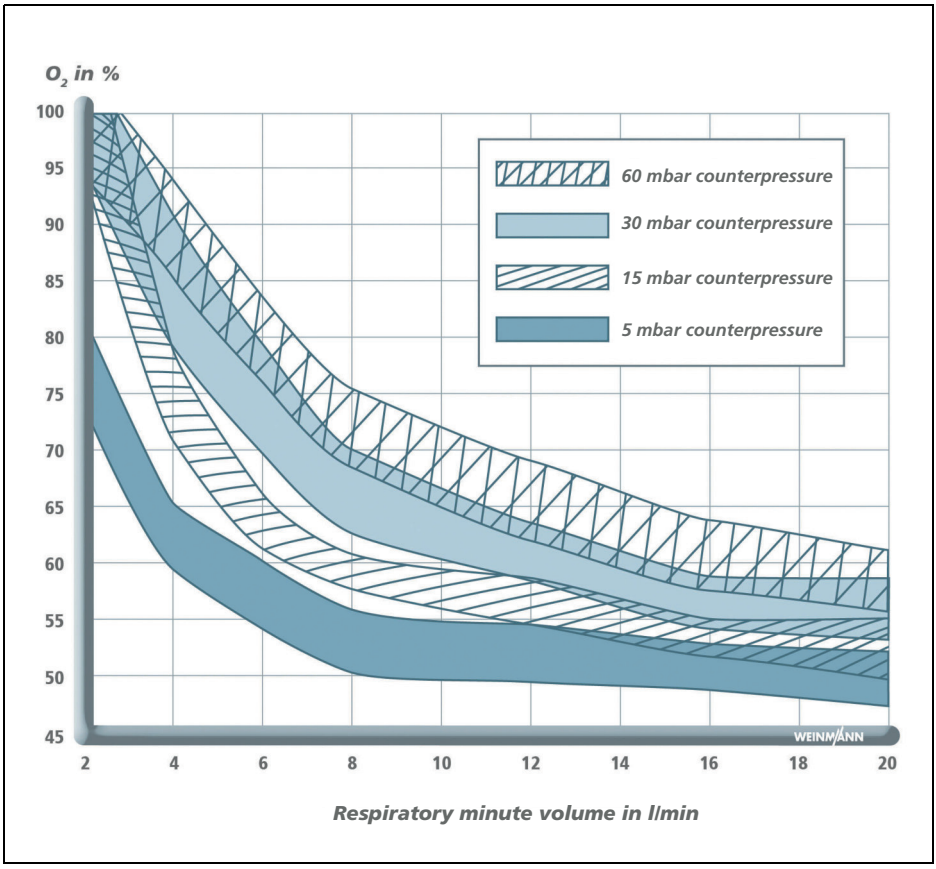
14.1.7 O_2 consumption of the device



WM 68011g 08/2020

14.1.8 Oxygen concentration in Air Mix mode

The following diagram shows the oxygen concentration for Air Mix mode at different counterpressures and respiratory minute volumes. The oxygen concentration is also reduced accordingly in Air Mix mode when concentrator oxygen is used.



WM 68011g 08/2020

14.1.9 Technical data on electromagnetic compatibility (EMC)

Medical electrical equipment is subject to special precautions in relation to electromagnetic compatibility (EMC). It must be installed and put into operation in accordance with the EMC information contained in the accompanying documentation.

Guidelines and manufacturer's declaration – electromagnetic interference		
MEDUMAT Standard^2 is intended for operation in an electromagnetic environment as specified below. The customer or the user of the MEDUMAT Standard^2 device must ensure that it is truly operated in such an environment.		
Interference measurements	**Compliance**	**Electromagnetic environment – guidelines**
RF emissions acc. to CISPR 11	Group 1 Class B	The RF emissions of MEDUMAT Standard^2 are very low and it is unlikely that they will interfere with neighboring electronic devices.
Emissions of harmonics acc. to IEC 61000-3-2	Complies	MEDUMAT Standard^2 is suitable for use in all premises including private residences and other such facilities connected directly to the public power grid which also supplies residential buildings.
Emissions of voltage fluctuations/flickers acc. to IEC 61000-3-3	Complies	
RF emissions acc. to RTCA DO-160 G	Section 21, Category M	MEDUMAT Standard^2 is suitable for use in Category M locations in aircraft due to its low RF emissions.
RF emissions acc. to UN / ECE rule no.10	Annex 6, Annex 7	MEDUMAT Standard^2 is suitable for use in motor vehicles due to its low RF emissions.
Interference emissions on motor vehicle supply lines acc. to ISO 7637-2	Complies	MEDUMAT Standard^2 is suitable for connection to vehicle electrical systems due to its low RF emissions.

WM 68011g 08/2020

Guidelines and manufacturer's declaration – electromagnetic immunity			
MEDUMAT Standard^2 is intended for operation in the electromagnetic environment specified below. The customer or the user of the MEDUMAT Standard^2 device must ensure that it is also used in such an environment.			
Immunity tests	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment – guidelines**
Electrostatic discharge (ESD) acc. to IEC 61000-4-2	± 8 kV contact discharge ± 15 kV air discharge	± 8 kV contact discharge ± 15 kV air discharge	Floors should be made of wood or concrete, or covered with ceramic tiles. If the floor is covered with a synthetic material, the relative humidity must be at least 30%.
Fast, transient electrical disturbances/bursts acc. to IEC 61000-4-4	± 2 kV for mains power lines ± 1 kV for input and output lines	± 2 kV for mains power lines ± 1 kV for input and output lines	The quality of the supply voltage should correspond to that of a typical business or hospital environment.
Surges acc. to IEC 61000-4-5	± 1 kV voltage Phase-to-phase ± 2 kV voltage Phase-to-earth	± 1 kV voltage Phase-to-phase ± 2 kV voltage Phase-to-earth	The quality of the supply voltage should correspond to that of a typical business or hospital environment.
Voltage dips, short-term power failures and fluctuations in the supply voltage acc. to IEC 61000-4-11	0% U_T; ½ cycle at 0, 45, 90, 135, 180, 225, 270 and 315 degrees, 0% U_T,1 cycle and 70% U_T, 25/30 cycles, Single phase: at 0 degrees, 0% U_T, 250/300 cycles	0% U_T; ½ cycle at 0, 45, 90, 135, 180, 225, 270 and 315 degrees, 0% U_T,1 cycle and 70% U_T, 25/30 cycles, Single phase: at 0 degrees, 0% U_T, 250/300 cycles	The quality of the supply voltage should correspond to that of a typical business or hospital environment. If the user of the MEDUMAT Standard^2 demands demands continuing function even if the power supply is interrupted, we recommend running MEDUMAT Standard^2 with a fully charged battery.
Note: U_T is the AC voltage in the mains prior to application of the test level.			
Interference pulse on motor vehicle supply lines acc. to ISO 7637-2	Test pulse 1, 2a, 2b, 3a, 3b and 4	Test pulse 1, 2a, 2b, 3a, 3b and 4	The vehicle on which MEDUMAT Standard^2 is to be mounted must be E1-certified.

WM 68011g 08/2020

Guidelines and manufacturer's declaration – electromagnetic immunity			
MEDUMAT Standard^2 is intended for operation in the electromagnetic environment specified below. The customer or the user of the MEDUMAT Standard^2 device must ensure that it is also used in such an environment.			
Immunity tests	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment – guidelines**
Conducted RF bursts acc. to IEC 61000-4-6	3 $V_{effective\ value}$ 150 kHz to 80 MHz Outside of the ISM bands[a]	3 V	Portable and mobile wireless devices should not be used at closer distances to the MEDUMAT Standard^2 device, including its cables, than the recommended separation distance calculated in accordance with the corresponding equation for the frequency of the transmitter. **Recommended separation distance:** $d = 1,2\sqrt{P}$
	6 $V_{effective\ value}$ 150 kHz to 80 MHz Within the ISM bands[a]	6 V	$d = 1,2\sqrt{P}$
Emitted RF bursts acc. to IEC 61000-4-3	10 V/m 80 MHz to 2.7 GHz	30 V/m	$d = 0,4\sqrt{P}$ for 80 MHz to 800 MHz $d = 0,8\sqrt{P}$ for 800 MHz to 2.5 GHz where P is the maximum rated output power of the transmitter in watts (W) as per the manufacturer of the transmitter's specifications and d is the recommended separation distance in meters (m).[b] The field strength of fixed RF transmitters, as determined by an electromagnetic site survey [c], should be lower than the compliance level in each frequency range.[d] Interference is possible in the vicinity of devices furnished with the following pictogram. 

WM 68011g 08/2020

Note 1: The higher frequency range applies at 80 MHz and 800 MHz.
Note 2: These guidelines may not be applicable in all cases. The size of electromagnetic fields depends on the extent to which they are absorbed and reflected by buildings, objects and persons.

[a]The ISM frequency bands (for industrial, scientific, and medical applications) between 150 kHZ and 80 Mhz are: 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz.
The amateur radio bands between 0.15 MHz and 80 MHz are: 1.8 MHz to 2.0 MHz, 3.5 MHz to 4.0 MHz, 5.3 MHz to 5.4 MHz, 7 MHz to 7.3 MHz, 10.1 MHz to 10.15 MHz, 14 MHz to 14.2 MHz, 18.07 MHz to 18.17 MHz, 21.0 MHz to 21.4 MHz, 24.89 MHz to 24.99 MHz, 28.0 MHz to 29.7 MHz and 50.0 MHz to 54.0 MHz.

[b]The compliance levels in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range from 80 MHz to 2.7 GHz are intended to reduce the likelihood of portable/mobile communication systems causing interference if brought into the PATIENT area unintentionally. For this reason, the additional factor of 10/3 is applied when calculating the recommended separation distances in these frequency ranges.

[c]Field strengths of fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio channels, and TV broadcasters cannot be predicted accurately in theory. A survey of the site should be performed to determine the electromagnetic environment with regard to the fixed transmitters. If the field strength measured at the site where MEDUMAT Standard^2 is used exceeds the upper compliance level, MEDUMAT Standard^2 should be monitored to ensure it is functioning as intended. If unusual performance characteristics are noted, additional measures may prove necessary such as changing the orientation or moving MEDUMAT Standard^2 to another site.

[d]The field strength should be lower than 3 V/m for the frequency range from 150 kHz to 80 MHz.

WM 68011g 08/2020

Guidelines and manufacturer's declaration – electromagnetic immunity						
MEDUMAT Standard^2 has been tested for immunity against the radio services listed below. If the field strength measured at the site where MEDUMAT Standard^2 is used exceeds the upper compliance level, MEDUMAT Standard^2 should be monitored to ensure it is functioning as intended. If unusual performance characteristics are noted, additional measures may prove necessary such as changing the orientation or moving MEDUMAT Standard^2 to another site.						
Testing frequency MHz	**Frequency band** [a] MHz	**Radio service** [a]	**Modulation** [b]	**Max. output** W	**Distance** m	**Immunity level** V/m
385	380 to 390	TETRA 400	Pulse modulation [b] 18 Hz	1.8	0.3	27
450	430 to 470	GMRS 460 FRS 460	FM [c] ± 5 kHz breath 1 kHz sinusoidal	2	0.3	28
710 745 780	704 to 787	LTE band 13, 17	Pulse modulation [b] 217 Hz	0.2	0.3	9
810 870 930	800 to 960	GSM 800/ 900, TETRA 800, iDEN 820, CDMA 850, LTE band 5	Pulse modulation [b] 18 Hz	2	0.3	28
1720 1845 1970	1700 to 1990	GSM 1800 CDMA 1900, GSM 1900 DECT, LTE band 1, 3, 4, 25, UTMS	Pulse modulation [b] 217 Hz	2	0.3	28
2450	2400 to 2570	Bluetooth, WLAN 802.11 b/g/n RFID 2450 LTE band 7	Pulse modulation [b] 217 Hz	2	0.3	28

WM 68011g 08/2020

Guidelines and manufacturer's declaration – electromagnetic immunity						
MEDUMAT Standard^2 has been tested for immunity against the radio services listed below. If the field strength measured at the site where MEDUMAT Standard^2 is used exceeds the upper compliance level, MEDUMAT Standard^2 should be monitored to ensure it is functioning as intended. If unusual performance characteristics are noted, additional measures may prove necessary such as changing the orientation or moving MEDUMAT Standard^2 to another site.						
Testing frequency MHz	**Frequency band [a]** MHz	**Radio service [a]**	**Modulation [b]**	**Max. output** W	**Distance** m	**Immunity level** V/m
5240 5500 5785	5100 to 5800	WLAN 802.11 a/n	Pulse modulation [b] 217 Hz	0.2	0.3	9
[a] Only the frequencies for radio connection of mobile communication devices to the base station (en: uplink) are included in the table for some radio services. [b] The carrier must be modulated with a square-wave signal with a 50% duty cycle. [c] As an alternative to frequency modulation (FM), it is also possible to use pulse modulation with a 50% duty cycle of 18 Hz, as this, although not the actual modulation, would reflect the worst case scenario.						

14.1.10 Factory settings for emergency modes and ventilation modes

Ventilation parameters	**Adult**	**Child**	**Infant**
Emergency mode	IPPV	IPPV	IPPV
Vt	500 ml	200 ml	60 ml
pInsp	20	15	15
Frequency	10/min	20/min	30/min
PEEP	0 mbar	0 mbar	0 mbar
Δ pASB	0	0	0
pMax	30 mbar	25 mbar	20 mbar
pMax CPR	30 mbar	25 mbar	20 mbar

WM 68011g 08/2020

14.2 Calculation of body weight on the basis of body height

In the start menu, you can set the height of the patient under the menu item **New patient** (see "4.7.3 Selecting a ventilation mode for a new patient", page 73). The device calculates the matching ventilation parameters based on the set height and the corresponding ideal body weight (IBW).

The IBW value is calculated as follows:

- Child[1] (height ≤ 154 cm):

⇒ IBW = 2.05 x $e^{0.02 \text{ x height}}$

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

⇒ IBW, male = 50 + 2.3 x [height/2.54 - 60]
⇒ IBW, female = 45 + 2.3 x [height/2.54 - 60]

With the aid of the IBW, the tidal volume can be calculated as follows:

$$\text{IBW x } \frac{\text{Vt}}{\text{kg KG}}$$

(KG = body weight)

Example

- Patient, male, height 185 cm
- Setting for Vt/kg KG = 6 ml/kg

⇒ IBW = 50 + 2.3 x [185 cm/2.54 - 60] = 79.51 kg ≈ 80 kg

⇒ Vt = 80 kg x 6 ml/kg = 480 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, pp. 195–201.
[2] Source: DEVINE, Ben J. Gentamicin therapy. The Annals of Pharmacotherapy, 1974, 8. Jg, No. 11, pp. 650-655

WM 68011g 08/2020

14.3 Exported log files

If you have exported log files to an SD card (see "6.3.4 Import / Export", page 126), you will find the following files on the SD card:

File name	Description
debug	Supports communication in the event of servicing.
status	Supports communication in the event of servicing.
fcheck	Record of the function checks which have been performed (see 14.3.1, p. 259).
mission logs	Detailed recording of session data

14.3.1 Recorded function checks

In the file **fcheck**, the function checks which have been performed are saved along with the date, time and their results. This information helps you with documentation within the scope of your quality management system. You can open the file **fcheck** with a spreadsheet program (e.g., Microsoft® Excel®).

In the column **result**, you will find the overall result of a function check (**ok** = passed, **failed** = not passed). A function check is failed if a test is not passed.

The following results are possible for the individual tests:

Result	Description
ok	Test passed
failed	Test not passed
not tested	Test not performed
n/a	Test not necessary with this device
-	Requested information has not been read out

The following tests are performed as part of the function check and listed in the file **fcheck**:

Column name	Description
#date	Date of the function check
time	Time of the function check
sequence	Consecutive application number
uid	For service purposes only
fcheck	For service purposes only
result	Result of the function check

WM 68011g 08/2020

Column name	Description
alarmsystem	Test of the visual and audible alarms
buttontest	Test of the buttons and navigation knobs
temperature sensor	Test of the internal temperature of the device
airway / mixing chamber pressure sensors	Test of the internal pressure sensors
int./ext. flow sensor	Test of the internal flow sensor
pressure drop	Test of the pneumatic bleed time
leak tightness	Test of the tightness of the device including the patient hose system
input pressure sensor	Test of the input pressure sensor
airmix valve	Test of the Air Mix mode
flowcheck sensor	Test of the FlowCheck sensor
flowcheck cable	Test of the FlowCheck sensor connection line/FlowCheck sensor connection line with MEDUtrigger
flowcheck offset	Test of the offset of the FlowCheck sensor
flowcheck sensor sn	Documentation of the serial number of the FlowCheck sensor which was connected during the function check
co2system	Test of the CO_2 module

14.3.2 Recorded mission logs

Mission logs contain detailed session data from up to 100 applications. The number of saved applications may vary depending on the session duration.

Depending on the frequency of the applications, the time required to export the data may vary.

The following data are saved in the mission logs:

- Measurements: The device records average values of the measured values as trend data.
- Ventilation settings and their changes: All triggered alarms and settings changes are saved immediately.
- Triggered alarms

WM 68011g 08/2020

14.4 Scope of supply

14.4.1 Standard product

MEDUMAT Standard^2 with capnography option **WM 29500**

Part	Article number
MEDUMAT Standard^2 basic device with CO_2 measurement	WM 28710-02
Reusable patient hose system for MEDUMAT Standard^2 without flow measurement and with CO_2 measurement, 2 m	WM 28905
MEDUtrigger for 2 m patient hose system for manual triggering of breath	WM 28992
Inhalation adapter	WM 28263
Battery	WM 45045
Testing bag	WM 1454
Set of CPAP/NIV disposable masks with air cushion	WM 15807
Ventilation mask with self-inflating silicone cushion for adults, size 5	WM 5074
$etCO_2/O_2$ nasal cannula	WM 1928
Hygiene filter	WM 28740
Velcro strap with clip	WM 28964
Medical device logbook	WM 16430
Delivery record	WM 16318
MEDUMAT Standard^2 Instructions for Use	WM 68011

MEDUMAT Standard^2 with capnography option, with compressed gas connection on rear **WM 29550**

Part	Article number
MEDUMAT Standard^2 basic device with CO_2 measurement	WM 28710-04
Reusable patient hose system for MEDUMAT Standard^2 without flow measurement and with CO_2 measurement, 2 m	WM 28905

WM 68011g 08/2020

Part	Article number
MEDUtrigger for 2 m patient hose system for manual triggering of breath	WM 28992
Inhalation adapter	WM 28263
Battery	WM 45045
Testing bag	WM 1454
Set of CPAP/NIV disposable masks with air cushion	WM 15807
Ventilation mask with self-inflating silicone cushion for adults, size 5	WM 5074
etCO_2/O_2 nasal cannula	WM 1928
Hygiene filter	WM 28740
Velcro strap with clip	WM 28964
Medical device logbook	WM 16430
Delivery record	WM 16318
MEDUMAT Standard^2 Instructions for Use	WM 68011

MEDUMAT Standard^2 without capnography option **WM 29300**

Part	Article number
MEDUMAT Standard^2 basic device without CO_2 measurement	WM 28710-01
Reusable patient hose system for MEDUMAT Standard^2 without flow measurement and without CO_2 measurement, 2 m	WM 28860
MEDUtrigger for 2 m patient hose system for manual triggering of breath	WM 28992
Inhalation adapter	WM 28263
Battery	WM 45045
Testing bag	WM 1454
Set of CPAP/NIV disposable masks with air cushion	WM 15807
Ventilation mask with self-inflating silicone cushion for adults, size 5	WM 5074
Hygiene filter	WM 28740
Velcro strap with clip	WM 28964
Medical device logbook	WM 16430
Delivery record	WM 16318
MEDUMAT Standard^2 Instructions for Use	WM 68011

WM 68011g 08/2020

MEDUMAT Standard^2 without capnography option, with compressed gas connection on rear **WM 29350**

Part	Article number
MEDUMAT Standard^2 basic device without CO_2 measurement	WM 28710-03
Reusable patient hose system for MEDUMAT Standard^2 without flow measurement and without CO_2 measurement, 2 m	WM 28860
MEDUtrigger for 2 m patient hose system for manual triggering of breath	WM 28992
Inhalation adapter	WM 28263
Battery	WM 45045
Testing bag	WM 1454
Set of CPAP/NIV disposable masks with air cushion	WM 15807
Ventilation mask with self-inflating silicone cushion for adults, size 5	WM 5074
Hygiene filter	WM 28740
Velcro strap with clip	WM 28964
Medical device logbook	WM 16430
Delivery record	WM 16318
MEDUMAT Standard^2 Instructions for Use	WM 68011

14.4.2 Options

Part	Article number
S-IPPV option	WM 28915
SIMV option	WM 28916
Inhalation option	WM 28920
Flow measurement + ASB option	WM 28959
Curve display option	WM 28963
NVG option	WM 28809
Pressure-controlled ventilation modes option	WM 28970
CCSV option	WM 28940
Bluetooth data transmission option	WM 28945

WM 68011g 08/2020

14.4.3 Patient hose systems

Reusable hose system

With flow measurement	With CO_2 measurement	Number	Article number	
			2 m	3 m
-	-	1	WM 28860	WM 28861
x	-	1	WM 29197	WM 29198
-	x	1	WM 28905	WM 28906
x	x	1	WM 29190	WM 29191

Disposable hose system

With flow measurement	With CO_2 measurement	Number	Article number	
			2 m	3 m
-	-	1	WM 28865	WM 28866
-	-	10	WM 15910	WM 15916
-	-	25	WM 15911	-
-	-	50	WM 15912	-
x	-	1	WM 29195	WM 29196
x	-	10	WM 17851	WM 17852
x	-	25	WM 17853	-
x	-	50	WM 17854	-
-	x	1	WM 28907	WM 28908
-	x	10	WM 17855	WM 17856
-	x	25	WM 17857	-
-	x	50	WM 17858	-
x	x	1	WM 29192	WM 29193
x	x	10	WM 17859	WM 17860
x	x	25	WM 17861	-
x	x	50	WM 17862	-

WM 68011g 08/2020

Disposable hose system with reduced dead space

With flow measurement	With CO_2 measurement	Number	Article number	
			2 m	3 m
-	-	1	WM 28867	-
-	-	10	WM 15913	
x	-	1	WM 29194	
x	-	10	WM 17863	
-	x	1	WM 28904	
-	x	10	WM 17866	
x	x	1	WM 29199	
x	x	10	WM 17869	

14.4.4 Accessories

Accessories can be ordered separately, if required.

Part	Article number
MEDUtrigger for patient hose system, 2 m	WM 28992
MEDUtrigger for patient hose system, 3 m	WM 28993
FlowCheck sensor connection line, 2 m	WM 32506
FlowCheck sensor connection line, 3 m	WM 32507
FlowCheck sensor connection line with MEDUtrigger, 2 m	WM 32508
FlowCheck sensor connection line with MEDUtrigger, 3 m	WM 32509
FlowCheck sensor, reusable	WM 28835
Set of 5 FlowCheck sensors, reusable	WM 17850
Testing bag with triggering	WM 1454
Charging adapter	WM 28979
100 W power supply	WM 28937
12 V cable	WM 28356
Charging station	WM 45190
EasyLung for WEINMANN Emergency	WM 28625
SD card	WM 29791
T-distributor with self-sealing coupling	WM 22395
Set, wall mounting for power supply unit/charger	WM 15846
Set, wall mounting for rechargeable battery pack	WM 15847
Hospital standard rail attachment set	WM 15795
Rail bracket attachment set	WM 15806
Breathing system filter for MEDUMAT ventilators	WM 22162

WM 68011g 08/2020

Part	Article number
AD22 protective cap	WM 28942
2 l oxygen cylinder, full, G 3/4", max. filling pressure 200 bar	Article number on request
2 l lightweight oxygen cylinder, full, G 3/4", max. filling pressure 200 bar	Article number on request
Set of 5 2 m CO_2 measuring hoses with filter, disposable	WM 15695
etCO_2/O_2 split nasal cannula for etCO_2 measurement and oxygen supply, for adults, 2.1 m connection hose	WM 1928
Nasal cannula for adults, double lumen, with 2.1 m connection hose	WM 1925
Pressure reducer OXYWAY Fix III, G 3/4"	Article number on request
Pressure reducer OXYWAY Fast II, G 3/4"	Article number on request
Low-pressure hose with connection nozzle G 3/8; at the other end, the option of a union nut G 3/8 or oxygen supply connector	Article number on request
Hygiene filter set	WM 17865
Pneumatic drug nebulizer set	WM 15827
Headgear for disposable NIV masks	WM 20702
Disposable NIV mask, size S	WM 20703
Disposable NIV mask, size M	WM 20704
Disposable NIV mask, size L	WM 20705
Set, comprising 1 disposable NIV mask in sizes S, M and L respectively and headgear	WM 15807
Eagle 1 Premium disposable NIV mask, size S	WM 20717
Eagle 1 Premium disposable NIV mask, size M	WM 20718
Eagle 1 Premium Disposable NIV mask, size L	WM 20719
Set of 10 premium disposable CPAP/NIV masks incl. headgear, size S (child)	WM 17940
Set of 10 premium disposable CPAP/NIV masks incl. headgear, size M (adult)	WM 17942
Set of 10 premium disposable CPAP/NIV masks incl.headgear, size L (adult)	WM 17944
Set of 40 premium disposable CPAP/NIV masks incl. headgear, size S (child)	WM 17941
Set of 40 premium disposable CPAP/NIV masks incl. headgear, size M (adult)	WM 17943

WM 68011g 08/2020

Part	Article number
Set of 40 premium disposable CPAP/NIV masks incl.headgear, size L (adult)	WM 17945
CapnoDura CO_2 detector	WM 20760
Set of 10 CapnoDura CO_2 detectors	WM 20770

14.4.5 Replacement parts

Replacement parts can be ordered separately, if required. A current list of replacement parts is available on the Internet at www.weinmann-emergency.com or from your authorized dealer.

14.5 Warranty

Starting from the date of purchase, WEINMANN Emergency offers the customer a limited manufacturer's warranty on a new original WEINMANN Emergency product or replacement parts installed by WEINMANN Emergency in accordance with applicable warranty terms and conditions for the particular product and the warranty periods listed below. The warranty terms and conditions are available on the Internet at www.weinmann-emergency.com. On request, we will send you the warranty terms and conditions by mail.
If you wish to make a warranty claim, consult your authorized dealer.

Product	Warranty periods
WEINMANN Emergency devices including accessories (for exceptions see below) for oxygen therapy and emergency medicine	2 years
MEDUtrigger connection line/FlowCheck sensor connection line/FlowCheck sensor connection line with MEDUtrigger	1 year
Masks, incl. accessories, batteries (unless otherwise stated in the technical documentation), sensors, hose systems, FlowCheck sensor	6 months
Disposable products	None

WM 68011g 08/2020

14.6 Declaration of Conformity

WEINMANN Emergency Medical Technology GmbH + Co. KG declares herewith that the product complies fully with the respective regulations of the Medical Device Directive 93/42/EEC. The unabridged text of the Declaration of Conformity can be found on our website at www.weinmann-emergency.com.

WM 68011g 08/2020

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WM 68011g 08/2020 EN