Instructions for use

Perseus A500

WARNING

To properly use this medical device, read and comply with these instructions for use.

Anesthesia workstation
Software 2.0n

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Contents

Information about this document

Applicability of these instructions for use

This document applies to products with software version 2.03 or higher.

Typographical conventions

1 Consecutive numbers indicate steps of action, with the numbering restarting with "1" for each new sequence of actions.

- Bullet points indicate individual actions or different options for action.

– Dashes indicate the listing of data, options, or objects.

(A) Letters in parentheses refer to elements in the related illustration.

A Letters in illustrations denote elements referred to in the text.

> The greater-than symbol indicates the navigation path in a dialog window.

Bold, italicized text indicates labels on the device and texts that are displayed on the screen.

Use of terms

Dräger uses the term "accessories" not only for accessories in the sense of IEC 60601-1, but also for consumables, removable parts, and attached parts.

The product "Perseus A500" is also referred to as "Perseus".

Illustrations

Illustrations of products and screen content in this document may differ from the actual products depending on configuration and design.

Further documents

The reprocessing of this product is described in the separate reprocessing instructions supplied with the product.

Trademarks

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Safety information definitions

WARNING

A WARNING statement provides important information about a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

A CAUTION statement provides important information about a potentially hazardous situation which, if not avoided, may result in minor or moderate injury to the user or patient or in damage to the medical device or other property.

NOTE

A NOTE provides additional information intended to avoid inconvenience during operation.

User group requirements

The term "user group" describes the personnel responsible who have been assigned by the operating organization to perform a particular task on a product.

Duties of the operating organization

The operating organization must ensure the following:

– Every user group has the required qualifications (e.g., has undergone specialist training or acquired specialist knowledge through experience).
– Every user group has been trained to perform the task.
– Every user group has read and understood the relevant chapters in this document.

User groups

Clinical users

This user group operates the product in accordance with the intended use.

Users have medical specialist knowledge in the field of anesthesia. Users have knowledge of device monitoring and perioperative care.

Reprocessing personnel

This user group carries out the necessary activities to reprocess the product.

Reprocessing personnel has specialist knowledge in the reprocessing of medical devices.

Service personnel

This user group installs the product and performs the service activities.

Service personnel has specialist knowledge in electrical and mechanical engineering and experience in the servicing of medical devices.

Where product specific knowledge or tools are required, the service activities must be carried out by specialized service personnel. The specialized service personnel was trained by Dräger for these service activities on this product.

For your safety and that of your patients

General safety information

The following WARNING and CAUTION statements apply to general operation of the medical device.
WARNING and CAUTION statements specific to its subsystems or particular features appear in the respective sections of these instructions for use or in the instructions for use of any other product being used with this device.

Strictly follow these instructions for use

WARNING

Risk of incorrect operation and incorrect use

Any use of the medical device requires full understanding and strict observation of all sections of these instructions for use. The medical device must only be used for the purpose specified under "Intended use" (see page 15) and in conjunction with appropriate patient monitoring (see page 10). Strictly observe all WARNING and CAUTION statements throughout these instructions for use and all statements on medical device labels.

Failure to observe these safety information statements constitutes a use of the medical device that is inconsistent with its intended use.

Service

WARNING

Risk if service is not performed regularly

If service is not performed regularly, malfunctions may occur, which can result in personal injury and property damage.

Perform the service in accordance with the chapter "Service".

Accessories

WARNING

Risk due to incompatible accessories

The use of incompatible accessories may adversely affect the functional integrity of the product. Personal injury and property damage may occur as a consequence.

Use only compatible accessories. The accessories that are compatible with this product are listed in the list of accessories supplied with the product.

WARNING

Risk due to faulty accessories

The use of faulty accessories may compromise the functional integrity of the product. Personal injury and property damage may result.

Use only accessories that are in good working order.

WARNING

Risk due to misoperation, incorrect use, or incorrect reprocessing

Strictly observe the instructions for use of all accessory parts, e.g.:
- **Water traps**
- **Flow sensors**
- **CLIC adapter**
- **CLIC absorber**
- **Soda lime**
- **Breathing hoses**
- **Masks**
- **Filter**
- **Bronchial suction**
- **Vaporizer**
- **Manual resuscitator**
- **AGSS terminal unit**

Patient safety

The design of the medical device, the accompanying documentation, and the labeling on the medical device are based on the assumption that the purchase and the use of the medical device are restricted to persons familiar with the most important inherent characteristics of the medical device.

Instructions and WARNING and CAUTION statements are therefore largely limited to the specifics of the Dräger medical device.

The instructions for use do not contain any information on the following points:

– Risks that are obvious to users
– Consequences of obvious improper use of the medical device
– Potentially negative effects on patients with different underlying diseases

Medical device modification or misuse can be dangerous.

Patient monitoring

The user of the medical device is responsible for choosing suitable monitoring that provides appropriate information about medical device performance and the patient's condition.

Patient safety may be achieved by a wide variety of means ranging from electronic surveillance of medical device performance and patient condition to simple, direct observation of clinical signs.

The responsibility for selecting the best level of patient monitoring lies solely with the user of the medical device.

Electromagnetic compatibility (EMC)

Medical electrical equipment is subject to special precautionary measures concerning electromagnetic compatibility. During installation and before initial operation, follow the information in section: "EMC declaration" (page 251).

This device can be affected by other electrical devices.

WARNING

Risk due to electrostatic discharge

Malfunctions that endanger the patient may occur if no protective measures against electrostatic discharge are employed in the following situations:

- **When touching the pins of connectors that carry the ESD warning symbol.**
- **When establishing connections with these connectors.**

To prevent malfunctions, observe the following measures and train the relevant personnel:

- **Observe the ESD protective measures. Such measures may include wearing antistatic clothing and shoes, touching a potential equalization pin before and while making the connection, or using electrically insulating and antistatic gloves.**
- **Observe the requirements for the electromagnetic environment. Observe the following section: "Electromagnetic environment" (page 251).**

WARNING

Risk due to electromagnetic disturbance

Wireless communication devices (e.g., cellular phones) and medical electrical equipment (e.g., defibrillators, electrosurgical devices) emit electromagnetic radiation. When such devices are operated too close to this device or its cables, the functional integrity of this device may be compromised by electromagnetic disturbances. As a result, the patient could be put at risk.

- **Maintain a distance of at least 0.3 m (1.0 ft) between this device and wireless communication devices, to ensure that the essential performance of this device is fulfilled.**
- **Maintain an adequate distance between this device and other medical electrical equipment.**

Training

User training is offered by the responsible Dräger organization, see www.draeger.com.

Keeping the instructions for use

WARNING

Risk of operating errors

The instructions for use must be kept in an accessible location for users.

Product-specific safety information

WARNING

Risk due to device failure

Device failure can compromise the correct therapy functionality of the device.

To ensure immediate remedial action in case of device failure, the device may only be operated under permanent supervision of users. Always have a manual resuscitator ready.

WARNING

Dräger recommends that the user remains in the vicinity of the anesthesia machine, i.e. within a distance of up to 4 meters (12 feet). This facilitates fast recognition and response in the event of an alarm.

WARNING

Risk due to modifications

Modifications to the product may lead to malfunctions and unforeseen risks. This may result in injury to the patient or the user or in property damage.

Do not modify this product.

WARNING

Risk of fire

The flow sensor can ignite medications or other substances based on highly flammable substances.

- **Do not nebulize medications or other substances that are easily flammable or spray them into the device.**
- **Do not use substances containing alcohol.**
- **Do not allow flammable or explosive substances to enter the breathing system or the breathing circuit.**
- **Do not use cyclopropane or ether.**

WARNING

Risk due to failure of flow measurement

Deposits that were not removed during reprocessing can damage the measuring wires in the flow sensor or cause a fire.

- **Before inserting the flow sensor check for visible damage, soiling, and particles. Repeat this check regularly.**
- **Replace flow sensors when damaged, soiled, or not particle-free.**

CAUTION

Risk of crushing

Movable device parts or attached components may cause crushing due to clamping. Pay special attention to edges, movable parts, and corners when working with the following components:

- Column cover
- Breathing system cover
- Drawers
- Extensible writing tray
- Swivel arms for mounted devices
- Accessories such as gas cylinders, vaporizers, CLIC absorber, and CLIC adapter

WARNING

Risk due to electromagnetic fields

Although the medical device does not exceed the applicable limiting values for electromagnetic fields, such radiation can interfere with the functioning of pacemakers.

All wearers of pacemakers should maintain a distance of at least 25 cm (10 in) between pacemaker and medical device.

Essential performance

General

- Supply of the anesthesia workstation with O_2:
  If the O_2 supply (central gas supply or gas cylinder) fails, an alarm is issued.
- Supply of the patient with adequately oxygenated breathing gas:
  If the breathing gas contains insufficient levels of O_2, an alarm is issued.
- Patients are not supplied with excessively high anesthetic gas concentrations:
  If excessively high anesthetic gas concentrations are delivered, an alarm is issued.
- Monitoring of the airway pressure:
  Alarms are issued depending on the set alarm limits.

Gas measurement

- Breathing gas monitoring:
  Measurement of the gas composition with ISO accuracy.
- Monitoring of the breathing gas concentrations:
  If a set alarm limit is exceeded or the gas measurement fails, alarms will be issued.

Handling Infinity ID components

Ownership or purchase of this medical device with RFID technology only includes the right to use the medical device and RFID technology in conjunction with products approved by Dräger and in strict compliance with these instructions for use. No intellectual property rights or any rights to the use of the medical device or RFID technology are hereby granted, either explicitly or implicitly, which are contrary to the above-mentioned conditions.

Application

Intended use

The Perseus anesthesia workstation is intended for use in anesthetizing adults, children, and neonates and can be used for automatic and manual ventilation, pressure-supported spontaneous breathing, and spontaneous breathing.

Perseus is equipped with airway monitoring, gas measurement and device monitoring, O_2 insufflation, and an anesthetic gas receiving system.

Anesthesia is achieved through a mixture of pure oxygen and Air (medical compressed air) or pure oxygen and nitrous oxide, with the addition of volatile anesthetic agents.

Ventilation is accomplished on the patient through a laryngeal mask airway, a full-face mask, or an endotracheal tube.

The integrated breathing system can be used with partial rebreathing (low-flow or minimum-flow).

A non-rebreathing system such as the Kuhn or Medec Water System may be used at the external fresh-gas outlet (optional).

Indications/Contraindications

Indications

Perseus is specified for inhalational anesthesia and/or patient ventilation in accordance with the intended use during surgical or diagnostic interventions.

Contraindications

– Perseus applies medications such as oxygen, nitrous oxide, or volatile anesthetic agents, among others. For contraindications to the applied medications, strictly follow the instructions for use of the medication.
– Do not use soda lime based on potassium hydroxide. Otherwise, there is a risk of CO formation.
– Only use pelletized soda lime. Otherwise, there is a risk of faulty measurement or faulty delivery as well as progressive damage to the breathing system due to dust.
– For patients suspected of malignant hyperthermia: Do not use any volatile anesthetic agent or Perseus with residual concentrations of these gases above 5 ppm.
– Do not perform low-flow anesthesia on patients with ketoacidosis or patients under the influence of alcohol. Otherwise, there is a risk of acetone accumulation in the patient.

The user is responsible for setting the gas delivery and ventilation according to the individual patient status. Patient status must be continually monitored for any potential changes.

Further information on application

Environments of use

Perseus is designed for use in rooms in which therapeutic or diagnostic interventions can be performed under permanent supervision of users.

WARNING

Risk of explosion and fire

This medical device is neither approved nor certified for use in areas where oxygen concentrations greater than 25 Vol%, combustible or explosive gas mixtures are likely to occur.

WARNING

Risk of device malfunctions and/or patient injury and user injury

Magnetic fields can negatively influence the correct functioning of the medical device and therefore endanger the patient or user.

Do not use the medical device in rooms where devices for magnetic field applications are used (e.g., magnetic resonance imaging).

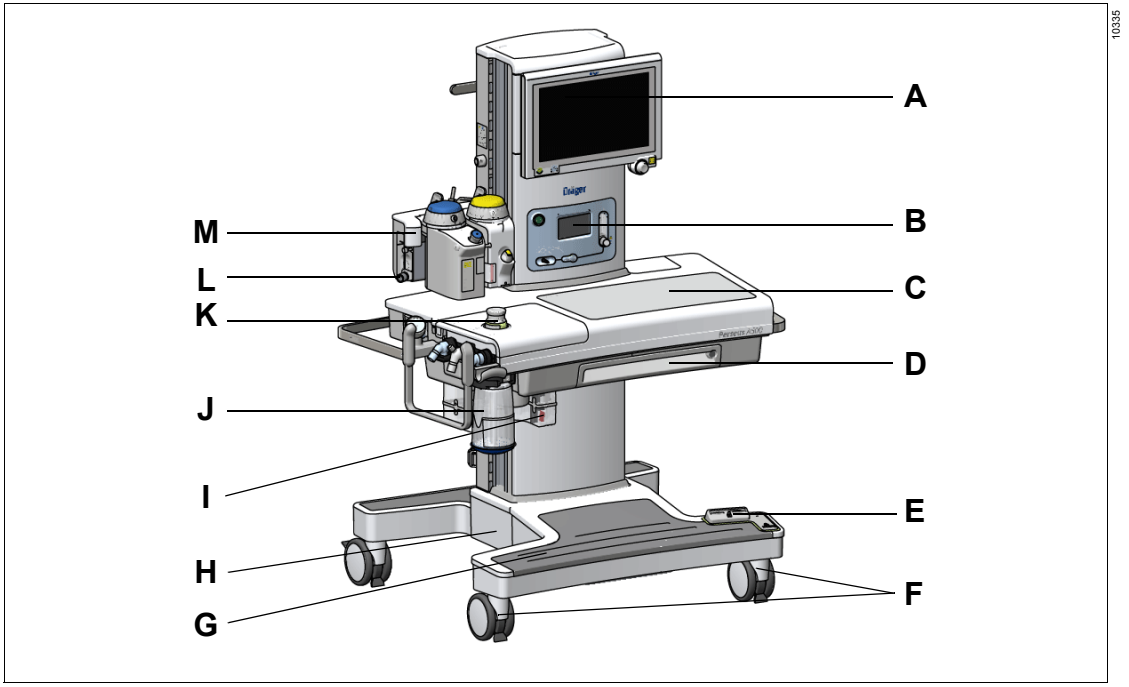
Also, do not use Perseus in the following environments:

– Outside buildings
– On intensive care units
– During patient transport
– In vehicles, airplanes, or helicopters

Overview

Hardware

Front (trolley version)



A Screen with integrated workplace illumination

B Gas mixing unit (electronically controlled gas mixer shown here)

C Work surface

D Drawer or pull-out writing tray with lockable compartment (optional)

E Central brake

F Castors with central brake

G Footrest

H Trolley

I Anesthetic gas receiving system with flow indicator

J CO_2 absorber

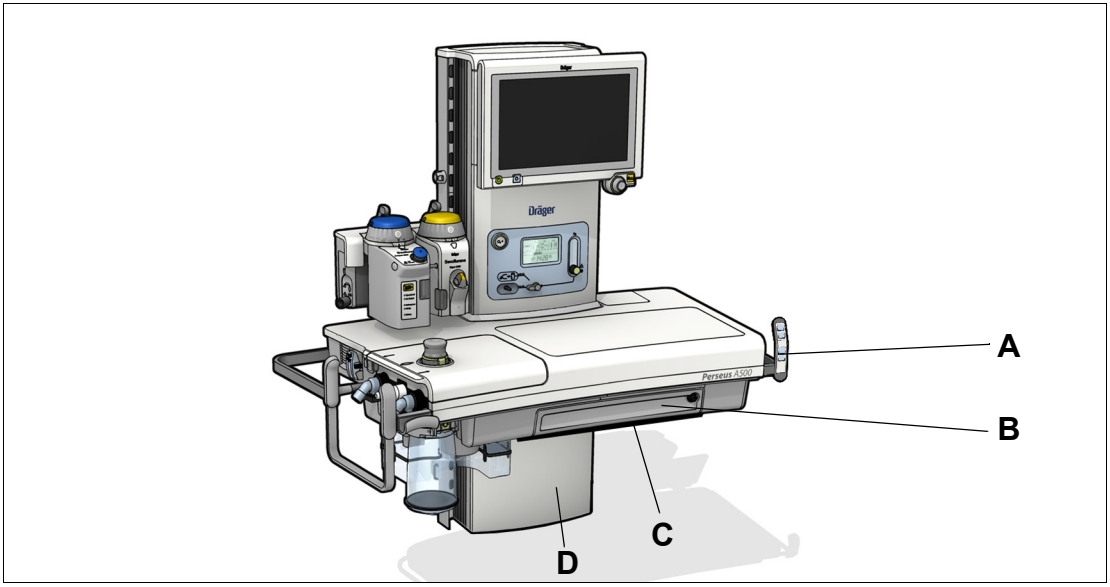
K APL valve

L External fresh-gas outlet (optional)

M Plug-in connector with Vapor View option for up to 3 vaporizers (the version for 2 vaporizers is shown here)

Front (ceiling-mounted version)

Differences from the trolley version:



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A Remote control for controlling and positioning the ceiling supply unit (functions dependent on the type of the ceiling supply unit)

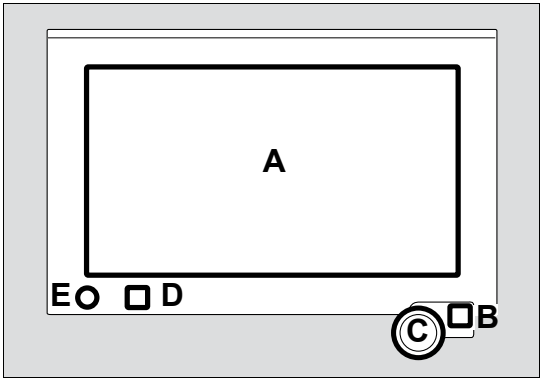
B Lockable drawer (optional)

C Safety sensor

D Device column without trolley

Although the remote control and the safety sensor are mounted on Perseus, from an electrotechnical point of view they are part of the connected ceiling supply unit. The safety sensor functions with any ceiling supply unit.

Screen



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A Touchscreen to call up functions or dialog windows

B ***Audio paused*** key to suppress the alarm tones of all active alarms for 2 minutes

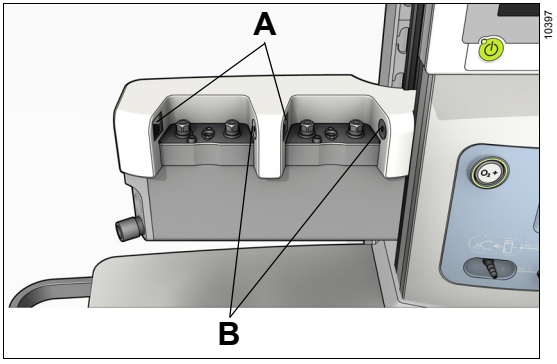
C Rotary knob with background illumination to select and confirm settings

D Key for switching the workplace illumination on and off and dimming the illumination intensity in 3 steps (dark, medium, and bright)

E Key for turning the device on or off

Plug-in connection with Vapor View option for up to 3 vaporizers

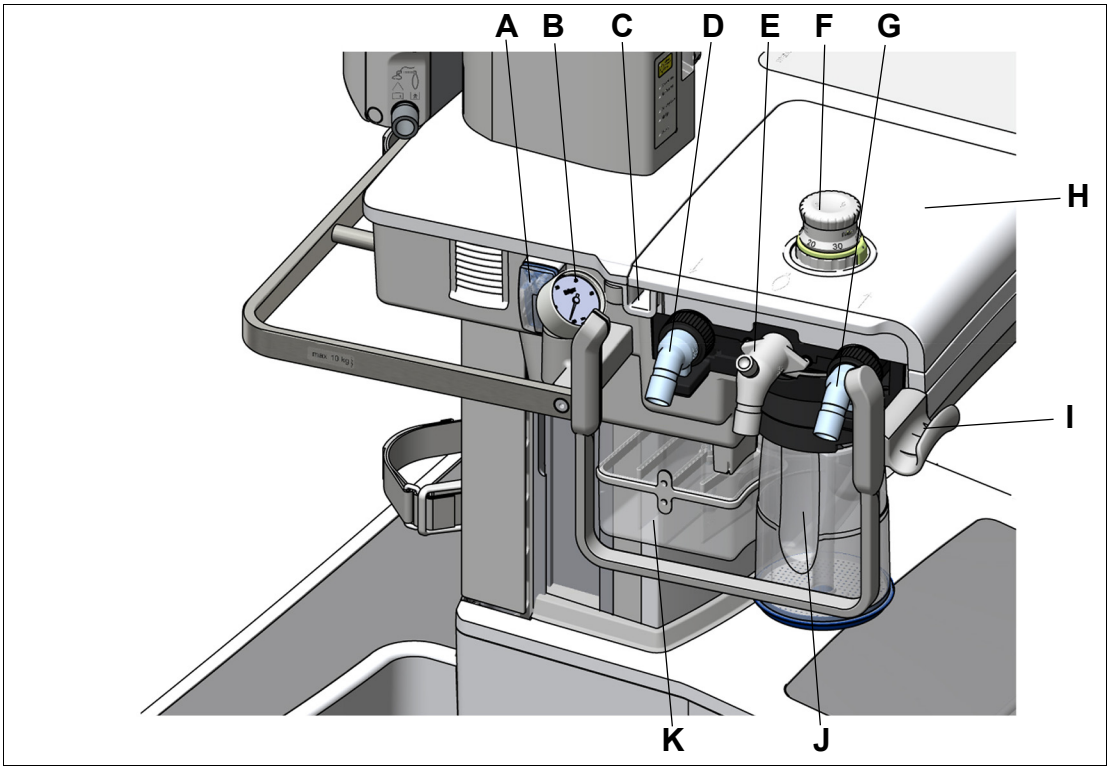
The version for 2 vaporizers is shown here:



A Sensor unit

B Illumination unit

Breathing system



A Water trap with connection for sample line

B Pressure gauge (optional) for indicating the pressure in the internal breathing system
The pressure in the internal breathing system is also indicated on the status display, see (G) on page 31 and (H) on page 32.

WARNING

Pressure gauge indication possibly inaccurate

Always compare the pressures indicated on the pressure gauge with those on the status display. Only use the pressure gauge as the primary source of information if the pressure indicator on the status display has failed.

C Collecting channel

D Inspiratory port

E Bag elbow with circuit plug, e.g., to seal the Y-piece during an automatic test

F APL valve

G Expiratory port

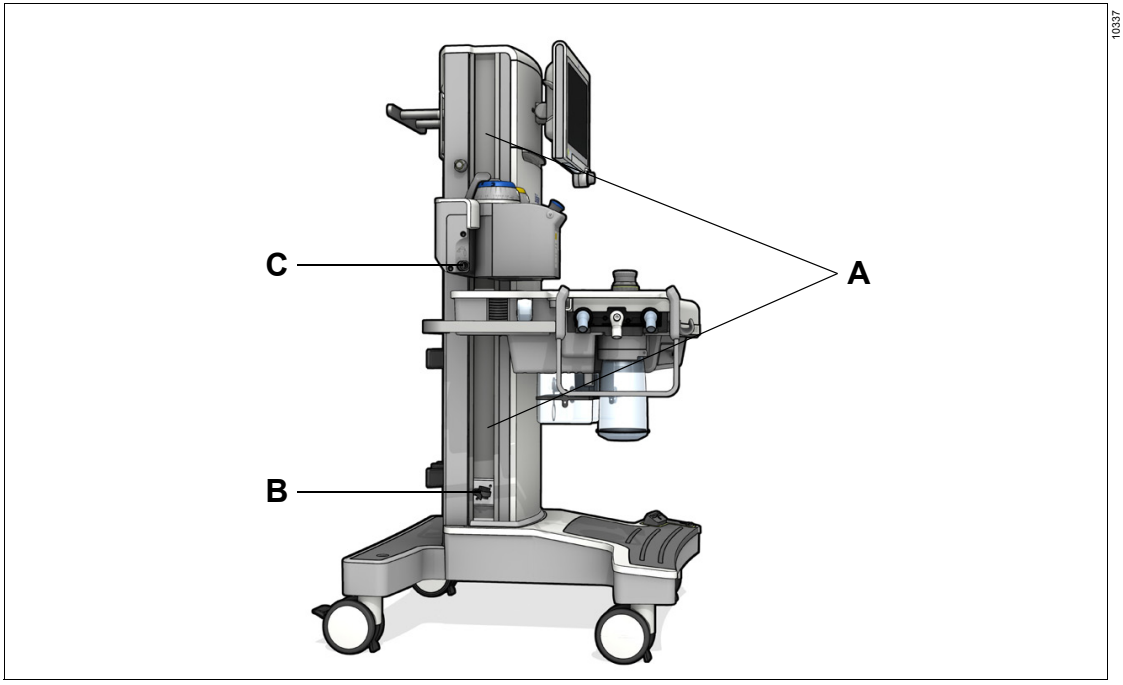
H Breathing system cover

I Holder, e.g., for breathing bag hose

J CO_2 absorber

K Anesthetic gas receiving system

Side view from left



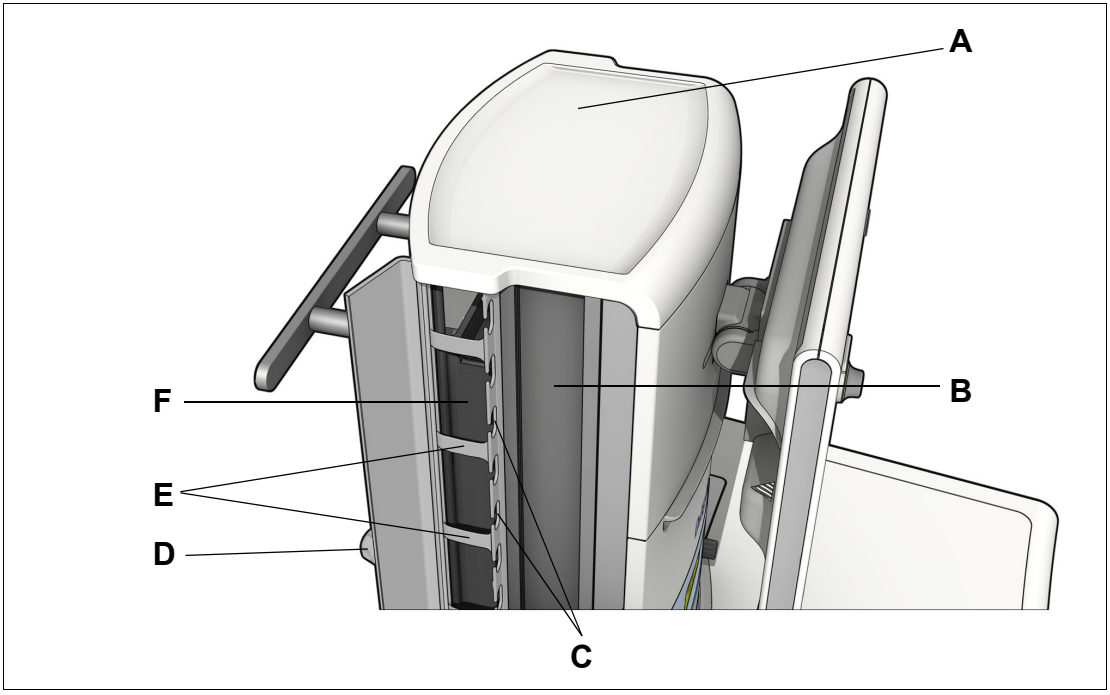
A GCX rail for mounting additional workstation components

B Strain relief for AGS hose, adjustable height

C External fresh-gas outlet (optional)

Device column

The following illustration shows the left side of the device:



A Column cover

B GCX rail

C Recesses for cables which lead e.g., into the device arms

D Screw for closing the cable channel lid

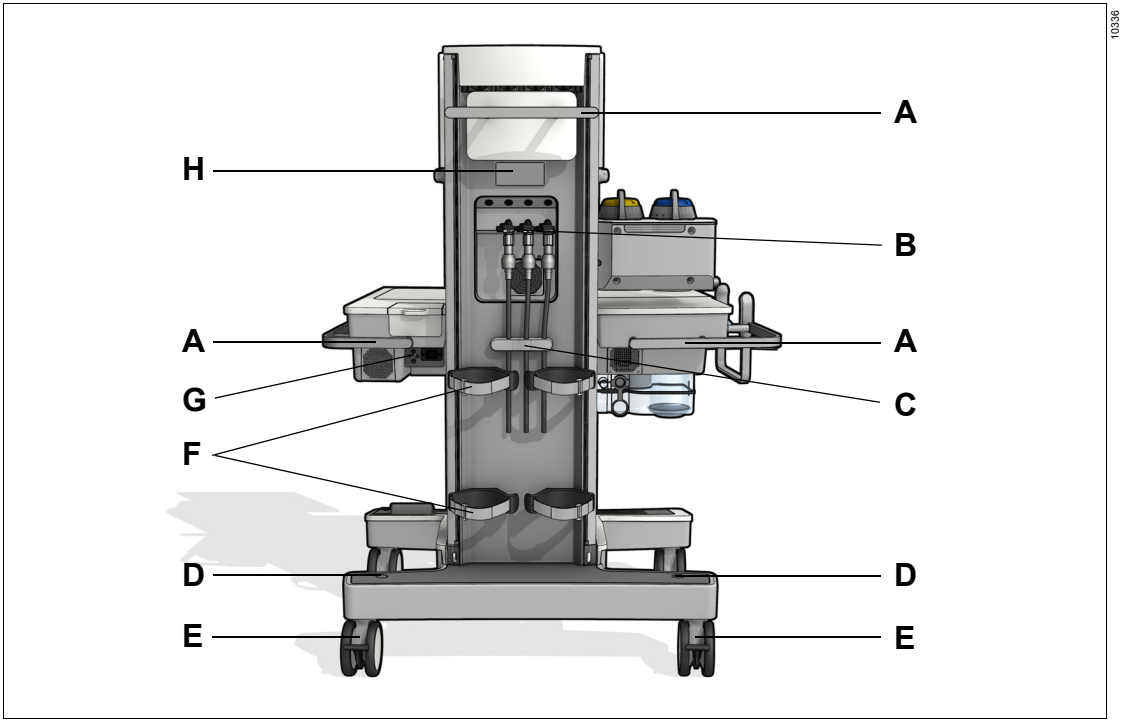
E Tabs to hold the cable

F Cable channel

On the ceiling-mounted version, there is a compartment located under the column cover for stowing accessories, e.g., a cable.

Rear (trolley version)

Version with screw connections for gas cylinders



A Mounting rail

B Gas inlets

C Strain relief for compressed gas hose (available for the trolley version only)

D Connection for optional pole (38 mm)

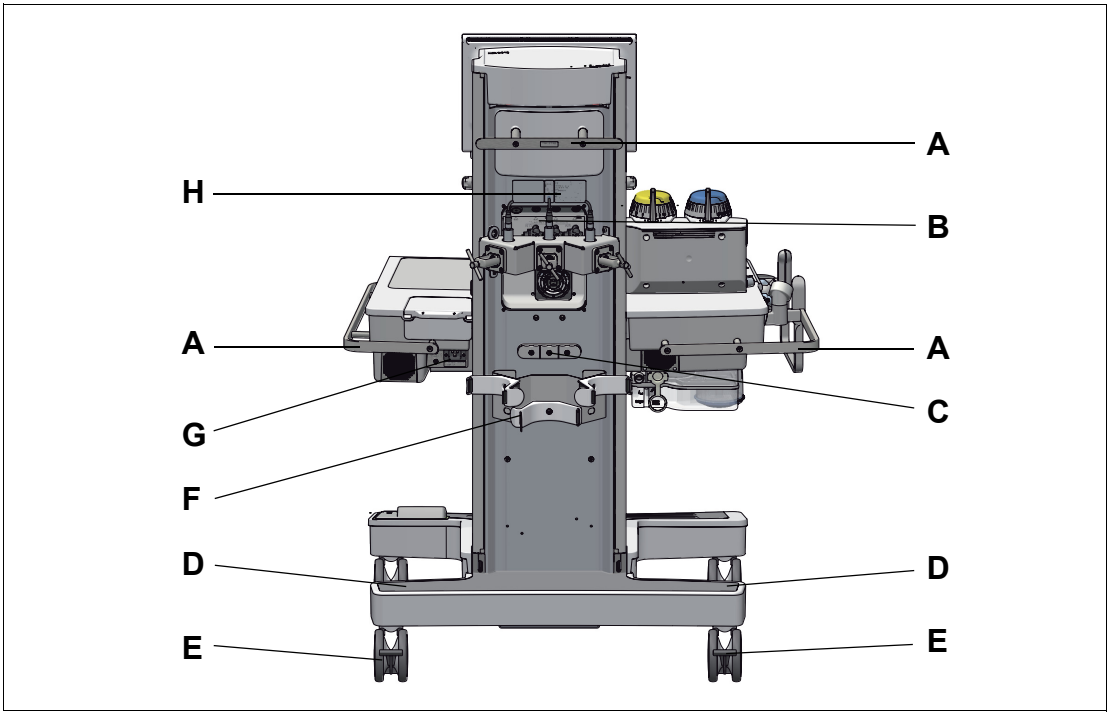
E Castor with castor brake

F Gas cylinder holders (optional) with hook-and-loop strap (available for the trolley version only)

G Interfaces

H Rating plate

Version with hanger yokes for gas cylinders with pin-index connections (optional)



A Mounting rail

B Gas inlets

C Strain relief for compressed gas hose
(only available for the trolley version shown here or in combination with the flexibility trolley)

D Connection for optional pole (38 mm)

E Castor with castor brake

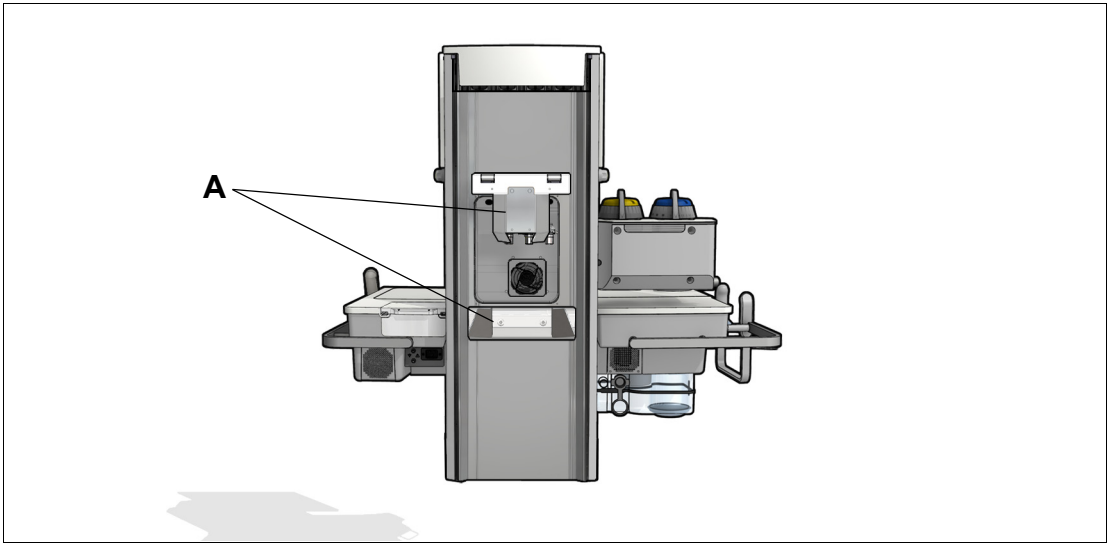
F Gas cylinder holders (optional) with hook-and-loop strap
(available for the trolley version only)

G Interfaces

H Rating plate

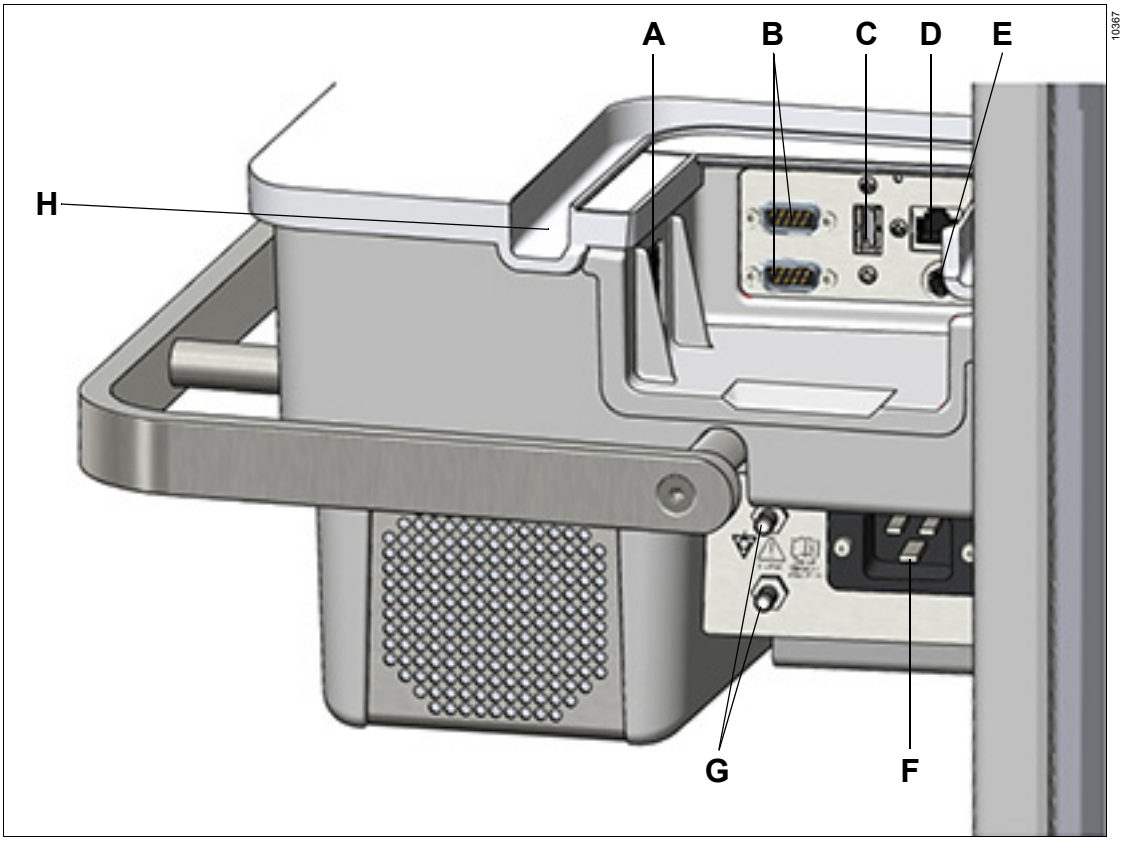
Rear (ceiling-mounted version)

Differences from the trolley version:



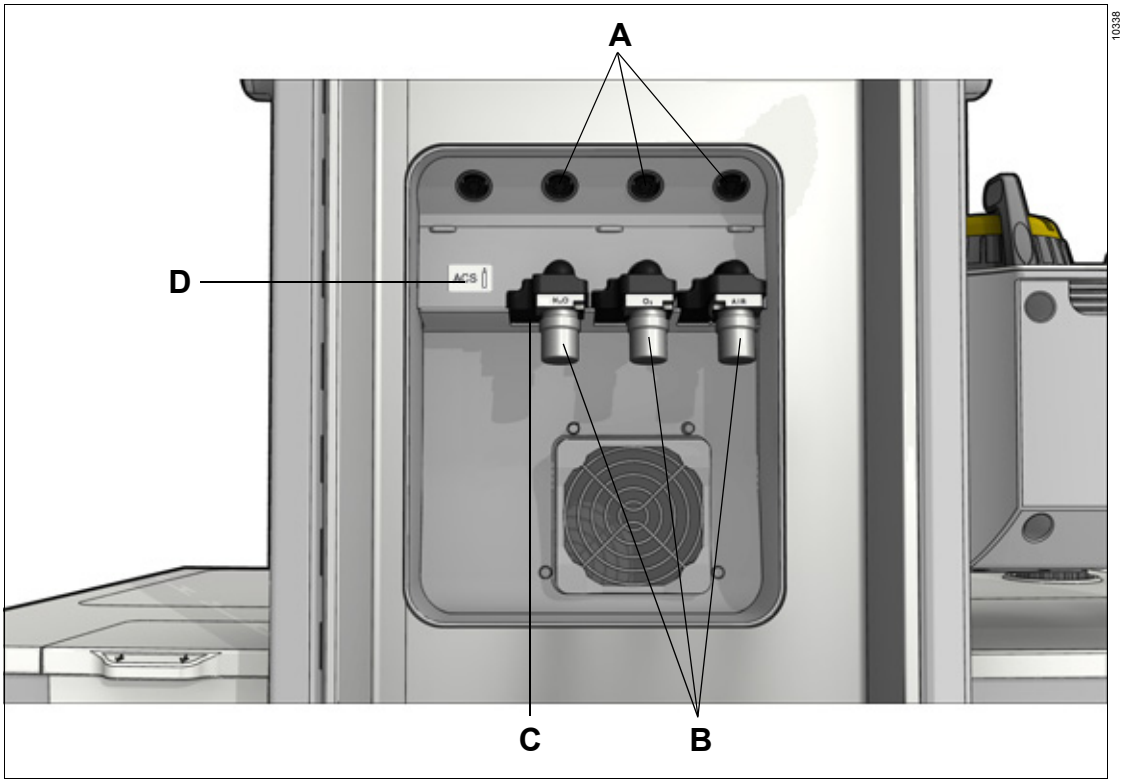
A Mounting interface for docking to the ceiling supply unit

Interfaces



A Main switch
B Serial interfaces (COM 1 and COM 2)
C USB interface
D Network interface
E Interface for workstation light (optional)
F IEC connector (socket for power cable)
G Potential equalization pin
H Collecting channel

Gas inlets



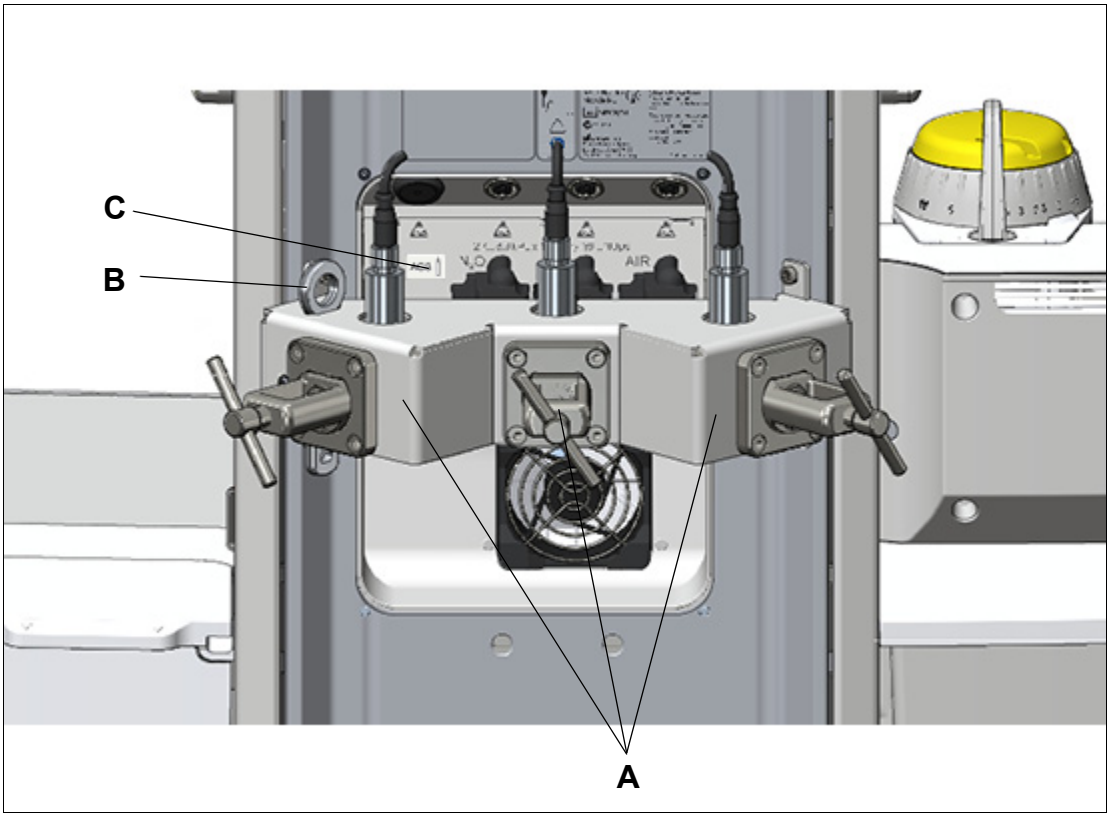
A Connections for gas pressure measurement for gas cylinders (optional)

B Connections for central gas supply (N_2O optional)

C Connections for external gas cylinders (optional)

D Advanced Cylinder Support label (if present)

Hanger yokes (optional) for gas cylinders with pin-index connections



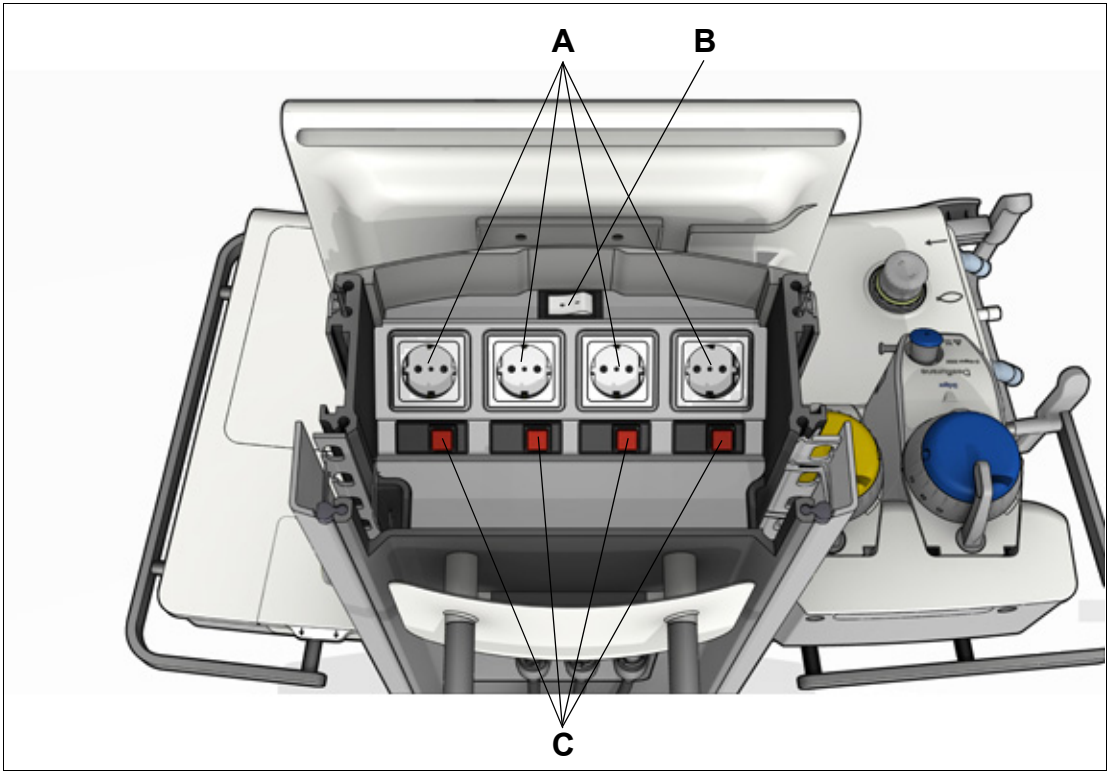
A Hanger yokes (optional) for gas cylinders with pin-index connections

B Wrench for opening and closing the gas cylinder valves

C Advanced Cylinder Support label (if present)

Auxiliary power sockets (trolley version)

View with column cover removed:

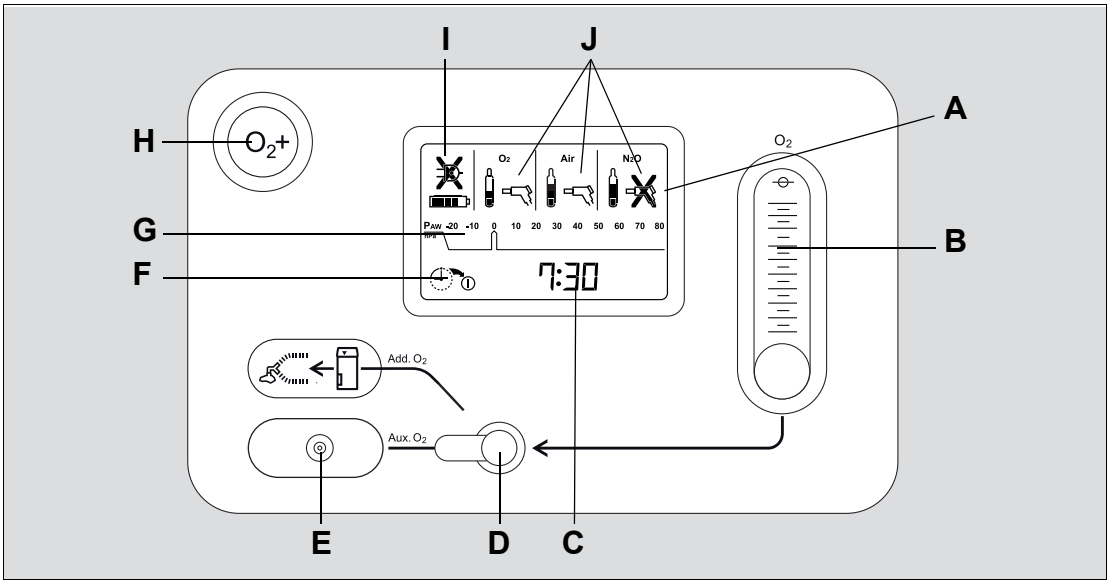


A Auxiliary power sockets, depending on equipment variant

B Isolation transformer switch (optional)

C Circuit breakers or fuses, depending on equipment variant

Gas mixing unit (electronically controlled)



A Status display

B O_2 flowmeter (for O_2 insufflation ***Aux. O_2*** and emergency O_2 delivery ***Add. O_2***)

C Current time or time for ***Auto On***

D O_2 switch (for switching between O_2 insufflation ***Aux. O_2*** and emergency O_2 delivery ***Add. O_2***)

E Outlet for O_2 insufflation, e.g., for nasal cannula

F Symbol for programmed ***Auto On***

G Display of pressure in the internal breathing system, see page 21

H ***O_2+*** key (O_2 flush)

I Symbols for mains power supply and power supply from internal battery

J Symbols for gas supply (O_2, Air, N_2O) through central supply and gas cylinders

WARNING

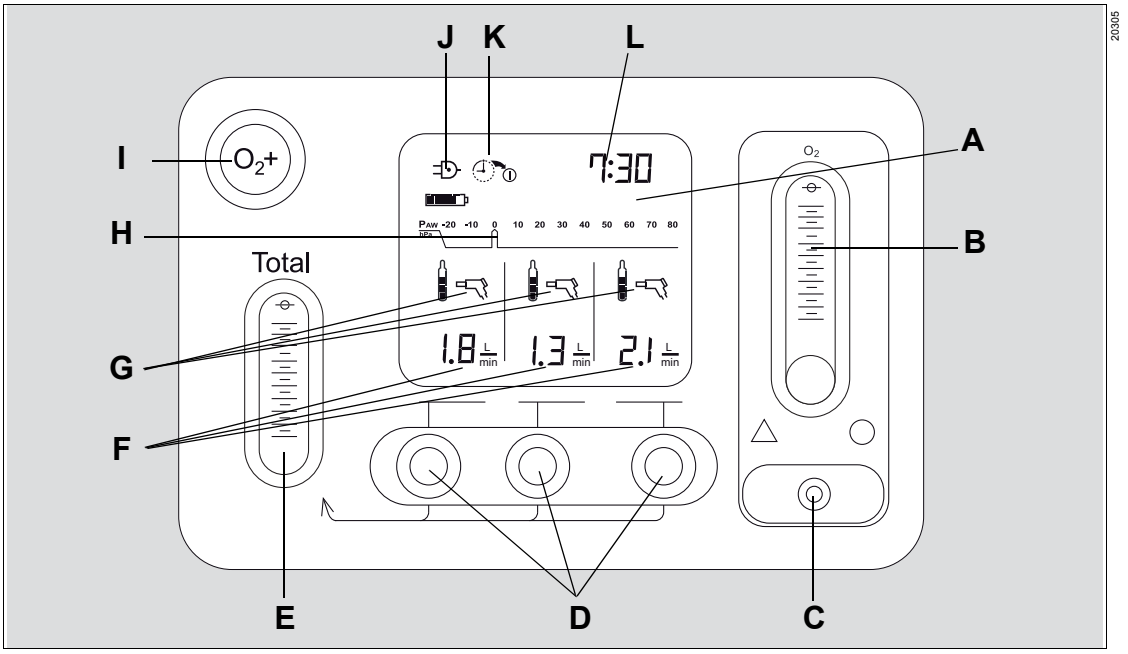
Risk of mix-up due to deviating arrangement

In certain countries, the arrangement of the gases on the status display may differ from the arrangement of the flow tubes depicted on the screen.

Always pay attention to the respective labeling.

Explanation of the symbols which may be displayed, see page 277.

Gas mixing unit (mechanically controlled)



A Status display

B O_2 flowmeter (for O_2 insufflation ***Aux. O_2***)

C Outlet for O_2 insufflation, e.g., for nasal cannula

D Flow control valves for fresh gas (O_2, Air, N_2O)

E Total flow tube for fresh gas

F Display of the set fresh-gas flows

G Symbols for gas supply (O_2, Air, N_2O) from central supply and gas cylinders

H Display of pressure in the internal breathing system, see page 21

I ***O_2+*** key (O_2 flush)

J Symbols for mains power supply and power supply from internal battery

K Symbol for programmed ***Auto On***

L Current time or time for ***Auto On***

Explanation of the symbols which may be displayed, see page 277.

Functional scope

Device versions, options, and accessories

Some functions are optional and differ from the individual device configuration. Not all device versions or options are available worldwide.

Perseus is intended for use with the options and accessories listed in the associated list of accessories.

Gas delivery

Perseus can deliver mixtures of medical gases to which an anesthetic agent is added by means of a vaporizer:

Usable gas mixtures (electronically controlled gas mixer)

- O_2/Air
- O_2/N_2O (optional)

Usable gas mixtures (mechanically controlled gas mixer)

- O_2/Air/N_2O

Usable anesthetic agents

- Halothane
- Enflurane
- Isoflurane
- Sevoflurane
- Desflurane

Ventilation modes

- Manual / Spontaneous
  On selection: CPAP (optional)
- CPAP / PSV (optional)
- PC - CMV
- PC - BIPAP
- PC - BIPAP / PS (optional)
- PC - APRV (optional)
- VC - CMV
- VC - SIMV
- VC - SIMV / PS (optional)
- VC - CMV / AutoFlow
- VC - SIMV / AutoFlow
- VC - SIMV / PS / AutoFlow (optional)

For a detailed description of the ventilation modes and the additional settings, see page 258.

Additional operation modes

- External fresh-gas outlet (optional)
- Pause (optional)
- Monitoring

Monitoring

Perseus can monitor the following:

- Airway pressure
- Minute volume
- Inspiratory tidal volume
- Inspiratory anesthetic gas concentration
- Inspiratory O_2 concentration
- Inspiratory and expiratory CO_2 concentrations
- Apnea (pressure, flow, and CO_2)
- Occurrence of anesthetic gas mixtures
- Degree of filling of the breathing bag

Display on the screen

Perseus can display the following:

– Waveforms
– Graphical trends
– Numeric trends
– Loops
– Alarm history
– Logbook
– Numeric parameters
– Prediction of the FiO_2 concentration (optional)
– Prediction of the anesthetic gas concentration (optional)
– Pre-configured lists for measured values and set values

Protocoling

Among other things, Perseus can save the following data in a logbook:

– Measured values
– Set values and their changes
– Patient data
– Ventilation modes
– Events (e.g., alarms, confirmed alarms, switch-on time and switch-off time)
– Test results
– Gas consumption and anesthetic agent consumption

Gas supply

Gas supply variants

Gas	Central gas supply	Gas cylinder connection with
O_2	Yes	permanently mounted Dräger pressure reducer (optional) or third-party pressure reducer (via country-specific NIST or DISS connection)
Air		permanently mounted Dräger pressure reducer (optional)
N_2O	Yes (optional)	

Gas scavenging

Gas scavenging is conducted through the integrated anesthetic gas receiving system (AGS). The particle filter it contains filters the ambient air. This ensures the display accuracy of the flow indicator.

Data exchange, interfaces

Serial interfaces

Two serial interfaces, COM 1 and COM 2, are provided for data communication using the Dräger MEDIBUS data protocol.

USB interface

After a Dräger USB flash drive is connected, a USB interface enables, e.g., the following actions:

– Saving screen content as screenshot
– Saving and loading device configurations
– Saving system test results or protocols (partly optional) as text file

Network interface

If a corresponding service contract has been obtained, the Dräger RemoteService function can be executed via a network connection and the hospital network.

Perseus can be connected to the Dräger ServiceConnect Gateway or a DrägerService computer.

If the connected network offers an NTP service, the time on the device can be synchronized with the time on the NTP server.

For more information, see "Connections to IT networks" on page 253.

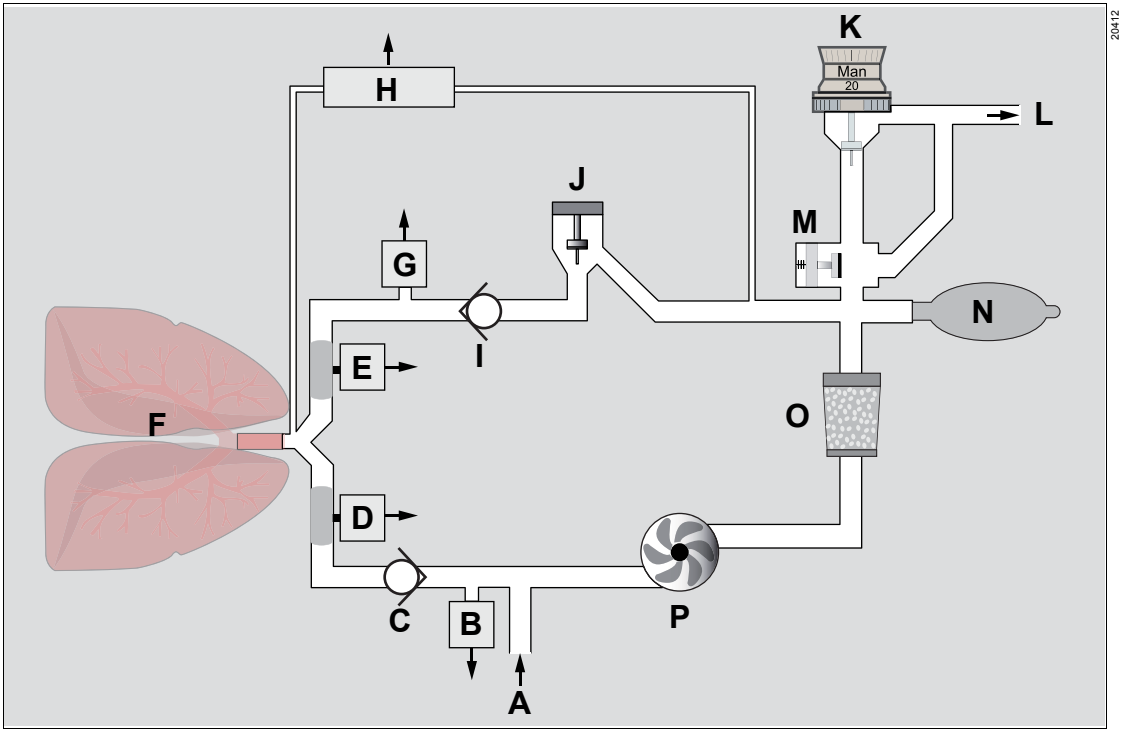
Infinity ID accessory support

– Exchange interval monitoring
– Anti-interchange security for breathing hoses

For more information, see page 269.

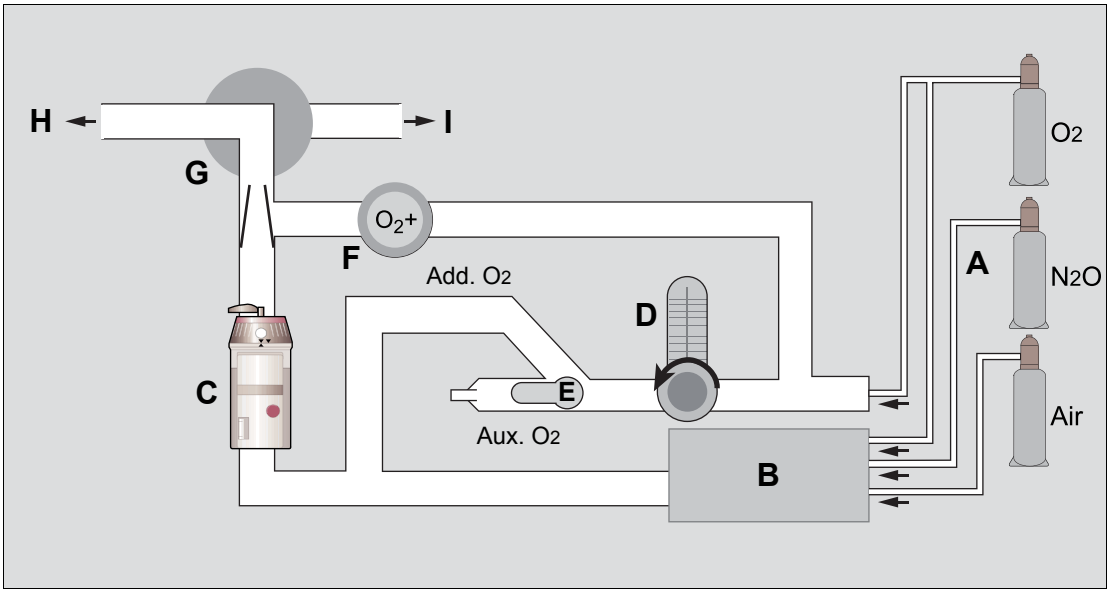
Gas flow plan

Breathing system



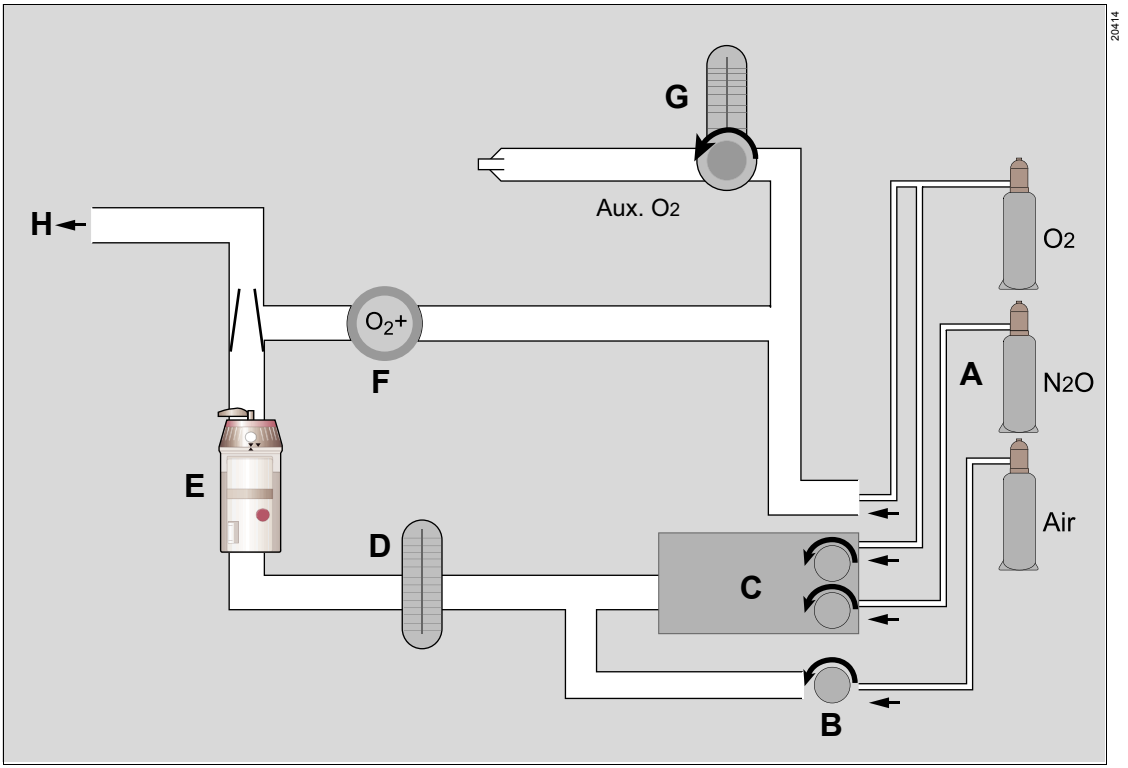
A Gas supply from gas mixer
B Inspiratory pressure measurement
C Inspiratory valve
D Inspiratory flow sensor
E Expiratory flow sensor
F Patient
G Expiratory pressure measurement
H Patient gas measurement module
I Expiratory valve
J PEEP/Pmax valve
K APL valve
L Anesthetic gas receiving system
M Changeover between automatic ventilation and ***Manual / Spontaneous***
N Breathing bag
O CO_2 absorber
P Blower module TurboVent 2

Gas supply (electronically controlled gas mixer)



A Gas supply (central supply or gas cylinders)
B Gas mixer
C Vaporizer
D O_2 flowmeter
E O_2 switch
F O_2 flush
G Switch-over valve
H Breathing system
I ***External fresh-gas outlet*** (optional)

Gas supply (mechanically controlled gas mixer)



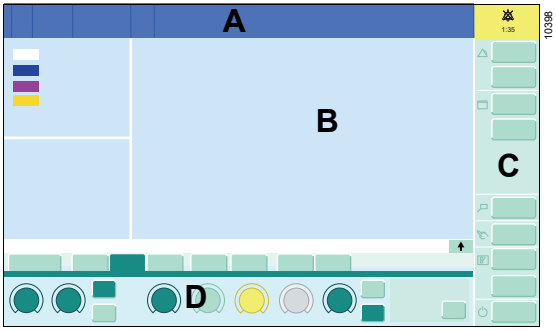
A Gas supply (central supply or gas cylinders)
B Flow control valves
C Minimum O_2 delivery
D Total flow tube
E Vaporizer
F O_2 flush
G O_2 flowmeter
H Breathing system

Operating concept

Screen

Main screen

The main screen displays the most important information regarding anesthesia and ventilation.



A Header bar
The header bar contains the following fields:
- Patient category
- Patient data
- System information (date, time, device name)
- Alarms, messages, and instructions for the user, see page 191
- Information regarding temporarily deactivated alarms

B Monitoring area
The following information is displayed in the monitoring area:
- Gas measurement
- Waveforms
- Parameter fields
- Loops (Pressure-Volume and Flow-Volume)
- Mini-trends
- Virtual flow tubes
- Prediction for anesthetic agents or FiO_2 (optional)

Information regarding configurable fields, see page 173.

C Main menu bar

The main menu bar contains permanently assigned buttons to open dialog windows and activate functions.

These buttons are assigned to various groups. Touching a button opens the corresponding dialog window with the same name or activates the corresponding function.

For more information, see page 282.

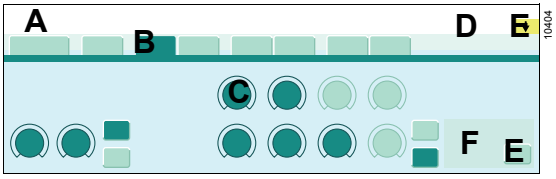
D Therapy bar
The ventilation settings can be adjusted in the therapy bar.

Electronically controlled gas mixer:
- Tabs for selecting ventilation mode
- Therapy controls for ventilation parameters
- Therapy controls for fresh-gas delivery

Mechanically controlled gas mixer:
- Tabs for selecting ventilation mode
- Therapy controls for ventilation parameters

Therapy bar

The illustration shows the expanded therapy bar for the electronically controlled gas mixer:



A Name of active ventilation mode

B Tabs

C Therapy controls

D Message field for information

E Buttons to expand and shrink the therapy bar.

F Field with additional information:
- Additional and calculated set values
- Spontaneous breathing activity of the patient

Start values

Arrows ▼ on the scales of the therapy controls mark the values resulting from the patient data and start settings. The start values can be configured, see page 150.

Linked therapy controls

Certain parameters can be linked to other parameters. If one parameter is changed, the linked parameter is also selected and changed. Among other things, this applies to the adjustment of ventilation pressures, ventilation times or during electronically controlled fresh-gas delivery.

Example: The device can be configured so that a change to the PEEP setting automatically causes a change to Pinsp; as a result, the difference between PEEP and Pinsp and therefore the tidal volume remain constant.

Linking therapy controls, see page 162.

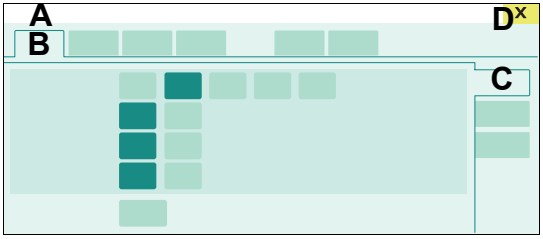
Additional information

Some settable parameters may be limited or be mutually restricted so that certain combinations of therapy settings are not possible, e.g., Ti 6.9 s at RR 100 /min.

If a condition is reached in which a parameter cannot be changed any more, Perseus displays a corresponding message in the message field (D).

Dialog windows

Dialog windows consist of one or several pages which are displayed by touching the corresponding horizontal or vertical tab.



A Dialog window title

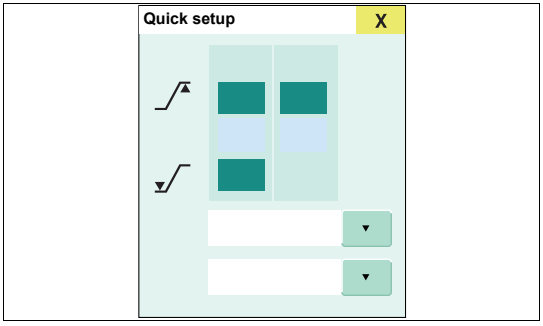
B Horizontal tab to open a page

C Vertical tab to open subordinate structures

D Button for closing the dialog window

Quick setup window

The ***Quick setup*** window is a context-sensitive dialog window. Depending on the selected parameter field or waveform, it contains various setting possibilities, e.g., for limits, scale, or content.



This window can be opened by touching the corresponding parameter field in the monitoring area. In the event of an alarm, the window can be opened automatically, see page 155.

Color concept

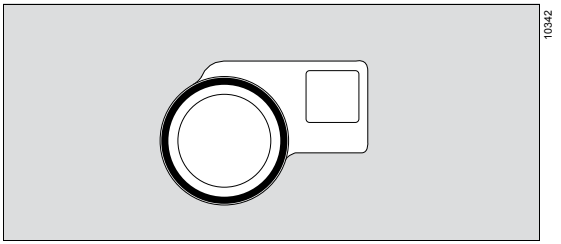
Colors of the control elements

The availability of functions and settings is indicated by certain colors of the therapy controls, of the therapy bar, and in dialog windows.

Therapy controls and buttons

Color	Example	Meaning
Dark green		Available element: function activated
Yellow		Selected element: not yet confirmed with rotary knob
Light green		Available element: function not activated
Dark gray		Operating element: currently not available, function activated
Gray		Unavailable element

Rotary knob



The rotary knob lights with different colors.

Color	Meaning
Blue	Therapy in progress
Orange	A selected function or setting must be confirmed.
Flashing orange	Functions or settings, which are still not confirmed, will be reset within the next 5 seconds.

Waveforms and parameters

Waveforms for mechanical breaths are displayed in the colors specified in the start settings, see page 151.

In the flow waveform, spontaneous breathing and pressure support are displayed in a light brown color.

Measured values whose specified accuracy cannot be maintained are displayed in dark gray.

Color coding for anesthetic agents and medical gases

Standardized color coding complying with ISO 5359 / ISO 32 / ISO 5360 is used to identify anesthetic agents and medical gases.

The colors for O_2, Air, and N_2O are adapted to locally applicable standards.

Day and night colors

There are 3 color schemes that can be selected:

– ***Day light***
– ***Day dark***
– ***Night***

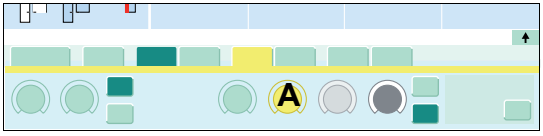
Setting the color schemes, see page 108.

Selecting and setting

Setting of parameters

Each of these settings requires confirmation by pressing the rotary knob.

1 **Select**
Touch the operation element (A). The color turns yellow. For therapy controls, the unit of the parameter to be set is displayed.



2 **Set**
Turn the rotary knob to set the value. For some therapy controls, faster turning raises the increment width.

3 **Confirm**
Press the rotary knob to confirm the value. The color of the operating element changes to green.

In the following chapters of this document, this sequence of action is represented by simplified explanations:

– "Set the value."

Or

– "Touch the button."

Canceling the setting procedure or the change procedure

If a change to a parameter should be canceled (color is still yellow), the following options exist to retain the previous setting:

- Touch the changed parameter again. This resets the selection of and the change to the parameter.
- Select another parameter. This selection resets the change to the other parameter.
- Do not press the rotary knob. After 15 seconds, the change is reset and signal tones sound during the last 5 seconds (timeout).

Activation of buttons

Some buttons are immediately active without additional confirmation. The color immediately turns to dark green.

Examples:

– Selecting a view
– Deactivating the CO_2 alarms.

Operating the flow control valves

The flow control valves of the mechanically controlled gas mixer and the O_2 flowmeter are operated as follows:

Opening the flow control valve

- Turn the flow control valve counterclockwise.

Closing the flow control valve

- Turn the flow control valve clockwise to the end stop.

In the subsequent chapters of this document, the following is represented by simplified explanations:

– "Open the flow control valve."

– "Close the flow control valve."

Remote control for the ceiling-mounted version (combination with Dräger ceiling supply units)

The remote control controls the following functions of the ceiling supply unit:

– Releasing the locking brakes for repositioning

– Height adjustment

The keys on the control panel on the media column of the respective ceiling supply unit can also be used for this purpose.

WARNING

Risk of operating errors and incorrect use

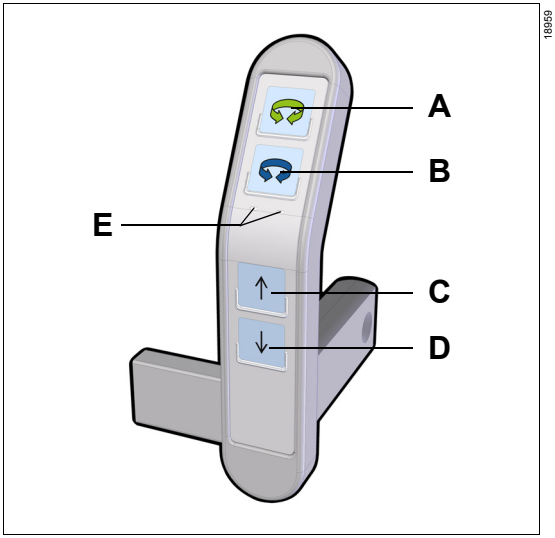
Strictly follow the instructions for use for the ceiling supply unit.

WARNING

Risk of injury or material damage

When the medical device is docked to the ceiling supply unit, unintentional movement of the device may trap persons or objects and, in the case of persons, cause crushing injuries.

- **Take particular care when moving the medical device.**
- **Prevent accidental activation of the remote control, e.g., by objects.**



Releasing the locking brakes

Function of the keys on double-arm ceiling supply units:

A Key (green) to release the brake on the ceiling bearing

B Key (blue) to release the brake on the intermediate bearing

Function of the keys on single-arm ceiling supply units:

A Key (green) has no function.

B Key (blue) to release the brake on the ceiling bearing

- Keep key (A) or (B) pressed while simultaneously moving the arm system and Perseus.

Height adjustment

Prerequisite: Remote control is connected to the ceiling supply unit.

C ***Up arrow*** key for lifting the ceiling supply unit

D ***Down arrow*** key for lowering the ceiling supply unit

- Keep key (C) or (D) pressed and then release it when the ceiling supply unit has reached the desired position.

Status display

E LEDs for status indication

Indication	Meaning
Green LED lights.	The remote control is connected to the ceiling supply unit and is ready for use.

Depending on the software of the ceiling supply unit, the following status conditions may be indicated:

Indication	Meaning
Green LED flashing.	The control system of the ceiling supply unit has a malfunction.
Red LED lights.	The mechanical connection between Perseus and the ceiling supply unit is not working properly.

Safety sensor

The ceiling-mounted version of Perseus is fitted with a safety sensor, see page 19.

The safety sensor is triggered by resistance from below, e.g., as a result of obstacles such as objects or persons. When the safety sensor is triggered, lowering of the ceiling supply unit is stopped.
To continue lowering the ceiling supply unit after the safety sensor has triggered, perform the following steps:

1 Briefly lift the anesthesia machine using the ceiling supply unit.

2 Make sure that no obstacles are present.

Assembly and preparation

Perseus as a ceiling-mounted version

Prerequisites and notes

Docking and undocking

Perseus may only be docked to a ceiling supply unit by service personnel. When docking and undocking, observe the instructions for use of the ceiling supply unit and the service cart.

WARNING

Risk of injury or damage to the device

Safety functions on the Dräger ceiling supply unit can be temporarily disabled with the keyswitch.

After the device has been docked or undocked by service personnel, make sure that the key is not left in the keyswitch but instead is kept in a secure place.

Establishing the cable connection between Perseus and the ceiling supply unit

WARNING

Risk of injury

If the cable connection between Perseus and the ceiling supply unit is not established, the safety sensor will be inoperative.

Before using Perseus, make sure that the cable connection has been established.

- Establish the cable connection between Perseus and the ceiling supply unit.
- Observe the instructions for use of the ceiling supply unit.

Combination with Dräger ceiling supply units

Keyswitch

The ceiling supply unit must be set up for operation with Perseus. Located on the media column there is a keyswitch with the following setting positions:

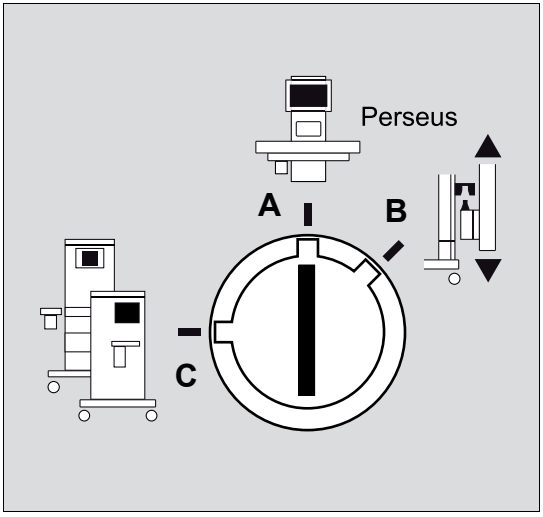
A Operation ofPerseus or Atlan

B Docking and undocking of Perseus or Atlan

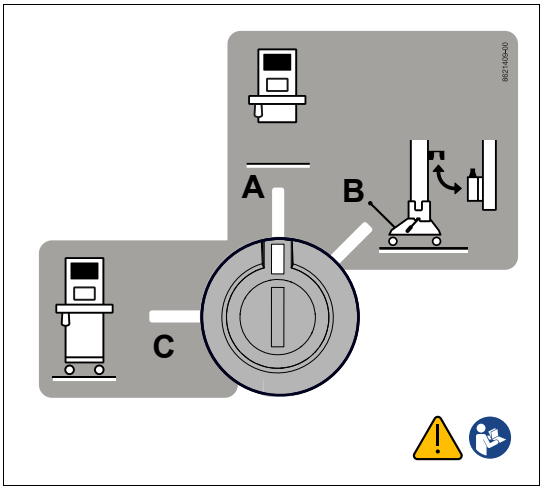
C Docking, undocking, and operation of other Dräger devices

The keyswitch can be marked with 2 different product labels.

Product label 1:



Product label 2:



- Make sure that the keyswitch on the ceiling supply unit is in position (A). Contact service personnel if necessary.

WARNING

Risk of injury

If the ceiling supply unit has not been set up for operation with Perseus or the keyswitch is in an incorrect setting position, the safety sensor will be inoperative.

Only operate Perseus with ceiling supply units that have been set up for Perseus and have the keyswitch in the correct setting position. If necessary, contact service personnel for clarification and specialized service personnel if the keyswitch is faulty.

Combination with other ceiling supply units

Perseus can be used with ceiling supply units from other manufacturers. In this case, a special kit (see list of accessories) is required. The ceiling supply unit must be prepared before Perseus can be mounted.
Dräger will provide the manufacturer of the ceiling supply unit with the document "Perseus A500 anesthesia workstation - ceiling-mounted version - interface description for ceiling supply units". The instructions in this document must be followed during construction.

Flexibility trolley for ceiling-mounted version

The ceiling-mounted version of Perseus can be mounted on a flexibility trolley and can then be used as a trolley version.

When Perseus is mounted on the flexibility trolley, the remote control is inoperative and the safety sensor is disabled.

Information on attaching accessories to Perseus on the flexibility trolley can be found in the chapter "Mounting of accessories".

Mounting of accessories

Information on mounting accessories is described in the assembly instructions.

Safety information

CAUTION

Risk of tipping over

When support arms are used, the end stops must be in perfect condition. Otherwise there is a risk that the support arms will swing out of control.

Check the functional integrity of the support arm end stops after the following activities:
– After fitting accessories
– After transporting the device

Mounting on the sides of the device column

Depending on the arm length, the following maximum weights are permissible:

Arm length	Maximum weight	
	Version with plug-in connections for 2 vaporizers	Version with plug-in connections for 3 vaporizers
215 mm (8.5 in)	20 kg (44 lbs)	13.5 kg (29.8 lbs)
300 mm (11.8 in)	15 kg (33 lbs)	8.5 kg (18.7 lbs)
400 mm (15.7 in)	15 kg (33 lbs)	8.5 kg (18.7 lbs)
570 mm (22.4 in)	15 kg (33 lbs)	8.5 kg (18.7 lbs)

Note the following information in addition:

– If more than one arm is installed on a device side, the weights or arm lengths must be reduced. Do not exceed the maximum tilting moment.
– Maximum weight on the right side of the device: 35 kg (77 lbs)
– Maximum weight on the left side of the device:
  – Versions with plug-in connections for 2 vaporizers: 25 kg (55 lbs)
  – Versions with plug-in connections for 3 vaporizers: 15 kg (33 lbs)
– Maximum installation height: 1400 mm (55.1 in)

The maximum tilting moment is calculated based on the following equation:

Variants with plug-in connections for 2 vaporizers:

One attached component:	P= (A * B) <8500 mm*kg (<738 in*lbs)
Multiple attached components:	P1 + P2 + P... <8500 mm*kg (<738 in*lbs)

Versions with plug-in connections for 3 vaporizers:

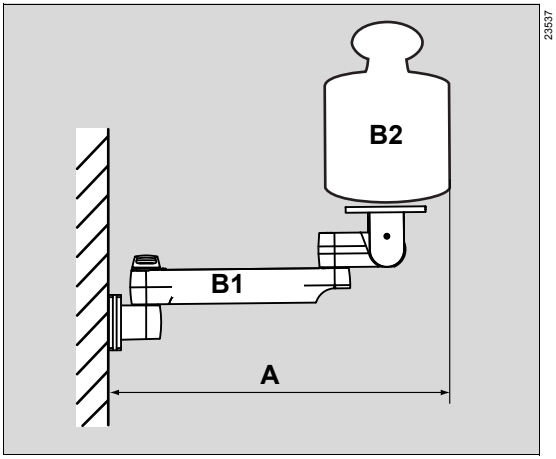
One attached component:	P= (A * B) <5000 mm*kg (<434 in*lbs)
Multiple attached components:	P1 + P2 + P... <5000 mm*kg (<434 in*lbs)

Explanation:

A: Distance (including arm length) to outer edge of the attached component

B: Arm weight (B1) + weight of attached component (B2)

P: Product of distance and weight



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Example of a permissible configuration:

Maximum length	Arm weight	Weight of the attached component
400 mm (15.7 in)	4 kg (8.8 lbs)	5 kg (11 lbs)
300 mm (11.8 in)	3 kg (6.6 lbs)	12 kg (26.5 lbs)

P1= 400 mm * (4 kg + 5 kg) = 3600 mm*kg
(P1=15.7 in * (8.8 lbs + 11 lbs) = 310.9 in*lbs)

P2= 300 mm * (3 kg + 12 kg) = 4500 mm*kg
(P2= 11.8 in * (6.6 lbs + 26.5 lbs) = 390.6 in*lbs)

3600 mm*kg + 4500 mm*kg = 8100 mm*kg
(310.9 in*lbs + 390.6 in*lbs = 701.5 in*lbs)

8100 mm*kg < 8500 mm*kg
(701.5 in*lbs < 738 in*lbs)

If a combination of arms on one device side exceeds the value of 8500 mm*kg (738 in*lbs), tipping stability as per IEC 60601-1 is no longer given. Check the tilting stability.

Mounting on the mounting rails

Depending on the position of the mounting rail, the following weights are permissible:

Position	Maximum weight
On the side of the working surface	10 kg (22 lbs)
At the top on the rear of the device	2.5 kg (5.5 lbs)

WARNING

Risk of tipping over

If the weight of the mounted accessories exceeds the permissible maximum weight, the medical device may tip over.

Observe the maximum weight per arm.

WARNING

Risk of tipping over

If the weight of the accessories is unevenly distributed about the device, the medical device may tip over.

Distribute the weight evenly.

Special features of the ceiling-mounted version

WARNING

Risk of tipping over

If the ceiling-mounted version has been placed on the flexibility trolley or the service cart, the information for fitting the accessories still applies as for the ceiling-mounted version.

- **Pay attention to the maximum weight of the accessories.**
- **Pay attention to the distribution of the weight.**

CAUTION

Risk of injury or material damage

If an accessory is fitted to Perseus which projects below the lowest point of the anesthesia workstation, the accessory may strike objects or persons when the ceiling supply unit is lowered.

Only fit accessories that maintain a distance of at least 12 cm (4.7 in) from the floor when the anesthesia workstation is lowered to its lowest point.

The total weight of all accessory parts that are fastened to standard rails or are placed on the shelves must not exceed 20 kg (44 lbs). Additionally, all product labels regarding the maximum load that are attached to standard rails, shelves, and ceiling supply units must be observed.

CAUTION

Risk of damage to the device

If the maximum load capacity of the ceiling supply unit is exceeded, the load cannot be supported.

Refer to the instructions for use of the ceiling supply unit and observe the maximum load capacity.

WARNING

Risk of injury or material damage

If Perseus is not properly mounted on the flexibility trolley or is being dismounted from it, the trolley may tip over or Perseus may fall off.

The mechanical coupling and uncoupling of Perseus and the flexibility trolley must only be performed by specialized service personnel.

WARNING

Risk of injury or material damage

If Perseus is mounted on a flexibility trolley and additional devices have been attached, it is possible that the maximum load capacity will be exceeded when Perseus is coupled to the ceiling supply unit again.

- **Observe the maximum load capacity of the ceiling supply unit.**
- **Use only those combinations of patient monitoring and accessories that are permissible for the ceiling-mounted version of Perseus.**
- **Observe the maximum weights and tilting moments.**

Before first operation

NOTE

Prior to initial commissioning, the breathing system and blower module TurboVent 2 must be reprocessed. Carry out the reprocessing as described in the reprocessing instructions supplied with the product.

Establishing the mains power supply

The mains voltage must correspond to the voltage range indicated by the rating plate on the rear of the device.

WARNING

Risk due to incorrect mains voltage or missing protective ground

If the device is connected to a power socket with incorrect mains voltage or a power socket without a protective ground, an electric shock may occur.

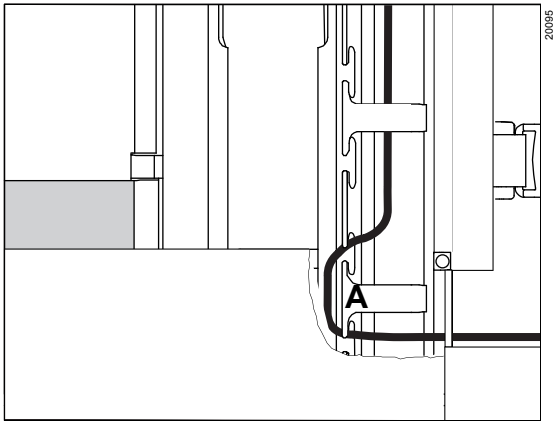
Connect the device only to power sockets with correct mains voltage and a protective ground.

NOTE

The mains plug must be readily accessible so that the power supply to Perseus can be interrupted quickly in the event of a device failure.

1 Connect the power cable to the device and secure it.

2 Lay the power cable in the cable conduit on the right side of the device.



3 Pass the power cable around the lower lug (A) for strain relief.

WARNING

Risk of electrical overload

If the device is connected to additional power socket strips, this may lead to increased leakage current. The leakage current may exceed the permissible values.
- **Do not connect the device to additional power socket strips.**
- **Do not connect additional power socket strips to the auxiliary power sockets under the column covering.**

4 Plug the power cable into the mains power socket on the wall.

5 Check the displays for mains voltage and battery on the status display.

6 Set the main switch to position ***I***, see page 27.

Charging the battery

The internal batteries are automatically charged by the mains power supply.

WARNING

Risk of device malfunction

If the batteries are not sufficiently charged, it may not be possible to maintain operation for long enough if the mains power supply fails.

Before first operation or after storage, charge the batteries for at least 8 hours.

WARNING

Risk due to reduced power supply from the internal battery

Batteries are wear parts. The capacity of the battery diminishes with the period of use.

Check the functional capability of the battery by performing regular inspections.

WARNING

Risk of patient injury

If Perseus is operated or connected to the mains power supply at ambient temperatures above 35 °C (95 °F), the battery cannot be charged properly. The power supply out of the battery may be limited.

Do not expose the device to temperatures above 35 °C (95 °F) on a permanent basis.

Connecting additional devices to the auxiliary power sockets

Perseus is equipped with auxiliary power sockets and circuit breakers or fuses under the column covering, see page 30.

1. Connect the power cable of the additional device to an auxiliary power socket.
2. For Perseus with isolation transformer: Switch on the power for the isolation transformer and the auxiliary power sockets using the isolation transformer switch.

Make sure that the maximum power consumption of additional devices does not exceed permissible values.

WARNING

Risk of fire

Sources of ignition such as electrosurgical equipment, laser surgical equipment, sparks, damaged cables, or damaged plugs can cause fires in combination with oxygen or nitrous oxide. As a result, the patient or user may be at risk.

- **Maintain a distance of at least 200 mm (7.9 in) between electrical connections and components which conduct oxygen and nitrous oxide.**
- **Cables and connections must be sufficiently insulated and must not be damaged. Check cables for damage daily.**
- **Do not allow the device to come into contact with sources of ignition.**

WARNING

Risk of electric shock

The connection of devices to auxiliary power sockets can lead to an increased leakage current. If the protective ground of one of these devices fails, the leakage current may rise above the permissible values. Only connect devices with the permission of the respective manufacturer. Have the leakage current checked by service personnel.

If the permissible value is exceeded, use a mains power socket on a wall instead of the auxiliary power socket of the device.

WARNING

Risk of electric shock and of device malfunction

Any connected devices or device combinations not complying with the requirements in these instructions for use may compromise correct functioning of the medical device.
- **Do not connect high-frequency surgery equipment to the auxiliary power sockets of the anesthesia machine.**
- **Before using the medical device, refer to and strictly comply with the instructions for use of all connected devices and device combinations.**

WARNING

Risk of electrical shock due to penetration of fluids

When the device is connected to the mains power supply, the auxiliary power sockets underneath the column cover receive current.
- **Reattach the column cover correctly after additional devices have been connected to the auxiliary power sockets.**
- **Only use the device with the column cover closed.**

WARNING

Risk of fire

Components such as power supply units which are connected to the auxiliary power sockets on Perseus become warm during operation. If these components are placed under the column cover, they may overheat.

Do not place components that become warm under the column cover.

Establishing potential equalization

Differences in electrical potential between devices can be reduced by potential equalization.

Potential equalization does not replace the protective ground connection.

During operation, the potential equalization connectors must be readily accessible and must be removable without tools.

Connecting the potential equalization cable

1 Connect the potential equalization cable to the potential equalization pin on the device.

2 Connect the potential equalization cable to a potential equalization connector of the hospital (e.g., wall, ceiling supply unit, operating table).

Connecting devices or computers to the data interfaces

This device is equipped with data interfaces such as RS232, LAN, and USB. These interfaces can be used to set up a network in accordance with IEC 60601-1.

WARNING

Risk of electric shock

If USB devices with their own power supply are used, the patient leakage current may increase.
- **Only use USB devices that do not have their own power supply.**
- **Do not connect USB devices by means of charger cables.**

WARNING

Risk of electric shock

Only connect devices to the serial interfaces, or devices and networks to the network interface, which have a maximum nominal voltage of 24 Vdc and meet one of the following standards:
- **– IEC 60950-1 / IEC 62368-1: ungrounded SELV circuits**
- **– IEC 60601-1 (as of 2nd edition): touchable secondary circuits**

WARNING

Risk of electric shock

Connecting devices to the serial data interfaces can lead to an increased leakage current. If the protective ground connector of one of these devices fails, the patient leakage current may rise above the permissible values.
- **– Have the leakage current checked by service personnel.**
- **– If the permissible value is exceeded, disconnect the devices from the serial interfaces.**
- **– Do not touch the connectors of the interfaces and the patient simultaneously.**

WARNING

Risk due to impermissible data connections

The impermissible use of data interfaces can result in new hazards.
- **– Only make connections to data interfaces with permission from the responsible organization (IT representative and the hospital equipment officer).**
- **– Follow the information in the chapter "Connections to IT networks".**

Establishing a data connection

- Connect the device to a network or a computer.

See page 27 for a picture of the interfaces.

Only use the cables from the list of accessories.

For further information on configuring the respective interface, see page 168.

Intrahospital transport

Transport comprises any movement of a medical device that does not serve solely for positioning.

WARNING

Risk of damage to the pressure reducers

If the device collides with an obstacle during transport, the pressure reducers may be damaged.
- **Align the pressure reducers so that they are protected from collisions during transport.**
- **Before transporting, close the valves on the gas cylinders.**

WARNING

Risk of tipping over during transport

The medical device may tip over if handled incorrectly.
- **The medical device may only be moved by people who have the physical ability to do so.**
- **Dräger recommends that the medical device always be transported by two people. This improves maneuverability. When transporting over inclines, around corners, or over thresholds (e.g., through doors or in elevators), make sure that the medical device does not bump against anything. Do not pull the medical device over hoses, cables, or other obstacles lying on the floor.**
- **Do not activate the central brake while the medical device is being moved.**
- **To push the medical device, hold on to the mounting rails on the work surface.**
- **Do not lean against the medical device.**

WARNING

Risk of injury

The device may tip over when it is transported over inclines.

Always move the device using two people.

CAUTION

Risk of tipping over

When support arms are used, the end stops must be in perfect condition. Otherwise there is a risk that the support arms will swing out of control.

Check the functional integrity of the support arm end stops after the following activities:
- After fitting accessories
- After transporting the device

The Perseus ceiling-mounted version can be transported on the service cart for servicing purposes.
Observe the following section: "Transport for maintenance purposes" (page 216)

Increasing the tipping stability during transport

1. Carefully fold the holding arm with any mounted equipment against the device, e.g., patient monitoring, data management systems, and syringe pumps. When folded in, these components should not project beyond the mounting rails if possible.
2. Remove loose objects from the attached arms and the shelves.
3. Remove the heavy objects of more than 8 kg from the mounting rails, e.g., the vaporizers.
4. Clear the writing tray and slide it completely into the device.
5. Position the optional flexible arm for the breathing bag close to the device.
6. Push the optional drawers in.
7. Lock the lockable optional drawers.

Parking the medical device

When parking, always engage the brakes (central brake for front castors, individual wheel brakes at rear), especially on inclined surfaces.

Visual inspection after transport

1. Visually check the medical device for damage, particularly the hoses and cables.
2. Any damage must be repaired by service personnel before using the device.

Establishing the gas supply

WARNING

Risk due to gas supply failure

All gas supplies (central gas supply, gas cylinders) must be correctly connected since otherwise the backup system (gas cylinders) will not be available if gas supply fails.

- **Make sure that all compressed gas hoses are correctly connected to the rear side of the device.**
- **After connecting the gas supply, check for correct function.**
- **Even when the anesthesia machine is connected to the central gas supply, the gas cylinders should remain at the device with valves closed as backup.**

WARNING

Risk of device malfunction

Gas supply (central gas supply or gas cylinders): To avoid damage to devices connected to the gas supply, only use medical gases. In particular, observe the national and international standards regarding the use of medical gases.

WARNING

Risk due to failure of central gas supply

If the central gas supply fails, additional devices such as such devices which are connected to the gas outlets on the device, will no longer be supplied with gas. The device will be supplied from the gas cylinders.

When using such additional devices, always monitor the gas supply independently of the main device.

WARNING

Danger to the patient and user

The device may be damaged if the strain relief of the compressed gas hoses is not used correctly.

Use the strain relief of the compressed gas hoses correctly.

WARNING

Risk of fire

Ignition sources in combination with oxygen can lead to fires.

Do not position oxygen sources in the vicinity of ignition sources, e.g., electrical connectors.

Central gas supply

1 Screw the compressed gas hoses for the central gas supply to the gas inlets on the rear of the device by hand, see page 28.

2 The following applies to the trolley version and to the ceiling-mounted version on the flexibility trolley:
Insert the compressed gas hoses into the strain relief and screw the strain relief tightly into place, see page 24.

3 Connect the compressed gas hoses to the terminal units.

4 Check if all gas supplies are correctly connected. Check if the gases to be supplied are available by observing the status display (see page 31).

Connecting the gas cylinders

WARNING

Risk due to gas supply failure

Using a pressure reducer without the required pressure sensor in place of a Dräger pressure reducer or connecting a central supply hose to the connection for the external gas cylinders will prevent the availability of the gas cylinders from being monitored during the system test and while the system is in use. The back-up functionality may be compromised.

If the gas cylinder monitoring function is not available, the user must employ suitable pressure monitoring conforming to ISO 80601-2-13 which allows the pressure indicator to be read from the user's operating location at the front. Do not connect central supply hoses to the connectors for external gas cylinders.

WARNING

Risk of injury or damage to the device

Defective pressure reducers can cause the connected device to malfunction.
- **Service the pressure reducer regularly. Follow the information in the chapter "Maintenance".**
- **If signs of wear are visible, replace the pressure reducer.**

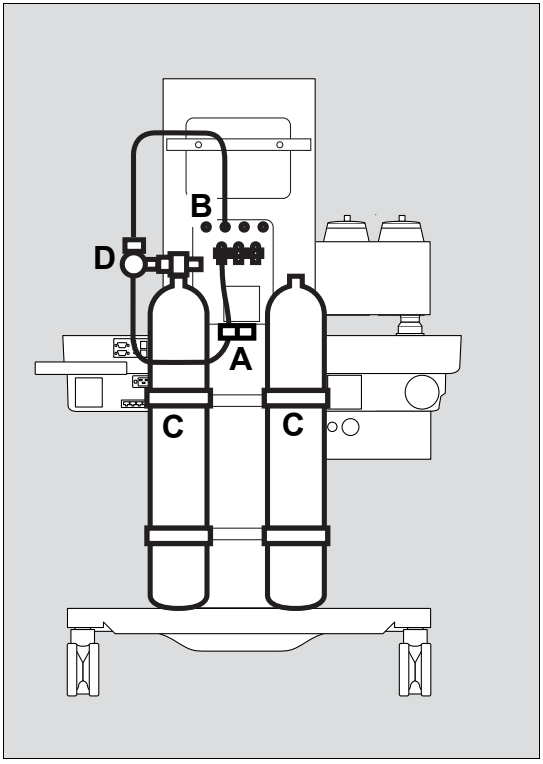
Connections of gas cylinders and pressure reducers must be undamaged as well as free of dust, particles, and grease. Otherwise, there is risk of fire.

When handling pressure reducers, observe the relevant national laws and regulations.

Special features of the ceiling-mounted version

There are no gas cylinder holders on the rear of the device.

Connecting the gas cylinders on variants with screw connections



1 Insert the compressed gas hoses into the strain relief (A) and screw the strain relief tightly into place.

2 Connect the pressure measurement lines to the connectors (B) above the gas inlets.

3 Set the full gas cylinders (C) into the gas cylinder holders and secure them with the hook-and-loop straps.

WARNING

Risk of injury or damage to the device

Pressure reducers have an internal relief valve. If a defect occurs, gas can escape into the ambient air.

Do not block or cover the relief valve.

WARNING

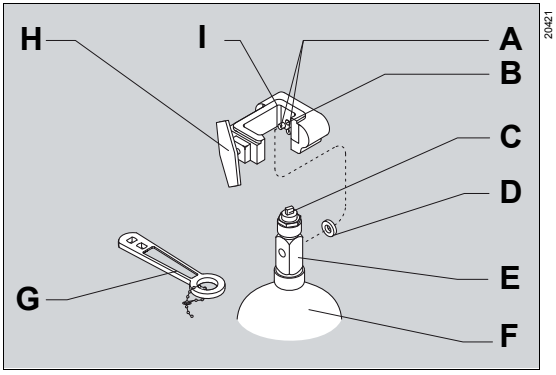
Risk of damage to the device

When connecting the pressure reducers, ensure that they do not protrude beyond the device.

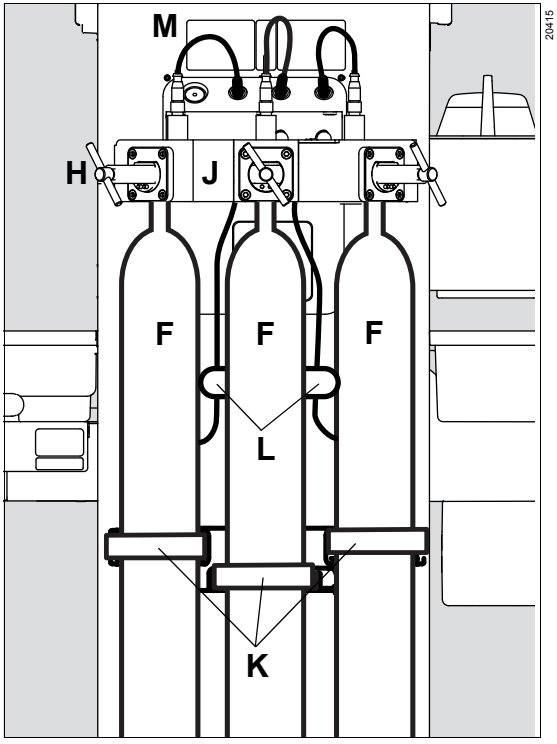
4 Tightly screw the pressure reducers (D) to the gas cylinder valves. The connections must fit each other directly; do not use transition pieces.

Connecting the gas cylinders on variants with pin-index connections

Gas cylinder with pin-index connection:



Rear of device:



Before first use:

1. Insert the compressed gas hoses into the strain relief (L) and screw the strain relief tightly into place.
2. Connect the pressure measurement lines to the connections (M).
3. Two fixing positions are possible for the gas cylinder holder (K). Adjust the position of the gas cylinder holder to the size of the gas cylinder in use. Contact service personnel to do this.
4. Remove the protection cap from the head of the cylinder.

When changing gas cylinders:

5. Remove the old sealing washer (D).
6. Insert a new sealing washer (D) at the cylinder holder (I).
7. Make sure that both pin-index pins (A) are present below the gas inlet (B).
8. Align the gas cylinder (F) so that the pin-index holes on the head of the cylinder (E) are pointing towards the pin-index pins (A) on the cylinder holder (I).
9. Insert the cylinder head (E) of the gas cylinder (F) from below into the cylinder holder (I) of the hanger yoke (J).
10. Allow the pin-index pins (A) to engage in the pin-index holes.
11. Turn the handle (H) on the cylinder holder (I) clockwise. The tip of the threaded retaining pin will then be turned into the visible recess on the cylinder head.
    Make sure that the gas cylinder (F) is suspended vertically.
12. Tighten the handle (H) on the cylinder holder (I).
13. Secure the gas cylinders (F) with hook-and-loop straps (K).

If required, the gas cylinder valve (C) can be opened with the supplied wrench (G).

Handling O_2 gas cylinders

WARNING

Risk of explosion

When pressurized, O_2 is self-igniting in combination with oil or grease.

Do not oil or grease the gas cylinder valve or the pressure reducer of the O_2 cylinder. Do not touch with oily or greasy fingers.

Gas cylinder valves must only be opened and closed slowly. Do not use any tools with the screw connection variants.

Have service personnel repair any leaky or stiff gas cylinder valves.

Fitting the vaporizers

Depending on the configuration, Perseus can be operated with vaporizers which have a Dräger Auto Exclusion plug-in adapter or a Selectatec plug-in adapter. Dräger recommends using only vaporizers that have been tested and are listed in the list of accessories.

WARNING

Risk due to incorrect anesthetic agent delivery

If the vaporizer is filled with the wrong anesthetic agent or if it is not filled sufficiently, incorrect anesthetic gas concentrations or concentrations that are too low can occur as a result.
- **Follow the instructions for use for the vaporizer.**
- **Compare the color coding and labeling on the vaporizer used with the anesthetic agent bottle and the anesthetic agent indicated on the screen.**

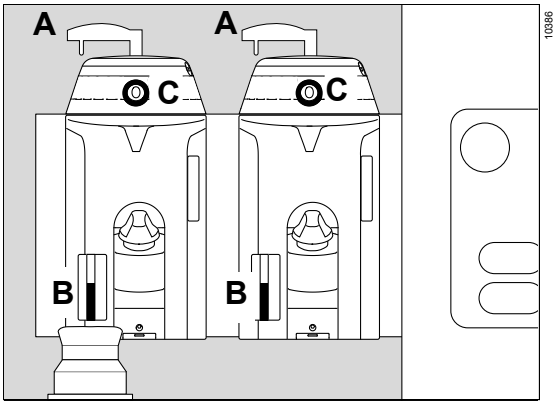
The vaporizers used must conform to the ISO 8835-4 or ISO 80601-2-13 standard. If the internal patient gas measurement module fails, an independent gas measurement system complying with ISO 80601-2-55 must be used.

WARNING

Risk due to improperly mounted vaporizers

Incorrectly mounted vaporizers can cause leakage. This can cause the fresh-gas delivery to be too low or contaminate the ambient air. Patient and user can be endangered.
- **Make sure that the connected vaporizers are hanging vertically and are not jammed by objects leaning on the device.**
- **When using D-Vapor vaporizers, make sure that the power cable is not pinched.**
- **After mounting the vaporizers, perform a leakage test.**

The following illustration shows the Dräger Vapor 3000.



1 Set the vaporizer on the plug-in connector evenly and firmly.

2 Turn the locking lever (A) clockwise. The lever is in the locked position when it is pointing left.

3 Check the vaporizer filling level through the sight glass (B). If necessary, fill the vaporizer.

4 Turn the control dial to position ***0***; the key (C) latches into place.

5 Check the locking:
Set the control dial on a vaporizer to a position other than ***0*** and make sure the other vaporizer remains locked in its ***0*** position. Repeat the test with the other vaporizer.

6 Set both control dials to position ***0***.

When connecting D-Vapor 3000 vaporizers

1 Connect the power cable to an auxiliary power socket beneath the column covering of Perseus.
2 If needed, establish potential equalization.
3 If needed, stow the cable in the cable conduit.

Vapor View option

When combined with the Dräger Vapor 3000 or D-Vapor 3000, the Vapor View option enables the following functions:

– Illumination of control dial and sight glass on vaporizer
– Reading the anesthetic agent type
– Reading the control dial position
– Monitoring the filling level
– Prediction of the anesthetic gas concentration

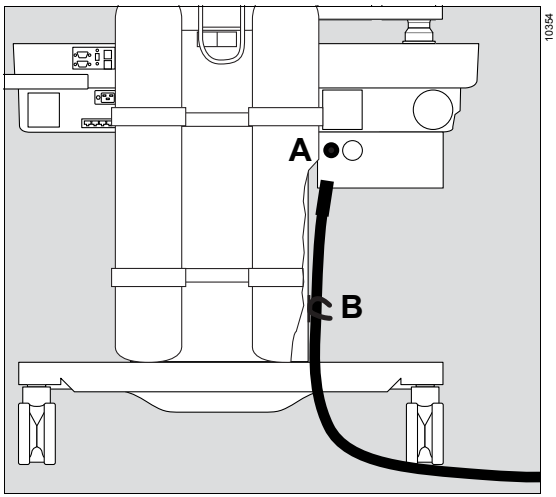
Ensuring the gas scavenging

CAUTION

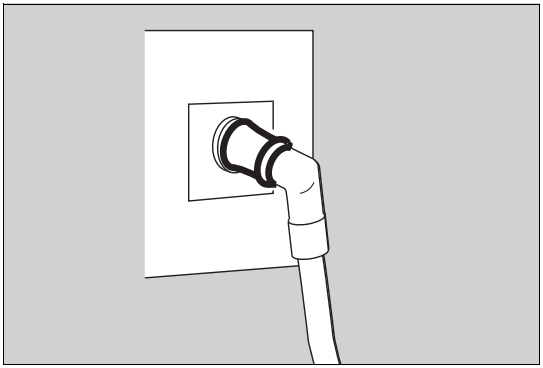
Risk of ambient air contamination

If the anesthetic gas receiving system is not connected to the disposal system, contamination of the ambient air with anesthetic gas may result. Ensure the following:
– The anesthetic gas receiving system is correctly connected to the disposal system.
– The anesthetic gas scavenging system is functioning properly. Check the flow indicator.

Perseus is equipped with an integrated anesthetic gas receiving system (AGS).



1 Connect the scavenging hose to the nozzle (A) on the receiving system.
2 Secure the scavenging hose with the strain relief (B).



3 Connect the probe of the scavenging hose to the terminal unit of the scavenging system.

As an option, the integrated anesthetic gas receiving system can be operated in combination with a control valve. Observe the assembly instructions for the control valve.

Preparation for a day of operations / after reprocessing

Assembling the breathing system

WARNING

Risk of insufficient anesthetic gas concentrations

If the component connections of the breathing system are not leak-tight enough, ambient air may be added to the anesthetic gas mixture.

Make sure that all components of the breathing system are connected tightly.

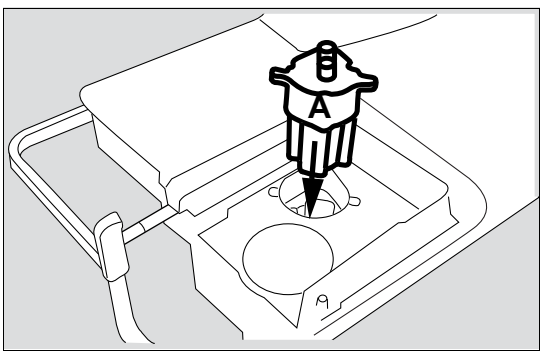
1 Check all parts for damage or wear:
- TurboVent 2 blower module
- APL valve
- Upper housing of the breathing system
- Lower housing of the breathing system
- Valve cages and valve plates
- Flow sensors
- Ports
- Incident flow meshes in the inspiratory limb of the lower part of the breathing system housing and in the expiratory port
- Seals and sealing rings

2 The following parts must be free from deposits:
- Incident flow meshes
- Non-return valves (red and blue)

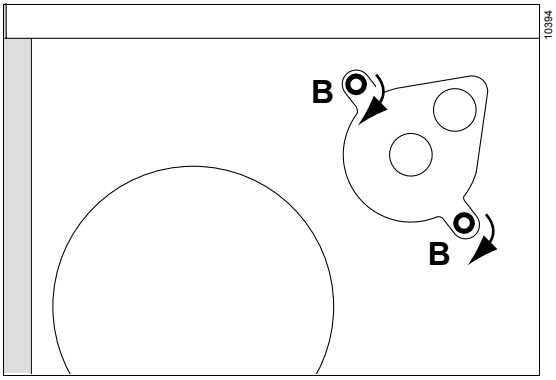
If necessary, remove deposits on the valve plates of the non-return valves with a soft cloth.

If the incident flow meshes are damaged, contact DrägerService.

Installing the TurboVent 2 blower module



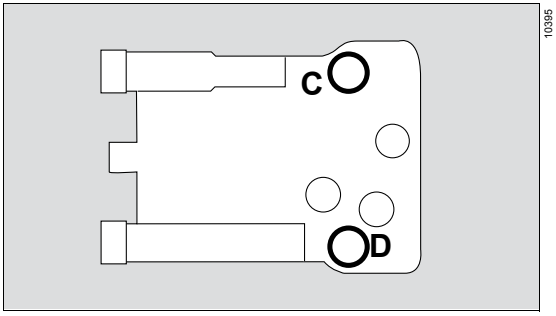
1 Insert the TurboVent 2 blower module (A) into the breathing system mount.



2 Screw in the quick release screws (B) tightly with a clockwise rotation of 90°, e.g., with a coin.

Inserting the non-return valves

There are recesses in the valve cages of the non-return valves. These recesses are arranged differently on the red valve cage (inspiratory valve) than on the blue valve cage (expiratory valve). When inserting the valve cages, these recesses align with the corresponding lugs on the lower housing of the breathing system.

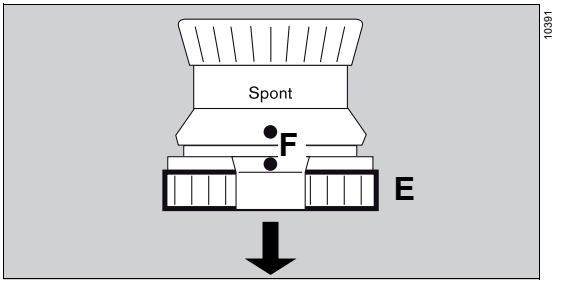


Perform the following steps for non-return valves (C) and (D):

1 Align the valves correctly.

2 Insert the valves.

Fitting the APL valve



1 Set the APL valve vertically on the upper housing of the breathing system.

2 Align the APL valve correctly and screw it tight with the knurled nut (E).

When the breathing system is installed, points (F) must point towards the user.

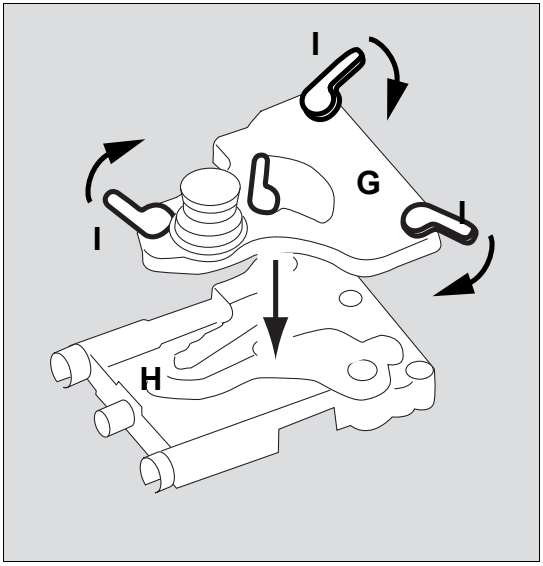
WARNING

Risk of an incorrectly set pressure limitation

If the lower dot marked on the APL valve is not aligned correctly, APL valve settings may be made incorrectly or read off incorrectly.

When fitting, take care that the lower dot is facing the user during operation.

Mounting the upper part of the breathing system housing



1 Place the upper part (G) of the breathing system on the lower part (H).

2 Pay attention to the correct alignment of the three levers (I), see illustration above.

3 Turn the 3 levers (I) by about 120° clockwise.

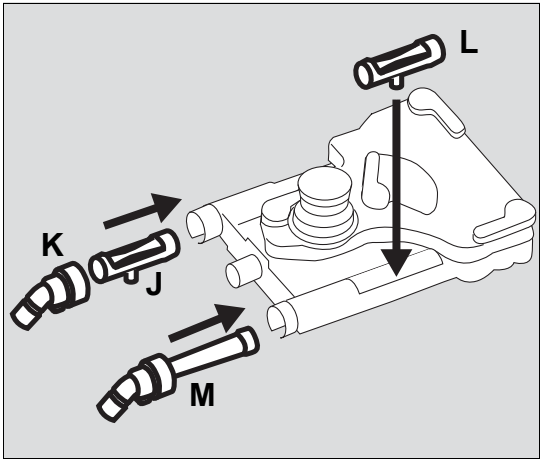
Inserting the flow sensors and the ports

WARNING

Risk of fire

High temperatures arise in the flow sensors, for example, in operation or while calibrating during a system test. Due to the high temperatures, residual vapors of flammable disinfectants (e.g., alcohols) and residues that were not removed during reprocessing may ignite.

- **Ensure particle-free cleaning and disinfection.**
- **After disinfection, allow the flow sensor to air for at least 30 minutes.**
- **Before inserting the flow sensor, check for visible damage and soiling, such as residual mucus, medication aerosols, and particles.**
- **Replace flow sensors when damaged, soiled, or not particle-free.**



1 Insert flow sensors (J) and (L).

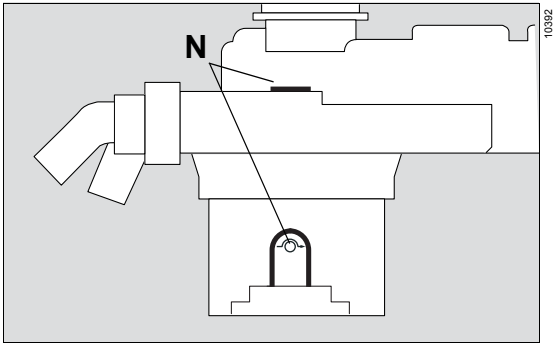
2 Insert the inspiratory port (K) and screw it tight with the knurled nut.

3 Insert in the expiratory port (M) and screw it tight with the knurled nut.

Mounting the CLIC adapter (optional)

The CLIC adapter allows the following disposable CO_2 absorbers to be used:

– Infinity ID CLIC Absorber 800+
– CLIC Absorber 800+
– Infinity ID CLIC Absorber Free
– CLIC Absorber Free



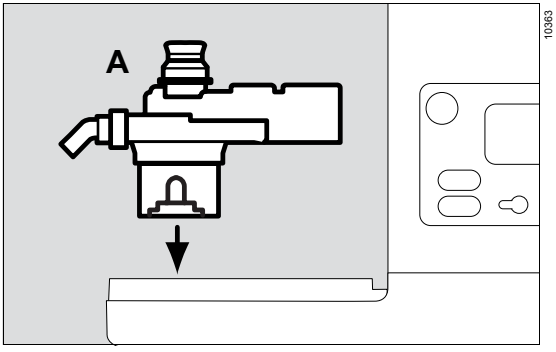
1 Remove the cleaning plate from the adapter.

2 Close the adapter so that it engages.

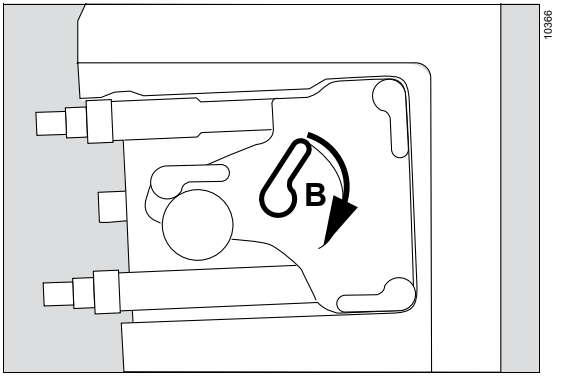
3 Pay attention to the correct orientation of the adapter: The two bypass symbols (N) must align in a vertical line.

4 Screw on the CLIC adapter.

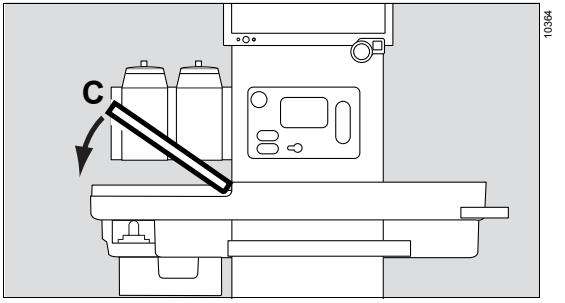
Inserting the breathing system



1 Insert the assembled breathing system (A) vertically into the breathing system mount.



2 Lock the inserted breathing system: Turn the middle lever (B) clockwise about 120°.

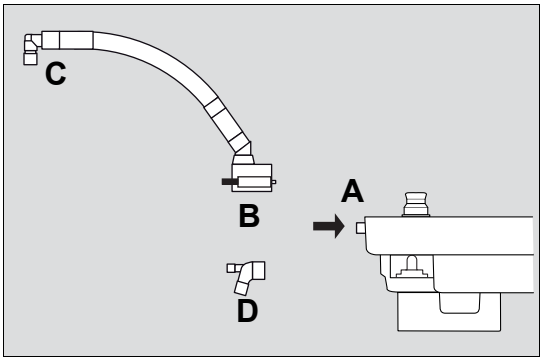


3 Set the breathing system cover (C) into place and click it into position.

Mounting the flexible arm (optional) or the bag elbow

The breathing bag can be mounted either on the flexible arm or, using the bag elbow and a breathing hose, mounted directly on the breathing system.

Mounting the flexible arm



1 Attach the attachment piece of the arm (B) to the connection piece (A) on the breathing system and screw down tightly with the two knurled screws. Check that the arm is fixed securely!

2 Attach the elbow (C) to the end of the flexible arm.

3 Align the flexible arm so that collisions with other mounted assemblies are prevented.

Mounting the bag elbow

- Attach the bag elbow (D) directly to the connection piece on the breathing system.

Selecting and connecting patient-specific accessories

Safety information

WARNING

Risk due to leakage in coaxial breathing circuit

Leakage in the inner hose of a coaxial breathing circuit may result in CO_2 rebreathing or inadequate gas exchange. The device can only detect such leakage if a separate test with a coaxial test adapter is performed.

- **Use a coaxial test adapter to check the inner hose for leakage, see page 125. Next, perform a leakage test on the entire breathing circuit.**
- **Monitor the measured gas concentrations during ventilation.**

NOTE

This device is made without natural rubber latex.

To minimize the risk of exposure to latex, use breathing bags and breathing hoses that are not made with natural rubber latex.

Fitting the breathing circuit and the filters

WARNING

Risk due to particles and dust

In order to protect the patient from particles and dust, a filter must be used between the inspiratory limb of the breathing system and the patient.

Use a patient-side filter or a filter at the inspiratory port.

WARNING

Risk of infection

The breathing system may be contaminated with infectious agents/pathogens. This may have the following causes:

- **No bacteria filters have been used at the Y-piece or at the expiratory port.**
- **The breathing system is being used for the first time.**

Perform the following steps:

- **Reprocess the breathing system before first use.**
- **Reprocess the breathing system if necessary.**
- **Carry out the reprocessing as described in the reprocessing instructions supplied with the product.**
- **To prevent future contamination, use bacteria filters close to the patient.**

Perseus can be used with Infinity ID breathing hoses or conventional breathing hoses. If no leakage test has yet been performed after switching on the system, hose compliance and hose resistance will automatically be adopted when Infinity ID breathing hoses are connected.

WARNING

Risk due to occluded components in the breathing circuit

If filters, hoses, or endotracheal tubes are occluded and sample gas is being taken from between the patient and the occluded component, the sample gas flow may lead immediately to negative pressure in the lungs.

Ensure the following when ventilating pediatric patients and neonates:

- **When fine pored filters are used, do not connect the sample line between the tube and the filter.**
- **When no filters but only an HME is in use, set the alarm limits for *MV low* and *Paw high* to values that are suitable for this patient so that an incipient occlusion can be detected.**

NOTE

When applying tidal volumes in the range of the maximum or minimum values indicated for each patient category, use the smaller breathing bag and the smaller breathing circuit.

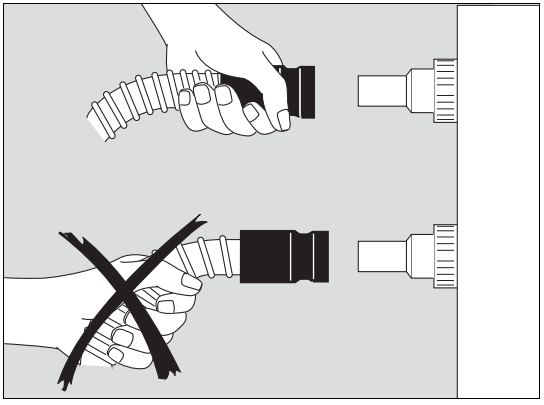
NOTE

In order to make use of the functionality of the Infinity ID breathing circuit, dispense with the inspiratory and expiratory microbial filters and fit the Y-piece with a filter instead. In cases which preclude use of a microbial filter at the Y-piece, the ID functionality of the Infinity ID breathing hoses cannot be used.

1 Select suitable accessories for the respective patient category.

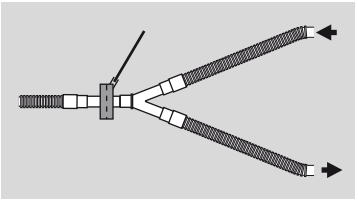
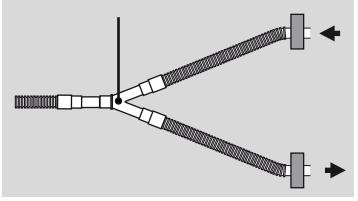
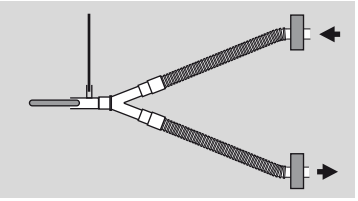
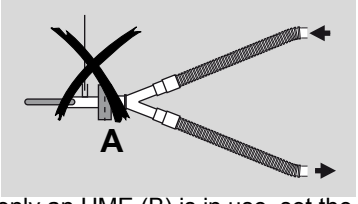
	Adults		**Pediatric patients**	**Neonates**
Tidal volume	>700 mL	301 to 700 mL	50 to 300 mL	<50 mL
Breathing bag	3 L	2 L	1 L	0.5 L
Breathing circuit	Adults		Pediatric	Neonates (or pediatric)
Filter	Filter or HMEF			Use filters with low resistance and compliance.

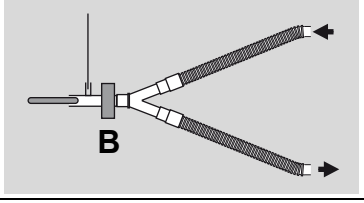
2 Assemble the breathing circuit and connect it to the Y-piece and to the inspiratory and expiratory ports on the breathing system, see page 70, "Table with recommended hose configurations".



When attaching or removing the breathing hoses, always hold them at the connection sleeve and not at the spiral ribbing.

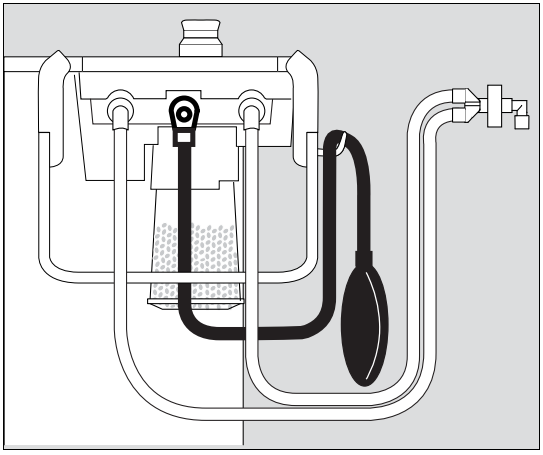
Table with recommended hose configurations

<table>
<tr><th colspan="2">Adults</th><th>Pediatric patients</th><th>Neonates</th></tr>
<tr><td colspan="2">Filter or HMEF with connector for sample line between Y-piece and patient:
 
Or
Filter at inspiratory port and expiratory port, connector for sample line at Y-piece:
  </td><td colspan="2">Filter at inspiratory port and expiratory port, connector for sample line as close to patient as possible:
 
Lateral connectors for the sample line support CO_2 measurement and help to flush the dead space between Y-piece and hose adapter.
If using an expiratory filter is not possible (e.g., due to an intrinsic PEEP due to air trapping), hygienically reprocess the device after use with this patient.
Carry out the reprocessing as described in the reprocessing instructions supplied with the product.</td></tr>
<tr><td colspan="2"></td><td colspan="2">When fine pored filters (A) are used, do not connect the sample line between the tube and the filter:
 

When no filters, but only an HME (B) is in use, set the alarm limits for ***MV low*** and ***Paw high*** to suitable values:
 
</td></tr>
</table>

Breathing bag

Attaching the breathing bag



1 Connect the breathing bag to the breathing bag hose using the connection nozzle. Attach the breathing bag hose to the bag elbow.

WARNING

Risk due to pinched breathing bag

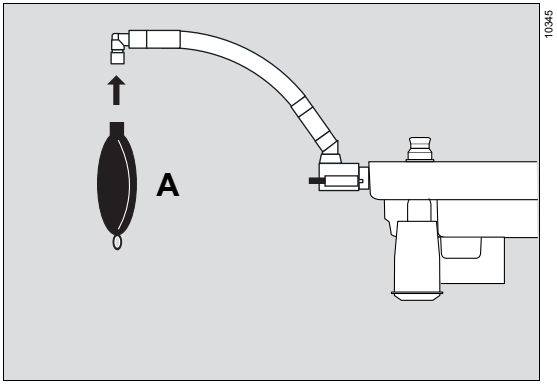
If the breathing bag is pinched, excessive airway pressures or a lack of fresh gas may result.

When attaching and aligning, pay attention to the following:

- **–The breathing bag is visible.**
- **–The breathing bag is not pinched.**
- **–The breathing bag can inflate freely.**

2 Hang the breathing bag over the hose holder so that it hangs vertically downwards.
To allow the bag to unfold freely, place it to the right over the hose holder so that it is not obstructed by cables or breathing hoses.

Attaching the breathing bag to the flexible arm (optional)



1 Attach the breathing bag (A) to the elbow.

Observing resistance and compliance

CAUTION

Risk due to accessory components in breathing circuit

When using additional components or hose configurations which deviate from the standard breathing circuit, the inspiratory and expiratory resistance values may be increased beyond standard requirements.
– When such configurations are used, the user must pay special attention to the measured values.
– After adding or replacing components such as breathing hoses, vaporizers, or soda lime, perform a leak test.

CAUTION

Risk due to misleading data

Exchanging breathing hoses, filters, vaporizers, or soda lime can change the determined leakage values or compliance values of the anesthesia machine and thus affect therapy.
– Perform a leakage test after replacing breathing hoses, particularly flex hoses, vaporizers or soda lime.
– Perform a leakage test after changing the length of flex hoses.

CAUTION

Risk due to changed hose lengths

Changed hose lengths can change resistance and compliance. Especially for neonates, this may cause increased or decreased ventilation volumes.

For neonates in particular, do not use flex hoses.

Accessories or accessory components such as filters affect the dead space, compliance, or resistance of the breathing circuit.

In addition, changes in resistance and compliance arise over time as a result of moisture in the breathing gas or deposits of secretions.

Calculating the resistance of the breathing system and connected accessories

The sum of the resistances in the inspiratory limb must not be less than –6.0 hPa (cmH_2O). The sum of the resistances in the expiratory limb must not exceed 6.0 hPa (cmH_2O).

Only include resistance data in calculations that were taken under the same flow conditions:

Patient category	Flow
Adults	30 L/min
Pediatric patients	15 L/min
Neonates	2.5 L/min

The following formula is used to calculate the resistance (R):

$$R_{Inspiration} = R_{Breathing\ system\_insp} - R_{Insp\ hose} - R_{Breathing\ bag\ hose} - R_{Insp\ filter\ (port)} - R_{Insp\ filter\ (Y\text{-}piece)}$$

$$R_{Expiration} = R_{Breathing\ system\_exp} + R_{Exp\ hose} + R_{Exp\ filter\ (port)} + R_{Exp\ filter\ (Y\text{-}piece)}$$

If necessary, take into consideration additional parts such as water traps or additional hoses. The specifications for the resistance of the breathing system can be found on page 249. The specifications for all other accessories can be found in the respective instructions for use.

In these instructions for use, the specifications for the resistance in the inspiratory limb are regarded as negative values. The resistance values given in the instructions for use for the accessories must therefore be subtracted from the inspiratory resistance of the breathing system.

Example of calculation: Adult hose with filter on Y-piece, no filters on the ports.

	Resistance [hPa (cmH_2O)]			
	Inspiratory at 30 L/min		**Expiratory at 30 L/min**	
Breathing system with reusable CO_2 absorber and MX50115 soda lime dust filter	$R_{Breathing\_system\_insp}$	–0.4	$R_{Breathing\_system\_exp}$	2.6
Breathing hose	- R_{Insp_hose}	0.5	+ R_{Exp_hose}	0.5
Breathing bag hose	- $R_{Breathing\_bag\_hose}$	0.3		
Filter at inspiratory port	- $R_{Insp\_filter(port)}$	0		
Filter at expiratory port			+ $R_{Exp\_filter(port)}$	0
Filter at Y-piece	- $R_{Insp\_filter(Y\text{-}piece)}$	2	+ $R_{Exp\_filter(Y\text{-}piece)}$	2
Result	**$R_{Inspiration}$**	**–3.2**	**$R_{Expiration}$**	**5.1**

Since $R_{Inspiration}$ is greater than –6 hPa (cmH_2O) and $R_{Expiration}$ is less than 6 hPa (cmH_2O), this configuration may be used.

Depending on the breathing circuit in use, the connected accessories, and the resistance of the patient's airways, air trapping (incomplete expiration) may occur with some ventilation settings.

The effects are, for example, a reduced minute volume in pressure-controlled ventilation or higher mean airway and peak pressures in volume-controlled ventilation.

Air trapping can be prevented on the anesthesia machine by the following measures:

– Adjusting the respiratory rate and inspiratory time
– Changing the configuration of breathing hoses and accessories that carry gases during the expiratory time

It is the responsibility of the user of the medical device to select the most suitable remedial measure.

Connecting a non-rebreathing system (optional)

This connection is only possible with the ***External fresh-gas outlet*** option.

WARNING

Insufficient gas supply to the patient

Non-rebreathing systems are only suitable and intended for manual ventilation or spontaneous breathing and may only be connected to the external fresh-gas outlet.

When using a non-rebreathing system, ensure an adequate gas monitoring.

WARNING

Risk of excessively high airway pressure

Without a pressure-relief valve or breathing bag, airway pressure may become too high.

Only connect breathing systems with breathing bags or pressure-relief valves which comply with ISO 8835-2.

Strictly follow the instructions for use for the non-rebreathing system and the transfer hose.

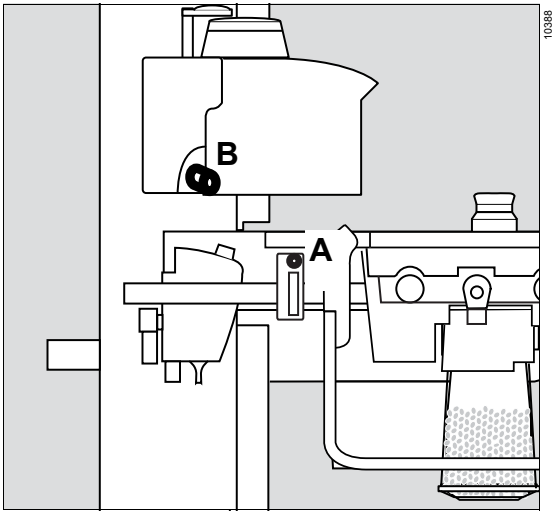
To prevent contaminating the ambient air, connect the gas outlet of the breathing system with the inlet on the AGS. Use transfer hose with overpressure valve complying with ISO 8835-3.

WARNING

Risk of faulty gas delivery

O_2 and CO_2 and any anesthetic gases must also be monitored for non-rebreathing systems.

The sample line must be connected to the elbow and the water trap on the anesthesia machine.



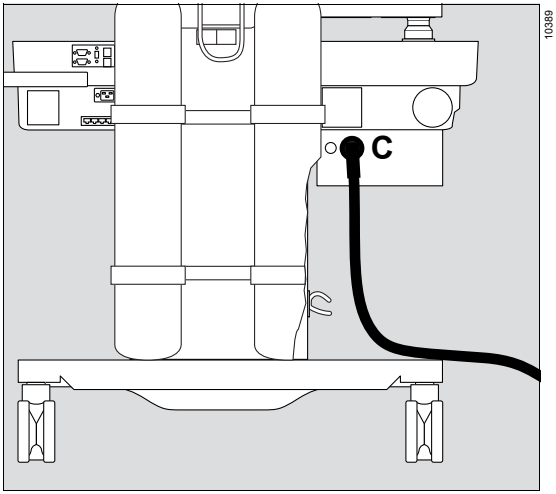
1 Tightly screw the sample line to the elbow of the non-rebreathing system and water trap (A). For elbows without port for sample line:

- Fit the T-piece with T-piece filter directly to the elbow and tightly screw the sample line to the T-piece filter. The part numbers for the T-piece and the T-piece filter are listed in the list of accessories.

Or

- If necessary, use the gas sampling port of the filter on the Y-piece.
  Ensure the correct course of the sample line. Do not use adapters.

2 Connect the fresh-gas hose of the non-rebreathing system to the external fresh-gas outlet (B).



3 Remove the sealing plug from the inlet nozzle (C) of the AGS.

4 Use the transfer hose to connect the non-rebreathing system with the inlet nozzle on the AGS (C).

CAUTION

Risk due to open AGS inlet nozzle

After using a non-rebreathing system, reinsert the sealing plug into the inlet nozzle to prevent contamination of the ambient air with anesthetic gases.

Connecting or exchanging consumables

WARNING

Risk of high inspiratory CO_2 values

Use of soda lime over prolonged periods can increase the inspiratory CO_2 values.

Check the color of the soda lime regularly and exchange as needed, especially if the inspiratory CO_2 value increases unexpectedly.

Single-use CO_2 absorber

- Connect or replace the CLIC absorber or the Infinity ID CLIC absorber.

Strictly observe the instructions for use of the single-use CO_2 absorber.

WARNING

Risk of insufficient ventilation

If the CO_2 absorber is not correctly locked into place, system leakage may occur.

After mounting and replacing, make sure the CO_2 absorber is firmly locked into place.

Reusable CO_2 absorber

As an alternative to single-use CO_2 absorbers, the reusable CO_2 absorber may also be used.

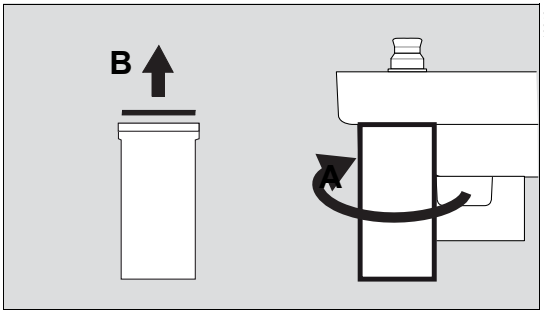
CAUTION

Risk of chemical burns

Soda lime is caustic and is a strong irritant for eyes, skin, and airway.

Handle this absorption material carefully and do not spill it.

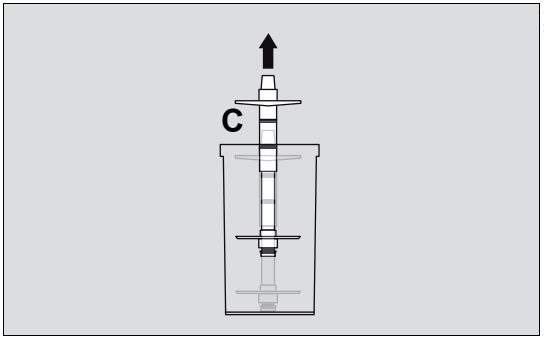
Dismounting and emptying



1 Turn the CO_2 absorber (A) clockwise and remove it from below.

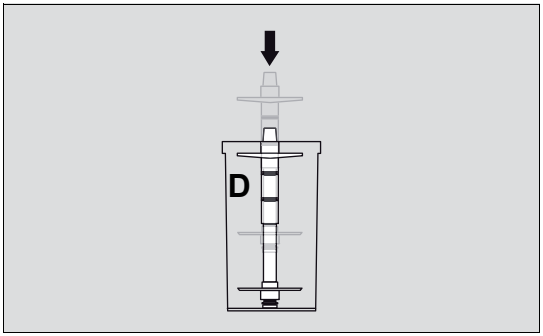
2 Remove and dispose of the disposable dust filter (B).

3 Empty used soda lime and dispose of according to the instructions for use.



4 If it is necessary to clean the absorber insert (C), remove the absorber insert from the absorber container. Leave the inner and outer sealing rings on the absorber insert.

Filling and mounting



1 After any cleaning, push the absorber insert back into the absorber container (D) completely.

2 Fill CO_2 absorber with fresh soda lime to the upper mark.

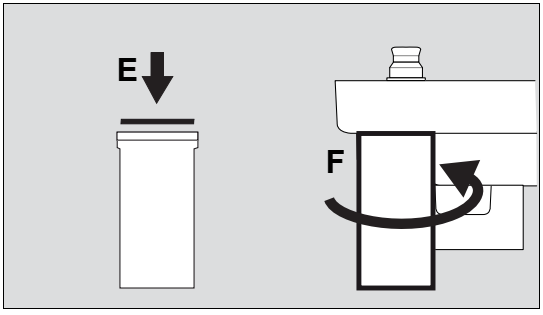
Recommendation: Only use Drägersorb 800 Plus or Drägersorb Free.

WARNING

Risk of hypoventilation and incorrect gas measurement

Reuse of the disposable dust filter can increase the filter resistance and impair the ventilation function of the device.

If the reusable CO_2 absorber is used, always use a disposable dust filter. Replace the disposable dust filter with every change of soda lime.



3 Insert a new disposable dust filter (E). Only use dust filters from the list of accessories. Only use undamaged filters.

4 Insert CO_2 absorber (F) on the breathing system from below and then rotate it counterclockwise as far as it will go.

Strictly observe the instructions for use for Drägersorb 800 Plus or Drägersorb Free soda lime.

Water trap

- Empty or replace the water trap according to its instructions for use.

WARNING

Risk due to full water trap

When the water trap is full, the gas measurement can fail and insufficient ventilation may occur.

Check the water level in the water trap regularly and empty it as necessary.

CAUTION

Risk due to gas measurement failure

Contaminants, damage, or overfilling of the water trap can influence gas measurement.
– Observe the instructions for use of the water trap.
– Always operate the device with a mounted water trap.

WARNING

Risk of infection

The water trap may contain infectious fluid.
– Proceed carefully when emptying and take protective measures if necessary.
– Follow the infection prevention policies and reprocessing regulations of the healthcare facility.

WARNING

Risk of incorrect measured gas values

Blocked water traps or blocked sample lines prevent correct gas measurement. As a result, incorrect gas values may be displayed.
- **Use only Dräger sample lines.**
- **Replace the O-rings of the water trap mount every 2 years.**

CAUTION

Risk of misleading data

Silicon can get into the measuring cuvette and disrupt measurement.

Do not spray the O-rings of the water trap holder with silicon spray.

WARNING

Risk of fire

Silicon or aerosol residues in the water trap can cause fires.

Do not spray the O-rings of the water trap holder with silicon spray.

Connecting the sample line

WARNING

Danger due to incorrectly connected sample line

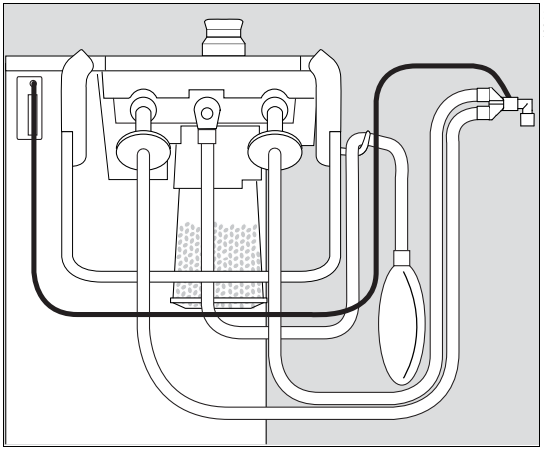
If the sample line is connected to the incorrect connections, e.g., infusion pump connections, liquids instead of sample gas can be sucked in. As a result, the gas measurement will not display correct values.

When attaching the sample line, make sure not to attach it incorrectly.

WARNING

Risk due to leakage from improperly connected or damaged sample line

Connect the sample line correctly, otherwise faulty gas measurements may result.



- Screw on the sample line at the Y-piece, HME filter, or hose adapter and at the water trap. Ensure the correct course of the sample line. Do not use adapters.

WARNING

Risk of incorrect measured gas values

Blocked water traps or blocked sample lines prevent correct gas measurement. As a result, incorrect gas values may be displayed.
- **Use only Dräger sample lines.**
- **Replace the O-rings of the water trap mount every 2 years.**

Getting started

Turning on Perseus

Prerequisite: The device has been reprocessed and assembled to be ready for operation in accordance with the reprocessing instructions (see page 46).

CAUTION

Risk of device malfunction

Condensation may form when the device is moved from a cold storage location to a warm environment.

To prevent condensate formation and resulting failures of electrical components, do not turn on the device after abrupt temperature changes for 1 to 2 hours.

WARNING

Risk of explosion and fire

Do not set the device into operation if oxygen leakage is suspected in the medical device or its vicinity.

Stop all oxygen supplies and contact service personnel.

WARNING

Risk due to unbraked device

An unbraked device may accidentally move during operation.

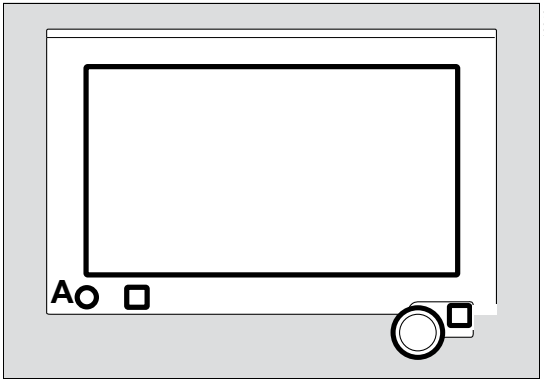
Prevent this by actuating the central brake or the castor brakes and check their function.

WARNING

Risk of device malfunction

Some safety systems are only checked during start-up.

Restart Perseus at least once per month to maintain proper functionality.



1 Connect the device to the mains power supply.

2 Set the main switch to position ***I***.

3 Turn on Perseus: Press the ⏻ (A) button.

If the battery charge is sufficient, Perseus will also start without the power plug being plugged in as long as the main switch is not set to position ***0***.

When the starting procedure is completed, the ***Standby*** page is displayed.

Checking the device configuration

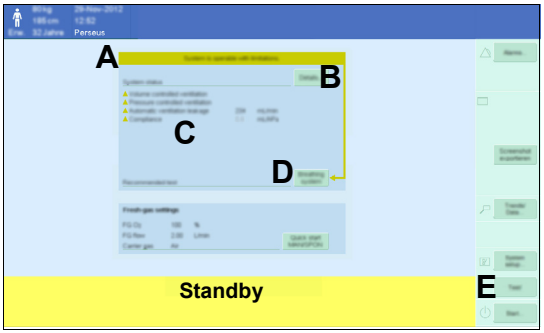
Perseus can be customized to suit the requirements of the user. Settings for the following features are possible:

– Start settings for the ventilation
– Alarm limits
– General device behavior

For further information about the configuration, see page148.

Checking the operational readiness

On the ***Standby*** page, the readiness for operation resulting from the system test is indicated by color (A).



Color	Meaning
Green	***System is fully operational.***
Yellow	***System is operational with limitations.*** There are functional restrictions. Take further measures to ensure patient safety (e.g., external monitoring).
Red	***System is not operational.*** Call service personnel.
Gray	The system has not been tested.

If the system is not fully operational, the most important irregularities (C) are displayed and a specific test (D) is recommended as a remedy where possible.

Additionally, the current system leakage is displayed in area (C).

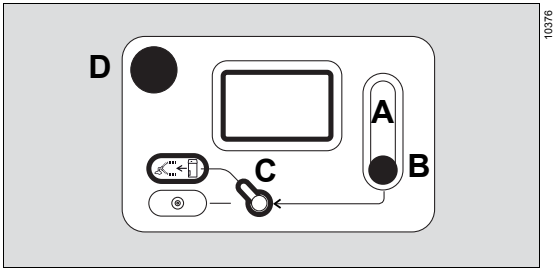
To view details regarding the status of the system, touch the ***Details...*** button (B) or the ***Tests...*** button (E), see page 121.

Dräger recommends performing the system test every 24 hours. Otherwise, it will not be possible to ensure that the device is functional.

Emergency start-up

Electronically controlled gas mixer

1 Adjust the APL valve.



2 Set O_2 switch (C) to the ***Add. O_2*** position.

3 Open the flow control valve (B) and set the desired O_2 flow. If necessary, press the ***O_2+*** (D) key to quickly fill the breathing bag.

4 Monitor the set flow on the O_2 flowmeter (A).

5 Set the anesthetic gas concentration at the vaporizer.

6 Manually ventilate the patient.

7 Switch on the device.

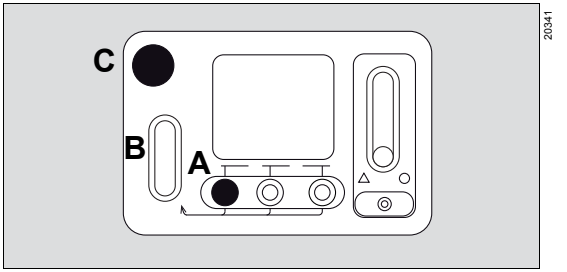
8 As soon as the ***Standby*** page is displayed, start the therapy, see page 87.

9 Set the O_2 switch (C) to ***Aux. O_2*** to stop the increased fresh-gas flow.

10 Close the flow control valve (B).

Mechanically controlled gas mixer

1 Adjust the APL valve.



2 Open the flow control valve (A) and set the desired O_2 flow. If required, press the ***O_2+*** key (C) to fill the breathing bag quickly.

3 Monitor the set flow on the total flow tube (B).

4 Set the anesthetic gas concentration at the vaporizer.

5 Manually ventilate the patient.

6 Switch on the device.

7 As soon as the ***Standby*** page is displayed, start the therapy, see page 87.

Operation

Safety information

WARNING

Risk of strangulation

Negligent placement of hoses, cables, sample lines, and similar device components can endanger the patient.

Use particular caution when establishing connections to the patient.

CAUTION

Risk due to falsified gas measurement values and failure of the gas measurement

Aerosols can damage the patient gas measurement module and the membrane of the water trap. Propellants can falsify the gas measurement values.

Do not use medication nebulizers.

WARNING

Risk of faulty gas delivery

O_2 and CO_2 and anesthetic gases must be monitored every time breathing systems are used.

Ensure adequate gas monitoring.

WARNING

Risk of misinterpretation

Misdiagnosis or misinterpretation of the measured values or other parameters can endanger the patient.

Do not make therapeutic decisions based solely on individual measured values and monitoring parameters. Therapeutic decisions must be made solely by the user.

CAUTION

Risk of injury

Looking directly into the LEDs of the workplace illumination and of the illumination unit on the vaporizer plug-in connection can cause damage to the retina.

Do not look directly into the LEDs. Make sure that the patient is not dazzled by the LEDs.

CAUTION

Risk due to unsuitable illumination

If illumination without neutral colors is used during the medical examination of the patient, this may result in, e.g., misinterpretation of skin coloring.

– Do not use the device's workplace light during examinations.
– For examinations, use an examination light conforming to IEC 60601-2-41.

WARNING

Risk of misinterpretation

Measured gas values and waveforms such as the CO_2 waveform are determined on the basis of the composition of the sample gas. The composition of the sample gas is affected by many factors and their interactions, especially in patients with low body weight. This may result in biased measurements or waveforms.

The following factors affect the sample gas measurement:

- **Dead space**
- **Patient resistance, patient compliance**
- **Type of surgical procedure**
- **Gas sampling site**
- **Breathing circuit, filter, sample line, tube**
- **Ventilation settings and the resulting ventilation**
- **Leakage**
- **Spontaneous breathing**
- **Cardiogenic oscillations**

Observe the following:

- **Do not make therapeutic decisions based solely on individual measured values or parameters.**
- **If possible, minimize the effects of the factors described above, e.g., take the sample gas from a gas sampling site close to the patient, minimize leakage, adjust the ventilation settings.**

CAUTION

Danger due to inaccurate gas measurement values

Due to the technical characteristics of gas measurements, the measured gas values might be inaccurate at high respiratory rates and at certain I:E ratios.

Observe the technical data.

WARNING

Risk of infection

Disease-causing germs can be transmitted between patients via the circuit plug. If a used Y-piece or filter is fitted to the circuit plug, and then later a reprocessed component is fitted (e.g., during a leakage test), the new component may become contaminated.

Do not fit hoses that have already been used and that have attached filters or Y-pieces to the circuit plug. Instead, hang them over the handle on the left-hand side of the device.

WARNING

Risk due to occluded components in the breathing circuit

If filters, hoses, or endotracheal tubes are occluded and sample gas is being taken from between the patient and the occluded component, the sample gas flow may lead immediately to negative pressure in the lungs.

Ensure the following when ventilating pediatric patients and neonates:

- **When fine pored filters are used, do not connect the sample line between the tube and the filter.**
- **When no filters but only an HME is in use, set the alarm limits for *MV low* and *Paw high* to values that are suitable for this patient so that an incipient occlusion can be detected.**

CAUTION

Danger from an unintentional therapy start

If Perseus is in the Standby mode and the flow control valves are open, ventilation starts in the Man / Spon mode.

Take care that this does not happen unintentionally.

WARNING

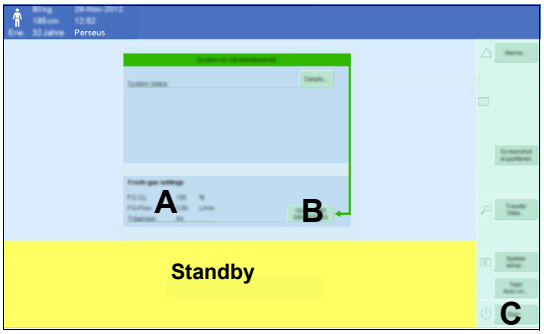
Risk of fire

Components such as power supply units that heat up are unable to cool down in enclosed storage locations and may cause a fire.

Do not keep components that heat up in the drawers or under the column cover.

Starting the therapy

Prerequisite: The device is in ***Standby*** mode.



There are 2 possibilities for starting the therapy:

Quick start with *Manual / Spontaneous* mode

- To perform a quick start with the displayed fresh-gas settings (A), touch the ***Quick start Man/Spon*** button (B).

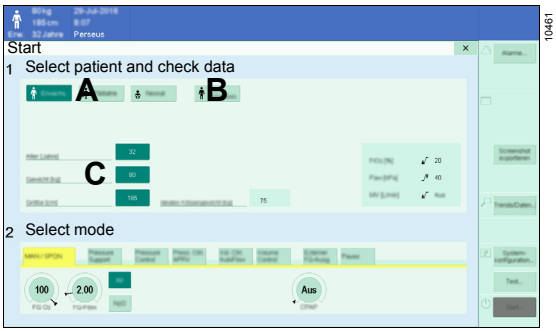
Or

Normal start with customized settings

1 Touch the ***Start...*** button (C).

2 Adjust the patient data and ventilation settings.

Loading the patient data



There are two possibilities for loading patient data:

A Defining a new case

B Continuing a case

Depending on the selection, the patient data in area (C), e.g., weight or age, are filled in automatically.

Defining a new case

Select to start the therapy for a new patient:

- Depending on the patient category needed, touch the ***New adult***, ***New pediatric***, or ***New neonate*** button (A).

The ventilation parameters and alarm limits are set to the configured start settings, see page 150. The set value for ***Ti*** is set automatically based on ***RR*** so that the ***I:E*** ratio set in the start settings are the result, see 158.

Continuing a case

Select to start the therapy with the settings of the last case:

- Touch the ***Continue case*** button (B).

The ventilation parameters and alarm limits are adopted from the preceding case.

After turning on the device, no previous case is available. Perseus then starts with the configured start settings.

Checking the patient data

WARNING

Risk due to incorrect settings

Different standard alarm limits or therapy settings might be configured for medical devices within the same area. The user must observe the following:

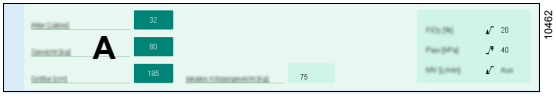
- **Make sure that the set values are suitable for the patient.**
- **Make sure that the alarm system is neither rendered useless by setting extreme values for the alarm limits nor deactivated by switching off the alarms.**
- **Check the start settings for alarms and alarm settings each time the ventilation mode is changed.**
- **Only switch off alarms if the safety of the patient is not affected.**

CAUTION

Risk due to incorrect setting for patient age

Incorrectly setting the patient age can lead to inappropriate xMAC values and therefore to an inappropriate anesthetic gas delivery.

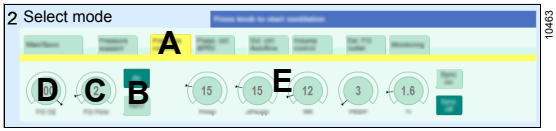
Always set patient age correctly.



- Adjust patient data (A) if necessary.

When these data are adjusted, appropriate therapy settings are suggested e.g., for tidal volume, respiratory rate, alarm limits. For more information, see page 269.

Setting and starting the therapy



1 Select a ventilation mode (A) as needed.

The following ventilation modes are available:

- ***Man / Spon***
- ***PSV*** (optional)
- ***PC***
- ***APRV*** (optional)
- ***VC - AF***
- ***VC***

The following operation modes are also available:

- ***Ext. FGO*** (optional)
- ***Pause***

For additional information about the ventilation modes, see page 258.

2 Set the fresh-gas delivery.

Perseus is equipped with a minimum O_2 delivery that ensures that a minimum quantity of oxygen is delivered, see page 268.

Electronically controlled gas mixer:

- Select the carrier gas (B).
  Set the O_2 concentration (D) and fresh-gas flow (C).

To prevent the soda lime from drying out at an increased rate, the electronically controlled gas mixer limits the setting range for the fresh-gas flow ***FG flow***. This restriction depends on the set tidal volume ***VT*** and the set respiratory rate ***RR***.

Mechanically controlled gas mixer:

WARNING

Risk of incorrect gas delivery

Use the flow values on the status display as the primary source of information. Always compare these values with the values on the total flow tube.

Only use the total flow tube as the primary source of information in the following cases:
– The status display has failed.
– The values on the status display do not match the values on the total flow tube.

- Use the flow control valves to adjust the fresh-gas flows.
  Use the total flow tube to check the total flow set, see page 32.

CAUTION

Risk of patient injury

Unsuitable soda lime can result in disintegration products from the anesthesia gases.

Use suitable soda lime such as Drägersorb Free.

WARNING

Risk of patient injury

Under certain conditions, acetone can accumulate in the body in patients under anesthesia. As a result, the patient could be put at risk.

Do not perform low-flow anesthesia on patients with ketoacidosis or patients under the influence of alcohol.

CAUTION

Risk of patient injury

The use of minimum-flow or low-flow settings can lead to accumulation of metabolic by-products in the breathing system.

When using minimum-flow setings or low-flow settings follow the recommendations of professional societies (e.g., regular flushing of the breathing system).

3 Adjust the ventilation settings (E).

4 To start therapy, press the rotary knob. A signal tone is emitted when therapy starts.

Useful tips

Quick start with *Man* / *Spon* mode

Electronically controlled gas mixer	Mechanically controlled gas mixer
● In the ***Standby*** mode, touch ***Quick start Man/Spon***.	● Open the flow control valves for fresh gas.

Opening the start dialog in *Standby* mode

- Touch the screen in the monitoring area.

Or

- Squeeze the breathing bag.

Starting when time is limited

When time is limited, it is possible to bypass the adjustment of the patient data and the ventilation settings. Start the therapy as follows:

1 Touch the screen.

2 Check the displayed start values.

3 To start therapy, press the rotary knob.

4 Adjust the patient data and ventilation settings as soon as possible.

Adjusting the therapy

Setting the APL valve

The pressure limitation set with the APL valve only takes effect during manual ventilation or spontaneous breathing.

WARNING

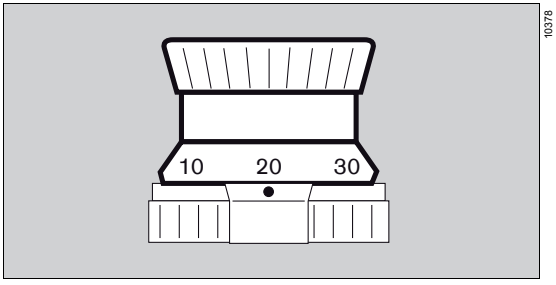
Risk of excessively high airway pressures

If the ventilator fails, the device switches into the *Man / Spon* ventilation mode.

The APL valve should also be set to a pressure limitation value suitable for the patient when using automatic ventilation modes. If the ventilator fails, ventilate the patient manually.

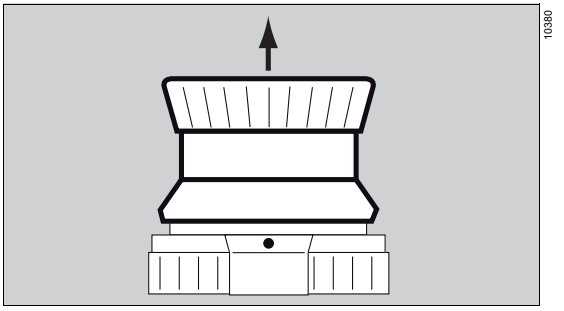
- The selection between manual ventilation (***Man***) and spontaneous breathing (***Spont***) is made at the APL pressure limitation valve, see page 18.

Manual ventilation



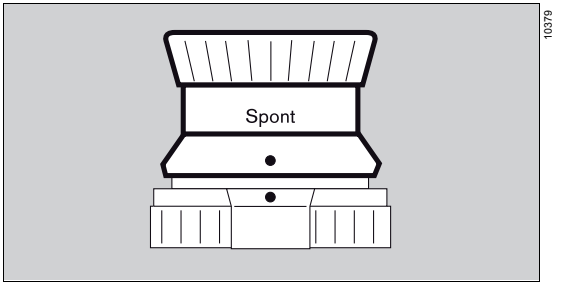
- Set the APL valve to the desired maximum airway pressure.

The patient can be manually ventilated with the breathing bag. The pressure is limited by the set value.



In the ***Manual / Spontaneous*** mode, lifting the valve relieves pressure from the breathing system.

Spontaneous breathing



- Turn the APL valve counterclockwise as far as it will go.

The points are vertically aligned and the valve is raised.

The pressure limitation is canceled and the valve is open for free spontaneous breathing.

Adjusting the fresh-gas flow

When a very high fresh-gas flow is reduced to a very low value, the gas concentration in the entire breathing system is optimized and changed as smoothly as possible.

Electronically controlled gas mixer

The setting range for the fresh-gas flow is temporarily restricted to values greater than 3 L/min. After the new fresh-gas flow is confirmed, it is not altered abruptly but, rather, continuously over a few seconds until the new target value is reached. After the reduced flow is reached, the full setting range is available once more, so that values below 3 L/min can also be set.

Mechanically controlled gas mixer

After a sharp reduction of the fresh-gas flow, the internal gas recirculation is temporarily ramped up without significantly altering the ventilation. This may result in visible effects in the displayed waveforms.
This is indicated in the waveforms by the messages ***Preparing low flow phase*** and ***Measurement temporarily inaccurate***.

Using the O_2 flush

The O_2 flush is used for flushing and quickly filling the breathing system and breathing bag with oxygen. The vaporizers are bypassed for this.

- Press the ***O_2+*** key. O_2 flows for as long as the key is held down.

The gas concentration can change abruptly when the O_2 flush is used.

Using the O_2 flush has the following effects:

- In manual ventilation, pressing the O_2 flush results in a rapid rise in pressure to the APL level.
- In automatic ventilation, permanently pressing the O_2 flush may result in a slight rise of the PEEP level. However, this rise has no effect on the peak pressure.

Using the vaporizer

WARNING

Risk due to incorrect anesthetic agent delivery

If the vaporizer is filled with the wrong anesthetic agent or if it is not filled sufficiently, incorrect anesthetic gas concentrations or concentrations that are too low can occur as a result.

- **Follow the instructions for use for the vaporizer.**
- **Compare the color coding and labeling on the vaporizer used with the anesthetic agent bottle and the anesthetic agent indicated on the screen.**

- Operate the vaporizer according to its instructions for use.

When the Vapor View option is installed, the control dial and sight glass on the Dräger Vapor 3000 and D-Vapor 3000 are illuminated:

Control dial position	Illumination
T to <***0***	Off
0	Medium
>***0***	Bright

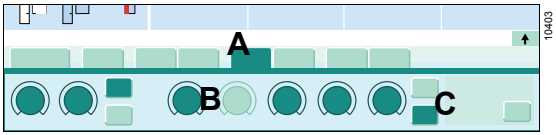
WARNING

Risk due to faulty Vapor View option

If the Vapor View option is faulty, the following information could be displayed incorrectly on the screen: Anesthetic gas type, filling level, control dial position, prediction of anesthetic gas concentration

- **Do not rely solely on the display on the screen, but always pay attention to the settings and values at the vaporizer as well.**
- **Do not make therapy decisions based solely on a displayed prediction.**

Changing the ventilation mode



1 In the therapy bar, touch the tab (A) of the new ventilation mode.

When the ventilation mode is changed, the start settings are adopted from the parameters of the previous ventilation mode and the patient data, or they are sensibly derived.

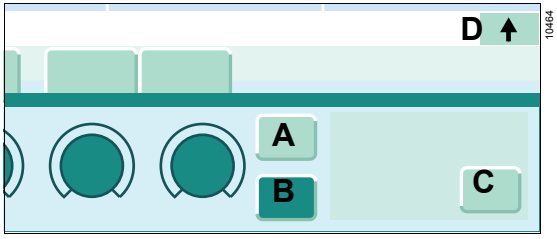
In addition, the alarm settings are adjusted to appropriate values, see page 143.

2 Adjust the therapy as needed with the therapy controls (B) or buttons (C).

3 Activate the ventilation mode by pressing the rotary knob. A signal tone is emitted when the mode is changed.

Synchronizing the breaths

Turning on the synchronization activates the set pressure support, for example, see page 258.



1 Turn the synchronization on or off with the buttons ***Sync. on*** (A) or ***Sync. off*** (B).

2 As needed, the expanded therapy bar can be displayed using the ***More*** buttons (C) or (D); here, additional parameters (***Trigger***, ***ΔPsupp***, etc.) can be adapted to the patient.

WARNING

Risk of insufficient ventilation

In ventilation modes in which breaths are to be triggered only by the patient (e.g., *PSV*), adverse settings or sensor failure can lead to insufficient ventilation.

Set the respiratory rate to a suitable value so that a minimum ventilation of the patient is maintained.

WARNING

Risk of insufficient ventilation

The display of the spontaneous minute volume *MVspon* shows the volume that results from the patient's own breathing and machine support. If machine support is triggered by small tidal volumes of the patient, a large part of *MVspon* is achieved by machine support and not by the patient's own breathing. In this case, *MVspon* shows a high value although the actual spontaneous minute volume is very low.

Do not base therapy decisions solely on the value displayed for *MVspon*.

Ventilating pediatric patients and neonates

For tidal volumes below 300 mL:

- Use suitable ventilation accessories, see chapter "Selecting and connecting patient-specific accessories" starting on page 67.

For tidal volumes below 20 mL or when using unblocked tubes:

- Use pressure-controlled ventilation, see table "Ventilation modes and effective parameters" starting on page 260.

Special forms of therapy

Using non-rebreathing systems

Only available with the option ***External fresh-gas outlet***.

Prerequisite: The non-rebreathing system is connected, see page 74.

CAUTION

Risk of gas contamination

The extracted sample gas is also returned to the internal breathing system during operation with an external fresh-gas outlet if the Perseus sample gas measurement is used.

Use breathing circuit to close the breathing system or set the APL valve to spontaneous breathing. Flush the breathing system each time patients or anesthetic gas are changed!

Conducting the fresh gas to the external outlet

1 Start ***Ext. FGO*** operating mode.

2 Adjust the fresh-gas delivery. Set vaporizer as required.

Strictly observe the instructions for use of the non-rebreathing system.

Activating or deactivating the CBM mode

The CBM mode allows patient monitoring without unnecessary alarms during extracorporeal oxygenation of the patient by a heart-lung machine.

Properties of CBM mode:

– All gas concentrations are measured independent of the respiratory phase.

– The CO_2 apnea and pressure apnea alarms are inactive.

The CBM mode can be used in all active ventilation modes.

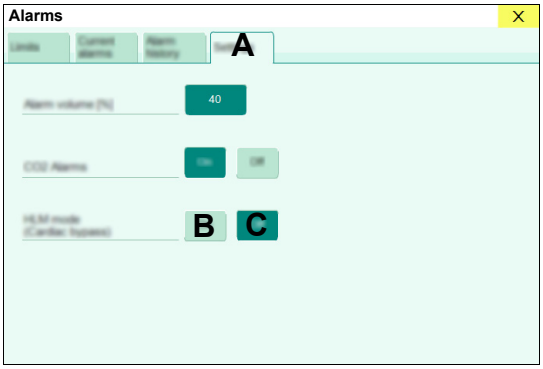
When ventilation modes are changed, the CBM mode remains active. Changing to the ***Standby*** mode deactivates the CBM mode.

Deactivating the CBM mode activates the apnea alarms.

Activating

1 Open the ***Alarms*** dialog window.

2 Touch the ***Settings*** tab (A).



3 For ***Cardiac bypass mode (CBM)***, touch the button ***On*** (B).

Deactivating

- For ***Cardiac bypass mode (CBM)***, touch the button ***Off*** (C).
  Or
- In the main menu bar, touch the ***Exit CBM*** button.

Only gas concentration measurement/use of *Monitoring*

No ventilation in ***Monitoring*** operation mode. Gas delivery is also stopped with electronically controlled gas mixers. The gas concentration measurement remains active and waiting for respiratory phases.

Use this operating mode for regional anesthesia, for example.

Prerequisite: The device is in ***Standby*** mode or ***Man / Spon*** mode.

Activating

- Start ***Monitoring*** operating mode.

Deactivating

- After ***Standby*** or change to ventilation mode.

For more information, see page 162.

Pausing the therapy/using *Pause* (optional)

In ***Pause*** mode, ventilation is stopped. Gas delivery is also stopped with electronically controlled gas mixers. The gas concentration measurement remains active and waiting for respiratory phases.

This mode is equipped with an adjustable therapy control ***Timer***, depending on the patient category. When the set time has elapsed, this emits an alarm as reminder that ventilation should be resumed. There is no automatic resumption of ventilation. Setting the therapy control ***Timer*** to "Off" deactivates the alarm. The total elapsed time is also displayed.

Use this operating mode for regional anesthesia or short pauses in therapy, such as disconnection or intubation, to reduce contamination of the ambient air with anesthetic gases due to an open Y-piece.

Activating

1. Start ***Pause*** operating mode.
2. Adjust the therapy control ***Timer*** if necessary.

Returning to the previous mode

1. Touch the ***Resume ventilation*** button.
2. Confirm the ventilation mode.

For more information, see page 155 and page 162.

Maneuvers (optional)

Perseus has various maneuvers for lung recruitment. During a maneuver, various data concerning the lung mechanics are displayed so that the user can assess the progress of the maneuver.

The reminder function (option) reminds the user to perform a maneuver. A reminder is issued after the first change to a ventilation mode with medium or high breathing support and also at settable intervals after the ending of a maneuver. The ***Consider recruitment*** message is displayed in the waveforms for flow and pressure.

The use of lung recruitment maneuvers is the sole responsibility of the user.

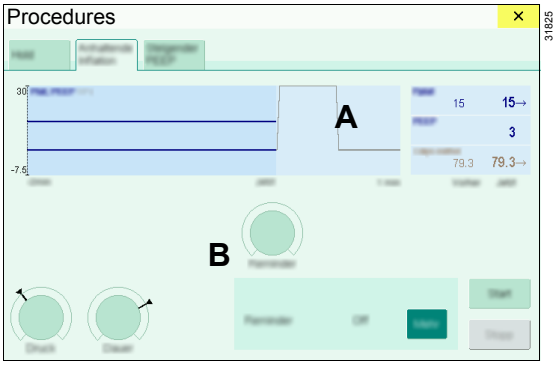
Dräger recommends that the patient's hemodynamics always be monitored while the maneuvers are being performed.

Available maneuvers

– **Insp./Exp. hold**
– ***One-step recruitment***
– ***Multi-step recruitment***

1 Open the ***Procedures*** dialog window.

2 Touch the tab for the required maneuver.

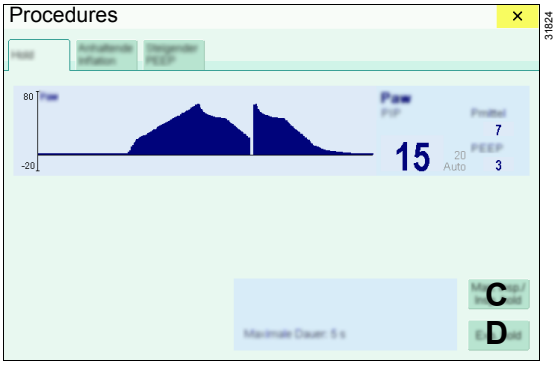


Relevant waveforms, trends, or measured values are displayed in area (A) of the dialog window. The parameters for the particular maneuver are displayed and set in area (B).

Inspiration hold, expiration hold

Perseus provides functions whereby a breath can be initiated or extended, or expiration can be extended.

This can be useful in situations where the lungs of the patient are not supposed to move, e.g., during use of imaging techniques.



Manual inspiration/inspiration hold

This maneuver is available in the volume-controlled modes, the pressure-controlled modes, and in the ***PSV*** mode, and offers the following options:

– In the expiratory phase between 2 mandatory breaths, a breath can be manually triggered and held. The ventilation pattern of the manually triggered breath corresponds to the ventilation pattern for the active ventilation mode.
– A mandatory breath can be extended.

Manually triggering a breath

- Touch the ***Man. insp./Insp. hold*** button (C) briefly.

Manually extending a breath

- Touch the ***Man. insp./Insp. hold*** button (C) and keep it pressed for the desired time.

Perseus will trigger an extended breath or will extend an already triggered automatic breath.

The breath is ended automatically:

– After a maximum of 40 seconds in the ***Adult*** patient category
– After a maximum of 30 seconds in the ***Ped*** patient category
– After a maximum of 5 seconds in the ***Neo*** patient category

Holding or extending the expiration

- Touch the ***Exp. hold*** button (D) and keep it pressed for the desired time.

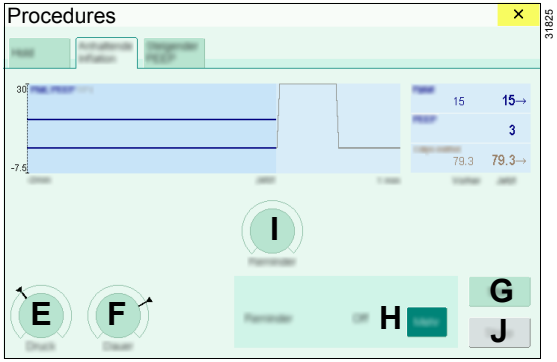
Perseus will extend the expiration and delay the next breath.

The expiration is ended automatically:

– After a maximum of 40 seconds in the ***Adult*** patient category
– After a maximum of 30 seconds in the ***Ped*** patient category
– After a maximum of 5 seconds in the ***Neo*** patient category

One-step recruitment

This maneuver applies a set pressure for a specific duration and thus enables, e.g., an extended breath with adjustable pressure.



1 Using the therapy controls, set the ***Pressure*** (E) and the ***Duration*** (F).
2 If necessary, touch the ***More*** button (H) and set a reminder with the therapy control (I).
3 Touch the ***Start*** button (G) and confirm.

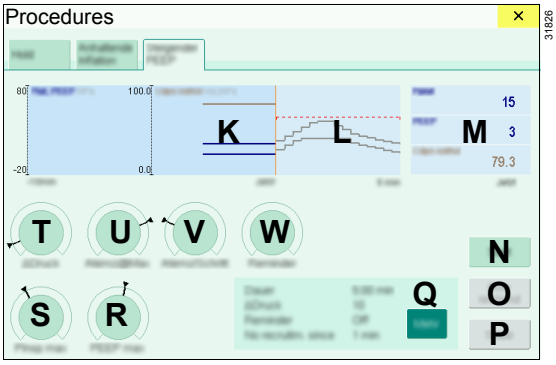
The rise in pressure from the ***PEEP*** level to the set pressure level and the decrease in pressure at the end of the maneuver take place at 20 hPa/s.

The maneuver ends automatically after the time has elapsed. To cancel the maneuver, touch the ***Cancel*** button (J) and confirm. If required, the ***PEEP*** can be adjusted before confirming.

The ***Paw high*** alarm limit is checked at the start of the maneuver. If the alarm limit is too low, it is changed to a value 5 hPa above the set pressure. After the maneuver, the alarm limit is reset to its original value.

Multi-step recruitment

This maneuver applies a sequence of pressure-controlled mandatory breaths at variable pressure levels. The inspiratory pressure and expiratory pressure are increased in steps and then reduced again to the starting levels. For parameters such as ***RR*** and ***Ti***, the values from the previous ventilation mode are used. If there is no value available for the ***Slope*** parameter, a value of 0.2 seconds is used.



K Trends of the measured values of pressure, compliance, or tidal volume

L Predicted trends of inspiratory pressure and expiratory pressure during the maneuver ("what if..." function)

The exact progress of the maneuver is influenced by the following values:

– Parameters entered in this dialog

– Values set for ***RR*** and ***PEEP*** in the therapy bar

M Values of pressure, compliance, or tidal volume

1 Using the ***Pinsp max*** (S) and ***PEEP max*** (R) therapy controls, set the pressures that are to be reached during the maneuver.

2 If required, touch the ***More*** button (Q) to display the following settings:

T	***ΔPressure***	Pressure difference between ***Pinsp*** and ***PEEP*** with which the ventilation is performed during the maneuver. After the set maximum pressures for ***PEEP max*** or ***Pinsp max*** is reached, the pressure difference is adapted accordingly so that the set values for both ***PEEP max*** and ***Pinsp max*** can be reached.
U	***Breaths@Max***	Number of breaths at the ***Pinsp max*** pressure level
V	***Breaths/Step***	Number of breaths after which the next pressure step begins
W	***Reminder***	Time after which a reminder for a new maneuver is issued

3 Touch the ***Start*** button (N) and confirm.

During the maneuver, the inspiratory pressure is automatically increased in steps to the set maximum ***Pinsp max*** value and the expiratory pressure is increased to the maximum ***PEEP max*** value. Both pressures are held at the highest pressure level for a certain number of breaths ***Breaths@Max*** and then reduced again in steps. The level of the pressure rise and the pressure decrease is dependent on the selected patient category. The appropriate settings are made in the system setup.

The ***Paw high*** alarm limit is checked at the start of the maneuver. If the alarm limit is too low, it is changed to a value 5 hPa above the set pressure. After the maneuver, the alarm limit is reset to its original value.

If the pressure is not to be increased any further during the maneuver, touch the ***Descend now*** button (O) and confirm. The pressure will then be reduced again in steps. The duration of the maneuver is reduced as a result.

To cancel the maneuver, touch the ***Cancel*** button (P) and confirm. If required, the ***PEEP*** can be adjusted before confirming. This can be useful, e.g., when the desired effect has already been achieved during the maneuver. The ventilation will now continue immediately with the previous settings and the adjusted ***PEEP***.

Due to the technically related delay between the set and the measured airway pressures, it may happen that the current and the last measured pressures differ by up to one step level.

The cursor can be used to display the previous measured values. To do this, touch screen area (K) and move the cursor with the rotary knob. To facilitate reading the data, screen area (K) will temporarily not be updated. To show the current measured values again, touch area (L).

Alarm behavior during the maneuvers

During the maneuvers, some alarms are adapted as follows:

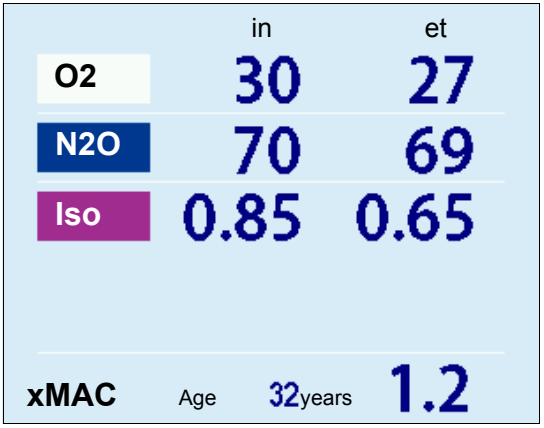
Alarm	**Maneuver**			
	Insp./Exp. hold		**One-step recruitment**	**Multi-step recruitment**
	Man. insp./Insp. hold	**Exp. hold**		
Pressure alarms:				
Airway pressure high	---	---	Alarm limit is adjusted to Pressure + 5	Alarm limit is adjusted to Pinsp max + 5
Airway press. continuously high	Stopped[1)]	---	When set to **Auto**, the alarm limit is automatically adjusted to Pressure +3	When set to **Auto**, the alarm limit is automatically adjusted to half way between PEEP max and Pinsp max. Example: PEEP max = 20 hPa Pinsp max = 40 hPa Adjusted alarm limit = 30 hPa
Airway pressure not achieved	Stopped[1)]	Stopped[1)]	Stopped[1)]	---
Volume alarms:				
Inspiratory tidal volume high	Suppressed in VC and VC - AF	---	Suppressed in VC and VC - AF	Suppressed in VC and VC - AF
Minute volume low	Displayed no sooner than 90 seconds after the start of the maneuver.			
Apnea alarms:				
Apnea (no pressure)	Stopped[1)]			---
Apnea (no flow)				
Apnea (no CO_2)				
Apnea				

1) Existing alarms are preserved. No new alarms will be issued.

Some technical alarms stop the maneuver automatically, e.g., alarms caused by a sensor failure.

Using fields with special functions

Breathing gas measurement and *xMAC* display (MAC multiples)



The MAC value is a simple navigation aid for anesthetic agent delivery.

Perseus displays the measured inspiratory and expiratory values for ***O2***, ***N2O***, and anesthetic gases, and the ***xMAC*** in the monitoring area. Measured nitrous oxide concentration or anesthetic gas concentration is only displayed when it is not zero.

The ***xMAC*** is the MAC multiple calculated from the current expiratory measured values and the age-dependent MAC values. If no respiratory phases are detected, expiratory values and ***xMAC*** cannot be displayed.

The integrated MAC algorithm is based on the MAC values shown in the following table. These values are guiding values only. The binding values are specified on the package information leaflet of the anesthetic agent.

The MAC values depend on the age of the patient. The values specified in the table apply to a patient age of 40 years.

	1 MAC corresponds to: (in 100 % O_2)
Halothane	0.77 Vol%
Enflurane	1.7 Vol%
Isoflurane	1.15 Vol%
Desflurane	6.0 Vol%
Sevoflurane	2.1 Vol%
N_2O	105 Vol%

The age-corrected MAC values are calculated according to the equation of W.W. Mapleson (British Journal of Anaesthesia 1996, pp. 179-185).

The equation applies to patients older than 1 year.

$MAC_{age\ corrected} = MAC^{1)} \times 10^{(-0.00269 \times (age - 40))}$

1) 40 years

For gas mixtures, the respective multiples for ***N2O*** and anesthetic agents are added according to the following equation.

$$xMAC = \frac{\text{exp. conc. anesth.1}}{\text{MAC}_{\text{age corrected}}\ \text{anesth1}} + \frac{\text{exp. conc. anesth.2}}{\text{MAC}_{\text{age corrected}}\ \text{anesth2}} + \frac{\text{exp. conc. } N_2O}{\text{MAC}_{\text{age corrected}}\ N_2O}$$

Example

exp. Iso. = 0.65 Vol%; exp. ***N2O*** = 69 %;
Age = 32 years

$\text{MAC}_{\text{age corrected}}$ for Iso.: MAC[1)] = 1.21 Vol%
$\text{MAC}_{\text{age corrected}}$ for ***N2O***: MAC[1)] = 110 Vol%

xMAC = 0.54 + 0.63 = 1.2

The influence of other drugs (opioids or intravenous hypnotics) is not considered in the ***xMAC*** calculation.

1) 32 years

Prediction of the anesthetic gas concentration (optional)

Perseus offers the option of displaying predictive concentrations of anesthetic agent in the breathing gas. This requires the Vapor View option and Dräger Vapor 3000 or D-Vapor 3000.

The anesthetic gas prediction is appropriate for patients with the following data only:

Height:	150 to 200 cm (59.1 to 78.7 in)
Weight:	40 to 140 kg (88 to 308 lbs)
Age:	18 to 90 years

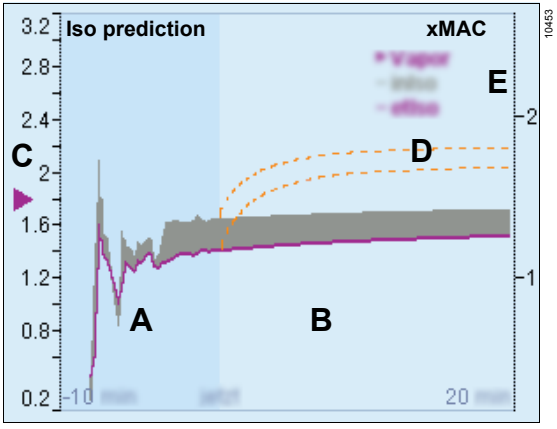
The anesthetic gas prediction is not suitable for the following patients:

- Alcohol dependents
- Greatly overweight patients
- Patients with ASA ≥IV
- Patients with severe circulatory disorders or a cardiopulmonary bypass

These restrictions in the patient data result from the scientific models all calculations are based on.

Using the anesthetic gas prediction

Prerequisite: The ***Agent prediction*** parameter field must be configured in the monitoring area and respiratory phases must be detected.



The following is displayed:

A Section for the trend of inspiratory and expiratory anesthetic gas concentration

B Section for the prediction

C Current vaporizer setting

D Prediction curve ("what if..." function)

E ***xMAC*** scale

WARNING

Risk of incorrect therapy settings

The anesthetic gas prediction is based on mathematical models and does not provide individual patient values.

Do not make therapy decisions based solely on the displayed anesthetic gas prediction.

The anesthetic gas concentration of the currently delivered anesthetic agent (or of the measured primary anesthetic agent if delivery is switched off) is displayed as a color diagram. The corresponding expiratory concentration is shown by the color coding for the anesthetic agent.

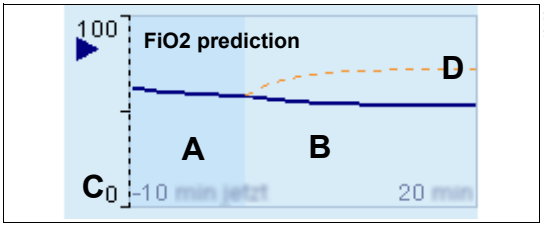
The previously measured concentrations are displayed in the left-hand section (A) and the predicted concentrations in the right-hand section (B). The predicted concentrations are dependent on the vaporizer setting, the set fresh-gas flow, and on various measurements.

Electronically controlled gas mixer only:
During the setting procedure, 2 dotted lines (D) are displayed for the fresh-gas flow (the so-called "what if..." function). When the value is altered with the therapy control, the lines move and show a preview of the predicted concentration.

Prediction of the inspiratory O_2 concentration (optional)

Perseus offers the option of displaying the predicted inspiratory O_2 concentration in the breathing gas. This requires the O_2 prediction option. The ***FiO_2 prediction*** parameter field must be configured in the monitoring area.

The FiO_2 prediction is suitable only for patients with a body weight of more than 30 kg (66 lbs).



The following is displayed:

A Section for the trend

B Section for the prediction

C Current O_2 fresh-gas concentration

D Prediction curve ("what if..." function)

WARNING

Risk due to incorrect O_2 prediction

Therapy decisions should not be made solely on the basis of a displayed O_2 prediction.

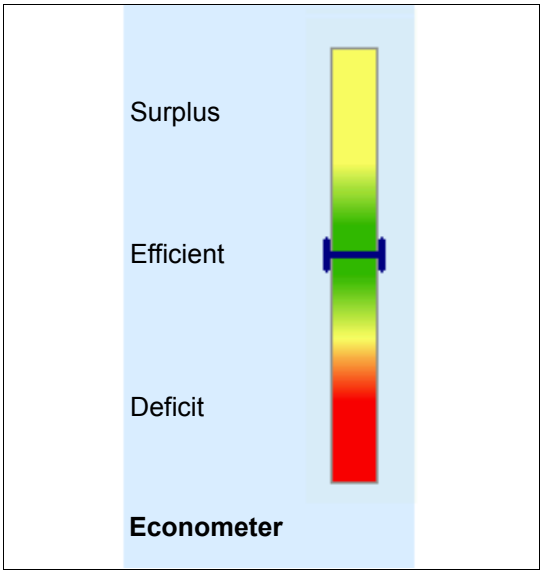
The inspiratory O_2 concentration is displayed as a line.

The previously measured concentration is displayed in the left-hand section (A) and the predicted concentration in the right-hand section (B). The predicted concentration is dependent on the set O_2 flow and the measured patient values.

Electronically controlled gas mixer only:
During the setting procedure, a dotted line (D) is displayed for the O_2 flow (the so-called "what if..." function). When the value is altered with the therapy control, the line moves and shows a preview of the predicted concentration.

Econometer (optional)

During operation, Perseus monitors the breathing bag for sufficient filling.



The bar graph indicates the qualitative fresh-gas supply.

Range	Color	Meaning
Surplus	Yellow	Indication of a possibility to save fresh gas and, therefore, volatile anesthetics
Efficient	Green	– No action necessary – Breathing bag sufficiently filled – Sufficient reserve capacity available
Deficit	Red	– Insufficient fresh-gas supply – Fill the breathing bag immediately

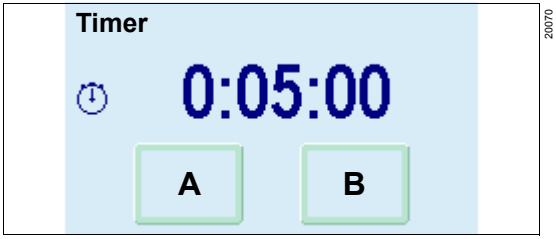
An insufficiently filled breathing bag can trigger the ***Fresh gas low or leakage*** or ***Emergency air inlet activated*** alarms, for example.

Stopwatch

Using the stopwatch

1 Touch the ***Start*** button (A) to start.
2 Touch the ***Stop*** button (A) to stop.
3 To reset the stopwatch to zero, touch the ***Reset*** button (A).

Countdown



Setting the countdown

1 Touch the ***Set*** button (B) or the parameter field.
2 Set the countdown time.

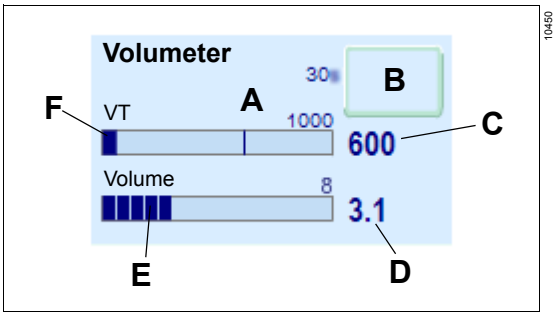
Using the countdown

The countdown always starts with the last time set.

1 Touch the ***Start*** button (A) to start.
2 Touch the ***Stop*** button (A) to stop.
3 To reset the countdown to zero, touch the ***Reset*** button (A).

Volumeter

The volumeter can be used to monitor and assess the ventilation during spontaneous breathing, manual ventilation, or mechanical ventilation.



The bar graph indicates the inspiratory and expiratory tidal volume.

At the end of the inspiration, the delivered tidal volume is displayed as a bar (A).

At the end of the expiration, the difference between the inspiratory and the expiratory tidal volume (F) is displayed.

The expiratory tidal volume is displayed next to the bar graph (C).

Using the volumeter (minute volume measurement)

1 Touch the ***Start*** button (B) to start.
The bar graph displays the individual measured breaths in segments (E). The summed volume (D) is displayed next to the bar graph.

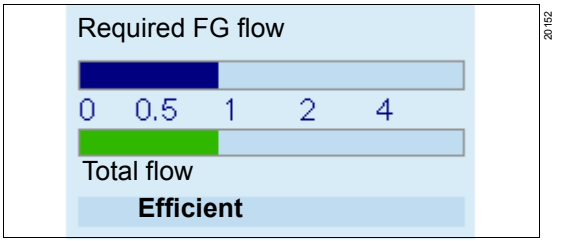
2 Touch the ***Stop*** button (B) to stop.

3 To reset the volumeter and time display to zero, touch the ***Reset*** button (B).

The volumeter stops automatically after 60 seconds. The measured values are displayed for 4 minutes and then deleted.

Low-flow wizard (optional)

The low-flow wizard displays bar graphs for the required fresh-gas flow and the total flow. Both bar graphs are to the same scale. The required fresh-gas flow is calculated on the basis of balancing the gas volumes.



An evaluation of the total flow is displayed below the bar graph:

Evaluation	Color	Meaning
Too high	Yellow	The fresh-gas flow is possibly too high. If the fresh-gas flow can be reduced, both fresh gas and anesthetic agent will be saved.
Efficient	Green	No action is necessary.
Too low	Red	The fresh-gas flow is too low. ● Check the fresh-gas flow. ● Check the position of the breathing bag.
Refill bag	Red	The fresh-gas flow is too low. ● Refill the breathing bag immediately, e.g., with O_2 flush.

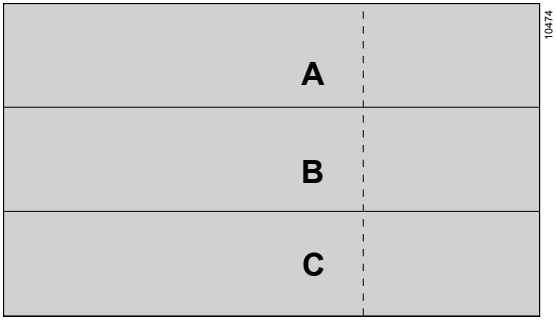
An insufficient fresh-gas flow may trigger the ***Fresh gas low or leakage*** or ***Emergency air inlet activated*** alarms, for example.

Organizing the screen display

Available views

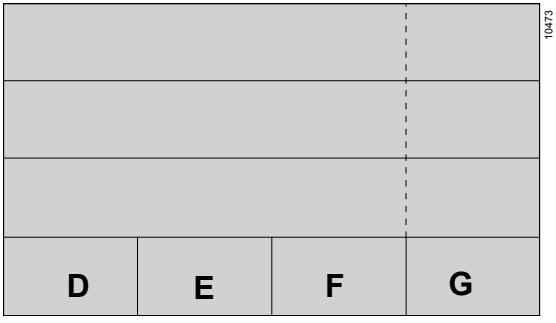
Perseus offers two view settings for the monitoring area:

– Standard view



The three waveforms (A), (B), and (C) are displayed along with their associated parameter fields.

– Expert view



In addition to the standard view, the four additional parameter fields (D), (E), (F), and (G) are displayed.

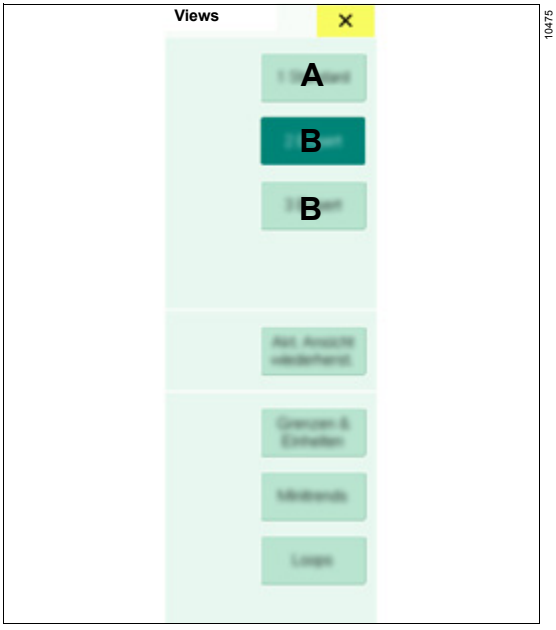
Changing the current view

Two buttons are available for changing the current view:

– ***Views...*** button

– ***View*** button

Changing with the *Views...* button



1 Touch the ***Views...*** button. The ***Views*** dialog window will be opened.

2 Touch the button for the desired view:

A Opens the standard view

B Opens the expert view

The views can be renamed, see page 150.

Changing with the *View* button

- Touch the ***View*** button.

The screen displays the second view .

- Touch the ***View*** button.

The screen displays the third view .

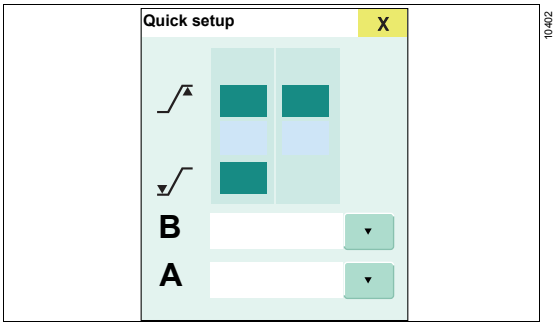
- Touch the ***View*** button.

The screen displays the first view .

Customizing the current view

The monitoring area can be customized during operation:

1 Touch a waveform or parameter field. The ***Quick setup*** window opens.



2 For ***Content*** (A), select the desired content from the list.

For a list of the possible screen content, see page 173.

3 For ***Scale*** (B), select the desired scale.

WARNING

Risk of insufficient monitoring

National and medical regulations require certain parameters to be displayed.

Always consider the relevant regulations when configuring the screen layout.

Restoring the current view

The changes in the current view can be reset to the saved standard.

1 Open the ***Views*** dialog window.

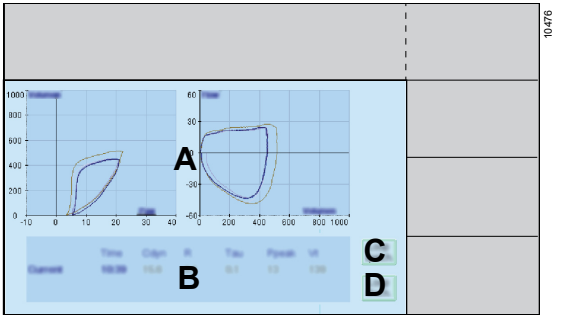
2 Touch the ***Restore current view*** button.

Using loops

The following loops are available:

– Pressure-Volume loop

– Flow-Volume loop



1 Open the ***Views*** dialog window.

2 Touch the ***Loops*** button.

The following is displayed:

A Current loop and the last 5 loops

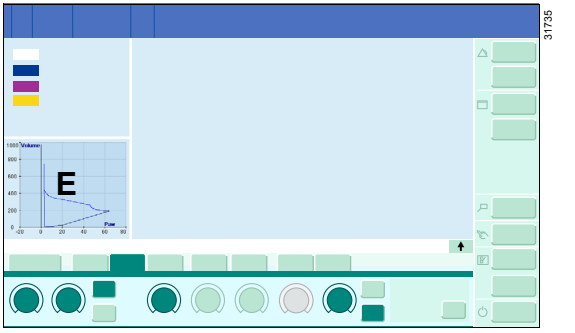
B Parameters:

– ***Cdyn***

– ***R***

– ***TC***

The area (E) can be configured so that the Pressure-Volume loop is displayed.



Displaying or deleting reference loops

- To save a reference loop, touch the ***Save ref.*** button (C).

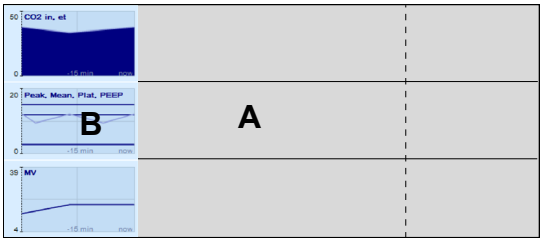
Or

- To delete the reference loop, touch the ***Delete ref.*** button (D).

These buttons are alternatively displayed in the ***Quick setup*** window.

Displaying mini-trends

Mini-trends (B) can be displayed for the waveforms (A).



10477

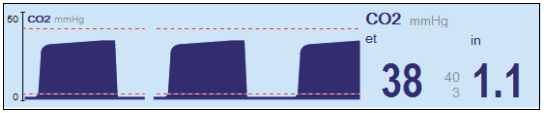
1 Open the ***Views*** dialog window.

2 Touch the ***Mini-trends*** button.

Larger and more detailed graphic and numeric trend displays, see page 109.

Displaying alarm limits and units of measurement

The alarm limits and the units of measurement can also be displayed in the waveform and parameter fields.



10478

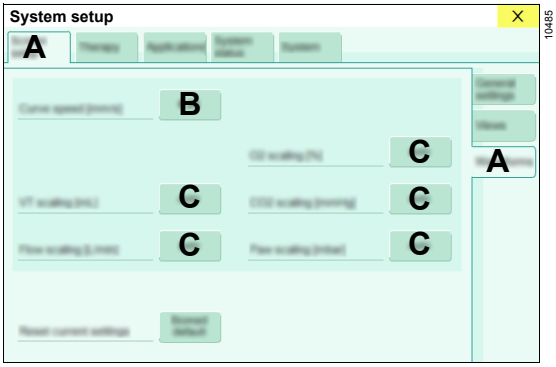
1 Open the ***Views*** dialog window.

2 Touch the ***Limits & units*** button.

Adjusting the sweep speed and the scale

1 Open the ***System setup*** dialog window.

2 Touch the ***Screen layout*** > ***Waveforms*** tab (A).



10485

Setting the sweep speed

- Touch button (B). Set the sweep speed.

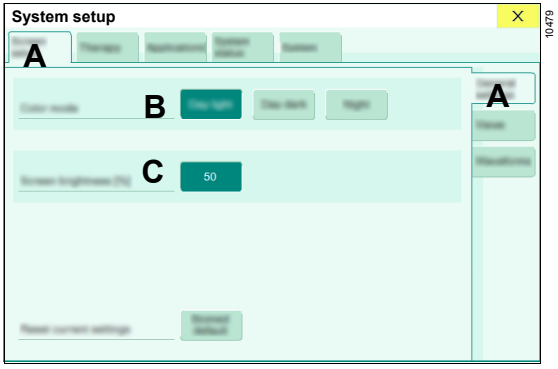
Adjusting the waveform scale

- To change the waveform scale, touch one of the buttons (C) and select the value.

Changing the color scheme and the screen brightness

1 Open the ***System setup*** dialog window.

2 Touch the ***Screen layout*** > ***General*** tab (A).



3 To change the color scheme, touch one of the buttons at (B).

4 Set the screen brightness at (C).

Displaying additional data

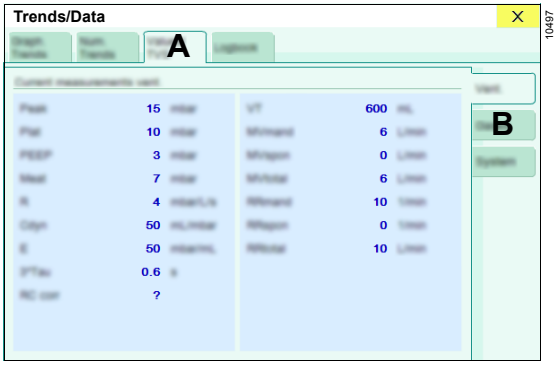
Viewing current measured values

During operation, measured values for ventilation, gases, and the device are available in tabular overviews.

1 Open the ***Trends/Data*** dialog window.

2 Touch the ***Values*** tab (A).

The vertical tabs (B) display different combinations of parameters.

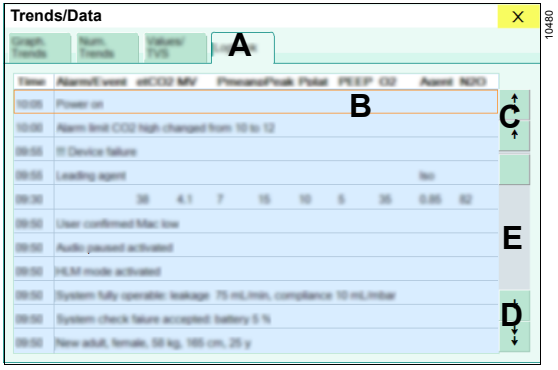


Logbook

The logbook can save up to a maximum of 20000 entries. Logbook data are displayed in table form.

1 Open the ***Trends/Data*** dialog window.

2 Touch the ***Logbook*** tab (A).



Use the rotary knob or the arrow buttons to scroll the cursor (B) up (C) or down (D) in the logbook. To scroll quickly, touch the gray area (E).

The entries in the logbook cannot be deleted and are retained even after the device has been switched off and on again or following a power supply failure. When the storage limit is reached, the oldest entries are overwritten.

Creating entries and associated settings, see page 115.

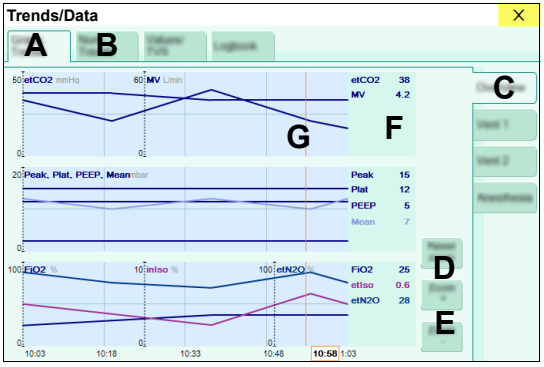
Trends

Trends are displayed in the form of a graphic or a table.

1 Open the ***Trends/Data*** dialog window.

2 Touch the ***Graphical trends*** (A) or ***Tabular trends*** tab (B).

The following illustration shows the graphical trend:



The vertical tabs (C) display different combinations of parameters.

Zooming

In both trend displays, the displayed time period can be enlarged or diminished.

Changing the time period:

- Touch one of the following buttons (D) according to choice:
  - ***Zoom +***
  - ***Zoom -***

Displaying the standard time period and the current point in time:

- Touch the ***Reset zoom*** button (E).

Moving the cursor

The exact measured values for a specific point in time can be displayed numerically in area (F). To do so, move the cursor.

- Use the rotary knob to move the cursor (G).

Or

- Touch the corresponding area on the screen.

Displaying installed options

Listing of the additionally installed software options.

1 Open the ***System setup*** dialog window.

2 Touch the ***Licenses/Options*** tab.

Displaying an overview of the accessories and consumptions

1 Open the ***System setup*** dialog window.

2 Touch the ***System status*** tab.

Vertical tab	Overview
Accessories	Accessories (when Dräger Infinity ID accessories are used) and information as to when the accessory must be replaced.
Supply	Status display of the connected gas and power supplies.
Consumption	Gas consumption During operation: – for the current case In ***Standby***: – for the last case – since the last reset

In ***Standby*** > ***System setup*** > ***System status*** > ***Consumption***, the gas consumption levels can be reset to zero, see page 170.

Setting the sound volume

Setting alarm tone volume and breathing sound volume

WARNING

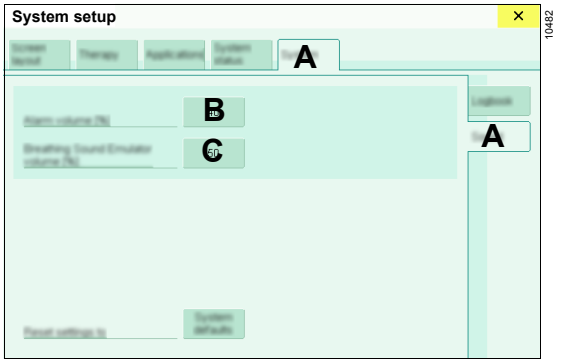
Risk of operation error

The acoustic alarm signals might not be heard if functions such as "Breathing sound" are used or when operating in a noisy environment.

Always set the alarm tone to be sufficiently loud.

1 Open the ***System setup*** dialog window.

2 Touch the ***System*** > ***Sound volume*** tab (A).



Alarm tone volume

- Set the desired value for ***Alarm tone volume*** (B).

Breathing sound volume (optional)

- Set the desired value for ***Breathing sound volume*** (C).

Adjusting the alarms

Setting the alarm limits

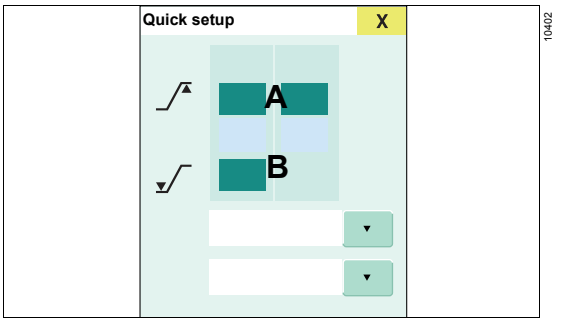
For a current case, the alarm limits can be set in two ways:

– Setting via the ***Quick setup*** window

– Setting via the ***Alarms*** dialog window

Setting via the *Quick setup* window

1 Touch the respective waveform or parameter field. The ***Quick setup*** window opens.



2 Set the upper alarm limit (A).

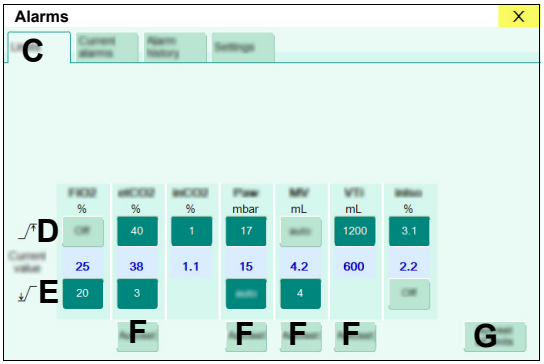
3 Set the lower alarm limit (B).

Setting via the *Alarms* dialog window

In the ***Alarms*** dialog window, the alarm limits can be set either manually or automatically.

1 Open the ***Alarms*** dialog window.

2 Touch the ***Limits*** tab (C).



Manual setting

1 Set the upper alarm limits (D).

2 Set the lower alarm limits (E).

Automatic setting

Alarm limits can be adapted to current measured or setting values.

1 Touch the ***Autoset limits*** button in the main menu bar.
The ***Autoset all*** button (G) is selected.

2 Confirm to adapt the alarm limits for all parameters.
Or
To adjust the alarm limits for an individual parameter, touch one of the buttons ***Autoset*** (F) and confirm.

As an alternative, open the dialog window via ***Alarms*** > ***Limits*** (B).

Only use the automatic setting when measured or setting values are stable to prevent artifacts of the adjustment algorithm.

The lower alarm limit for the ***xMAC*** level is also adjusted during automatic setting, see page 112.

Configuration and algorithm, see page 154.

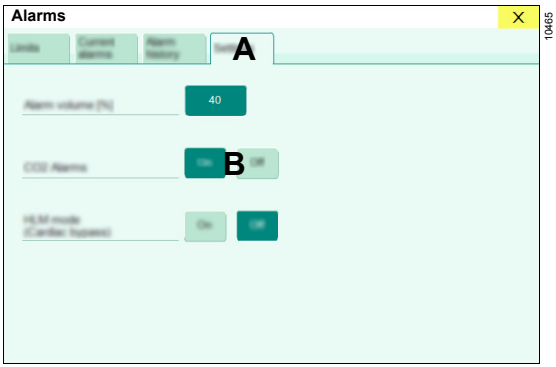
Activating or deactivating CO_2 alarms

The CO_2 monitoring (affects the alarms for ***inCO_2***, ***etCO_2***, and ***CO_2*** apnea) can be activated or deactivated.

Deactivation is indicated in the header bar and in the parameter field by the ⛒ symbol.

1 Open the ***Alarms*** dialog window.

2 Touch the ***Settings*** tab (A).



3 For ***CO_2 alarms***, touch the button (B):
On: Alarms are activated.
Off: Alarms are deactivated

Or

- Use the ***CO_2 alarms off*** button in the main menu bar to activate or deactivate the alarms. This button is only visible in the following ventilation modes:
  - ***Manual / Spontaneous***
  - ***External fresh-gas outlet***
  - ***Pause***

The alarm system is immediately activated when the CO_2 monitoring is activated.

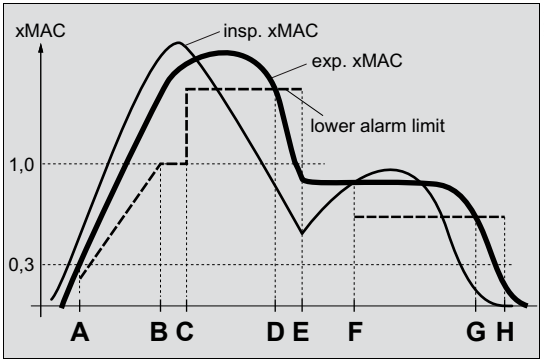
Automatic *xMAC* monitoring

Perseus provides monitoring of the ***xMAC*** level. The monitoring is automatically activated as soon as the following conditions are met:

– Anesthetic gas is administered.

– The inspiratory ***xMAC*** value is greater than the expiratory ***xMAC*** value.

– The expiratory ***xMAC*** value reaches approximately 0.3.



If the ***xMAC*** value rises, the lower alarm limit for the ***xMAC*** level will be automatically adjusted to the anesthetic gas concentration after activation (A). The lower alarm limit (B) can thus reach a maximum value of 1.0.
The lower alarm limit can be recalculated by touching the ***Autoset*** button (C). In special anesthesia situations, the ***xMAC low*** alarm can be adjusted in this way and consequently also exceed the value of 1.0 if necessary.
If the expiratory ***xMAC*** value falls below the alarm limit (D or G), Perseus generates the ***xMAC low*** alarm with low priority. If the alarm is not acknowledged with the ***ALARM RESET*** button, the priority is raised to medium priority after 60 seconds.

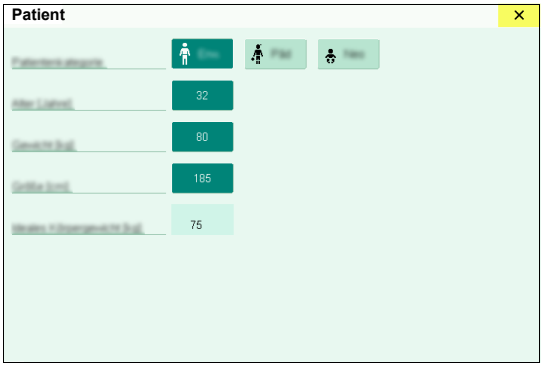
Deactivation of automatic *xMAC* monitoring

If the ***xMAC low*** alarm (D or G) is acknowledged with the ***ALARM RESET*** button (E or H), the monitoring is deactivated. This prevents renewed alarms as a result of the anesthetic gas concentration continuing to fall at the end of anesthesia (H). If the anesthesia is continued (E), the monitoring will be automatically reactivated as soon as the inspiratory ***xMAC*** value rises above the expiratory ***xMAC*** value (F).
In CBM mode the lower alarm limit is adjusted both upwards and downwards so that no alarm is issued during this time. Similarly, the value is not limited to 1.0 during this time.

Changing the patient data

Patient data can be changed during operation.

1 Open the ***Patient*** dialog window.



2 Make the desired changes.

Changes influence, e.g., therapy suggestions, as is recognizable by the position of the arrow ▼ at the therapy controls.

The current therapy settings remain unaffected.

When patient category is changed, age, weight, and height are adapted as needed so they remain within the described limits, see page 157.

Exporting data

General information

Prerequisite: USB flash drive is connected to the USB interface.

During a saving process, the button is displayed as activated (dark green).

The data are stored in the "Draeger\ExportData" directory.

Exporting the screen contents

The screen contents can be exported to a USB flash drive as a screenshot.

- Touch the ***Export screenshot*** button in the main menu bar.

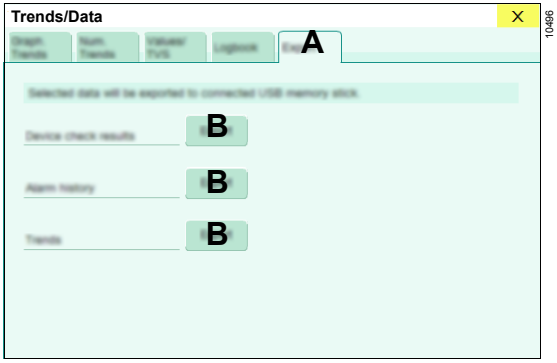
The screenshot will be saved as a ".png" file.

Exporting trends and data

In the ***Standby*** mode, the following data can be exported to a USB flash drive:

– System test results
– Logbook
  Selection from the following time periods is possible:
  – Last case
  – Today
  – All
– Alarm history
– Trends

1 Open the ***Trends/Data*** dialog window.
2 Touch the ***Export*** tab (A).



3 Touch the desired button (B).

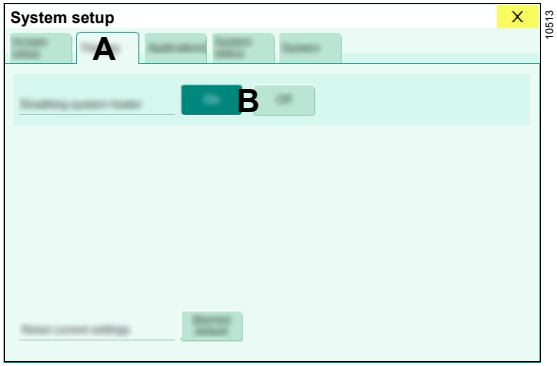
The data will be saved as a ".txt" file.

Other settings

Switching the breathing system warmer on or off

The breathing system warmer should only be switched off in special situations (e.g., for intentional reduction of the body temperature of the patient).

1 Open the ***System setup*** dialog window.
2 Touch the ***Therapy*** tab (A).



3 To switch the warmer on or off, touch the corresponding button (B).

When switching to ***Standby*** mode, the warmer is reset to the value configured in ***System setup***.

CAUTION

Risk due to faulty or switched-off breathing system warmer

Increased condensation or accumulation of water in the breathing system and the hoses may occur.

Increase fresh-gas flow as required. Remove condensate from hoses, water traps, and breathing system regularly. Have service personnel repair the faulty breathing system warmer.

CAUTION

Risk of inaccurate measured values

The accuracy of the flow measurement may be compromised if the breathing system warmer is switched off.

When the breathing system warmer is switched off, do not make therapy decisions solely on the basis of the displayed values for flow and volume.

Creating additional logbook entries

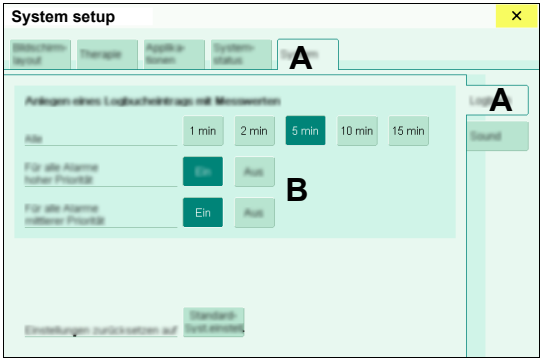
The following events can create logbook entries with measured values for the parameters ***etCO2***, ***MV***, ***Pmean***, ***PIP***, ***Pplat***, ***PEEP***, ***FiO2***, exp. concentration of the primary anesthetic gas, and ***etN2O***:

– Adjustable time intervals

– Alarms with high or medium priorities

1 Open the ***System setup*** dialog window.

2 Touch the ***System*** > ***Logbook*** tab (A).



3 Touch the corresponding button (B).

Resetting user-specific settings

Changes made in the ***System setup*** dialog window during operation can be reset to the start settings.

1 Open the ***System setup*** dialog window.

2 Open the corresponding dialog window.

3 Touch the ***System defaults*** button and confirm.

Ending the therapy

Switching to the *Standby* mode

1 In the main menu bar, touch the ***Standby...*** button.
Or
Press the ⏻ key below the screen.

2 In the ***Standby*** dialog window, confirm the automatically selected ***Standby*** button.

With mechanically controlled gas mixer:

3 Close the flow control valves.

Using O_2 insufflation

WARNING

Risk of fire

In combination with oxygen or nitrous oxide, ignition sources such as electrosurgical devices and laser surgical devices can cause fires.

- **Prevent leakage, e.g., at endotracheal tubes, laryngeal mask airways, face masks, Y-piece, breathing system including hoses, filters, and breathing bag, at the external fresh-gas outlet, and at the outlet for O_2 insufflation.**
- **Use only intact and leak-free hoses at the outlet for O_2 insufflation.**
- **Before beginning laser surgery or electrosurgery, flush with sufficient air (<25 % O_2), and flush beneath the surgical drapes as well.**
- **Close the flow control valve on the O_2 flowmeter to the end stop.**
- **When O_2 outlets are in use (e.g., for insufflation), do not use any ignition sources in the immediate vicinity.**
- **Do not position oxygen sources in the vicinity of ignition sources, e.g., electrical connectors.**

WARNING

Risk of a device fire

If there is a fire on the patient side, the device may ignite.

If there is a fire, disconnect the device from all oxygen-carrying supplies.

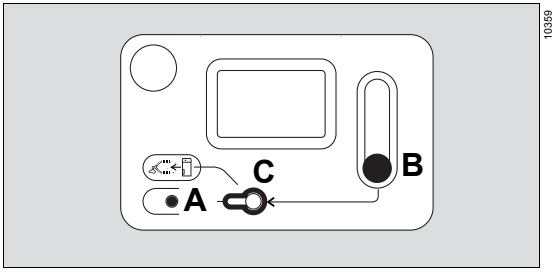
WARNING

Risk due to overpressure

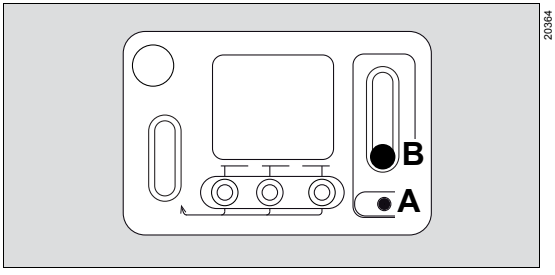
When the patient is connected to the outlet for O_2 insufflation without a relief valve, increased pressure may be applied to the patient.

Only connect the patient in a way that allows excess gas to escape (e.g., through a relief valve).

Electronically controlled gas mixer:



Mechanically controlled gas mixer:



Prerequisite:

– The appropriate accessory is connected to the outlet for O_2 insufflation (A).
– With electronically controlled gas mixer: The O_2 switch is horizontal in the ***Aux. O_2*** position (C).

Beginning O_2 insufflation

- Open the flow control valve (B) of the O_2 flowmeter.

Ending O_2 insufflation

- Close the flow control valve (B) of the O_2 flowmeter.

Change of patient

Cleaning and disinfecting the workstation

- Clean and disinfect the workstation according to hospital hygiene regulations. Follow the reprocessing instructions supplied with the product.

Checking or replacing consumables

Prerequisite: Device is in ***Standby*** mode

Sample gas measurement

WARNING

Risk of infection

Used sample lines and water traps may be infectious due to the breathing gases that passed through them.

- **Replace the sample line regularly in the following situations:**
  - **If the sample line is connected to the filter on the Y-piece, replace it daily.**
  - **If there is no filter fitted to the Y-piece and the sample line is connected directly to the Y-piece, replace the sample line after every patient.**
- **Remove the sample line from the water trap.**
- **Initially leave the water trap fitted to prevent infectious fluid from spurting out. Remove the water trap only after surface disinfection.**
- **Empty or replace the water trap according to its instructions for use.**

1 Check the water trap of the sample gas measurement; empty or replace as needed.

2 When no filter is used, replace the sample line and dispose of used sample lines.

Vaporizer filling level

- Check the vaporizer filling level at the sight glass. If necessary, fill the vaporizer.

CO_2 absorber

- Check the coloration of the soda lime and replace it if necessary, see page 76.

Breathing hoses and filters

1 Replace the hoses and filters according to hospital hygiene regulations.

2 Select and connect a suitable breathing circuit and filters, see page 67.

Checking the device

Prerequisite: Device is in ***Standby*** mode

1 Perform the leakage test, see page 122.

2 Flush the breathing system if necessary.

Flushing the breathing system

With the ***Flush*** function, excess moisture and residual anesthetic agent present in the breathing system and breathing circuit can be reduced by flushing with ambient air.

Prerequisite: Device is in ***Standby*** mode

1 Touch the ***Flush*** button. Alternatively, flushing can also be started via the ***Tests...*** button in the main menu bar.

2 Prepare the device according to the displayed checklist.

3 Touch the ***Start*** button.

4 After the end of flushing, the device switches to ***Standby*** mode.
If necessary, end the flushing prematurely with ***Cancel***.

WARNING

Risk due to residual concentrations of anesthetic agent

Even after flushing the breathing system and breathing circuit, residual concentrations of anesthetic agent might not be sufficiently reduced.

For patients suspected of having malignant hyperthermia, do not rely solely on the flushing function.

For further information and recommendations for therapy settings for patients with suspected malignant hyperthermia, contact the responsible national Dräger organization.

CAUTION

Risk of impaired ventilation due to faulty drying function

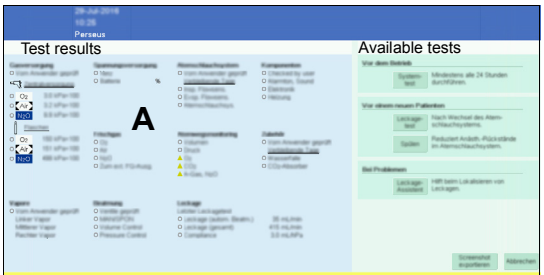
The breathing system and breathing hoses may still retain traces of moisture even after the flushing and drying functions are performed.

Check the breathing system and breathing hoses for condensate.

Tests

Information on the availability of individual device functions

- In the ***Standby*** mode, touch the ***Details...*** button or the ***Tests...*** button.



In the ***Test results*** list (A), the following information is displayed in color:

– Influence of the individual device functions on the availability of the entire device

– Latest detected leakage values

Color	Meaning
Green	Successfully tested, fully available
Yellow	A non-critical fault has been detected. The device can be operated with restricted function.
Red	A serious fault has been detected. Operation is not possible or is forbidden.
Gray	Function not tested.

WARNING

Risk due to faulty sensors

If the sensors for flow, O_2, N_2O, CO_2, or anesthetic agent are not operational, the patient will not be adequately monitored.

Before using the medical device, ensure a suitable substitute monitoring.

Testing the device

CAUTION

Risk due to device malfunction and/or patient injury

If the system test is canceled, it is possible that some malfunctions might not be detected. Thus, more attention is required during operation.

Perform the system test every day. If the system test is canceled during execution, perform it again as soon as possible.

WARNING

Risk of patient injury

During the system test, the system is pressurized.

To prevent patient injury, do not perform the system test on the medical device if a patient is connected.

Available test types

Test	Type and duration	Perform the test	Description
System test	Automatic, about 8 min	– Daily – After service activities	Initialization: – Checking of components which frequently cause operational restriction: e.g., high leakage, incorrect setting of APL valve. Test: – Calibration of all valves and sensors – Test of all device functions – Includes the leakage test – The test can be programmed, see page 136
Leakage test	Automatic, approx. 2 min	– After filling the CO_2 absorber – After changing the hose configuration (e.g., changed hoses, changed lengths of extendable hoses etc.) – After replacing the breathing system – After replacing the flow sensors	– Calculation of leakage, system compliance, and system resistance – Calibration of valves and flow sensors, if required. In this case, the test is extended by approx. 3 minutes.
Leakage assistant	Manual, as required	– After occurrence of problems with leakage during automatic tests – If leakage in breathing system and breathing circuit is suspected – If leakage at vaporizer is suspected – If coaxial breathing circuits are used	– Continuous display of the test pressure and the leakage to support the manual check. Changes are immediately visible. – Leakage test of a connected vaporizer – Leakage test of the inner hose of a connected Dräger coaxial breathing circuit. Use the coaxial test adapter for this. For more information, see page 124.

Performing the tests

Special characteristics of Dräger coaxial hoses

When using coaxial breathing hoses, always use the leakage assistant to check the inner hose of the coaxial breathing circuit for leakage prior to the system test or leakage test, see page 125.

System test and leakage test

Prerequisite:

– Electronically controlled mixer: Central O_2 supply or central Air supply is connected.
– Mechanically controlled mixer: Central O_2 supply is connected.
– The anesthetic gas receiving system is correctly connected.

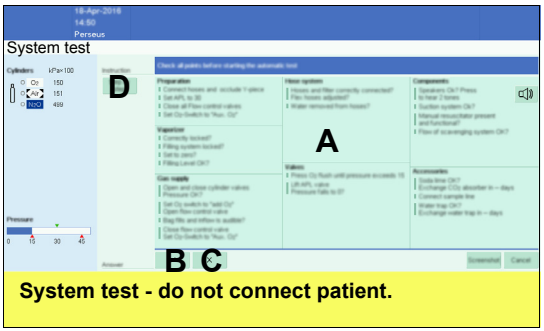
The two tests consist of a checklist followed by an automatic test.

The checklist can be presented in tabular form or as a walk-through mode.

Button (D) can be used to switch from the tabular checklist to the walk-through mode.

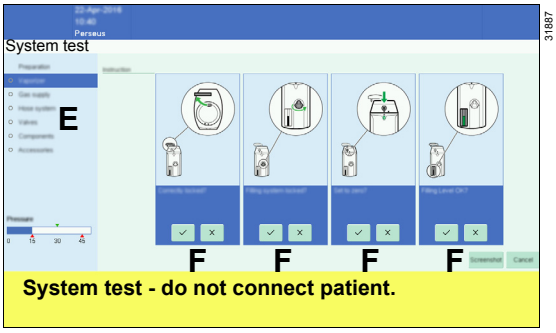
Whether tests always start in the walk-through mode can be specified in the system setup, see page 166.

1 Touch the button for the required test.



2 Complete the checklist (A), see page 126.

3 If all components are ready for operation, touch the ✓ button (B). The automatic test will start.
If a component is not ready for operation, touch the ✕ button (C).
The walk-through mode will start.

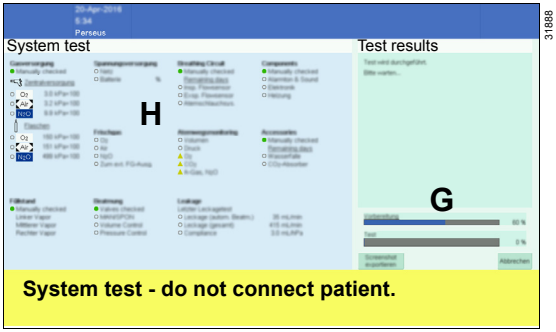


The components (E) are polled sequentially.

Buttons (F) are used to document whether the test passed.

Button	Meaning
✓	Test passed
✕	Test failed

The automatic test starts after all the tests in the walk-through mode are complete.



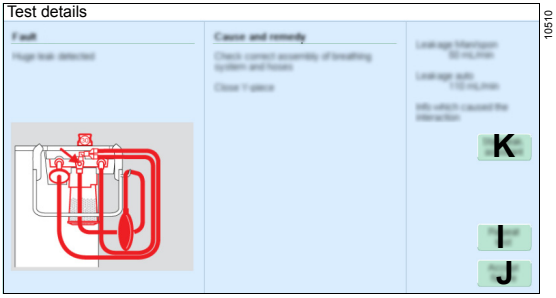
The test progress is displayed in area (G) while the automatic test is running. All test results are displayed in area (H).

After the test, the final test result is displayed on the ***Standby*** page, see page 81.

Test interruption due to irregularities

If an irregularity is detected during the automatic test, the following occurs:

– The test is interrupted.
– An acoustic signal sounds.
– Information on the cause and remedy are displayed.



Remedying the cause:

1 Remedy the cause of the interruption.
If there is leakage, the leakage assistant (K) can be used to support troubleshooting.

2 Touch the ***Repeat*** button (I) and repeat the test of the component.

Accepting the irregularity:

● Touch the ***Accept*** button (J) and continue the test.

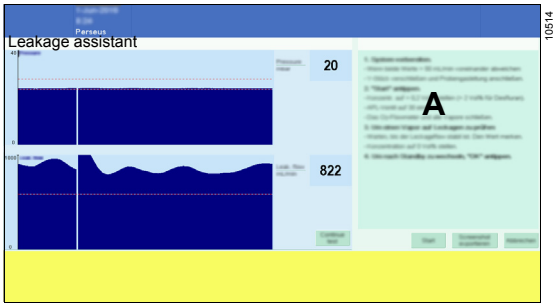
Accepted irregularities prevent the total result of the system test from indicating "fully operational" and are protocoled in the logbook.

Leakage assistant

Prerequisite when vaporizers are connected:

– Vaporizer is vertically level and securely mounted on the plug-in adapter.
– Filling inlet is closed.

In this test, a continuous pressure is generated and the current leakage value is displayed.



If the leakage value changes as a result of changes made to the device (e.g., loosening or readjusting hose connections), this can help locate the cause of the leakage.

The displayed leakage value may differ from the value that was determined in the leakage test. The reasons for this are the different measuring methods and different pneumatic ranges.

1 Touch the button for the test (***Leakage assistant***).

2 Follow the instructions (A).

Checking a vaporizer for leakage

Prerequisites:

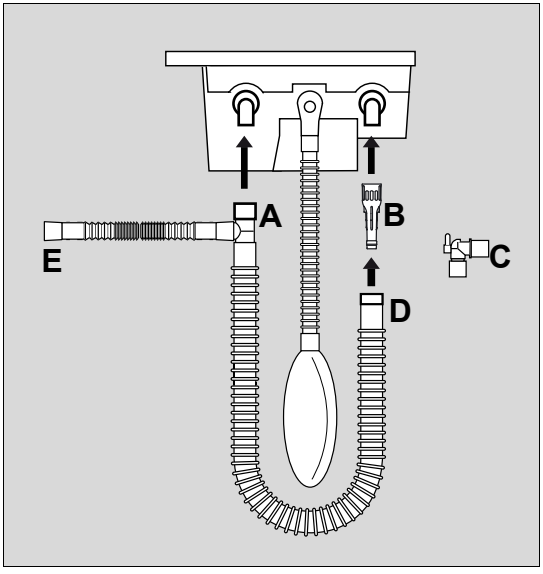
– Gas mixer:
  – With electronically controlled gas mixer: The flow control valve of the O_2 flowmeter is closed.
  – With mechanically controlled gas mixer: All flow control valves are closed.
– The vaporizers are closed.
– The breathing circuit is correctly connected.
– The APL valve is set to 30.

Perform the test:

1 Touch the ***Start*** button.
   – Wait until the leakage value is stable. Memorize the value.
   – Set the anesthetic gas concentration on the vaporizer to >0.2 Vol% (>2 Vol% for desflurane).
   – Wait until the leakage value is stable. Memorize the value.
   – If the two values differ from one another by more than 50 mL/min, check the vaporizer and the vaporizer interface for leakage.
   – Set the anesthetic gas concentration to 0 Vol%.
2 Touch the ***OK*** button to switch back to the display of available tests.

Checking a coaxial breathing hose for leakage

The leakage assistant can be used to identify leakage in the inner hose of a coaxial breathing circuit. When Dräger coaxial breathing circuits are used, the inner hose must be connected directly to the expiratory port using a test adapter.



Prerequisites:

– Gas mixer:
   – With electronically controlled gas mixer: The flow control valve of the O_2 flowmeter is closed.
   – With mechanically controlled gas mixer: All flow control valves are closed.
– The vaporizers are closed.
– The APL valve is set to 30.

Perform the test:

1 Connect the connector (A) to the inspiratory port.
2 Connect the coaxial test adapter (B) to the expiratory port.
3 Remove the elbow (C) from the hose. Connect the connector (D) to the coaxial test adapter (B).
4 Touch the ***Start*** button.
   – Wait until the leakage value is stable. **If the leakage value exceeds 500 mL/min, use another breathing circuit.**
5 Touch the ***OK*** button to switch back to the display of available tests.
6 Fully connect the breathing circuit.
   – Remove the coaxial test adapter.
   – Plug in the elbow again.
   – Connect the connector (E) (expiration) to the expiratory port.
   – Perform the system test or the leakage test.

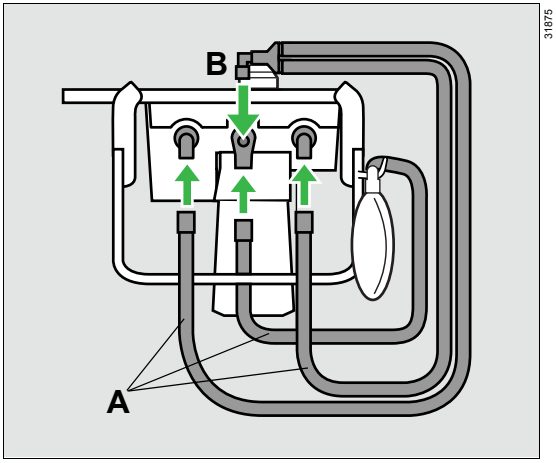
Completing the checklist

This section describes how the checklist is processed, using as an example a device with an electronic gas mixer and factory defaults.

The scope of the checklist can vary due to differing system settings.

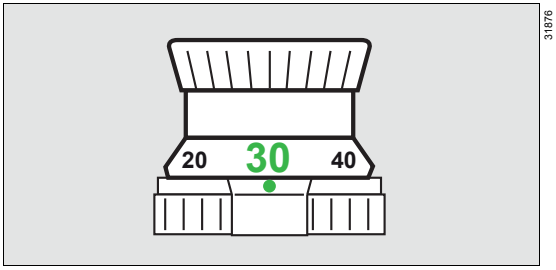
The instructions on the screen take precedence.

Prerequisites

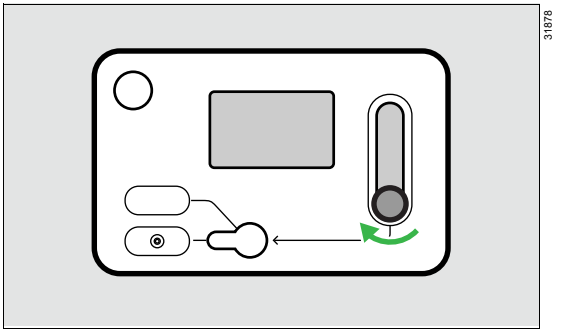


1 Connect the hoses (A).

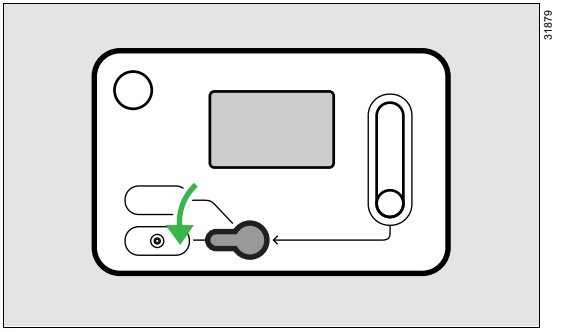
2 Seal the Y-piece (B).



3 Set the APL valve to 30.



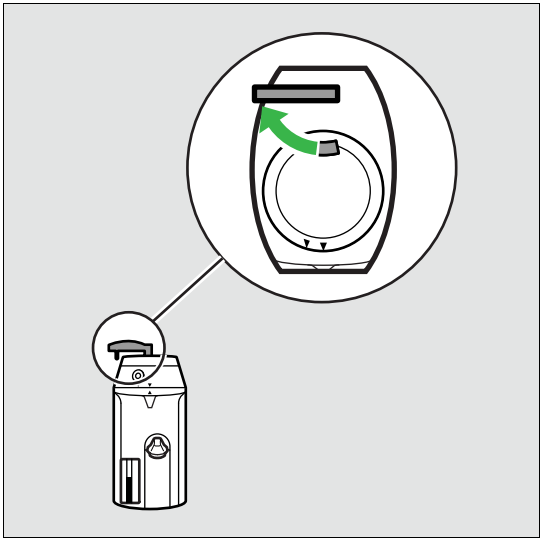
4 Close all the flow control valves.



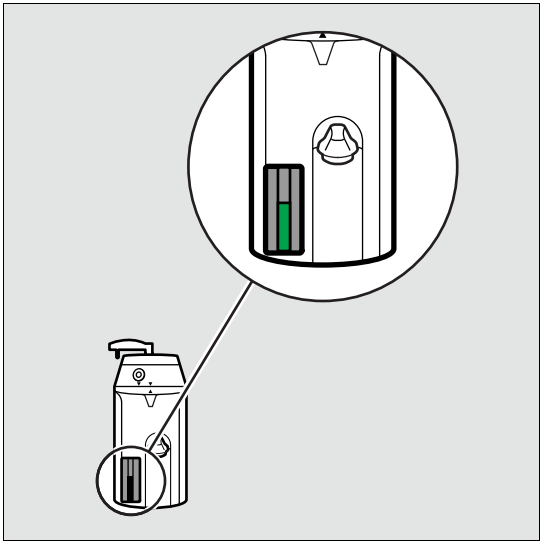
5 Set the O_2 switch to ***Aux. O_2***.

Vaporizers

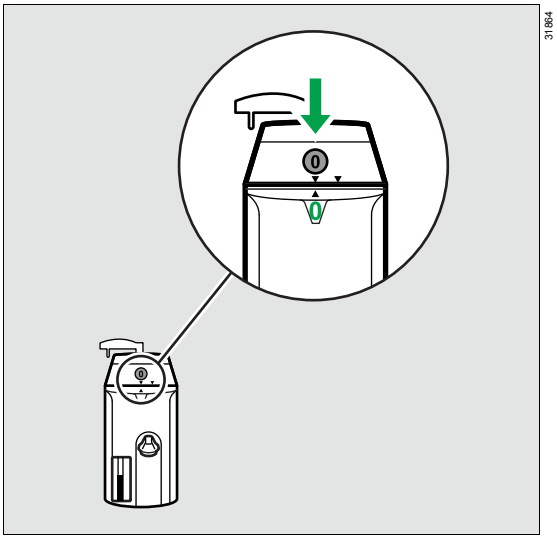
For each vaporizer, check:



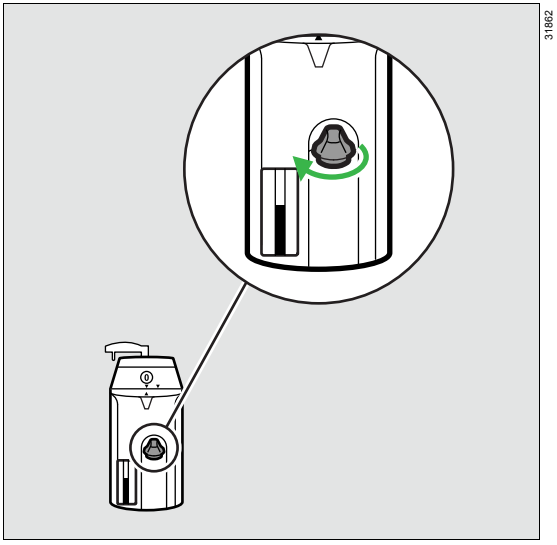
1 The locking lever points left, indicating the vaporizer is locked.



2 Check the filling level in the sight glass. Refill anesthetic agent if required.
When using a Dräger Vapor 3000 or D-Vapor 3000 with the Vapor View option, a yellow triangle on the screen indicates that the filling level has fallen below the refill mark.



3 The control dial is set to position ***0*** and the key is locked in placed.



4 The filling inlet is closed.

Gas flow

WARNING

Risk due to impermissible gas supply pressure

Impermissible gas supply pressures may cause incorrect gas composition.

Check the supply pressures of the central gas supply and of the gas cylinders before operation.

WARNING

Risk due to impermissible gas supply

Using oxygen supplies with less than 100 % O_2 may cause incorrect gas composition.

When using O_2, only use 100 % O_2.

WARNING

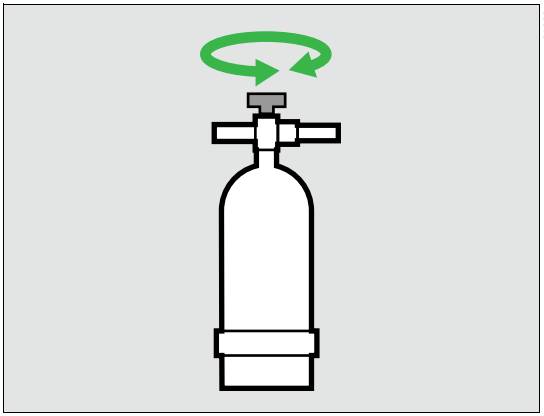
Danger when using O_2 concentrators

The following effects may occur:

- **Discrepancies between the set value and the actual value for fresh-gas flow and O_2 concentration in the fresh gas**
- **Inaccurate measured values for volume, anesthetic agent consumption, econometer (optional), and low-flow wizard**
- **Inaccuracy in the FiO_2 prediction**
- **Inaccurate volume delivery in volume-controlled ventilation modes**
- **Accumulation of argon in low-flow operation and minimal-flow operation**

Do not use any O_2 concentrators.

Gas cylinders



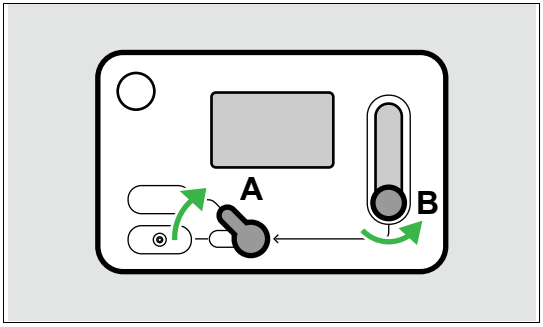
1 Open the gas cylinder valves slowly.
Check that the displayed pressures are sufficient.
When using pressure reducers without electronic pressure measurement, read the pressure from the pressure gauge.

2 Close the gas cylinder valves.

On devices that are equipped with Advanced Cylinder Support, the gas cylinder valves can remain open during operation. These devices are identified by an appropriate label near the gas inlets, see page 28.

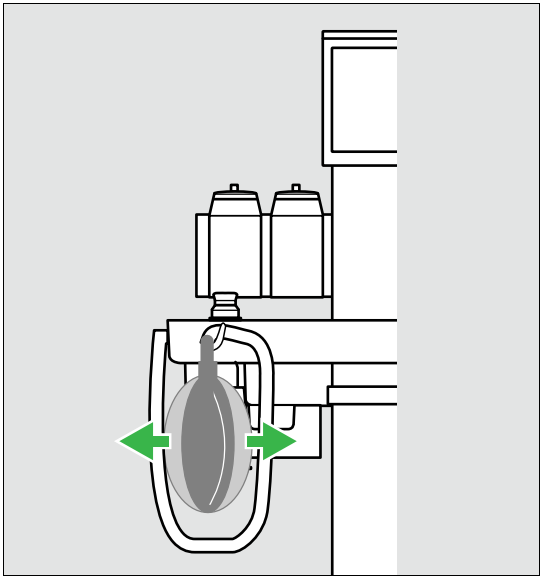
Checking the emergency O_2 delivery (with electronically controlled gas mixer)

Prerequisite: Y-piece is sealed.

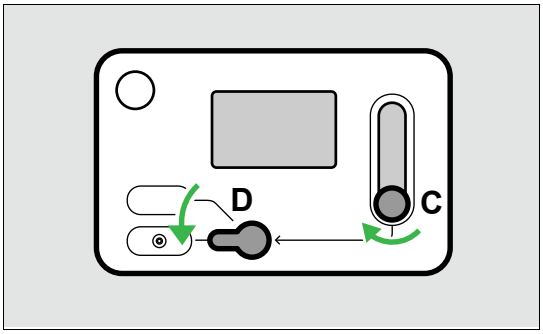


1 Set O_2 switch (A) to the ***Add. O_2*** position.

2 Open the flow control valve (B) of the O_2 flowmeter and set the desired O_2 flow.



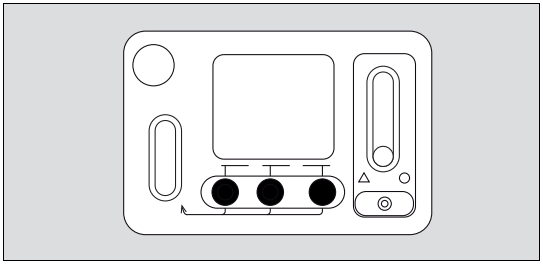
The breathing bag fills and the inflow of gas is audible.



3 Close the flow control valve (C).

4 Reset O_2 switch (D) to the ***Aux. O_2*** position.

Checking the flow control valves (mechanically controlled gas mixer)



1 Open the flow control valve for O_2 and set a flow of approximately 2 L/min.
   – The breathing bag inflates.
   – The inflow of gas is audible.
   – The total flow tube shows the total fresh-gas flow.

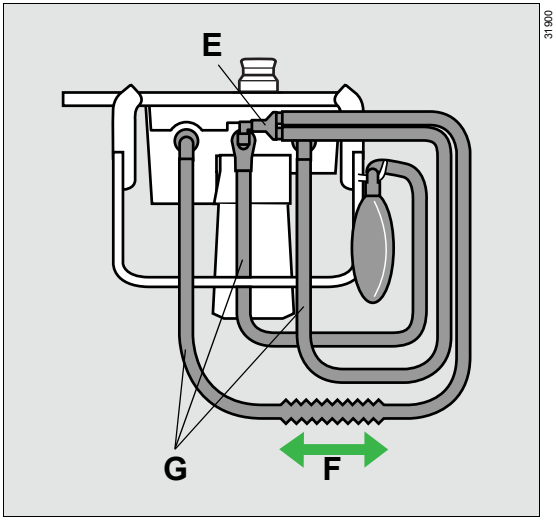
2 Repeat the settings for the Air and N_2O flow control valves.

3 Close all the flow control valves.

Breathing circuit

Prerequisite:

– Breathing system is complete and locked.
– Breathing system cover is in place.

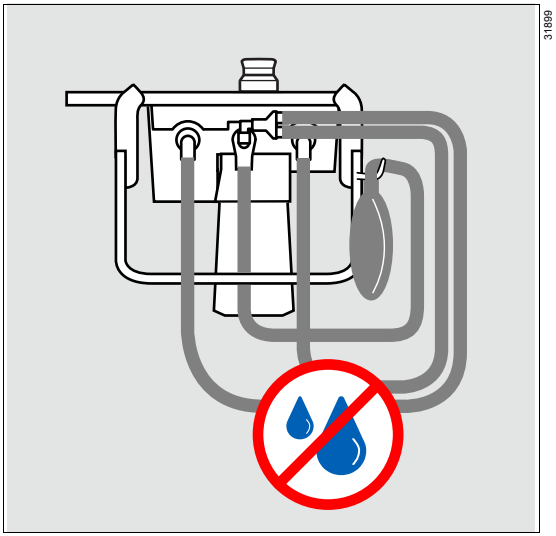


1 Hoses (G) and filters, e.g., at the Y-piece (E), are connected properly.

2 Extendable hoses (F) are extended to the foreseen application length.

NOTE

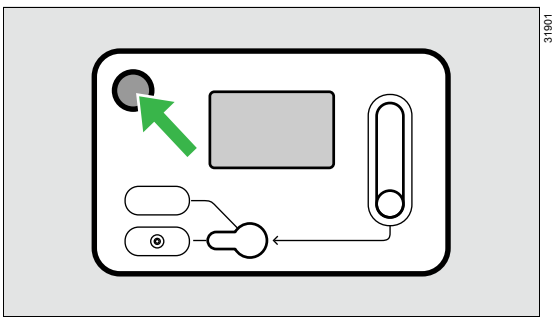
Do not change the length of flex hoses after the test is done.



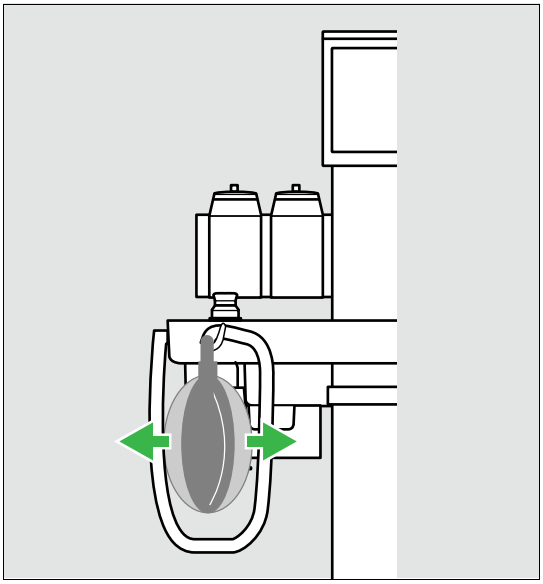
3 Remove the water from the hoses.

Valves

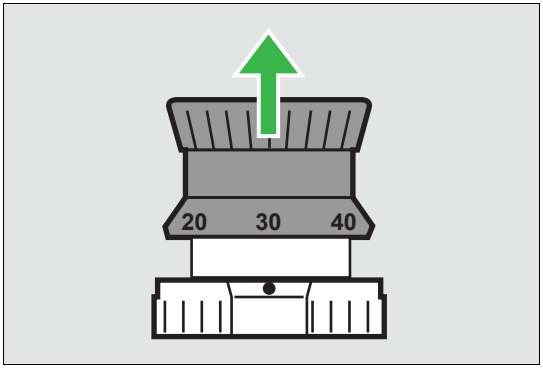
Checking the O_2 flush



1 Press the ***O2+*** key and keep it pressed until the pressure exceeds 15 hPa.



The breathing bag fills and the inflow of gas is audible.

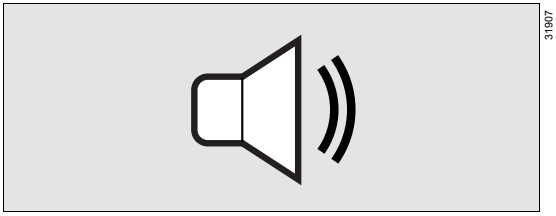


2 Lift the APL valve.

The pressure is released.

Components

Loudspeakers

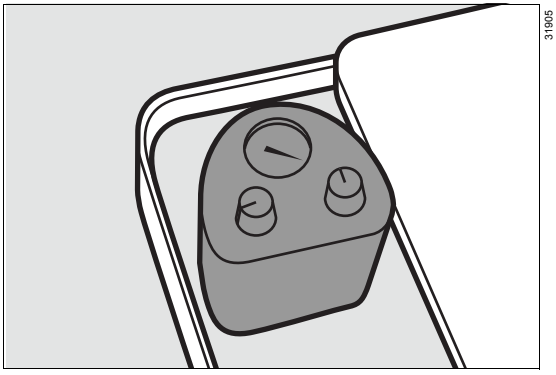


- Touch the button and wait for 2 acoustic signals.

NOTE

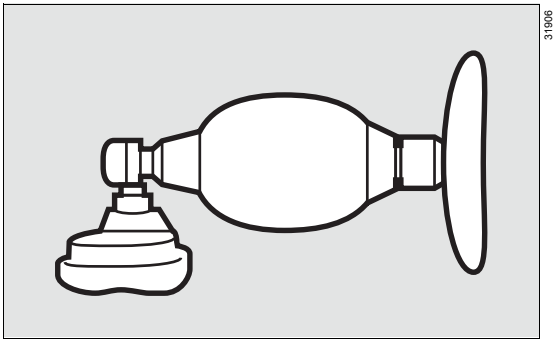
If the acoustic signals are not emitted, contact service personnel.

Bronchial suction



- Check the functional integrity of the bronchial suction.

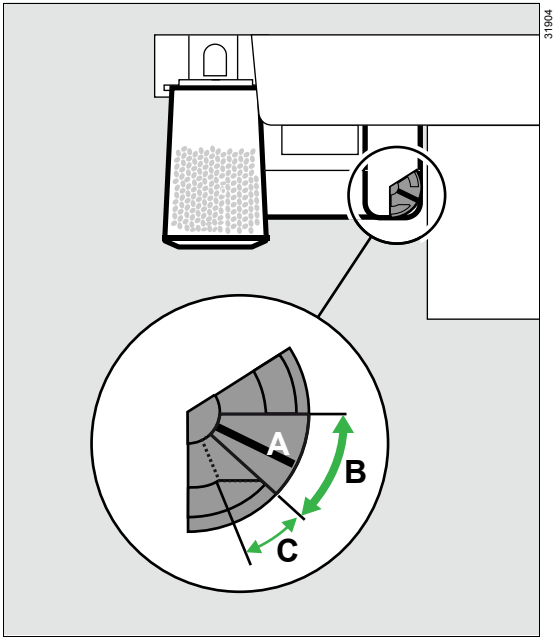
Manual resuscitator



1 Make sure there is a manual resuscitator on the device.

2 Check the functional integrity of the manual resuscitator.

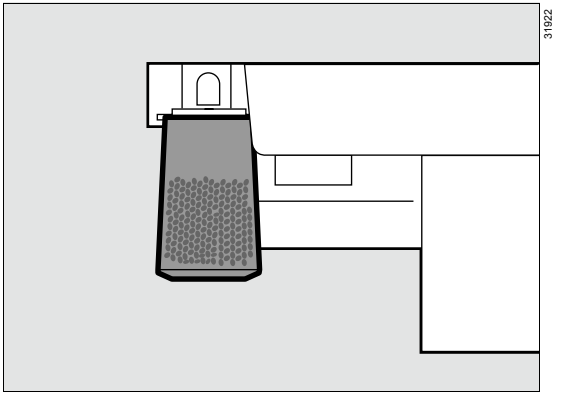
Anesthetic gas receiving system



- Have the flow for the anesthetic gas scavenging system set so that the red flow indicator (A) floats in range (B) ("normal range").
  When the flow indicator is floating in range (C) ("restricted range"), certain fresh-gas flow rates should not be exceeded, see "Anesthetic gas receiving system" in chapter "Technical data". This can prevent contamination of the ambient air.

Accessories

Soda lime



1 Make sure that the soda lime is not discolored. Change the soda lime if it is discolored or when its maximum period of use has been reached, see page 76.

When Infinity ID functionality is configured:

– Absorbers of the type Infinity ID CLIC Absorber will automatically be detected, and the exchange date will automatically be set.

When Infinity ID functionality is not configured:

– Absorbers will not be detected, e.g., reusable CO_2 absorbers

- Update the exchange date manually: Touch the ***Reset*** button after the soda lime has been replaced.

WARNING

Risk due to soda lime drying out

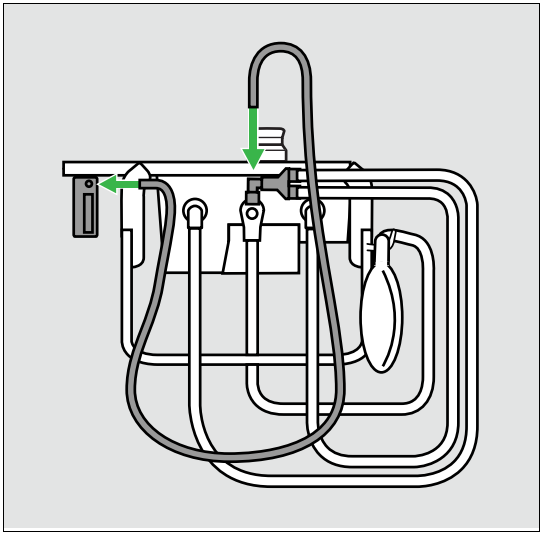
The soda lime loses moisture. If the moisture level falls below the minimum moisture level, the following adverse reactions occur regardless of the type of soda lime and the inhalational anesthetic agent used: Decreased CO_2 absorption, increased generation of heat in the CO_2 absorber resulting in increased breathing gas temperature, formation of CO, absorption and/or degradation of the inhalational anesthetic agent.

- **Do not use unnecessarily high fresh-gas flows.**
- **Only use the O_2 flush if necessary.**
- **With electronically controlled gas mixer: Only use the emergency O_2 delivery if necessary.**
- **With mechanically controlled gas mixer: Do not leave the flow control valves open unnecessarily long.**

NOTE

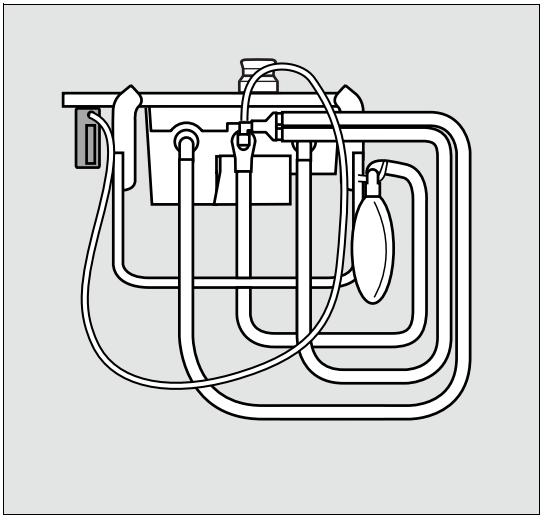
Only perform leakage tests with CLIC absorber locked into place because this affects the system compliance values.

Sample line



- Connect the sample line.

Water trap



1 Check the water level in the water trap.

2 Pay attention to the period of use of the water trap and replace if necessary.

When Infinity ID functionality is configured:

– Water traps of type Infinity ID WaterLock 2 will automatically be detected and the exchange date will automatically be set.

When Infinity ID functionality is not configured:

– Water traps will not be detected.

- Update the exchange date manually: Touch the ***Reset*** button after a new water trap has been installed.

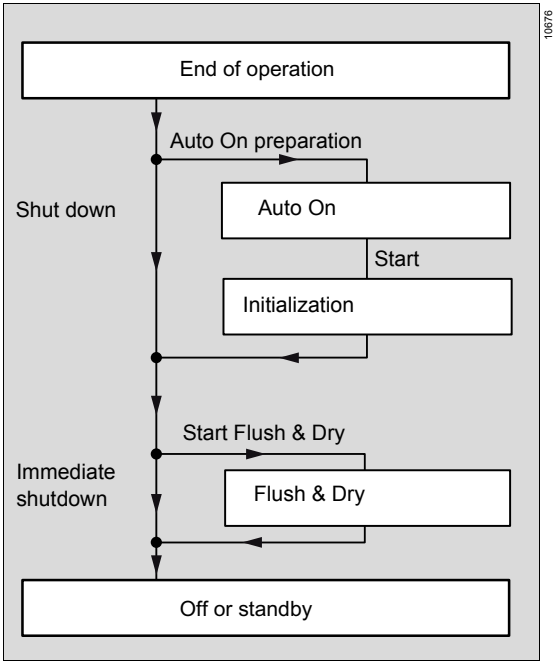
Ending operation

Turning off the device

Dräger recommends shutting down Perseus during longer periods of non-use such as overnight or on weekends. This can lower power consumption and prolong the life span of the medical device without negatively influencing device availability.

When shutting down the device, several functions are available to the user.

Function	
Auto On (optional)	Prepares the device for automatic start-up, including system test.
Flush & Dry	Flushes and dries the breathing system.



For more information, see page 165.

End of operation

1. Make sure that all flow control valves are closed.
2. Press the ⏻ button.
3. Follow the instructions on the screen.

Programming the system test (*Auto On* option)

Using the ***Auto On*** function, the device can be programmed so that it performs an automatic system test and is tested at a specific time.

During the initialization, the ***Auto On*** function checks the components that frequently cause irregularities: e.g., high leakage, incorrect setting of APL valve. After that, the device remains in the ***Standby*** mode until the automatic system test, or it is shut down.

1. Press the ⏻ button.
2. Touch the ***Auto On preparation*** button.
3. Prepare the device in accordance with the instructions on the screen. For details on the test steps, see page 126.
4. Set the desired day and time when the device should next be ready for operation.
5. Select whether the device should remain in ***Standby*** mode or shut down.
6. Touch the ***Start*** button.
7. Take note of any messages that appear.

After the Auto On initialization is complete, the time remaining until the system test is displayed in the ***Standby*** mode. When the device is being shut down, the corresponding symbol is shown in the status display, see page 31.

For a final test of the operational readiness of the device, it is only necessary to perform some brief manual checks after the automatic system test.

Flushing and drying the breathing system (*Flush & Dry* function)

Dräger recommends always flushing the breathing system before switching off to prevent damage or failure due to residual anesthetic agent and residual moisture.

During this process, first ambient air is used for flushing because this does not dry out the soda lime. Then a small amount of Air or O_2 from the central gas supply or the gas cylinders is used to dissipate residual moisture.

1. Prepare the device in accordance with the instructions on the screen.
2. Touch the ***Start Flush & Dry*** button.
3. If necessary, cancel the flushing with ***Cancel*** to return to the ***Standby*** mode.

After the flushing procedure, Perseus shuts down or remains in the ***Standby*** mode (***Auto On*** option).

Storing the device

To store Perseus

1. Set the main switch to position ***0***.
2. Disconnect from mains power supply if necessary.

Disconnecting the mains power supply

- Pull out the mains plug.

On the ceiling-mounted version, the corresponding cable is labeled with ***Perseus***.

Alarms

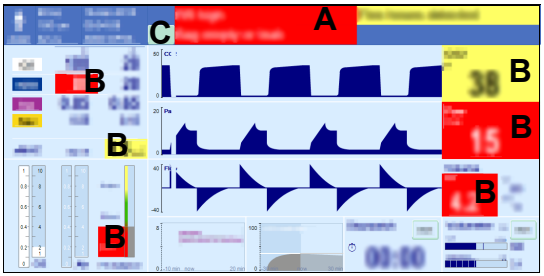
Displaying alarms

Alarms are signaled optically and acoustically.

Optical alarm signals

On the screen

In the event of an alarm, the system displays the relevant alarm message in the alarm message field (A). The parameter field (B) for the alarm-generating parameter flashes.



Up to 8 alarms can be displayed simultaneously in the alarm message field in the header bar (A). If more alarms occur, the ***All alarms*** button (C) is displayed in the header bar. Touching this button opens the dialog window ***Alarms*** > ***Current alarms*** with information about all active alarms, see page 140.

On Dräger Vapor 3000

When the Vapor View option is installed, alarms concerning the vaporizer are signaled by blinking illumination on theDräger Vapor 3000 if their cause can be remedied by adjusting or refilling the vaporizer, for example:

- ***Inspiratory xMAC high***
- ***Filling level of vaporizer low***
- ***Vaporizer open***
- ***xMAC low***

Acoustic alarm signals

It always is the alarm with the highest priority that is acoustically signaled. The signal is emitted until either the cause of the alarm is remedied or the 🔕 ***Audio paused*** key is pressed.

Depending on the overall alarm situation, it is possible that the 10-tone sequence for the high alarm priority is only issued as a 5-tone sequence due to the coinciding occurrence of alarms.

Regardless of the set alarm volume, the ***No O_2 delivery*** alarm is issued at maximum volume.

Alarm priorities

Perseus assigns the appropriate priority to each alarm message.

The background color of the alarm message field indicates the alarm priority of the active alarms. The parameter field of the parameter triggering the alarm flashes in the color matching the alarm priority.

Background color	Alarm priority	Marking	Meaning
Red	High	!!!	Immediate action is necessary in order to avert imminent danger.
Yellow	Medium	!!	Prompt action is necessary in order to avert a danger.
Cyan	Low	!	Attention is necessary, but a delayed response is sufficient.

Response to alarms

Displaying information on alarms

1 Touch the alarm in the header bar.
Or
Open the ***Alarms*** dialog window and touch the ***Current alarms*** tab (A).

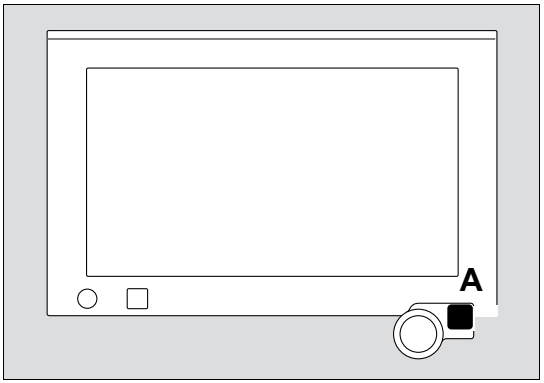
2 In the list (B), touch the corresponding alarm or select it with the rotary knob.

3 Refer to the information under ***Cause*** (C) and ***Remedy*** (D) to remedy the error.

A list of all possible alarms can be found in chapter "Troubleshooting", see page 191

Suppressing the alarm tone

The alarm tone can be suppressed for a maximum of 2 minutes.



- Press the 🔕 ***Audio paused*** key (A) below the screen, see page 19.

The 🔕 symbol and the remaining time for the suppressed alarm tone are displayed in the header bar.

After the alarm suppression has expired, the alarm tone immediately resumes if the cause of the alarm still exists.

While the alarm tone is suppressed, only those alarms with a higher alarm priority or internal priority rating are issued acoustically, see page 191.

Reactivating the alarm tone

- Press the 🔕 ***Audio paused*** key again.

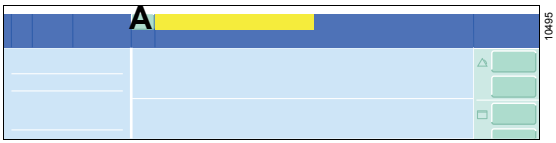
Downgrading and acknowledging alarm messages

Some alarms can be downgraded to low priority or can be cleared completely. The relevant alarms can be identified in the table "Alarm – Cause – Remedy" on page 191 by the following remedial messages:

Remedial message	Effect
Use "ALARM RESET" to downgrade alarm priority.	Alarm priority is changed to low.
Use "ALARM RESET" to acknowledge alarm.	Alarm is reset.

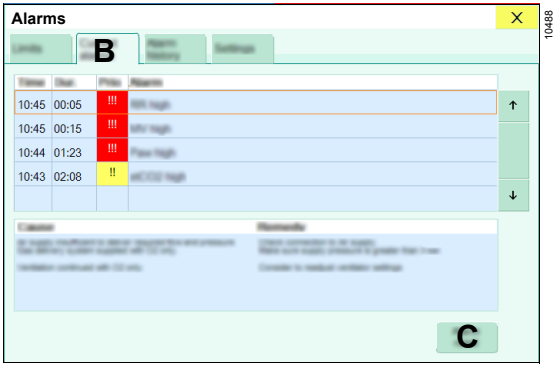
There are 2 options for downgrading or resetting the alarms:

Option 1:



Or

Option 2:



Option 1	Option 2
Touch the ***ALARM RESET*** button (A) in the header bar and confirm.	In the ***Alarms*** > ***Current alarms*** dialog window (B), touch the ***Reset all*** button (C) and confirm.
All the alarms displayed in the alarm message field will be downgraded or reset.	All alarms will be downgraded or reset.

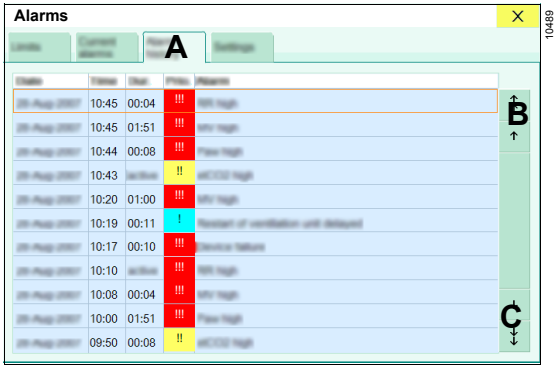
After an alarm is downgraded, the respective priority rating is maintained , see table "Alarm – Cause – Remedy" on page 191.

Opening the alarm history

The alarm history records all alarm messages for the current case in chronological sequence.

1 Open the ***Alarms*** dialog window.

2 Touch the ***Alarm history*** tab (A).

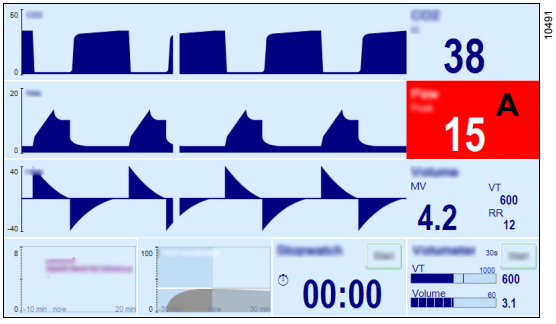


Use the rotary knob or the arrow buttons to scroll the cursor up (B) or down (C).

The alarm history is deleted when Perseus is shut down or a new case is started.

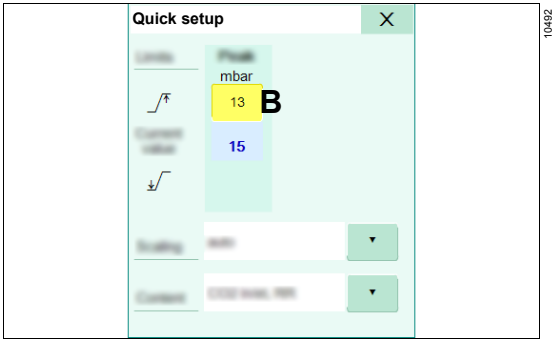
Adjusting the alarm limits

If an alarm is triggered because a lower limit or an upper limit is transgressed, it might be necessary to adjust the alarm limits. To do so, either set the alarm limits, see page 110, or change the alarm limits via the ***Quick setup*** window.



1 Touch the parameter field (A).

The ***Quick setup*** window opens, and the alarm limit (B) that was violated is already selected.



2 Adjust the value (B) and confirm.

Perseus can be configured so that the ***Quick setup*** window opens automatically in the event of an alarm, see page 155.

Adopting alarm settings when changing the ventilation mode

When the ventilation mode is changed, the alarm settings are also adapted.

Depending on the mode, alarm settings can either be adopted or set to Off.

Some modes can be configured whether or not the settings are adopted.

However, the settings can be adjusted at any time during operation.

<table>
<tr><th rowspan="2">Alarm or alarm limit</th><th colspan="4">Mode</th></tr>
<tr><th>VC,
VC - AF,
PC,
PC - APRV (optional)
PSV (optional) with
ΔPsupp
≥
5 hPa</th><th>Pause, Man/Spon,
PSV (optional) with
ΔPsupp <5 hPa</th><th>Ext. FGO (optional)</th><th>CBM mode</th></tr>
<tr><td>FiO2 low</td><td rowspan="12">Is restored or remains active</td><td colspan="3" rowspan="2">Alarm settings are adopted</td></tr>
<tr><td>inAgent high</td></tr>
<tr><td>Apnea (no CO2)</td><td colspan="2">Alarm settings are adopted</td><td rowspan="3">Off</td></tr>
<tr><td>etCO2 high
etCO2 low</td><td colspan="2" rowspan="4">configurable, see page 156</td></tr>
<tr><td>inCO2 high</td></tr>
<tr><td>FiO2 high</td><td>configurable, see page 156</td></tr>
<tr><td>inAgent low</td></tr>
<tr><td>xMAC low</td><td colspan="2">Not activated</td></tr>
<tr><td>Paw high</td><td>Alarm settings are adopted</td><td rowspan="4">Not measured</td><td>Alarm settings are adopted</td></tr>
<tr><td>Paw low</td></tr>
<tr><td>MV high</td><td rowspan="2">configurable, see page 156</td><td rowspan="2">configurable, see page 156</td></tr>
<tr><td>MV low
Apnea (no flow)[1)]</td></tr>
<tr><td>Apnea (no pressure)</td><td>On</td><td colspan="3">Off</td></tr>
</table>

1) This alarm is only activated when the MV low alarm limit is also activated.

Activating the alarms related to volume

The upper alarm limit for ***MV*** is deactivated at the start of the ventilation, but can be set during the ventilation. The upper alarm limit for ***VTi*** is automatically set to 130 % of the set ***VT*** in volume-controlled ventilation modes. In pressure-controlled ventilation modes, it is deactivated at the start of the ventilation, but can be set during the ventilation.

The ***MV low*** alarm is delayed in certain cases and is issued as follows:

– No sooner than 90 seconds after a case starts,

– No sooner than 60 seconds after changing to a mode with greater respiratory support, see page 259.

– No sooner than 60 seconds after an ***Apnea (no flow)*** or ***Apnea (no pressure)*** alarm.

In volume-controlled ventilation modes, the alarm limit for the inspiratory tidal volume is automatically set to 130 % of the set tidal volume.

Resetting the Apnea (no CO_2) alarm

When changing to a ventilation mode with higher respiratory support, the ***Apnea (no CO_2)*** alarm is reset. If the apnea situation persists, an alarm appears after the time specified in the table "Alarm delay and alarm escalation".

Alarm delay and alarm escalation

To prevent unnecessary alarms, some alarms are not displayed immediately after a limit violation, but after a delay. In addition, certain circumstances can cause the alarm priority to change.

Alarm	Priority		
	Low	Medium	High
inCO_2 high etCO_2 high etCO_2 low FiO_2 high Inspiratory N_2O high	---	After two successive respiratory phases and 15 seconds	---
inAgent low	After two successive respiratory phases and 15 seconds	---	---
FiO_2 low	---	---	After two successive respiratory phases and 15 seconds or after 30 seconds if no respiratory phases are detected

Alarm	Priority		
	Low	**Medium**	**High**
inAgent high	---	After two successive respiratory phases and 15 seconds or after 30 seconds if no respiratory phases are detected	>165 seconds later
Inspiratory xMAC high	---	insp. MAC ≥ 3 for more than 180 seconds	longer than 30 seconds: insp. MAC ≥ 3 and exp. MAC ≥ 2.5 or insp. MAC ≥ 5
xMAC low	0 to 60 s	>60 s	---
Apnea (no CO_2) Apnea (no flow) Apnea (no pressure) Apnea	---	at the latest after 20 seconds (for RR ≥ 6) or At the latest after 35 seconds (for RR <6) or at the latest after 65 seconds for the Pause, Manual / Spontaneous and Ext. FGO modes	15 seconds later (for RR ≥ 6) or 30 seconds later (for RR <6)
Apnea Ventilation	At the latest after 20 seconds (15 seconds for RRmin ≥ 4) (configurable, see page 155)		---
No CO_2 detected	>60 s	---	---
Inspiratory tidal volume high Tidal volume not achieved	---	After 3 successive breaths	---

Alarm	Priority		
	Low	**Medium**	**High**
Airway press. continuously high	---	---	> 15 seconds above the manually or automatically set limit
Airway pressure negative	---	---	Pmean < –2 or Paw < –10
PEEP/CPAP high	---	Airway pressure >(PEEP +5 hPa) during more than 10 consecutive breaths	---
Airway pressure not achieved	---	>15 seconds (for RR ≥ 6) or >30 s (for RR <6 or PSV)	---
Cardiac bypass mode still active?	---	If a minute volume of >50 % of the suggested value is measured after CBM mode has been activated for >60 seconds	---
Fresh gas low or leakage	Breathing bag almost empty	Breathing bag empty	after 30 s or in the event of the additional alarm "Apnea (no flow)" or "Apnea (no pressure)" or in the event of the additional alarm "Emergency air inlet activated"
O_2 measurement not available N_2O measurement not available Agent measurement not available O_2 measurement temporarily inaccurate CO_2 sensor accuracy low Agent measurement temporarily inaccurate N_2O measurement temporarily inaccurate Measured gas concentrations temporarily inaccurate	>20 s	---	---

Activation of alarms after breath detection

If no breaths have been detected even after leaving the ***Standby*** or ***Pause*** modes, the breathing gas is monitored with regard to an O_2 concentration that is too low or an anesthetic gas concentration that is too high, regardless of the respiratory phase. At the same time, the message ***Waiting for respiratory phases*** is displayed in the CO_2 waveform, and the symbol "Alarm temporarily inactive" is displayed beside the relevant parameters.

Once 2 breaths have been detected, the message and the symbol disappear. Only then, the respiratory-phase-dependent O_2, CO_2, N_2O, and anesthetic gas alarms are completely activated.

Intelligent alarm behavior

Combined alarms

If multiple alarms occurring at the same time are caused by the same problem, they are combined into one alarm.

Problem	Alarms occurring at the same time	Combined alarm
Several causes of apnea are present.	***Apnea (no flow)*** ***Apnea (no pressure)*** ***Apnea (no CO_2)***	***Apnea***
Faults in multiple components. This causes failure of a system function.	Example: ***Insp. press. sensor failure*** ***Exp. press. sensor failure***	***Ventilator failure***

Suppressed alarms

Some low-priority alarms indicate a fault in a measurement function. If this measurement function monitors physiological parameters, alarms based on these parameters will not be generated.

Example:

Fault	Displayed alarm	Non-generated alarm
CO_2 measurement is faulty	***Sample line occluded***	***Apnea (no CO_2)***

Configuration

Device settings

Factory settings

Dräger delivers Perseus with factory settings that are used when starting the device for the first time. Service personnel can reset the device to the factory settings.

Start settings

Start settings take effect after every restart of the device or when starting a new case (touching one of the ***New adult***, ***New pediatric*** or ***New neonate*** buttons). The start settings can be adjusted after the configuration password is entered.

If required, Perseus can be delivered with start settings that may differ from the factory settings.

User-specific settings

User-specific settings can be adjusted by the user without a configuration password. The settings take effect immediately but are discarded at the latest after a device restart.

Setting the date and time

Perseus can adopt the time from a network or from a device connected via MEDIBUS. The time synchronization takes place shortly after switch-on and at regular intervals thereafter.

If time synchronization is not set, the time can be changed manually:

- Touch field (A).

Or

- Set the date and time in the system setup.

The source for the time synchronization can also be set in the system setup. For more information, see page 164.

Defining the start settings

As soon as a vertical tab is selected, entry of the configuration password is required to access the settings in the ***System setup*** dialog window.

For information on the configuration password, see page 285.

Adjusting the settings

The following tables show all the setting possibilities in the ***System setup*** dialog window.

The respective factory settings are marked in **bold** format.

System setup > Screen layout

Vertical tab "General"

Headline/ Parameter	Setting range			Description
				
Color scheme	**Day light**; Day dark; Night			Set the color scheme, see page 43
Screen brightness	10 to 100 **80**			Set the screen brightness.

Vertical tab "Views"

Headline/ Parameter	Setting range			Description
				
Rename views	1 Standard; 2 Expert; 3 Expert			Specify names for screen layouts. Touch the button with the respective screen layout, enter the new name on the screen keyboard, and confirm with the ↵ button or with the rotary knob.
Number of waveforms (view 3)	**3**; 4			
Default view	**1 Standard**; 2 Expert; 3 Expert			Specify the standard view.
Save as system defaults	Current view (only available during operation)			Save current screen layout.
	All views			Save all screen layouts.

Vertical tab "Waveforms"

Headline/ Parameter	Setting range			Description
				
Sweep speed [mm/s]	**6.25**; 12.5; 25	**6.25**; 12.5; 25	6.25; **12.5**; 25	Specify sweep speed.
VT scale [mL]	**Auto**; 0 to 10; 0 to 50; 0 to 150; 0 to 500; 0 to 1000; 0 to 2000	**Auto**; 0 to 10; 0 to 50; 0 to 150; 0 to 500; 0 to 1000; 0 to 2000	**Auto**; 0 to 10; 0 to 50; 0 to 150; 0 to 500; 0 to 1000; 0 to 2000	Specify scale for volumeter.
Flow scale [L/min]	**Auto** -5 to 5 -10 to 10; -30 to 30; -60 to 60; -120 to 120	**Auto** -5 to 5 -10 to 10; -30 to 30; -60 to 60; -120 to 120	**Auto** -5 to 5 -10 to 10; -30 to 30; -60 to 60; -120 to 120	Specify scale for flow waveform.
O_2 scale [%]	**Auto**; 0 to 100; 15 to 35; 25 to 45; 35 to 55; 45 to 65; 55 to 75; 65 to 85; 75 to 95; 85 to 105			Specify scale for O_2 waveform.
CO_2 scale	[%]; [kPa]: **Auto**; 0 to 6; 0 to 12 [mmHg]: **Auto**; 0 to 50; 0 to 100			Specify scale for CO_2 waveform.
Paw scale [mbar]; [hPa]; [cmH_2O]	**Auto**; -5 to 20; -7.5 to 30; -10 to 40; -20 to 80			Specify scale for the Paw waveform.
Agent prediction scale	**Full range**; 0 to 2 xMAC; 0 to 1 xMAC			Specify scale for anesthetic gas prediction.
Flow-volume loop	**ISO standard**; Dräger			Specify coordinate axes for flow/volume loop display.

Vertical tab "Colors"

Headline/ Parameter	Setting range			Description
				
CO_2; Paw; Flow, volume	**Default color**; color palette with 7 additional colors			Specify parameter colors.
O_2; Agent	**Default color**; ISO color			

System setup > Alarms

Vertical tab "Alarm limits"

Headline/ Parameter	Setting range			Description
				
Alarm limits for ventilation and gases for each patient category				
FiO_2 ⌐▲ [%]	19 to 99; **Off**	19 to 99; **Off**	19 to 99; Off **90**	Inspiratory oxygen fraction
FiO_2 ▼¬ [%]	18 to 98 **20**	18 to 98 **20**	18 to 98 **20**	
$etCO_2$ ⌐▲ [%]; [kPa] [mmHg]	0.1 to 9.8; Off **7.0** 1 to 75; Off **53**	0.1 to 9.8; Off **7.0** 1 to 75; Off **53**	0.1 to 9.8; Off **7.0** 1 to 75; Off **53**	Expiratory CO_2 concentration
$etCO_2$ ▼¬ [%]; [kPa] [mmHg]	**Off**; 0.0 to 9.7; **Off**; 0 to 74	**Off**; 0.0 to 9.7; **Off**; 0 to 74	**Off**; 0.0 to 9.7; **Off**; 0 to 74	
$inCO_2$ ⌐▲ [%]; [kPa] [mmHg]	0.1 to 1.4; Off **1.0** 1 to 10; Off **8**	0.1 to 1.4; Off **1.0** 1 to 10; Off **8**	0.1 to 1.4; Off **1.0** 1 to 10; Off **8**	Inspiratory CO_2 concentration
Paw high ⌐▲ [mbar]; [hPa]; [cmH_2O]	5 to 99 **40**	5 to 99 **25**	5 to 99 **20**	Airway pressure If the airway pressure is above the set value for Paw low for longer than 15 s, the alarm Airway press. continuously high is issued. If the setting Auto is selected, the lower alarm limit is automatically adapted to the set value for PEEP.
Paw low ▼¬ [mbar]; [hPa]; [cmH_2O]	**Auto**; 3 to 97	**Auto**; 3 to 97	**Auto**; 3 to 97	
inSev ⌐▲ [%]; [kPa]	0.10 to 9.95 **4.40**	0.10 to 9.95 **5.10**	0.10 to 9.95 **6.70**	Sevoflurane
inSev ▼¬ [%]; [kPa]	**Off**; 0.00 to 9.85	**Off**; 0.00 to 9.85	**Off**; 0.00 to 9.85	

Headline/ Parameter	Setting range			Description
Alarm limits for ventilation and gases for each patient category				
inDes ▲ [%]; [kPa]	0.1 to 20.0 **12.5**	0.1 to 20.0 **14.5**	0.1 to 20.0 **19.0**	Desflurane
inDes ▼ [%]; [kPa]	**Off**; 0.0 to 19.9	**Off**; 0.0 to 19.9	**Off**; 0.0 to 19.9	
inEnf ▲ [%]; [kPa]	0.10 to 9.95 **3.60**	0.10 to 9.95 **4.10**	0.10 to 9.95 **5.40**	Enflurane
inEnf ▼ [%]; [kPa]	**Off**; 0.00 to 9.85	**Off**; 0.00 to 9.85	**Off**; 0.00 to 9.85	
inIso ▲ [%]; [kPa]	0.10 to 8.50 **2.40**	0.10 to 8.50 **2.80**	0.10 to 8.50 **3.70**	Isoflurane
inIso ▼ [%]; [kPa]	**Off**; 0.00 to 8.40	**Off**; 0.00 to 8.40	**Off**; 0.00 to 8.40	
inHal ▲ [%]; [kPa]	0.10 to 8.50 **1.60**	0.10 to 8.50 **1.90**	0.10 to 8.50 **2.40**	Halothane
inHal ▼ [%]; [kPa]	**Off**; 0.00 to 8.40	**Off**; 0.00 to 8.40	**Off**; 0.00 to 8.40	

Vertical tab "Alarm tone volume"

Headline/ Parameter	Setting range			Description
Alarm tone volume	10 to 100 **40**			Set the alarm tone volume.
Minimum alarm tone volume	10 to 100 **10**			Set the minimum volume with which an alarm tone will be signaled.

Vertical tab "Autoset limits"

Headline/ Parameter	**Setting range**			**Description**
				
Offset for "Autoset limits" function				
	Automatic adjustment of the parameters to current measured values, see page 111 By touching the Autoset button, the alarm limits are adjusted so that the upper alarm limit is above the current measured value by at least the percentage or value set here and the lower alarm value is correspondingly below it. Example: In the PC - CMV mode: measured MV: 5 L/min set offset: ±40 % new alarm limits: 7 and 3 L/min			
$etCO_2$ ± [%]	Off; 20 to 80 **20**			In modes with low or no breathing support (Man / Spon, Ext. FGO (optional), CPAP / PSV (optional) and Pause), a further 20 percentage points are added to the configured value.
Paw + [mbar]; [hPa]; [cmH_2O]	Off; 5 to 20 **5**			The following parameters are taken into account when determining the Paw value: PIP, Pplat, Pinsp, PEEP, ΔPsupp and Phigh. In the Man / Spon and Pause modes, the new alarm limit is at least 25 hPa.
MV ± [%]	Off; 20 to 80 **40**			In modes with low or no breathing support (Man / Spon, CPAP / PSV (optional) and Pause), a further 20 percentage points are added to the configured value.
VTi + [%]	Off; 20 to 80 **40**			The setting for this parameter has no effect in volume-controlled ventilation modes.

Vertical tab "Alarm config. 1"

Headline/ Parameter	**Setting range**			**Description**
				
General alarm behavior				
Open "Quick setup" if alarm occurs	**On**; Off			Opens the Quick setup window automatically in the event of an alarm.
"Second agent detected" alarm	**On**; Off			Issues an alarm when an anesthetic gas mixture is detected.
"xMAC low" alarm	**On**; Off			Activate the xMAC low alarm.
"FiO_2 too high for neonates" threshold value [%]	**50**; 25 to 90			Set the FiO_2 value that is considered critical for neonates. If this value is exceeded for a certain time, the FiO_2 too high for neonates alarm will be triggered.
"FiO_2 too high for neonates" alarm after [h:mm]	Off; 0:10 to 9:50 **0:15**			Set the time after which the FiO_2 too high for neonates alarm will be triggered.
Priority of "Apnea ventilation" alarm	**Medium**; Low			Specify the alarm priority when the set minimum respiratory rate is not reached in PSV ventilation mode.
Alarm behavior in "Pause" mode				
Priority of "Pause time expired" alarm	**High**; Medium; Low			Specify the alarm priority for the alarm that is issued when the time set in the Pause mode has expired.
Default value for "Timer" [mm:ss]	0:30 to 02:00 **2:00**	0:30 to 02:00 **1:00**	0:30 to 02:00 **0:30**	Specify default time for Pause.

Vertical tab "Alarm config. 2"

Headline/ Parameter	**Setting range**			**Description**
				
Deactivate the alarm limit when activating Man/Spon, CPAP, CPAP/PSV with ΔPsupp < 5, or Pause?				The CPAP and CPAP / PSV modes are optional.
FiO_2 high	Yes; **No**	Yes; **No**	Yes; **No**	Specifies the alarm behavior when changing to a different ventilation mode. These settings apply only to a change to a ventilation mode with lower or no breathing support (see page 259). The alarm behavior at the start of the therapy is defined by the configuration in the vertical tab ***Alarm limits***.
MV low	**Yes**; No			
MV high	**Yes**; No			
xMAC low	Yes; **No**			
$etCO_2$ low	**Yes**; No			
$etCO_2$ high	**Yes**; No			
$inCO_2$ high	**Yes**; No			
inAgent low	**Yes**; No			
Deactivate the alarm limit in cardiac bypass mode (CBM)?				
FiO_2 high	Yes; **No**			Specify alarm behavior in CBM mode.
MV low	**Yes**; No			
MV high	**Yes**; No			
inAgent low	**Yes**; No			

Vertical tab "Alarm config. 3"

Headline/ Parameter	**Setting range**			**Description**
				
Alarm limits for "Cylinder almost empty"				
O_2	[bar]; [kPax100]: Off; 15 to 50 **20** [psi]: Off; 218 to 725 **290**			Specify alarm limits for supply pressure of connected gas cylinders.
Air	[bar]; [kPax100]: Off; 15 to 50 **20** [psi]: Off; 218 to 725 **290**			
N_2O	[bar]; [kPax100]: Off; 15 to 40 **20** [psi]: Off; 218 to 580 **290**			

System setup > Therapy

Vertical tab "Vent. 1"

Headline/ Parameter	**Setting range**			**Description**
				
Default ventilation mode	Buttons with available ventilation modes **Man/Spon**			Specify the default ventilation mode at start of therapy.
VT and RR start settings				Specify the tidal volume and respiratory rate.
Based on	Patient category; **Ideal body weight**			
Selected: [Patient category]				Specify tidal volume and respiratory rate based on patient category.
VT [mL]	20 to 2000 **500**	20 to 2000 **150**	20 to 2000 **50**	
RR [1/min]	3 to 100 **12**	3 to 100 **20**	3 to 100 **30**	
Selected: [Ideal body weight]				Specify the tidal volume and respiratory rate based on ideal body weight. Set the tidal volume and the respiratory rate for the supporting points 5; 15; 75; 100 kg (11; 33; 165; 220 lbs). For calculated values for ideal body weight values that lie between these four supporting points, the start settings for tidal volume and respiratory rate are interpolated linearly. For ideal weight values lying outside these supporting points, calculation proceeds with the values of the highest or lowest supporting point.
VT [mL]	20 to 2000 100 kg (220 lbs): **700** 75 kg (165 lbs): **520** 15 kg (33 lbs): **110** 5 kg (11 lbs): **35**			
RR [1/min]	3 to 100 100 kg (220 lbs): **10** 75 kg (165 lbs): **12** 15 kg (33 lbs): **26** 5 kg (11 lbs): **32**			

The start settings for VT and RR influence the start values of the alarm limits for MV high, MV low, and VTi high:

MV high = VT x RR x (1 + offset);
minimal: 2.0 L/min

MV low = VT x RR x (1 – offset);
minimal: 0.3 L/min

VTi high = VT x (1 + offset)

The "offset" value corresponds to the respective offset setting for automatic alarm adjustment. The "offset" value can be set in the ***System setup*** > ***Alarms*** > vertical tab ***Autoset limits***.

The following applies in volume-controlled modes:

VTi high = 130 % x VT

Vertical tab "Vent. 2"

Headline/ Parameter	**Setting range**			**Description**
				
Start settings for ventilation				Specify start settings for the ventilation.
Pmax [mbar]; [hPa]; [cmH2O]	7 to 80 **40**	7 to 80 **30**	7 to 80 **25**	
Pinsp [mbar]; [hPa]; [cmH2O]	3 to 80 **15**	3 to 80 **15**	3 to 80 **15**	
ΔPsupp [mbar]; [hPa]; [cmH2O]	Off; 1 to 80 **10**	Off; 1 to 80 **10**	Off; 1 to 80 **10**	
Insp. term. [%PIF]	5 to 80 **25**	5 to 80 **25**	5 to 80 **25**	
PEEP [mbar]; [hPa]; [cmH2O]	Off; 2 to 35 **3**	Off; 2 to 35 **3**	Off; 2 to 35 **3**	
Slope [s]	0 to 2 **0.2**	0 to 2 **0.2**	0 to 2 **0.2**	
RRmin [1/min]	Off; 3 to 25 **6**	Off; 3 to 25 **10**	Off; 3 to 25 **15**	
I:E	1:50 to 50:1 **1:2.0**	1:50 to 50:1 **1:2.0**	1:50 to 50:1 **1:1.0**	
%Tplat [%]	0 to 60 **20**	0 to 60 **20**	0 to 60 **20**	
Trigger [L/min]	0.3 to 15 **4.0**	0.3 to 15 **2.0**	0.3 to 15 **1.0**	
Sync.	On; **Off**	On; **Off**	On; **Off**	

Headline/ Parameter	**Setting range**			**Description**
				
Start settings for APRV (optional)				
Phigh [mbar]; [hPa]; [cmH2O]	3 to 80 **15**	3 to 80 **15**	3 to 80 **15**	
Plow [mbar]; [hPa]; [cmH2O]	Off; 2 to 35 **3**	Off; 2 to 35 **3**	Off; 2 to 35 **3**	
Tlow [s]	0.2 to 10 **4.0**	0.2 to 10 **2.0**	0.2 to 10 **1.0**	
Thigh [s]	0.2 to 10 **2.0**	0.2 to 10 **1.0**	0.2 to 10 **1.0**	
Slope [s]	0 to 2 **0.0**	0 to 2 **0.0**	0 to 2 **0.0**	

Vertical tab "Proced. 1"

Headline/ Parameter	**Setting range**			**Description**
				
General settings				
Default maneuver	One-step recruitment; Multi-step recruitment; **Insp./Exp. hold**			Defines the default maneuver.
Reminder [min]	**Off**, 10 to 180	**Off**, 10 to 180	**Off**, 10 to 180	If the value is not set to Variable , a reminder for a maneuver is given after the first switch to a controlled ventilation mode. Defines the time after which, following the end of a One-step recruitment or Multi-step recruitment maneuver, a reminder for a further maneuver is given.
Layout				
Displayed parameter	**Cdyn**; VT			Defines which additional parameter is displayed in the One-step recruitment and Multi-step recruitment dialogs.

Vertical tab "Proced. 2"

Headline/ Parameter	Setting range			Description
				
Default settings for one-step recruitment				
Pressure [mbar]; [hPa]; [cmH2O]	PEEP + 1 to 80 **30**	PEEP + 1 to 80 **25**	PEEP + 1 to 80 **20**	Sets the pressure level for the maneuver.
Duration [s]	3 to 40 **30**	3 to 40 **15**	3 to 40 **5**	Sets the duration of the maneuver.
Default settings for multi-step recruitment				
PEEP max [mbar]; [hPa]; [cmH2O]	PEEP to 35 **20**	PEEP to 35 **15**	PEEP to 35 **12**	Sets the maximum PEEP pressure for the maneuver.
Pinsp max [mbar]; [hPa]; [cmH2O]	15 to 80 **35**	15 to 80 **30**	15 to 80 **25**	Sets the maximum inspiratory pressure for the maneuver.
ΔPressure [mbar]; [hPa]; [cmH2O]	5 to 30 **10**	5 to 30 **10**	5 to 30 **10**	Sets the pressure difference between Pinsp and PEEP with which pressure-controlled ventilation is carried out. If PEEP max or Pinsp max is reached in the course of the maneuver, the pressure difference will be reduced in steps until the other set value is also reached. The smallest possible value must be at least 3 above the set value for the pressure rise for each level.
Breaths/Step	1 to 20 **3**	1 to 20 **4**	1 to 20 **5**	Number of breaths at a pressure level during the increase or reduction
Breaths@Max	1 to 20 6	1 to 20 **8**	1 to 20 **10**	Number of breaths at the Pinsp max pressure level
Pressure rise per step [mbar]; [hPa]; [cmH2O]	2 to 10 **5**	2 to 10 **4**	2 to 10 **3**	Specifies the pressure by which PEEP and Pinsp will be increased in steps.
Pressure decrease per step when PEEP > 15 [mbar]; [hPa]; [cmH2O]	2 to 10 **5**	2 to 10 **4**	2 to 10 **3**	For PEEP >15: Specifies the pressure by which PEEP and Pinsp will be reduced in steps.

Headline/ Parameter	Setting range			Description
Pressure decrease per step when PEEP ≤ 15 [mbar]; [hPa]; [cmH_2O]	1 to 10 **2**	1 to 10 **2**	1 to 10 **2**	For PEEP ≤15: Specifies the pressure by which PEEP and Pinsp will be reduced in steps.

Vertical tab "Fresh gas" (only with electronically controlled gas mixer)

Headline/ Parameter	Setting range			Description
Start settings for fresh gas				Select start settings for the fresh-gas delivery.
FG O_2 [%]	21 to 100 **100**	21 to 100 **100**	21 to 100 **100**	Set the O_2 concentration.
FG flow [L/min]	0.20 to 15.00 **2.00**	0.20 to 15.00 **2.00**	0.20 to 15.00 **2.00**	Set the flow.
Minimal O_2 flow (carrier gas: Air) [mL/min]	Off, 50 to 300 **Off**	Off, 50 to 300 **Off**	Off, 50 to 300 **Off**	Set the minimum O_2 flow that is delivered when Air is used as carrier gas. Do not set this value too small; recommended is, e.g., 200 for adults, 100 for pediatric patients, and 50 for neonates.
Minimal O_2 flow (carrier gas: N_2O) [mL/min]	50 to 300 **200**	50 to 300 **200**	50 to 300 **200**	Set the minimal O_2 flow that is delivered when N_2O is used as carrier gas. Do not set this value too small; recommended is, e.g., 200 for adults, 100 for pediatric patients, and 50 for neonates.
Carrier gas	**Air**; N_2O	**Air**; N_2O	**Air**; N_2O	Set the carrier gas.

Vertical tab "Patient"

Headline/ Parameter	**Setting range**			**Description**
				
Default selection for "Start" dialog	Continue case; **New adult**; New pediatric; New neonate			Load patient data: The button that is selected here is preselected the first time the Start dialog window is opened or after changes to the system setup.
Weight [kg] [lbs]	30 to 300 **80** 67 to 661 **176**	5 to 50 **25.0** 12 to 110 **55**	0.4 to 10 **3.0** 0.9 to 22 **6.6**	Specify start settings for: – Patient weight – Patient height – Patient age If the Height parameter is configured to Off for the New neonate patient category, the corresponding setting control will not be displayed in the Start dialog window.
Height [cm] [in]	120 to 300 **185** 48 to 118 **73**	50 to 300 **100** 20 to 118 **39**	Off; 20 to 80 **Off** Off; 8 to 31 **Off**	
Age [years, Neo: months]	12 to 130 **32**	0 to 16 **8**	0 to 24 **6**	

Vertical tab "General"

Headline/ Parameter	**Setting range**			**Description**
				
Pinsp changes with PEEP	**On**; Off			Changing PEEP automatically changes Pinsp, so that the difference between PEEP and Pinsp remains constant.
Ti changes with RR (I:E ratio is locked)	**On**; Off			Changing the respiratory rate automatically changes Ti, so that the I:E ratio remains constant.
Breathing system warmer	**On**; Off			Switch breathing system warmer on or off.
Auto wake-up	**On**; Off			The Start dialog window opens automatically when ventilation activity is detected (e.g., by squeezing the breathing bag several times).

Headline/ Parameter	Setting range			Description
				
Enable pause mode (deactivates monitoring mode)	**On**; Off			Select whether Pause mode or Monitoring mode should be available. On: Pause mode is available. The mode has an adjustable timer, after which an alarm is generated. Pause can be activated from standby and from all ventilation modes. Off: Monitoring mode is available. Monitoring can be activated from Standby mode and from Man/Spon mode.

System setup > Licenses/Options

Vertical tab "Licenses/Options"

Headline/ Parameter	Setting range			Description
				
Licenses for software options				– Overview of available and active software options. – Activating software options. For more information, see page 172
Gas supply				
Disable N_2O	On; **Off**			A device with connectors for nitrous oxide can be configured so that nitrous oxide is no longer displayed, nor can it be selected as a carrier gas. Prerequisite: – Current carrier gas is Air – Nitrous oxide is not connected or available To make the settings, restart Perseus if necessary. On: Nitrous oxide cannot be delivered. Off: Nitrous oxide can be delivered.

System setup > System

Vertical tab "General"

Headline/ Parameter	Setting range			Description
				
Language	List of available languages **English (United States)**			Select language. A flag symbol identifies the tabs that lead to the page with the language settings.
Time source	MEDIBUS 1; MEDIBUS 2; NTP server; **None**			Select source for time synchronization. Prerequisite: Connected device supports this function.
IP address	4 numeric fields			Enter the IP address of the NTP server and confirm.
Date and time	day; month; year hour; minute			Set the date and time. The change is applied on leaving the "General" vertical tab.
Automatic switch to daylight savings time	**On**; Off			Activate or deactivate automatic switching to daylight saving time.
OR working hours	Hour : Minute to Hour : Minute **6:30 to 18:30**			Set the working hours of the operating room. During this time, the gas measurement is kept in a preheated and calibrated state so measured values are available after only a short waiting period. However, this decreases the life span of the patient gas measurement module.
Device name	Rename Device name (up to 16 alphanumeric characters) **Perseus**			Change system name to, e.g., enter the installation site.
Configuration password	Change password			Change the configuration password.
Reset all pages to	Factory defaults			Reset all the settings for the System setup dialog window to the factory settings.

Vertical tab "Units"

Headline/ Parameter	Setting range			Description
				
Weight	**kg**; lbs			Set units.
Height	**cm**; in			
Airway pressure	mbar; **hPa**; cmH_2O			
Supply pressure	bar; **kPa×100**; psi			
CO_2	%; kPa; **mmHg**			
Volatile agents	**%**; kPa			

Vertical tab "Auto On/Flush & Dry"

Headline/ Parameter	Setting range			Description
				
Auto On				Set the Auto On option. Perseus provides a calendar function which, when the device is shut down, suggests the next time the device should be ready for use, depending on the weekday. To activate the automatic ready-for-use time for any desired day, select the corresponding day and set the time, see page 136. Pay attention to the correct setting of the gas supplies to be tested, see page 166.
Day and time	Monday to Sunday; Hour : Minute **Monday to Friday**: **6:30** **Saturday & Sunday**: **Off**			
When completed	Standby/ **Shut down**			
Flush & Dry				
Flush duration between cases [min]	Off; 1 to 5 2			Set the flush cycle duration, e.g., at patient change. Off: Flush function is deactivated.
Flush & Dry duration before shut-down [min]	Off; 5 to 30 **10**			Set the duration of flushing and drying when the device is shut down. Off: Drying function is deactivated.

Vertical tab "System test"

Headline/ Parameter	Setting range			Description
				
General				
Always use walk-through mode	**On**; Off			When this function is switched on, system tests and leakage tests will always be executed in walk-through mode.
Sample line is connected during test	**On**; Off			Specify whether the sample line is connected to the Y-piece or to the filter on the Y-piece during the automatic tests. When On is configured, the device can automatically check whether, e.g., breathing hoses or central supply hoses are incorrectly connected. When Off is configured, additional checks are required during the system test.
Test gas supply				
Central O_2 supply	**On**; Off			Select which gas supplies are tested during the automatic system test. If Auto On is configured, only check the gas supplies whose actual availability is guaranteed after the automatic start-up. Setting both O_2 sources to Off - in order to make the system test succeed - is not possible.
Central Air supply	**On**; Off			
Central N_2O supply	**On**; Off			
O_2 cylinder	**On**; Off			
Air cylinder	**On**; Off			
N_2O cylinder	**On**; Off			
Verify O_2 delivery	**On**; Off			Select whether the system test will check that the O_2 supply is actually delivering oxygen. The Sample line is connected during test parameter must also be set to On for this.

Headline/ Parameter	Setting range			Description
				
Test breathing circuit				
Test correct assembly of breathing hoses and Y-piece	**On**; Off			Select whether the automatic test will check that the breathing circuit is correctly connected. During this test, a check is made as to whether the breathing gas can flow from the inspiratory port via the Y-piece to the expiratory port. If Sample line is connected during test is set to On, this test is carried out fully automatically. If Sample line is connected during test is set to Off, additional manual checks are required.

Vertical tab "Logbook"

Headline/ Parameter	Setting range			Description
				
A logbook entry with measured values is created				Create additional logbook entries with measured values.
Every	1 min; 2 min; **5 min**; 10 min; 15 min			Create entries regularly.
For all high-priority alarms	**On**; Off			Create entries for alarms.
For all medium-priority alarms	**On**; Off			

Vertical tab "Sound volume"

Headline/ Parameter	Setting range			Description
				
Alarm tone volume	10 to 100 **40**			Set the alarm tone volume.
Minimum alarm tone volume	10 to 100 **10**			Set the minimum volume with which an alarm tone will be signaled.
Breathing sound volume (optional)	Off; 10 to 100 **50**			Set the breathing sound volume.

Vertical tab "Interfaces"

Headline/ Parameter	**Setting range**			**Description**
				
LAN				Configure the network.
DHCP	On; **Off**			Make network settings. When using DHCP, consult with IT personnel to ensure that Perseus is always assigned the same IP address by the DHCP server. Restart the device after each change to the network settings. The network settings are not affected by a reset to factory settings. Accept the changes to IP address, Subnet mask, or Default gateway with the Apply button. The changes are only active after the device has been restarted.
IP address	XXX . XXX . XXX . XXX			
Subnet mask	XXX . XXX . XXX . XXX			
Default gateway	XXX . XXX . XXX . XXX			
MAC address				Displays the MAC address.
COM 1				Configure the COM interfaces. A baud rate of 19200 or 38400 is required for transmission of high-speed data, e.g., for waveforms.
Protocol	**MEDIBUS.X**; None			
Baud rate	1200; 2400; 4800; 9600; **19200**; 38400			
COM 2				
Protocol	MEDIBUS.X; **None**			
Baud rate	1200; 2400; 4800; 9600; **19200**; 38400			
USB				Activate or deactivate the USB interface.
USB interface	**On**; Off			

Vertical tab "Infinity ID"

Headline/ Parameter	**Setting range**			**Description**
				
Monitoring of Infinity ID accessories				
Breathing circuit	**On**; Off			Activate or deactivate the Infinity ID functionality. On: – Generates a message when the maximum period of use is exceeded – Generates a message when Infinity ID breathing hoses are incorrectly connected Off: – Messages are suppressed.
Water trap	**On**; Off			
Flow sensors	**On**; Off			
CO_2 absorber	**On**; Off			
Exchange interval [days]				
Breathing circuit	Off; 2 to 9 **2**			Set the exchange intervals for Infinity ID accessories.
Water trap	Off; **28**			
Flow sensors	Off; 1 to 180 **90**			
CO_2 absorber	Off; 1 to 28 **7**			

Vertical tab "Service"

Headline/ Parameter	**Setting range**			**Description**
				
				The following functions are available after the appropriate credentials have been entered: – Access to the service dialog

Resetting the start settings

Certain tabs in the ***System setup*** dialog window have a button for resetting the respective start settings to the factory settings.

Resetting the changes in a dialog window

1 Open the corresponding tab.

2 Touch the ***Factory defaults*** button and confirm.

Resetting the consumptions

The gas consumption can be reset in ***Standby*** > ***System setup*** > ***System status*** > ***Consumption***.

- Touch the ***Reset data*** button and confirm.

General device information

Further information is displayed in ***Standby*** > ***System setup*** > ***System status***:

A General information
- Installed software version
- Next maintenance date

B QR code for further product information

- Scan the QR code with suitable equipment.

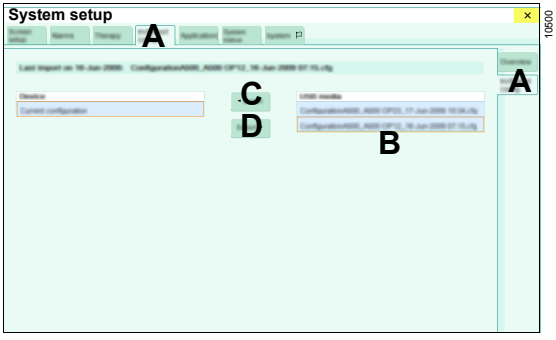
The QR code is decoded into an internet address which enables access to the stated information in a browser.

Transferring device configurations

Configurations can be exported and imported with the aid of a USB flash drive. Configurations from one device version (electronically or mechanically controlled gas mixer) can be transferred to other Perseus devices of the same version in this way.

Prerequisite: The USB flash drive is connected to the USB interface.

- Open ***System setup*** > ***Im/Export config.*** > ***Im/Export config.*** (A).



The configurations saved on the USB flash drive are displayed in a list (B). If not all of the configurations can be seen, delete all configurations from the USB flash drive that are not needed or move them to a subdirectory on the flash drive.

The following settings are neither imported nor exported:

– ***Device name***
– ***Date and time***
– ***IP address***

Importing the configuration

1 Touch one of the configurations in the list (B).
2 Touch the ***Import*** button (C) and confirm.
3 Restart Perseus.

Exporting the configuration

- To export configurations, touch the ***Export*** button (D) and confirm.

Activating software options

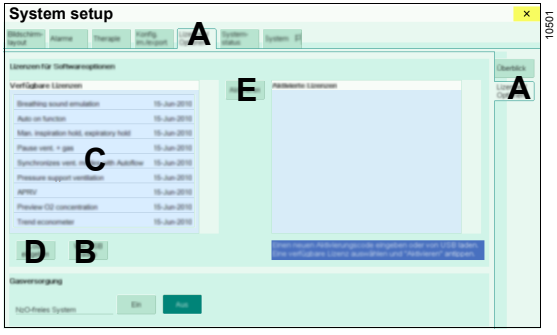
The following software options require an activation code to be entered, followed by activation:

– Pressure Support
– APRV
– FiO_2 prediction
– Econometer trend
– Low-flow wizard
– Breathing sound
– Lung recruitment
– Lung recruitment reminder
– Inspiration hold / Expiration hold
– Logbook export

Trial licenses for these options are time-limited.

An activation code is linked with the serial number of the respective device and cannot be transferred. The activation codes can either be loaded from a USB flash drive or entered manually.

- Open page ***System setup*** > ***Licenses/Options*** > ***Licenses/Options*** (A).



Loading the activation code from a USB flash drive

Prerequisite: A USB flash drive with valid licenses is connected to the USB interface.

- Touch the ***Load from USB*** button (B).

The activation codes are read and displayed in the list (C).

Entering the activation code

1 Touch the ***Enter code*** button (D).
2 Enter the activation code and confirm with ***OK***.

The license is displayed in the list (C).

Activating the licensed software option

The licensed software options must be activated before they become available.

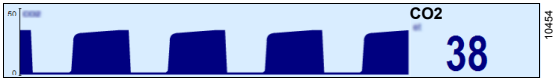
1 Select the corresponding license from the list (C).
2 Touch the ***Activate*** button (E) and confirm.
3 After activating all desired licenses, restart Perseus.

Overview of configurable screen contents

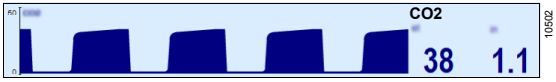
During operation, waveforms and parameter fields are selected in the ***Quick setup*** window, see page 106.

Waveforms and associated parameter fields

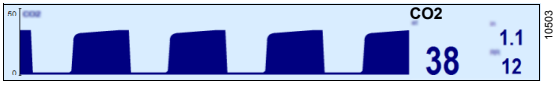
etCO2



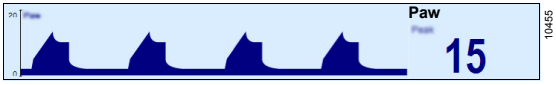
CO2 in/et



CO2 in/et, RR



Paw



Paw (3)

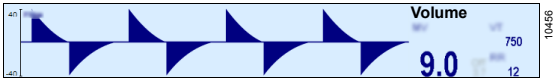
Volume-controlled modes:
Parameters PIP, Pplat, PEEP

All other modes:
Parameters PIP, Pmean, PEEP

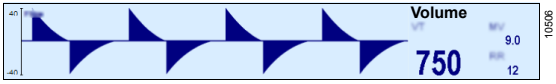
Paw (4)

Parameters PIP, Pplat, Pmean, PEEP

Volume MV, VT, RR



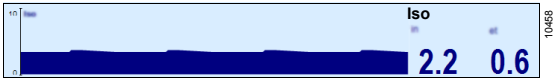
Volume VT, MV, RR



O2

O2, Δ

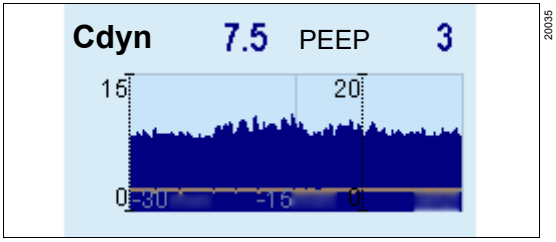
Primary agent



"Empty"

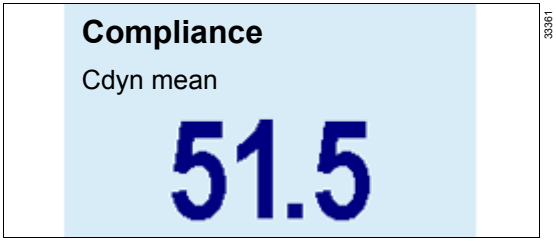
Parameter fields

Compliance trend



20035

Compliance

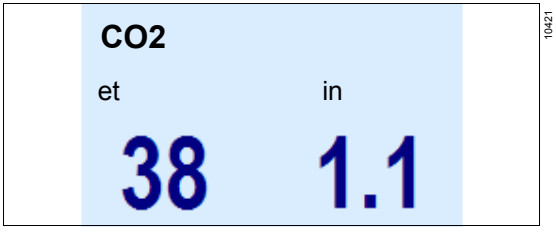


33361

etCO2

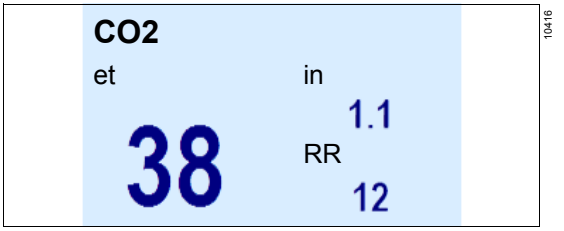
10420

CO2 in/et



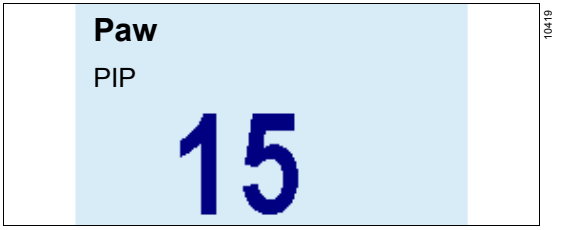
10421

CO2 in/et, RR



10416

Paw

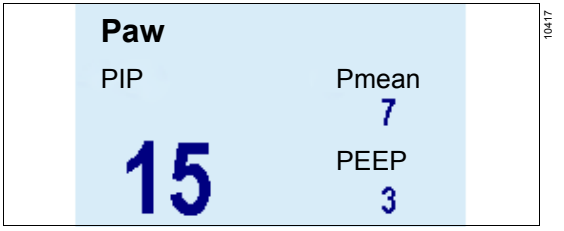


10419

Paw (3)

Volume-controlled modes:
Parameters PIP, Pplat, PEEP

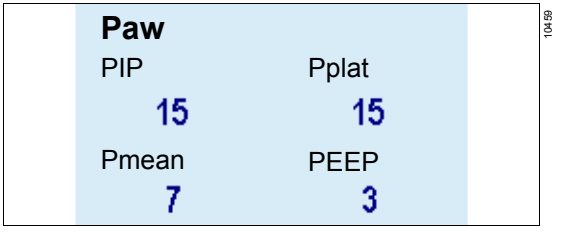
All other modes:
Parameters PIP, Pmean, PEEP



10417

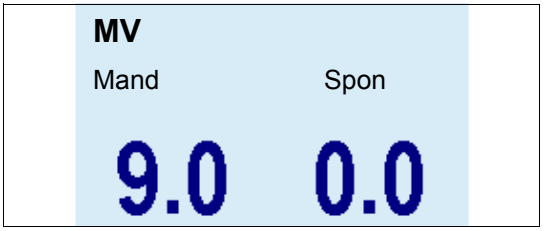
Paw (4)

Parameters PIP, Pplat, Pmean, PEEP:

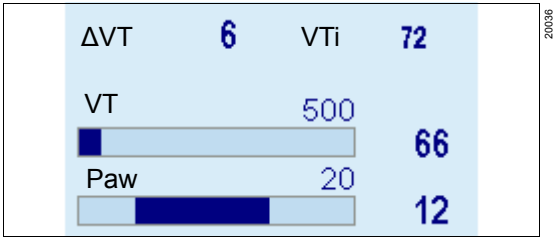


10459

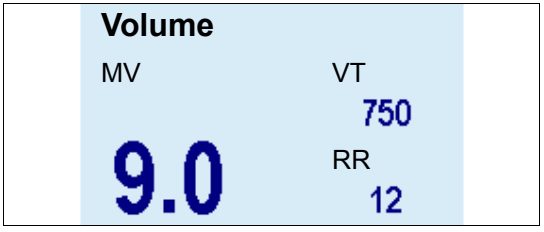
MVmand, spon



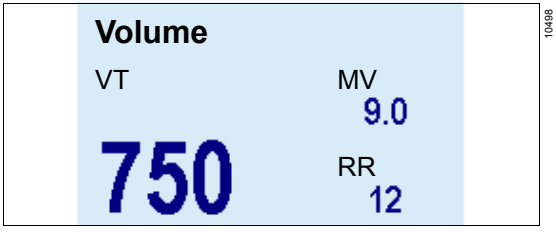
ΔVT



MV, VT, RR



Volume MV, VT, RR



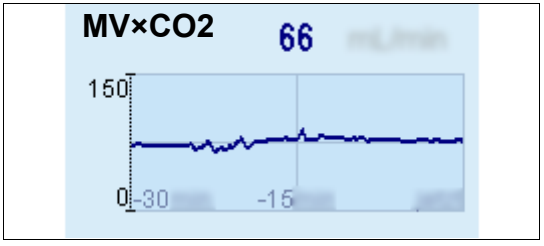
MV×CO_2 trend

WARNING

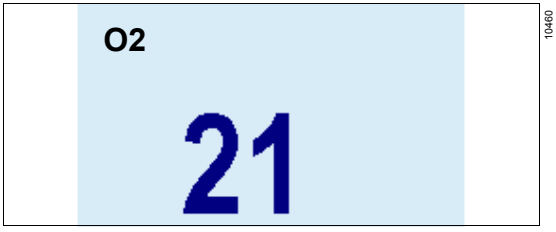
Risk of incorrect therapy settings

The numerical value displayed for the MV×CO_2 **parameter is not sufficiently accurate to enable therapy decisions to be made.**

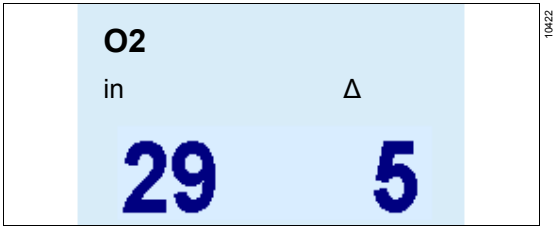
Do not make therapy decisions based solely on the displayed numerical value. Only the trend curve can be used for therapeutic decisions.



O_2



O_2, Δ



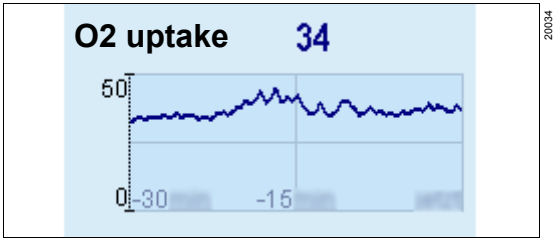
O_2 uptake trend

WARNING

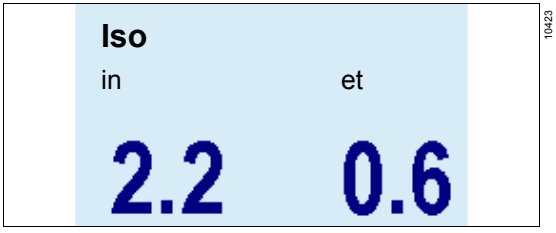
Risk of incorrect therapy settings

The numerical value displayed for the O_2 uptake parameter is not sufficiently accurate to enable therapy decisions to be made.

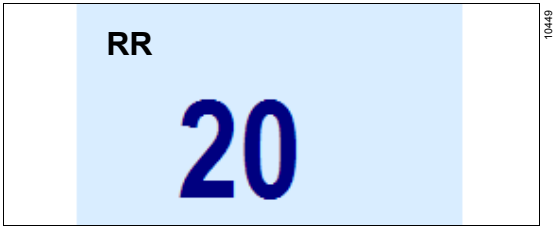
Do not make therapy decisions based solely on the displayed numerical value. Only the trend curve can be used for therapeutic decisions.



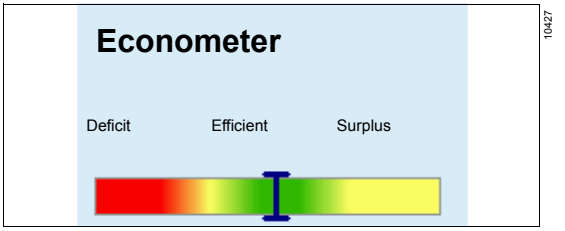
Primary agent



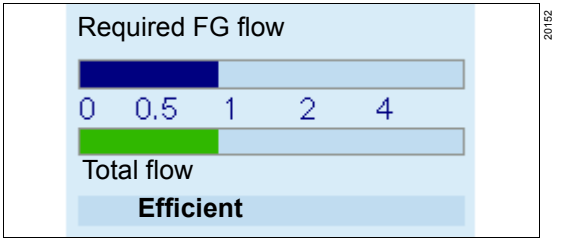
RR



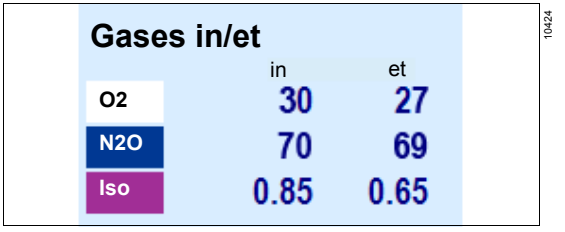
Econometer (optional)



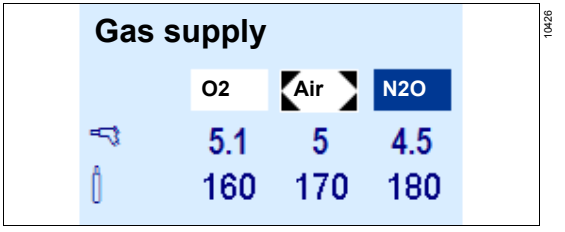
Low-flow wizard (optional)



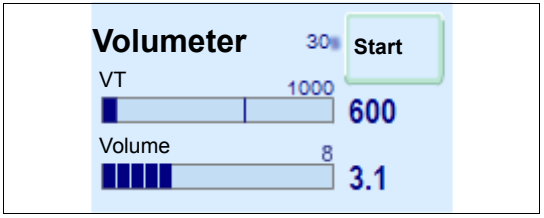
Gases in/et



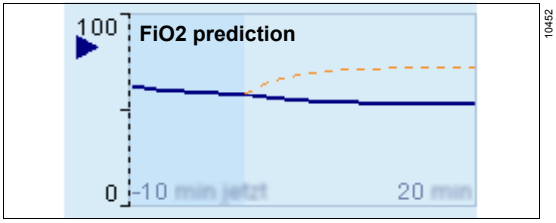
Gas supply



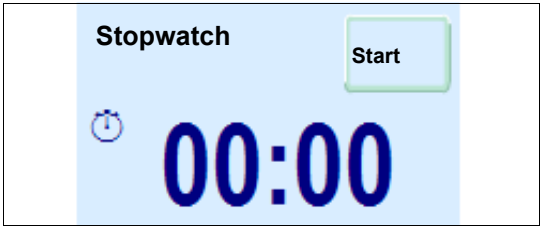
Volumeter



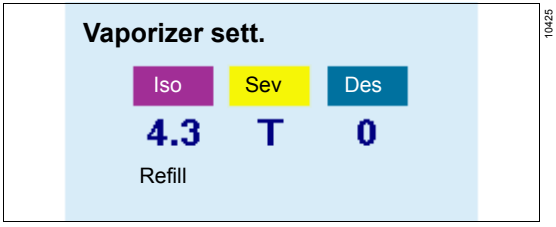
FiO2 prediction (optional)



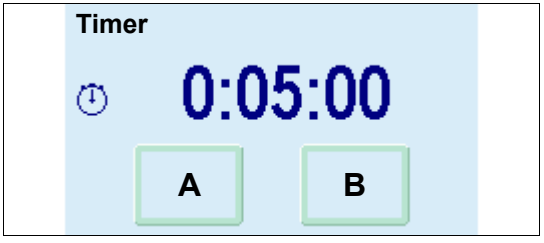
Stopwatch



Vaporizer setting (optional)

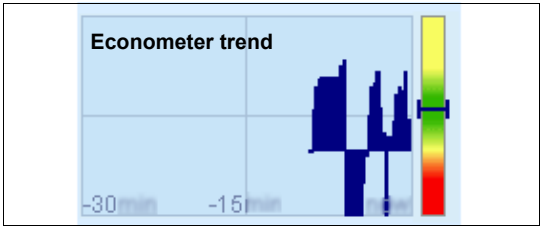


Timer

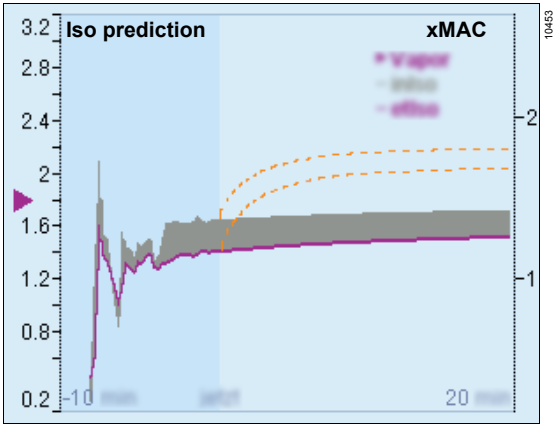


Empty

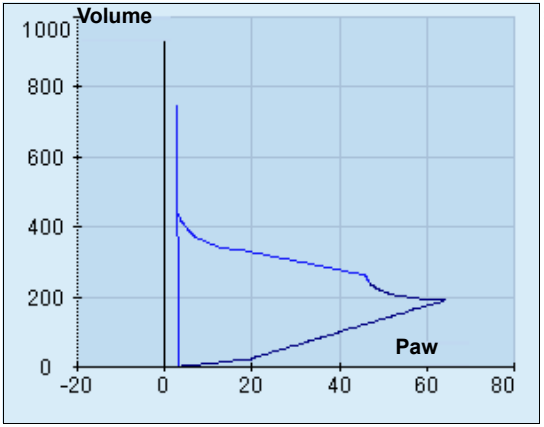
Econometer trend (optional)



Agent prediction (optional)



PV loop



31702

Flow tubes (electronically controlled gas mixer)

WARNING

Risk of mix-up

In some countries, the representation and order of the virtual flow tubes on the screen may differ from that illustrated here.

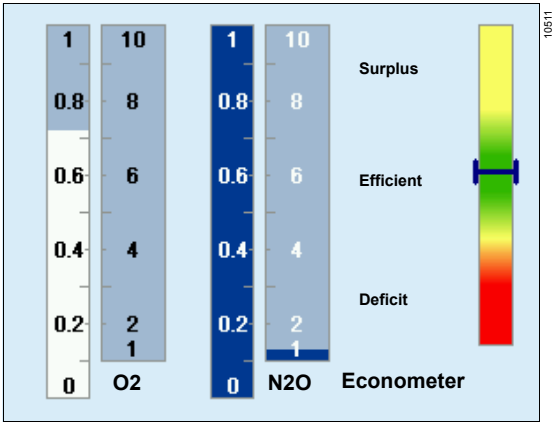
Pay attention to the labeling of the virtual flow tubes.

WARNING

Insufficient fresh-gas supply

The indication on the virtual flow tubes is intended only as additional information.

Do not use the virtual flow tubes alone when making therapeutic decisions.



10511

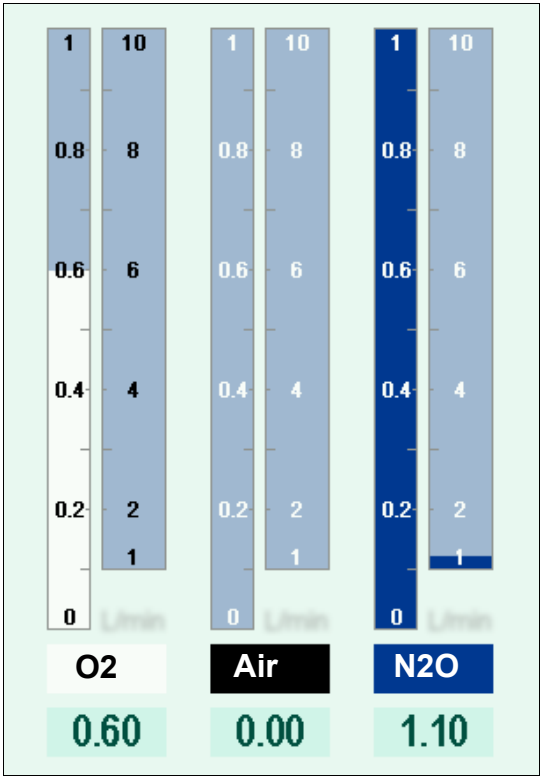
Flow tubes (mechanically controlled gas mixer)

WARNING

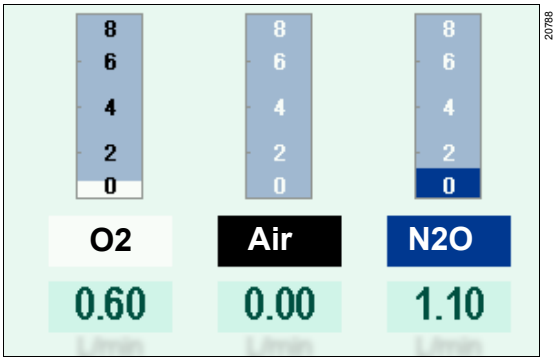
Risk of mix-up

In some countries, the representation and order of the virtual flow tubes on the screen may differ from that illustrated here.

Pay attention to the labeling of the virtual flow tubes.



When the Agent prediction or PV loop parameter field is displayed, the flow tubes will be displayed at reduced size:



Troubleshooting

Leakage

Leakages may result in the system not being operational or being operational with limitations only.

WARNING

Risk due to leaks

As a result of leakage, ambient air may get into the breathing gas and cause a reduction in the depth of anesthesia, or ambient air may become enriched with anesthetic gas and consequently put the user at risk.

Perform the leakage test before using the device. Reduce leakage to a minimum.

WARNING

Risk of insufficient ventilation

Breathing gas may escape because of leakages, with the result that the applied volume is less than the set volume.

Perform the leakage test before using the device. Remedy all leakages.

Possible causes of leakage

– The CO_2 absorber or the CLIC adapter is not securely screwed to the breathing system.
– The APL valve is not correctly fitted to the breathing system or is not set to 30 hPa (cmH_2O).
– The breathing bag, the breathing hoses, the Y-piece, or the microbial filter is incorrectly fitted or damaged.
– The flexible arm for the breathing bag (optional) is incorrectly fitted to the breathing system. The sealing ring is soiled or damaged.
– The water trap is not connected.
– The sample line is not connected, is kinked, or is leaking.
– The connections for the sample line are damaged.
– The O-rings on the inspiratory port or expiratory port are damaged, soiled, or missing.
– The flow sensors are incorrectly installed or damaged. The rear O-ring is missing.
– The upper part of the breathing system housing is incorrectly fitted or damaged.
– The valves or seals of the breathing system are damaged.
– The circuit plug is scratched or damaged.
– The filling or emptying connections on the vaporizer are leaking or are open. The vaporizer is incorrectly fitted. The O-ring is missing or damaged. The control dial is not set to the ***0*** position.

Systematic localization of leakages

To find causes of leakages, isolate individual components from the leakage test.

Component	Measure
Sample line	Remove the sample line and seal the Luer-Lock connector on the Y-piece.
Breathing hoses	Disconnect the breathing hoses. Connect the inspiratory port and expiratory port with a hose that is known to be without leakages. Connect the breathing bag directly to the breathing system.
Vaporizers	Remove the vaporizers.

1 Perform a leakage test, see page 123, and use the leakage assistant if necessary.

2 Contact service personnel if the leakages cannot be localized.

Power supply failure

Mains power supply failure

If mains power fails, Perseus automatically switches to the internal battery. A fully charged battery will maintain operation for at least 30 minutes.

Remaining battery charge is displayed on the status display.

The breathing system warmer is deactivated during battery operation. The peak inspiratory pressure ***PIP*** may be limited, but it will be at least 55 hPa (cmH_2O).

CAUTION

Risk of device malfunction

If mains power fails, devices connected to the auxiliary power sockets are not supplied from the internal battery.

Ensure an alternative power supply for connected devices.

Mains power supply failure and empty batteries

If mains power fails and the batteries are empty, a signal tone is emitted. Manual ventilation and spontaneous breathing remain available. O_2 and anesthetic agent can still be delivered using the emergency O_2 delivery (with electronically controlled gas mixer) or the flow control valves (with mechanically controlled gas mixer) and connected vaporizers.

The following are not available:

– Ventilator
– Electronically controlled gas mixer
– Device monitoring and patient monitoring

WARNING

Risk of patient injury

If all power sources fail, the screen goes dark and automatic ventilation ends.

Manually ventilate the patient.

Further procedures:

1 Check vaporizer setting.
2 Electronically controlled gas mixer:
Use emergency O_2 delivery.

Mechanically controlled gas mixer:
Close the Air flow control valve and the N_2O flow control valve and use only O_2 as fresh gas.
3 Monitor the O_2 flow on the O_2 flowmeter (electronically controlled gas mixer) or on the total flow tube (mechanically controlled gas mixer).
4 Manually ventilate the patient.
5 Ensure corresponding substitute monitoring.

After power supply is restored

1 Restart the device, see page 80.
2 Charge empty batteries for at least 8 hours.
3 Check the displays for mains voltage and battery on the status display.

Blown fuses for the auxiliary power sockets

1 Disconnect mains power supply.
2 Remedy the malfunction.
3 For devices without isolation transformer:
Replace the fuses.

For devices with isolation transformer:

– If necessary, wait 2 minutes for the circuit breaker to cool.
– Press the key on the circuit breaker back in or operate the switch on the isolation transformer.

4 Restore mains power supply.

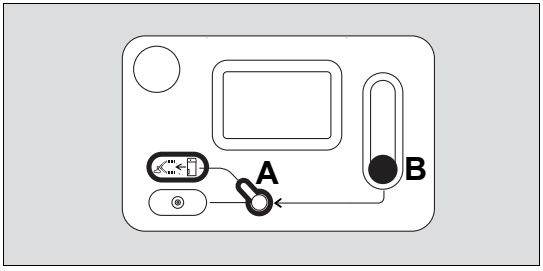
Emergency O_2 delivery (electronically controlled gas mixer)

WARNING

Risk of increased anesthetic agent delivery

When the emergency O_2 delivery (*Add. O_2*) is in use, anesthetic agent continues to be delivered into the breathing system. When the emergency O_2 delivery is used during low-flow anesthesia or minimal-flow anesthesia, an increased quantity of anesthetic agent may enter the breathing system. This may lead to an increased anesthetic gas concentration.

Carefully monitor the gas mixture.



1 Check vaporizer setting.

2 Set the O_2 switch (A) upwards to the ***Add. O_2*** position.

3 Open the flow control valve (B) on the O_2 flowmeter and set the desired flow. This O_2 flow flows through the vaporizer.

Failure of the gas supply

A failure of the central gas supply can result in simultaneous device malfunctions on all systems connected to it.

Perseus signals an alarm if the gas supply for the gases O_2, Air, or N_2O (optional) fails.

WARNING

Risk of contaminating the gas supply

When the central gas supply is connected, the smallest internal leakage can cause contamination of the supply gases.

If the central gas supply fails during operation, disconnect the hoses for the failed gas from the central supply.

- Open the corresponding gas cylinder.
- Restore central gas supply.

Electronically controlled gas mixer only: If the central gas supply for a gas fails and there is no sufficiently filled gas cylinder connected (see page 31 "Status display"), a substitute gas is used:

Failed gas	Substitute gas
O_2	100 % Air
N_2O	100 % O_2
Air	100 % O_2

The level of the fresh-gas flow remains constant.

Failure of one gas supply

Operation of fresh-gas delivery is still possible when supply of one gas fails. If, e.g., N_2O fails, with the electronically controlled gas mixer, Air or 100 % O_2 can be set as carrier gas. With the mechanically controlled gas mixer, open the corresponding flow control valve of the substitute gas.

Changing an empty gas cylinder

1. Close the valve of the empty gas cylinder.
2. Completely use up or completely vent any gas remaining in the pressure reducer and in the hose between Perseus and the gas cylinder. If there is no patient connected, venting can be performed as follows:
   - Disconnect the central O_2 supply.
   - Open the flow control valve of the O_2 flowmeter. Wait until gas is no longer flowing.
   - Close the flow control valve of the O_2 flowmeter again.
3. Unscrew the pressure reducer from the gas cylinder valve.
4. Replace the gas cylinder with a full gas cylinder.
5. Connect the pressure reducer to the new filled gas cylinder, see page 58.
6. Open the valve of the filled gas cylinder.

Complete failure of the gas supply

If the central gas supply for O_2 and Air fails at the same time and there are no sufficiently filled gas cylinders connected, operation can be continued in automatic ventilation modes. This is possible because the ventilator does not require a drive gas.

1. Remove the breathing bag.
2. Continue automatic ventilation.

When the breathing bag is removed, the missing fresh-gas volume will automatically be filled by ambient air. This is likely to cause the alarm ***Fresh gas low or leakage*** to be triggered.

WARNING

Risk of patient recovering consciousness

If the gas supply fails completely, further operation takes place through gas supply of the anesthesia machine with ambient air. Anesthetic agents are no longer delivered and the inspiratory anesthetic gas concentration in the breathing gas decreases.

Monitor the gas mixture carefully and use intravenous anesthetic agents if need be.

CAUTION

Risk of increased anesthetic gas concentration in the ambient air

If the breathing bag is not connected, expiratory anesthetic gases may escape from the breathing system.

Ensure adequate circulation of the ambient air.

After the central gas supply is restored

1. Connect the compressed gas hoses to the terminal units.
2. Close the gas cylinder valve on the corresponding gas cylinder again.

On devices that are equipped with Advanced Cylinder Support, the gas cylinder valves can remain open.

Failure of fresh-gas delivery (electronically controlled gas mixture)

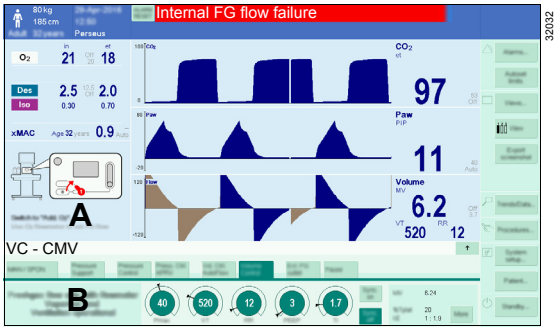
If the fresh-gas delivery has failed, the emergency O_2 delivery can be used to deliver oxygen and anesthetic agent. The current ventilation mode and the fresh-gas deficiency detection remain active.

WARNING

Risk of patient injury

If the gas mixer fails, no fresh gas is delivered.

Check vaporizer setting. Supply the patient with O_2. Use emergency O_2 delivery.



In the event of a fault, figures and instructions showing how to start the emergency O_2 delivery are displayed in areas (A) and (B).

The emergency O_2 delivery is started as folows:

1. Set the O_2 switch (A) upwards to the ***Add. O_2*** position. (Pay attention to the figure on the screen.)
   The ***Internal FG flow failure*** alarm will then be automatically downgraded.
2. Open the flow control valve on the O_2 flowmeter and set the desired flow. This O_2 flow flows through the vaporizer.
3. Check vaporizer setting.
4. Continuously monitor the O_2 flow for the emergency delivery.

- If necessary, perform ventilation with ambient air, see "Complete failure of the gas supply" on page 184.
- If necessary, ventilate the patient with the manual resuscitator.

Ventilator failure

If the ventilator fails, only manual ventilation or spontaneous breathing remain possible. No other ventilation modes can be selected. The fresh-gas delivery remains ready for operation.

1. Switch to the ***Man/Spon*** ventilation mode.
2. Manually ventilate the patient.

Gas measurement failure

CAUTION

Risk due to gas measurement failure

If the gas measurement fails, the patient can no longer be adequately monitored.
– Ensure corresponding substitute monitoring.
– Check sample line and water trap for damage or blockage and resolve these as needed. Observe the exchange intervals.

- Arrange for appropriate substitute monitoring conforming to ISO 80601-2-55.

Flow measurement failure

If the flow measurement fails, normally the therapy can be continued. Thus, the flow sensors can be exchanged during the next ***Standby***. There may be limitations in measured parameters or selection of therapy.

WARNING

Risk due to malfunction of the inspiratory flow measurement

If the inspiratory flow sensor malfunctions, the device automatically switches to pressure-controlled ventilation. If there is an additional malfunction of the inspiratory pressure sensor, the system automatically switches to the non-synchronized *PC - CMV* mode.

In either case, check the ventilation settings and adjust as needed.

1 Replace the flow sensor:
To remove the flow sensors, follow the steps described in chapter "Inserting the flow sensors and the ports" in reverse order, see page 65.
Then install the new flow sensors.

2 Perform the leakage test, see page 123.

Screen fault/user interface failure

The screen does not respond to operation. It has failed or the screen display is faulty.

1 Switch Perseus to ***Standby*** mode:
Press the ⏻ button and confirm with the rotary knob.
2 Use emergency O_2 delivery, see page 183.
3 Check vaporizer setting.
4 Manually ventilate the patient.
5 Ensure corresponding substitute monitoring.

Complete failure

The device no longer responds to operation.

1 Turn off the device with the main switch, see page 27.
2 Manually ventilate the patient.
3 Perform a start-up for operation in case of emergency, see page 82.

WARNING

Risk of device malfunction

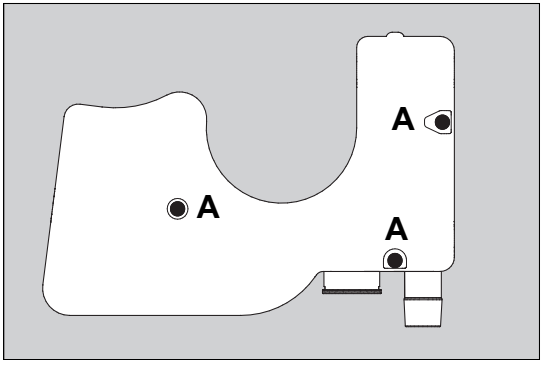
If the breathing bag does not fill with fresh gas, the patient cannot be sufficiently ventilated.
- **Check the oxygen supply and, if necessary, open the gas cylinder valves.**
- **If fresh gas still is not delivered or manual ventilation is not possible, close the flow control valve of the O_2 flowmeter.**
- **Disconnect the patient from the device and use a replacement device!**

Problems with the anesthetic gas receiving system (AGS)

Fault	Cause	Remedy
Flow indicator beneath the "restricted range"	The suction power of the ejector in the terminal unit of anesthetic gas scavenging system (AGSS) is insufficient.	Have the function of the AGSS terminal unit checked. Observe related instructions for use.
	Particle filter contaminated or blocked.	Replace the anesthetic gas receiving system (AGS) or have service personnel replace the particle filter.
Flow indicator above "normal range"	The suction power of the ejector in the AGSS terminal unit is too high.	Have the suction power of the ejector in the AGSS terminal unit adjusted to the working range of the AGS.
	Particle filter missing.	Replace the anesthetic gas receiving system (AGS) or have service personnel install the particle filter.

Replacing the anesthetic gas receiving system (AGS)

View from below:



Disassembling the anesthetic gas receiving system (AGS)

1 Disconnect the scavenging hose.

2 If necessary, remove the transfer hose for the non-rebreathing system.

3 Unfasten the 3 screws (A)

4 Dispose of the AGS.

Assembling the anesthetic gas receiving system (AGS)

- Follow the above steps in reverse order to assemble the new AGS.

Problems with cylinder pressure reducers

Fault	Cause	Remedy
The connection between gas cylinder and pressure reducer leaks.	The sealing ring is damaged.	Replace the sealing ring.
The outlet pressure rises; the relief valve relieves the outlet of the pressure reducer.	The valve seat is soiled or damaged.	Close the gas cylinder valve. Repair by service personnel
Leakage in the housing area	The diaphragm is faulty.	Repair by service personnel

Problems with the Vapor View option

Fault	Cause	Remedy
Dräger Vapor 3000/ D-Vapor 3000 is not detected.	Vaporizer is not correctly mounted and locked.	Correctly mount and lock vaporizer.
	Sensor unit is faulty.	Have item repaired by service personnel.
Control dial setting position or filling level of a Dräger Vapor 3000/ D-Vapor 3000 is not detected.	Sensor unit or vaporizer is soiled.	Clean sensor unit and remove foreign matter.
	Sensor unit or vaporizer is damaged.	Have item repaired by service personnel.
Dräger Vapor 3000/ D-Vapor 3000 is not illuminated.	Control dial is in position ***T***.	Turn control dial to position ***0***.
	Illumination unit is soiled.	Clean illumination unit and remove foreign matter.
	Illumination unit is faulty.	Have item repaired by service personnel.
Illumination is turned on, even though no Dräger Vapor 3000/ D-Vapor 3000 is fitted.	Vapor View option is faulty.	Have item repaired by service personnel.

Support request

If the device is configured for remote maintenance, device information can be sent to Dräger in the event of a problem. Proceed as follows to send a support request to Dräger:

1. In the ***Standby*** mode, touch the ***Tests...*** button.
2. Touch the ***Request support*** button.

Alarm – Cause – Remedy

Alarm messages are displayed in hierarchal form in the alarm message field of the header bar, see page 140.

Different background colors indicate the priority levels of the alarms.

In the ***Current alarms*** table and ***Alarm history*** table, the priority of the alarm messages is also indicated by exclamation marks.

High	!!!	Red
Medium	!!	Yellow
Low	!	Cyan

In order to classify the alarms within an alarm priority, internal priority numbers are given in the table below. The most critical alarm is given the number 255. Lower numbers indicate a lower alarm priority.

The following table lists the alarm messages in alphabetical order. If an alarm occurs, the table helps to quickly identify causes and remedies. The possible causes and remedial measures should be looked through in the order they are listed until the alarm is resolved.

Some alarms appear in this table several times with different priorities because their priority may change under certain conditions, see page 144.

Priority		Alarm	Cause	Remedy
!	100	Absorber disconnected?	Infinity ID CLIC absorber is not correctly connected.	Check absorber.
				Use "ALARM RESET" to acknowledge alarm.
!!	100	"Add. O_2" activated	O_2 switch is set to "Add. O_2".	Close the flow control valve of the O_2 flowmeter. Set the O_2 switch to "Aux. O_2".
				Use "ALARM RESET" to downgrade alarm priority.
!	255	Agent measurement failed	There is electromagnetic interference.	Check for electromagnetic radiation in the vicinity.
			There is an internal failure.	Use an alternative gas measurement system.
				If the problem persists, call DrägerService.
!	255	Agent measurement not available	The ambient air used for calibrating the sensor was impure.	Position the device in an environment with clean ambient air.
				Wait for the automatic calibration.
			There is electromagnetic interference.	Check for electromagnetic radiation in the vicinity.
			Ambient temperature is too high.	Check ambient conditions.

Priority	Alarm	Cause	Remedy
! 255	Agent measurement temporarily inaccurate	The sensor has not yet warmed up.	Wait for the automatic calibration.
		The ambient air used for calibrating the sensor was impure.	Position the device in an environment with clean ambient air.
			Wait for the automatic calibration.
! 220	Air cylinder almost empty	The cylinder is almost empty.	Replace the cylinder. Use the central supply.
! 255	Air cylinder empty	The cylinder is empty or closed.	Replace the cylinder. Use the central supply.
! 190	Air cylinder sensor?	Cylinder pressure sensor is not connected.	Check if cylinder pressure sensor is connected.
			Use "ALARM RESET" to acknowledge alarm.
!! 150	Air FG flow measurement failed	The measurement system for the Air fresh-gas flow has failed.	Only use O_2 as fresh gas.
			Use the total flow tube to check the fresh-gas flow. Adjust the fresh-gas flow so that it equals or exceeds the minute volume.
!!! 110	Air supply low	Central supply pressure and cylinder pressure are low.	Check central Air supply or use cylinder.
			Use "ALARM RESET" to downgrade alarm priority.
!!! 255	Airway press. continuously high	Airway pressure has been continuously high.	Check ventilation settings.
			Check breathing hoses, breathing system, and anesthetic gas scavenging system.
			In Man/Spon mode, check the APL valve setting.
			Check lower alarm limit for airway pressure.
!!! 255	Airway pressure high	The upper alarm limit for the airway pressure has been exceeded. The applied inspiratory pressure is higher than the set value.	Check patient condition.
			Check ventilation settings.
			Check alarm limit.
		Breathing hoses are blocked or the tube is kinked.	Check breathing circuit and tube.

Priority	Alarm	Cause	Remedy
!!! 255	Airway pressure negative	Fresh-gas flow is insufficient, breathing bag is blocked or positioned incorrectly.	Check fresh-gas settings and position of breathing bag.
		Suction maneuver during ventilation.	Check the bronchial suction system.
		Failure of the anesthetic gas scavenging system.	Check anesthetic gas scavenging system.
!! 10	Airway pressure not achieved	Fresh-gas flow is insufficient, breathing bag is blocked or positioned incorrectly.	Check fresh-gas settings and position of breathing bag.
		Leakage or disconnection.	Check the breathing circuit for tight connections and leakages.
!!! 220	Apnea	No breathing or ventilation.	Start manual ventilation!
			Check ventilation settings.
			Check spontaneous breathing ability of the patient.
!! 255	Apnea	No breathing or ventilation.	Start manual ventilation!
			Check ventilation settings.
			Check spontaneous breathing ability of the patient.
!!! 220	Apnea (no CO_2)	No breathing or ventilation.	Start manual ventilation!
			Check ventilation settings.
			Check spontaneous breathing ability of the patient.
		Sample line is not connected.	Connect sample line to breathing circuit.
!! 255	Apnea (no CO_2)	No breathing or ventilation.	Start manual ventilation!
			Check ventilation settings.
			Check spontaneous breathing ability of the patient.
		Sample line is not connected.	Connect sample line to breathing circuit.
!!! 220	Apnea (no flow)	No breathing or ventilation.	Start manual ventilation!
			Check ventilation settings.
			Check spontaneous breathing ability of the patient.
		Fresh-gas flow is insufficient, breathing bag is blocked or positioned incorrectly.	Check fresh-gas settings and position of breathing bag.
		The breathing hoses are blocked or leaking.	Check breathing circuit and tube.

Priority	Alarm	Cause	Remedy
!! 255	Apnea (no flow)	No breathing or ventilation.	Start manual ventilation!
			Check ventilation settings.
			Check spontaneous breathing ability of the patient.
		Fresh-gas flow is insufficient, breathing bag is blocked or positioned incorrectly.	Check fresh-gas settings and position of breathing bag.
		The breathing hoses are blocked or leaking.	Check breathing circuit and tube.
!!! 220	Apnea (no pressure)	No breathing or ventilation.	Start manual ventilation!
			Check ventilation settings.
		Fresh-gas flow is insufficient, breathing bag is blocked or positioned incorrectly.	Check fresh-gas settings and position of breathing bag.
		The breathing hoses are blocked or leaking.	Check breathing circuit and tube.
!! 255	Apnea (no pressure)	No breathing or ventilation.	Start manual ventilation!
			Check ventilation settings.
		Fresh-gas flow is insufficient, breathing bag is blocked or positioned incorrectly.	Check fresh-gas settings and position of breathing bag.
		The breathing hoses are blocked or leaking.	Check breathing circuit and tube.
!! 0	Apnea Ventilation	No inspiratory effort of the patient detected.	Check spontaneous breathing ability of the patient.
			Adjust the setting for "Trigger".
			Change to pressure-controlled or volume-controlled ventilation mode.
			Use "ALARM RESET" to downgrade alarm priority.
! 0	Apnea Ventilation	No inspiratory effort of the patient detected.	Check spontaneous breathing ability of the patient.
			Adjust the setting for "Trigger".
			Change to pressure-controlled or volume-controlled ventilation mode.
! 100	"Audio paused" key stuck	Key is stuck or was pressed for more than 10 seconds.	Ventilation performance is not affected.
			If the problem persists, call DrägerService.

Priority	Alarm	Cause	Remedy
!! 100	Backup speaker failure	The backup speaker for alarm tones is faulty.	Call DrägerService.
			Use "ALARM RESET" to acknowledge alarm.
! 170	Bag pressure sensor failure	Sensor calibration failed.	Manually check the filling level of the breathing bag.
			Perform the system test.
! 180	Battery charge low	The battery charge is low and the mains power supply is not available.	Restore mains power supply.
			The breathing system warmer has been switched off. Check the breathing circuit for condensate. Increase the fresh-gas flow if necessary.
!! 30	Battery charge very low	The battery charge is critical and the mains power supply is not available. The device will shut down in the next 5 minutes.	Make sure that the mains power supply is correctly connected.
			The breathing system warmer has been switched off. Check the breathing circuit for condensate. Increase the fresh-gas flow if necessary.
			Once the battery has been depleted, ventilate the patient manually.
!! 170	Battery failure	The battery is faulty. If the mains power supply fails, the device will switch off immediately.	Call DrägerService.
! 100	Battery temperature high	The battery temperature is high. Charging of the battery has been suspended to protect it from damage.	Ensure that the system is connected to the mains power supply.
			Check the ambient temperature.
! 135	Breathing bag too small?	The breathing bag is too small. The tidal volume cannot be delivered.	Use correct breathing bag.
		The breathing bag hose is kinked, too long, or too thin.	Check the hose and replace if necessary.
			Increase the fresh-gas flow.
			Use "ALARM RESET" to acknowledge alarm.
! 100	Breathing circuit expired	Accessory has been used too long.	Replace the accessory if necessary.
			Use "ALARM RESET" to acknowledge alarm.

Priority	Alarm	Cause	Remedy
!!! 255	Breathing system temp. high?	The breathing system warmer is faulty.	Check the inspiratory breathing gas temperature as close to the Y-piece as possible.
			Use longer inspiratory hose.
			Remove breathing system cover.
			Turn off the breathing system warmer.
			Turn off the device with the main switch. Use "Add. O_2". Ventilate the patient manually.
			If the breathing gas temperature is too high, ventilate the patient with a manual resuscitator.
! 100	Breathing system warmer failure	The breathing system warmer is faulty.	Check breathing circuit for condensation. Increase fresh-gas flow if necessary.
			Call DrägerService.
		An internal temperature sensor is faulty.	Call DrägerService.
! 100	Cardiac bypass mode still active?	A significant minute volume was measured during cardiac bypass mode.	Deactivate the cardiac bypass mode.
			Use "ALARM RESET" to acknowledge alarm.
! 100	Central Air supply high	The central supply pressure is high. The gas delivery might fail.	Check central supply.
! 255	Central Air supply low	Central supply pressure is low.	Check central supply.
! 100	Central N_2O supply high	The central supply pressure is high. The gas delivery might fail.	Check central supply.
! 255	Central N_2O supply low	Central supply pressure is low.	Check central supply.
! 100	Central O_2 supply high	The central supply pressure is high. The gas delivery might fail.	Check central supply.
!!! 210	Central O_2 supply low	Central supply pressure is low.	Check central O_2 supply or use cylinder.
			Use "ALARM RESET" to downgrade alarm priority.
! 255	Central O_2 supply low	Central supply pressure is low.	Check central supply.

Priority	Alarm	Cause	Remedy
! 100	CO_2 absorber expired	Accessory has been used too long.	Replace the accessory if necessary.
			Use "ALARM RESET" to acknowledge alarm.
! 255	CO_2 measurement failed	There is electromagnetic interference.	Check for electromagnetic radiation in the vicinity.
		There is an internal failure.	Use an alternative gas measurement system.
			If the problem persists, call DrägerService.
! 255	CO_2 sensor accuracy low	The sensor has not yet warmed up.	Wait for the automatic calibration.
		The ambient air used for calibrating the sensor was impure.	Position the device in an environment with clean ambient air.
! 0	Communication failure	The network connection could not be established.	Re-establish the connection.
			Use "ALARM RESET" to acknowledge alarm.
			Check the connections from/to Connectivity Converter CC300.
		A network certificate has expired or Connectivity Converter CC300 is faulty.	Call DrägerService.
		In the network, there is another anesthesia machine with the same integrated system ID.	Check the integrated system ID.
!! 135	Cooling fan failure	An internal fan for evacuating gases is faulty.	To prevent potential damage, switch off system at your earliest convenience. Increased risk of fire.
			Call DrägerService.
!! 140	CPAP changed to "Off"	The set CPAP pressure could not be achieved due to leakage. The system has changed the CPAP setting to "Off".	Check the breathing circuit for tight connections and leakages.
			Increase fresh-gas flow.
			Reapply the CPAP setting.
			Use "ALARM RESET" to acknowledge alarm.

Priority		Alarm	Cause	Remedy
!!	150	Emergency air inlet activated	There was not enough gas to ventilate the patient. To maintain a minimum ventilation, the device has started to use ambient air.	Refill the breathing bag, e.g., with O_2 flush.
				Increase fresh-gas flow.
				Check the breathing circuit for tight connections and leakages.
				Use correct breathing bag.
!!	135	etCO_2 high	etCO_2 has exceeded the upper alarm limit.	Check ventilation.
!!	135	etCO_2 low	etCO_2 is below the lower alarm limit.	Check ventilation.
!!	100	Exp. press. sensor failure	Sensor calibration failed.	Ensure that a suitable substitute monitoring is available.
				Perform the system test.
!	100	Expiratory flow sensor expired	Accessory has been used too long.	Replace the accessory if necessary.
				Use "ALARM RESET" to acknowledge alarm.
!	190	Expiratory flow sensor not calibrated	The sensor is not calibrated. The breathing system has been replaced or disconnected since last calibration.	Perform the leakage test.
			Failure of the flow sensor.	Replace the flow sensor. Perform the leakage test.
!!!	200	External fresh-gas outlet failure?	Failure when switching to external fresh-gas outlet. Failure when switching from external fresh-gas outlet to another ventilation mode.	Use "O_2+" button to determine flow direction of fresh gas: -If internal breathing system or breathing bag fill, external fresh-gas outlet is not available. -If gas flows out of the external fresh-gas outlet, external fresh-gas outlet can be used. Internal breathing system can only be used when the breathing bag is not connected (ventilation with ambient air only).
				Check fresh-gas settings.
				Call DrägerService.
!!	50	Filling level of vaporizer low	The filling level of the active vaporizer is low.	Check filling level. Refill if necessary.
				Use "ALARM RESET" to downgrade alarm priority.
!	100	Filling level of vaporizer low	The filling level of an inactive vaporizer is low.	Check filling level. Refill if necessary.

Priority	Alarm	Cause	Remedy
!! 10	FiO_2 high	FiO_2 has exceeded the upper alarm limit.	Check FG O_2.
!!! 255	FiO_2 low	FiO_2 has fallen below the lower alarm limit.	Check O_2 concentration and fresh-gas settings.
			Check the breathing system for high leakages.
			Check O_2 supply.
!! 135	FiO_2 too high for neonates	FiO_2 has exceeded the threshold value for longer than the time configured in the system setup.	Check O_2 concentration and fresh-gas settings.
			Use "ALARM RESET" to acknowledge alarm.
!! 30	Flow control valve still open	At least one flow control valve is still open.	Close all flow control valves.
! 80	Flow sensor calibration required	The flow sensors have not been calibrated for more than 24 hours or since the device was turned on.	Perform the leakage test.
!!! 100	Fresh gas low or leakage	Fresh-gas flow is insufficient, breathing bag is blocked or positioned incorrectly.	Refill the breathing system immediately, e.g., with O_2 flush.
			Check fresh-gas settings and position of breathing bag.
		Leakage or disconnection.	Check the breathing circuit for tight connections and leakages.
			Check tube or mask.
!! 150	Fresh gas low or leakage	Fresh-gas flow is insufficient, breathing bag is blocked or positioned incorrectly.	Check fresh-gas settings and position of breathing bag.
		Leakage or disconnection.	Check the breathing circuit for tight connections and leakages.
			Check tube or mask.
			Use "ALARM RESET" to downgrade alarm priority.
! 170	Fresh gas low or leakage	Fresh-gas flow is insufficient, breathing bag is blocked or positioned incorrectly.	Check fresh-gas settings and position of breathing bag.
		Leakage or disconnection.	Check the breathing circuit for tight connections and leakages.
			Check tube or mask.
!! 100	Fresh-gas flow high	The total fresh-gas flow is greater than 15 L/min.	Reduce fresh-gas flow.

Priority	Alarm	Cause	Remedy
!! 60	Fresh-gas flow inaccurate	The delivered fresh-gas flow differs from the set fresh-gas flow.	Make sure that sufficient fresh-gas and anesthetic agent are delivered.
			Check the measured gas concentrations.
			Use "ALARM RESET" to downgrade alarm priority.
!! 50	Fresh-gas flow inaccurate	The accuracy of the fresh-gas flow measurement is reduced.	Use the total flow tube to verify the current fresh-gas flow.
			Check the measured gas concentrations.
			Use "ALARM RESET" to downgrade alarm priority.
			Perform the system test.
			If the problem persists, call DrägerService.
!! 100	Gas sensor failure	The patient-gas measurement module has failed.	Use an alternative gas measurement system.
			Use "ALARM RESET" to downgrade alarm priority.
			Call DrägerService.
!! 255	Hose connected to wrong port	A breathing hose is not correctly connected.	Connect breathing hoses correctly.
!! 100	Hose does not fit to pat. category	The detected breathing hose is not suitable for the selected patient category.	Use compatible accessory.
			Use "ALARM RESET" to acknowledge alarm.
! 100	Hose does not fit to pat. category	The detected breathing hose is not suitable for the selected patient category.	Use compatible accessory.
			Use "ALARM RESET" to acknowledge alarm.
!! 150	inCO_2 high	Soda lime is depleted.	Check soda lime.
			Increase fresh-gas flow.
			Check fresh-gas settings.
		There is internal leakage in the breathing system or in the coaxial breathing hose.	Replace the breathing system or the coaxial breathing hose.
		Gas measurement is inaccurate due to high respiratory rate.	Adjust alarm limits if necessary.
		Large dead space.	Check the ventilation settings and the breathing circuit.
! 100	Infinity ID breathing circuit not compatible	An incompatible accessory is connected.	Check accessory.
			Use "ALARM RESET" to acknowledge alarm.

Priority		Alarm	Cause	Remedy
!	100	Infinity ID CO_2 absorber not compatible	An incompatible accessory is connected.	Check accessory.
				Use "ALARM RESET" to acknowledge alarm.
!	100	Infinity ID water trap not compatible	An incompatible accessory is connected.	Check accessory.
				Use "ALARM RESET" to acknowledge alarm.
!!	100	Insp. press. sensor failure	Sensor calibration failed.	Change to Man/Spon mode and ventilate manually.
				Perform the system test.
!!!	255	Inspiratory desflurane high	Inspiratory anesthetic gas concentration has exceeded the upper alarm limit.	Check vaporizer and fresh-gas settings.
!!	255	Inspiratory desflurane high	Inspiratory anesthetic gas concentration has exceeded the upper alarm limit.	Check vaporizer and fresh-gas settings.
!	75	Inspiratory desflurane low	The inspiratory anesthetic gas concentration is below the lower alarm limit.	Check vaporizer and fresh-gas settings.
				Refill the vaporizer.
				Check the breathing system for high leakages.
			The soda lime has dried out.	Replace the soda lime.
!!!	255	Inspiratory enflurane high	Inspiratory anesthetic gas concentration has exceeded the upper alarm limit.	Check vaporizer and fresh-gas settings.
!!	255	Inspiratory enflurane high	Inspiratory anesthetic gas concentration has exceeded the upper alarm limit.	Check vaporizer and fresh-gas settings.
!	75	Inspiratory enflurane low	The inspiratory anesthetic gas concentration is below the lower alarm limit.	Check vaporizer and fresh-gas settings.
				Refill the vaporizer.
				Check the breathing system for high leakages.
			The soda lime has dried out.	Replace the soda lime.
!	100	Inspiratory flow sensor expired	Accessory has been used too long.	Replace the accessory if necessary.
				Use "ALARM RESET" to acknowledge alarm.
!	190	Inspiratory flow sensor not calibrated	The sensor is not calibrated. The breathing system has been replaced or disconnected since last calibration.	Perform the leakage test.
			Failure of the flow sensor.	Replace the flow sensor. Perform the leakage test.

Priority	Alarm	Cause	Remedy
!!! 255	Inspiratory halothane high	Inspiratory anesthetic gas concentration has exceeded the upper alarm limit.	Check vaporizer and fresh-gas settings.
!! 255	Inspiratory halothane high	Inspiratory anesthetic gas concentration has exceeded the upper alarm limit.	Check vaporizer and fresh-gas settings.
! 75	Inspiratory halothane low	The inspiratory anesthetic gas concentration is below the lower alarm limit.	Check vaporizer and fresh-gas settings.
			Refill the vaporizer.
			Check the breathing system for high leakages.
		The soda lime has dried out.	Replace the soda lime.
!!! 255	Inspiratory isoflurane high	Inspiratory anesthetic gas concentration has exceeded the upper alarm limit.	Check vaporizer and fresh-gas settings.
!! 255	Inspiratory isoflurane high	Inspiratory anesthetic gas concentration has exceeded the upper alarm limit.	Check vaporizer and fresh-gas settings.
! 75	Inspiratory isoflurane low	The inspiratory anesthetic gas concentration is below the lower alarm limit.	Check vaporizer and fresh-gas settings.
			Refill the vaporizer.
			Check the breathing system for high leakages.
		The soda lime has dried out.	Replace the soda lime.
!! 10	Inspiratory N_2O high	Inspiratory N_2O exceeds 82 %.	Check fresh-gas composition.
			Press the O_2+ button to flush the breathing system.
!!! 255	Inspiratory sevoflurane high	Inspiratory anesthetic gas concentration has exceeded the upper alarm limit.	Check vaporizer and fresh-gas settings.
!! 255	Inspiratory sevoflurane high	Inspiratory anesthetic gas concentration has exceeded the upper alarm limit.	Check vaporizer and fresh-gas settings.
! 75	Inspiratory sevoflurane low	The inspiratory anesthetic gas concentration is below the lower alarm limit.	Check vaporizer and fresh-gas settings.
			Refill the vaporizer.
			Check the breathing system for high leakages.
		The soda lime has dried out.	Replace the soda lime.

Priority	Alarm	Cause	Remedy
!! 255	Inspiratory tidal volume high	The delivered inspiratory tidal volume is higher than the set value.	Check ventilation settings.
			Check patient compliance. Check if the patient is breathing spontaneously.
			Check the breathing circuit for tight connections and leakages.
!! 255	Inspiratory tidal volume high	The delivered inspiratory tidal volume exceeds the upper alarm limit.	Check ventilation settings.
			Check patient compliance. Check if the patient is breathing spontaneously.
			Check the breathing circuit for tight connections and leakages.
			Check alarm limit.
!! 50	Inspiratory tidal volume high	The ventilation settings are not adequate for AutoFlow.	Change the ventilation mode or increase the tidal volume.
!!! 255	Inspiratory xMAC high	The inspiratory anesthetic gas concentration has exceeded 3 xMAC for more than 30 seconds. The expiratory anesthetic gas concentration has exceeded 2.5 xMAC for more than 30 seconds.	Check vaporizer and fresh-gas settings.
		The inspiratory anesthetic gas concentration has exceeded 5 xMAC.	Check vaporizer and fresh-gas settings.
!! 255	Inspiratory xMAC high	The inspiratory anesthetic gas concentration has exceeded 3 xMAC for more than 180 seconds.	Check vaporizer and fresh-gas settings.
!! 100	Internal device temperature high	A ventilation slot at the rear of the device is blocked.	Check the ventilation slots. Ensure air flow at the rear of the device.
		Ambient temperature is too high.	Check ambient conditions.
		A fan is faulty.	Call DrägerService.
		Excessive ventilation settings are applied (e.g., high respiratory rate, high inspiratory pressure, short slopes).	Check ventilation settings.

Priority		Alarm	Cause	Remedy
!	255	Internal device temperature high	A ventilation slot at the rear of the device is blocked.	Check the ventilation slots. Ensure air flow at the rear of the device.
			Ambient temperature is too high.	Check ambient conditions.
			Excessive ventilation settings are applied (e.g., high respiratory rate, high inspiratory pressure, short slopes).	Check ventilation settings.
			A fan is faulty.	Call DrägerService.
!!!	150	Internal FG flow failure	The internal gas delivery system is not operational. A system test may be able to resolve the issue.	Deliver O_2: 1. Set the O_2 switch to "Add. O_2". 2. Set the O_2 flowmeter to the desired flow. Check the vaporizer setting. Make sure that fresh gas is reaching the patient.
				Perform the system test after finishing the case.
				If the problem persists, call DrägerService.
!	150	Internal FG flow failure	The internal gas delivery system is not operational. A system test may be able to resolve the issue.	Set the O_2 flowmeter to the desired flow. Check the vaporizer setting. Make sure that fresh gas is reaching the patient.
				Perform the system test after finishing the case.
				If the problem persists, call DrägerService.
!	60	License expired	A license has expired. After next startup, some functions will no longer be available.	Use "ALARM RESET" to acknowledge alarm.
				To order a permanent license, call Dräger.
!	50	License will expire soon	A trial license will expire within the next 14 days.	Use "ALARM RESET" to acknowledge alarm.
				To order a permanent license, call Dräger.
!!!	0	Loss of data	An internal memory failure has occurred. System data and system settings are lost.	Check current settings and default settings.
				Call DrägerService.
!	50	Maintenance will be due soon	Maintenance will be due within the next 30 days.	Call DrägerService.
				Use "ALARM RESET" to acknowledge alarm.

Priority	Alarm	Cause	Remedy
! 255	Measured gas concentrations out of range	The measured values are out of the measurement range.	Check patient condition.
			Check the vaporizer setting and the fresh-gas settings.
			Use an alternative gas measurement system.
			Perform the system test.
! 255	Measured gas concentrations temporarily inaccurate	The sensor has not yet warmed up.	Wait for the automatic calibration.
		The ambient air used for calibrating the sensor was impure.	Position the device in an environment with clean ambient air.
			Wait for the automatic calibration.
! 0	MEDIBUS COM 1 failure	Communication via the corresponding COM port is interrupted.	Re-establish the connection.
			Use "ALARM RESET" to acknowledge alarm.
		The configured baud rate is not sufficient for the amount of data to be transferred.	Increase the baud rate. Check the configuration of the external device.
! 0	MEDIBUS COM 2 failure	Communication via the corresponding COM port is interrupted.	Re-establish the connection.
			Use "ALARM RESET" to acknowledge alarm.
		The configured baud rate is not sufficient for the amount of data to be transferred.	Increase the baud rate. Check the configuration of the external device.
!! 30	Minute volume high	Upper alarm limit for the minute volume has been exceeded.	Check spontaneous breathing.
			Check ventilation settings (e.g., VT, Pinsp, RR).
			In Pressure Support, correct the trigger threshold if necessary.
			Check alarm limit.
		Flow measurement is inaccurate.	Replace the expiratory flow sensor. Perform the leakage test.

Priority		Alarm	Cause	Remedy
!!	10	Minute volume low	The minute volume is below the lower alarm limit.	Check patient condition.
				Check tube or mask.
				Check ventilation settings.
				Check alarm limit.
			Leakage or disconnection.	Check the breathing circuit for tight connections and leakages.
			Flow measurement is inaccurate.	Replace the expiratory flow sensor. Perform the leakage test.
!	220	N_2O cylinder almost empty	The cylinder is almost empty.	Replace the cylinder. Use the central supply.
!	255	N_2O cylinder empty	The cylinder is empty or closed.	Replace the cylinder. Use the central supply.
!	190	N_2O cylinder sensor?	Cylinder pressure sensor is not connected.	Check if cylinder pressure sensor is connected.
				Use "ALARM RESET" to acknowledge alarm.
!!	150	N_2O FG flow measurem. failed	The measurement system for the N_2O fresh-gas flow has failed.	Only use O_2 as fresh gas.
				Use the total flow tube to check the fresh-gas flow. Adjust the fresh-gas flow so that it equals or exceeds the minute volume.
!	255	N_2O measurement failed	There is electromagnetic interference.	Check for electromagnetic radiation in the vicinity.
			There is an internal failure.	Use an alternative gas measurement system.
				If the problem persists, call DrägerService.
!	255	N_2O measurement not available	The ambient air used for calibrating the sensor was impure.	Position the device in an environment with clean ambient air.
				Wait for the automatic calibration.
			There is electromagnetic interference.	Check for electromagnetic radiation in the vicinity.
			Ambient temperature is too high.	Check ambient conditions.

Priority	Alarm	Cause	Remedy
! 255	N_2O measurement temporarily inaccurate	The sensor has not yet warmed up.	Wait for the automatic calibration.
		The ambient air used for calibrating the sensor was impure.	Position the device in an environment with clean ambient air.
			Wait for the automatic calibration.
!!! 110	N_2O supply low	Central supply pressure and cylinder pressure are low.	Check central N_2O supply or use cylinder.
			Use "ALARM RESET" to downgrade alarm priority.
!!! 110	No Air delivery	Air is not available. Gas mixer is using 100 % O_2 instead.	Check central Air supply or use cylinder.
			Use "ALARM RESET" to downgrade alarm priority.
! 100	No CO_2 detected	Ventilation was started, but no exhaled CO_2 was detected for more than 60 seconds.	Check patient condition.
			Check sample line, water trap, and patient-side filter.
			Use "ALARM RESET" to acknowledge alarm.
!!! 200	No fresh-gas flow	No fresh-gas flow is set.	Open the flow control valves.
			Use "ALARM RESET" to downgrade alarm priority.
!!! 110	No N_2O delivery	N_2O is not available. Gas mixer is using O_2 instead.	Check central N_2O supply or use cylinder.
			Use "ALARM RESET" to downgrade alarm priority.
!!! 210	No O_2 delivery	O_2 is not available. Gas mixer is using Air instead.	Check central O_2 supply or use cylinder.
			Use "ALARM RESET" to downgrade alarm priority.
!!! 120	No ventilation	An internal error occurred. Ventilation has stopped.	Change the ventilation mode to Man/Spon and ventilate the patient manually, or change back to automatic ventilation.
			Check the upper alarm limit for the airway pressure.
			If the problem persists, call DrägerService.
! 220	O_2 cylinder almost empty	The cylinder is almost empty.	Replace the cylinder. Use the central supply.
!!! 210	O_2 cylinder empty	The cylinder is empty or closed.	Replace the cylinder. Use the central supply.
			Use "ALARM RESET" to downgrade alarm priority.

Priority		Alarm	Cause	Remedy
!	255	O_2 cylinder empty	The cylinder is empty or closed.	Replace the cylinder. Use the central supply.
!	190	O_2 cylinder sensor?	Cylinder pressure sensor is not connected.	Check if cylinder pressure sensor is connected.
				Use "ALARM RESET" to acknowledge alarm.
!!	150	O_2 FG flow measurement failed	The measurement system for the O_2 fresh-gas flow has failed.	Only use O_2 as fresh gas.
				Use the total flow tube to check the fresh-gas flow. Adjust the fresh-gas flow so that it equals or exceeds the minute volume.
!!	255	O_2 measurement not available	The ambient air used for calibrating the sensor was impure.	Position the device in an environment with clean ambient air.
				Wait for the automatic calibration.
			There is electromagnetic interference.	Check for electromagnetic radiation in the vicinity.
			Ambient temperature is too high.	Check ambient conditions.
!	255	O_2 measurement temporarily inaccurate	The sensor has not yet warmed up.	Wait for the automatic calibration.
			The ambient air used for calibrating the sensor was impure.	Position the device in an environment with clean ambient air.
				Wait for the automatic calibration.
!!	255	O_2 sensor failure	The O_2 sensor in the patient-gas measurement module is faulty.	Use alternative O_2 measuring system.
				Use "ALARM RESET" to downgrade alarm priority.
				Perform the system test.
				Call DrägerService.
!!!	210	O_2 supply low	Central supply pressure and cylinder pressure are low.	Check central O_2 supply or use cylinder.
				Use "ALARM RESET" to downgrade alarm priority.
!	100	On/Standby key stuck	Key is stuck or was pressed for more than 10 seconds.	Ventilation performance is not affected.
				If the problem persists, call DrägerService.
!	75	Patient-gas measurement module is calibrating	The automatic calibration of the patient-gas measurement module is in progress.	Wait for the calibration to complete.

Priority	Alarm	Cause	Remedy
!!! 100	Pause time expired	Ventilation and gas delivery have been paused longer than the set pause time.	Resume ventilation or adjust timer.
!! 100	Pause time expired	Ventilation and gas delivery have been paused longer than the set pause time.	Resume ventilation or adjust timer.
! 100	Pause time expired	Ventilation and gas delivery have been paused longer than the set pause time.	Resume ventilation or adjust timer.
!! 60	PEEP not applied	Failure of the PEEP valve.	Check the breathing circuit for tight connections and leakages.
			Perform the system test.
!! 50	PEEP/CPAP high	The expiratory limb is blocked.	Check expiratory breathing hose and breathing system.
			Perform the leakage test.
		Failure of the anesthetic gas scavenging system.	Check anesthetic gas scavenging system.
!! 100	PEEP/CPAP low	Fresh-gas flow is insufficient, breathing bag is blocked or positioned incorrectly.	Check fresh-gas settings and position of breathing bag.
		Leakage or disconnection.	Check the breathing circuit for tight connections and leakages.
		Failure of the anesthetic gas scavenging system.	Check anesthetic gas scavenging system.
! 170	Power failure	Mains power supply is not available. The device has switched to battery operation.	Restore mains power supply.
!! 100	Power supply failure	Internal fault in the power supply.	Operation of the device can be continued.
			Call DrägerService.
!! 100	Pressure sensor failure	There is condensate in the breathing hoses.	Check the breathing hoses.
		Sensor calibration failed.	Perform the system test.
			If the problem persists, call DrägerService.
! 255	Pressure-relief valve opened	Pressure in the breathing system is too high.	Check APL valve and fresh-gas settings.

Priority		Alarm	Cause	Remedy
!!!	200	Rotary knob stuck	Key is stuck or was pressed for more than 10 seconds.	Ventilation performance is not affected.
				Press and turn rotary knob repeatedly. If alarm condition persists, settings cannot be adjusted anymore.
				Disconnect the patient and ventilate with a manual resuscitator.
				Turn off the device with the main switch. Use "Add. O_2". Ventilate the patient manually.
!	170	Sample line disconnected?	The sample line or the water trap has been disconnected.	Check sample line and water trap.
!	170	Sample line occluded	Sample line is occluded.	Check sample line, water trap, and patient-side filter.
!	75	Second agent detected	A second anesthetic agent has been detected.	Flush the system if necessary.
				Check fresh-gas settings.
				Wait for transition phase to end.
!	60	Service date reached	Maintenance is due.	Use "ALARM RESET" to acknowledge alarm.
				Call DrägerService.
!!!	200	Set O_2 switch to "Add. O_2"	The internal gas delivery system has failed and the O_2 switch is still set to "Aux. O_2".	Set the O_2 switch to "Add. O_2". Set the O_2 flowmeter to the desired flow.
!!	0	Speaker failure	The loudspeaker is faulty.	Call DrägerService.
				Use "ALARM RESET" to downgrade alarm priority.
!!	100	Synchronized ventilation failure	Inspiratory efforts of the patient cannot be detected due to faulty sensors.	Check ventilation settings.
				Change to a non-synchronized ventilation mode.
				Change to Man/Spon mode and ventilate manually.
!!!	100	System failure	Failure of internal components. System is no longer operational.	Ventilate the patient with a manual resuscitator.
				Call DrägerService.
!	255	Temperature of TurboVent 2 blower module high	Temperature of TurboVent 2 blower module is too high.	Reduce airway pressure or respiratory rate.

Priority	Alarm	Cause	Remedy
!!! 0	Therapy settings not applied	The last changes to the therapy settings were not applied.	Change to Man/Spon and restart the ventilation mode.
			Use "ALARM RESET" to acknowledge alarm.
			If the problem persists, call DrägerService.
!! 100	Third agent detected	A mixture of more than 2 anesthetic agents has been detected.	Flush the system if necessary.
			Check fresh-gas settings.
			Wait for transition phase to end.
		There is electromagnetic interference.	Check for electromagnetic radiation in the vicinity.
!! 30	Tidal volume not achieved	The delivered inspiratory tidal volume is lower than the set value.	Check ventilation settings.
			Check Pmax setting.
			Check patient compliance. Check if the patient is breathing spontaneously.
!!! 100	TurboVent 2 failure	The TurboVent 2 blower module is not operational or overheated.	Start manual ventilation!
			Replace TurboVent 2 blower module.
!!! 100	TurboVent 2 not connected	The TurboVent 2 blower module is not connected.	Insert the TurboVent 2 blower module.
			Use "ALARM RESET" to downgrade alarm priority.
!!! 100	Unknown alarm	Error in the internal alarm system.	Check patient condition.
			Call DrägerService.
! 0	USB write error	The USB flash drive is full, faulty, write-protected, or not compatible. The USB flash drive is not correctly connected. The USB flash drive is not correctly formatted.	Check the USB flash drive.
			Use "ALARM RESET" to acknowledge alarm.
! 100	Vapor View failure (left slot)	Failure of Vapor View hardware.	If the problem persists, call DrägerService.
			Use "ALARM RESET" to acknowledge alarm.
! 100	Vapor View failure (middle slot)	Failure of Vapor View hardware.	If the problem persists, call DrägerService.
			Use "ALARM RESET" to acknowledge alarm.
! 100	Vapor View failure (right slot)	Failure of Vapor View hardware.	If the problem persists, call DrägerService.
			Use "ALARM RESET" to acknowledge alarm.

Priority		Alarm	Cause	Remedy
!	100	Vapor View not operational	Failure of Vapor View hardware.	Call DrägerService.
				Use "ALARM RESET" to acknowledge alarm.
!!	100	Vaporizer open	Control dial is not in position "0".	Close vaporizer to prevent accumulation of anesthetic agent in the breathing system.
!!!	120	Ventilator failure	Failure of the pressure sensors.	Start manual ventilation!
				Perform the system test.
				If the problem persists, call DrägerService.
!!	100	Vol. Ctrl. ventilation failure	The inspiratory flow sensor is faulty.	Change to a pressure-controlled ventilation mode.
				Replace the flow sensor. Perform the leakage test.
!	100	Water trap disconnected?	Infinity ID water trap is not correctly connected.	Check water trap.
!	100	Water trap expired	Accessory has been used too long.	Replace the accessory if necessary.
				Use "ALARM RESET" to acknowledge alarm.
!	170	Water trap full	The water trap of the gas measurement is full.	Check water trap.
			Sample line is occluded.	Check sample line, water trap, and patient-side filter.
!!	80	xMAC low	Inspiratory and expiratory gas concentrations are lower than the automatically calculated limit.	Check patient condition.
				Check filling level. Refill if necessary.
				Check vaporizer setting.
				Check the breathing system and the breathing bag for leakages.
				If the current xMAC is acceptable, use "ALARM RESET" to acknowledge the alarm.

Priority	Alarm	Cause	Remedy
! 170	xMAC low	Inspiratory and expiratory gas concentrations are lower than the automatically calculated limit.	Check patient condition.
			Check filling level. Refill if necessary.
			Check vaporizer setting.
			Check the breathing system and the breathing bag for leakages.
			If the current xMAC is acceptable, use "ALARM RESET" to acknowledge the alarm.
!! 100	Y-piece is open or not connected	The Y-piece is open or not connected during flush or Flush & Dry procedure.	Make sure that the Y-piece is sealed.

Service

Safety information

WARNING

Risk due to inappropriately reprocessed products

The product may be contaminated with infectious agents.

Before maintenance and before returning the product for repair, reprocess the product. Carry out the reprocessing as described in the reprocessing instructions supplied with the product.

WARNING

Risk if service is not performed regularly

Wear and material fatigue of the components may lead to device failure and malfunctions.

Perform service at the specified intervals.

WARNING

Risk if service is not performed properly

Personal injury and property damage may occur if service is not performed properly.

Service must be performed by those user groups that are assigned to the particular measure.

WARNING

Risk if maintenance is not performed properly

If the device is connected to the power supply or the gas supply during maintenance, there is a risk of personal injury and property damage.

Before performing maintenance, disconnect all electrical connections from the power supply and all gas connections from the gas supply.

WARNING

Risk when the housing is being opened

Under the housing, there are live electrical components, which may cause an electric shock.

The housing may only be opened by those user groups that are assigned to that particular measure.

WARNING

Risk of patient injury

If maintenance activities are carried out during ventilation, the patient will be put at risk.

Only carry out maintenance activities when there is no patient connected to the device.

Transport for maintenance purposes

Additional information concerning the ceiling-mounted version

WARNING

Risk of injury or damage to the device

If the medical device is not correctly docked or has been undocked from the ceiling supply unit, it may fall from the device mounting interface or tip over.

The medical device may only be docked to the ceiling supply unit or be undocked from it by service personnel.

WARNING

Risk of injury or damage to the device

If the medical device was placed on the service cart, it does not fulfill the tipping stability requirements as per IEC 80601-2-13 and IEC 60601-1, and there is an increased risk of tipping over.

- **Only service personnel may move the medical device on the service cart.**
- **Preparation for transport and actual transport of the medical device on the service cart must only be carried out if there is no patient in the immediate vicinity.**

- For docking to the ceiling supply unit, undocking from the ceiling supply unit, and for transporting on the service cart, contact service personnel.

Definition of service terminology

Concept	Definition
Service	All measures (inspection, maintenance, repair) intended to maintain or restore the functional integrity of a product
Inspection	Measures intended to determine and assess the current state of a product
Maintenance	Regular specified measures intended to maintain the functional integrity of a product
Repair	Measures intended to restore the functional integrity of a product after a failure

A service contract with Dräger is recommended.

Inspection

Measure	Interval	User group
Inspection and safety check	Every 12 months	Service personnel

Remote service

Perseus supports the following Remote Service functions:

– Help ticket
– Remote Device Check
– Proactive call

Contact the responsible DrägerService organization for further information on the Remote Service function.

Safety checks

Safety checks are no substitute for preventive maintenance measures (including preventive replacement of wear parts) as identified by the manufacturer.

Performing the safety checks

1 Check whether the corresponding instructions for use are available in the correct version.
2 Perform a functional test of the following functions in accordance with the instructions for use:
  – Emergency O_2 delivery
3 Check that the product is in good condition:
  – All labels are complete and legible
  – No visible damage to the following components:
    – Trolley and castors
    – Housing parts
    – Brakes
    – Auxiliary power sockets
    – Vaporizer mount
    – Water trap mount
    – O-rings of the water trap mount
    – Screen
    – Gas inlets
    – Status display
    – Breathing system
    – AGS and AGS valves
    – Hoses and cables
    – Strain reliefs for AGS, compressed gas hoses, cables
    – Optional: Holding arms
    – Optional: Flexibility trolley, castors, and locking mechanisms
    – Optional: Pressure reducers and their sensor lines
  – Fuses which are accessible from the outside are in compliance with the specified values
  – Check that the country-specific labeling of the gas type matches the screen display.
  – Check the end stop of the holding arms for patient monitors.
4 Check the electrical safety in accordance with the IEC 62353 standard.
5 Check the safety equipment:
  – Functional integrity of optical and acoustic alarm generators
  – O_2 switch on gas mixing unit (electronically controlled gas mixer)
  – Internal battery
  – Optional: Check the function of the minimum O_2 delivery (mechanically controlled gas mixer).

6 Check the accuracy of the gas measurement based on a certified test gas concentration:
- Anesthetic gas measurement:
  Isoflurane, 1 Vol%
  Sevoflurane, 1 Vol%
  Accuracy ±0.35 Vol%
- N_2O measurement, 70 Vol%
  Accuracy ±7.6 Vol%
- CO_2 measurement, 5 Vol%
  Accuracy ±0.83 Vol%

7 Check the accuracy of the O_2 measurement:
- Ambient air 21 Vol%
  Accuracy ±3 Vol%
- 100 Vol%
  Accuracy –5 Vol%

8 Check the sample gas flow of the patient-gas measurement module:
- Accuracy 200 ±20 mL/min

9 Check the patient gas measurement module for leakage:
- Leakage at –200 hPa (cmH_2O)
- <20 hPa/min (cmH_2O/min)

10 Check the non-return valve of the central gas supply for leakage:
- Leakage ≤20 mL/min

11 Check the operational readiness by means of a system test.

12 Optional: Check the accuracy of the pressure gauge for the internal breathing system:
- Accuracy 30 hPa (cmH_2O) ±10 hPa (cmH_2O)

13 Optional: Check the external cylinder pressure reducers
- Annually: Relief valve
  7.5 to 8 kPa x 100
- Every 6 years: output pressure
  5 to 6 kPa x 100

14 Optional: Check the functional integrity of the safety sensor.

15 Optional: Check the functional integrity of the service cart.

Maintenance

Component	Interval	Measure	User group
CO_2 absorber/soda lime with disposable dust filter	If colored violet or according to the configured Infinity ID exchange interval	Replace, see page 76	Users
Water trap	If required, if soiled, or according to the configured Infinity ID exchange interval	Replace, see page 77	Users
Flow sensors	If required, if calibration is no longer possible, or according to the configured Infinity ID exchange interval	Replace, see page 187	Users
AGS	If required, if filter is soiled, or flow is no longer achieved	Replace, see page 189	Users
AGS filter	If required, if filter is soiled, or flow is no longer achieved	Replace	Service personnel
O-rings on the water trap mount	Every 2 years	Replace	Service personnel
Sealing, sieve insert, and sintered filter on the cylinder connection of the external cylinder pressure reducer (optional)	Every 3 years	Replace	Specialized service personnel
Air filter mat – Patient gas measurement module – Power supply unit	Every 3 years	Replace	Service personnel
CLIC adapter (optional)	Every 4 years	Replace	Users
Lead-gel battery (2 pieces)	Every 2 years	Replace	Service personnel

Component	Interval	Measure	User group
Pressure reducer (optional)			
Cylinder pressure reducer, type MP:			
– complete	Every 6 years	Replace	Service personnel
Cylinder pressure reducer, type MK:			
– Sealing	Every 3 years		
– Sieve insert	Every 3 years		
– Sintered metal filter on the cylinder connection	Every 3 years		
– Diaphragm unit	Every 6 years	Replace	Specialized service personnel
– Valve cone	Every 6 years		
– Blow-off valve	Every 6 years		
– Safety valve spring	Every 6 years		

It is recommended that only original parts from Dräger are used and that the parts are replaced by Dräger.

Repair

Repairs may be performed only by specialized service personnel.

It is recommended that only original parts from Dräger are used and that the parts are replaced by Dräger.

Disposal

Safety information

WARNING

Risk due to inappropriately reprocessed products

The product may be contaminated with infectious agents.

Before disposal, reprocess the product. Carry out the reprocessing as described in the reprocessing instructions supplied with the product.

Disposing of the device

The disposal of electrical and electronic devices is subject to special guidelines. This device must be disposed of in accordance with national regulations. In countries of the European Union, Dräger will organize the return of the device. Additional information is available at www.draeger.com (search term: WEEE).

Disposing of accessories

When disposing of the following accessory parts, observe the hospital hygiene regulations and the respective instructions for use:

– Flow sensors
– Breathing hoses
– Filter, HME, HMEF
– Breathing bag
– Masks
– Water trap
– CLIC absorber, Infinity ID CLIC absorber
– Soda lime

Dispose on the following articles according to hospital hygiene regulations:

– Sample line
– Disposable dust filter
– AGS

Technical data

General information

Units of measurement for pressure	1 hPa = 1 mbar = 1 cmH_2O 100 kPa = 0.1 MPa = 1 bar = 1 kPa x 100
User's operating location	At the front at a distance of 1 m (39 in) and a height of 1.5 m (59 in)

All specified tolerances apply for 20 °C (68 °F), 60 % relative humidity, and 1013 hPa (760 mmHg).

The accuracies indicated below change according to ambient pressure, temperature, and relative humidity. If one of the ambient conditions is changed up to the permissible limit, the accuracy of the corresponding value can change by up to 50 %. If more than one of the ambient conditions are changed, the accuracy may change by up to 100 %.
Example: Accuracy of a measured pressure value: ±4 % under standard conditions. At 10 °C, the accuracy changes to ±6 %; at 10 °C and 20 % relative humidity, to ±8 %.

All patient-related volumes and flow values are standardized to the conditions in the lung. (BTPS)

Ambient conditions

During operation	
Temperature	10 to 40 °C (50 to 104 °F)
Ambient pressure	620 to 1060 hPa (9.0 to 15.3 psi)
Relative humidity	20 to 95 %, non-condensing
CO_2 concentration	300 to 1000 ppm
Height	Up to 4000 m (13123 ft)
During storage and transport	
Temperature	
Device without battery	–20 °C to 60 °C (–4 °F to 140 °F)
Battery	–15 °C to 40 °C (5 °F to 104 °F)

Ambient conditions (continued)

For storage longer than 12 months	–15 °C to 25 °C (5 °F to 77 °F)
Maximum storage duration without recharging	180 days
Ambient pressure	500 to 1060 hPa (7.3 to 15.3 psi)
Relative humidity	10 to 95 %, without condensate formation
CO_2 concentration	Not relevant
The permissible ambient conditions depend on the accessories used. Follow the corresponding instructions for use.	

Fresh-gas delivery

All data are standardized to STPD conditions.

O_2 flush	25 to 75 L/min at 2.7 to 6.9 kPa x 100 (39 to 100 psi; 0.27 to 0.69 MPa) supply pressure
O_2 flow for ***Aux. O_2*** and ***Add. O_2***	
Range	Off; 2 to at least 10 L/min at 2.7 kPa x 100 (39 psi or 0.27 MPa) supply pressure
Accuracy	±10 % of the set value for flows >2.0 L/min
Resolution of displayed value	1.0 L/min (up to 10 L/min) 5.0 L/min (above 10 L/min)

Fresh-gas delivery (electronically controlled gas mixer)

All data are standardized to STAPD conditions.

O_2 concentration FG O_2	
Setting range	21 to 100 Vol% (carrier gas: Air) 25 to 100 Vol% (carrier gas: N_2O)
Accuracy	±5 % or ±2 Vol% (the larger value applies)
Fresh-gas flow FG flow	
Setting range	Off; 0.2 to 15 L/min
Accuracy	±10 % or ±50 mL/min (the larger value applies)

Fresh-gas delivery (mechanically controlled gas mixer)

All data are standardized to STAPD conditions.	
O_2 concentration	21 to 100 Vol%
Setting range for fresh-gas flow	0 to at least 12 L/min (O_2, Air, and N_2O)
Electronic measurement of fresh-gas flow	
Range	0 to 15 L/min (O_2, Air, and N_2O)
Accuracy	±10 % or ±0.12 L/min (the larger value applies)
Resolution of the value displayed on the screen	0.01 L/min (from 0 to 0.2 L/min) 0.02 L/min (from 0.2 to 0.5 L/min) 0.05 L/min (from 0.5 to 1 L/min) 0.1 L/min (from 1 to 15 L/min)
Resolution of the value displayed in the status display	0.1 L/min
Total flow tube	All data are standardized to STPD conditions.
Range	0 to 10 L/min
Accuracy	±10 % of the set value at 100 % O_2 and for flows >1 L/min
Resolution of displayed value	0.5 L/min

Ventilator

Electronically driven ventilator, fresh-gas decoupled	
Time-based settings:	
Respiratory rate RR	3 to 100 /min ±10 % of the set value or ±1/min (the larger value applies)
Minimum respiratory rate in PSV RRmin mode	Off, 3 to 25 /min ±10 % of the set value or ±1/min (the larger value applies)
Inspiratory time Ti	0.2 to 10 s ±10 % of the set value or ±100 ms (the larger value applies)
Maximum inspiratory time for supported breaths (fixed setting)	
Patient category "adult"	4 s or 1 / (2 x RRmin) (the smaller value applies)
Patient categories "pediatric patient" and "neonate"	1.5 s or 1 / (2 x RRmin) (the smaller value applies)

Ventilator (continued)

Pressure rise time (Slope)	0 to 2 seconds; ±20 % of the set value or ±200 ms (the larger value applies)
Ratio of inspiratory time to expiratory time	1:50 to 50:1
Time at upper pressure level (Thigh) in PC - APRV mode	0.2 to 10 s ±10 % of the set value or ±100 ms (the larger value applies)
Time at lower pressure level (Tlow) in PC - APRV mode	0.2 to 10 s ±10 % of the set value or ±100 ms (the larger value applies)
Inspiration termination criterion (Insp. term.)	5 to 80 %PIF ±20 % of the set value or ±2.5 L/min (the larger value applies)
Percentage ratio of plateau time to inspiratory time of the mandatory breaths in the VC - CMV , VC - SIMV, and VC - SIMV / PS (%Tplat)	0 to 60 % ±20 % of the set value or ±200 ms (the larger value applies)
Inflation time (Duration) including rising and falling slopes in the One-step recruitment maneuver	3 to 40 s ±10 % of the set value
Number of breaths at each level (Breaths/Step), with the exception of the highest level in the Multi-step recruitment maneuver	1 to 20
Number of breaths at the highest level (Breaths@Max) in the Multi-step recruitment maneuver	1 to 20
Reminder for repeated One-step recruitment or Multi-step recruitment maneuver	Off, 10 to 180 min ±1 min
Volume-based and flow-based settings:	
Tidal volume VT	20 to 2000 mL, standardized to BTPS conditions ±10 % of the set value or ±15 mL (the larger value applies) The applied VT is corrected by the determined breathing hose compliance. The applied VT is also corrected by the sampling flow of the built-in patient-gas measurement module as soon as CO_2 respiratory phases are detected.
Trigger sensitivity Trigger	0.3 to 15 L/min ±20 % of the set value or ±1 L/min (the larger value applies)

Ventilator (continued)

Inspiratory flow Flow for adults	Minimum 1 L/min, maximum >180 L/min Results from the VT / Pinsp and Ti settings
Inspiratory flow Flow for children and neonates	Minimum 1 L/min, maximum 60 L/min Results from the VT / Pinsp and Ti settings
Pressure-related settings:	
Inspiratory pressure Pinsp	PEEP +1 to 80 hPa (cmH_2O); ±10 % of the set value or ±2 hPa (cmH_2O) (the larger value applies)
Pressure limitation Pmax	PEEP +5 to 80 hPa (cmH_2O); ±10 % of the set value or ±3 hPa (cmH_2O) (the larger value applies)
Lower pressure level Plow in APRV mode	Off, 2 to 35 hPa (cmH_2O); ±10 % of the set value or ±2 hPa (cmH_2O) (the larger value applies)
Upper pressure level Phigh in APRV mode	Plow +1 to 80 hPa (cmH_2O); ±10 % of the set value or ±2 hPa (cmH_2O) (the larger value applies)
Pressure amplitude above PEEP: ΔPsupp	
In the CPAP/PSV and PC - BIPAP / PS modes	Off, 1 to (80 - PEEP) hPa (cmH_2O), ±10 % of the set value or ±2 hPa (cmH_2O) (the larger value applies)
In the VC - SIMV / PS and VC - SIMV / PS / AutoFlow modes	Off, 1 to (Pmax - PEEP) hPa (cmH_2O), ±10 % of the set value or ±2 hPa (cmH_2O) (the larger value applies)
Positive end-expiratory pressure PEEP	Off, 2 to 35 hPa (cmH_2O); ±10 % of the set value or ±2 hPa (cmH_2O) (the larger value applies)
Continuous positive pressure CPAP	Off, 2 to 35 hPa (cmH_2O); ±10 % of the set value or ±2 hPa (cmH_2O) (the larger value applies)
Inspiratory pressure Pressure in the One-step recruitment maneuver	3 to 80 hPa (cmH_2O) and greater than PEEP;; ±10 % of the set value or ±2 hPa (cmH_2O) (the larger value applies)
Highest inspiratory pressure Pinsp max in the Multi-step recruitment maneuver	15 to 80 hPa (cmH_2O); ±10 % of the set value or ±2 hPa (cmH_2O) (the larger value applies)
Highest PEEP pressure PEEP max in the Multi-step recruitment maneuver	2 to 35 hPa (cmH_2O); ±10 % of the set value or ±2 hPa (cmH_2O) (the larger value applies)
Pressure amplitude above PEEP: ΔPressure in the Multi-step recruitment maneuver	5 to 30 hPa (cmH_2O); ±10 % of the set value or ±2 hPa (cmH_2O) (the larger value applies)

Ventilator (continued)

Minimum pressure limit as per ISO 8835-5 and ISO 80601-2-13	0 hPa (cmH_2O)

Breathing system

Total volume including the disposable CO_2 absorber CLIC Absorber Free	
In the Man / Spon mode	Typically 2.18 L
In automatic ventilation modes	Typically 2.18 L
Compliance (without breathing circuit)	
In the Man / Spon mode	Typically 2.18 mL/hPa (mL/cmH_2O) corresponds to 65.4 mL at 30 hPa (cmH_2O)
In automatic ventilation modes	Typically 0.28 mL/hPa (mL/cmH_2O) corresponds to 8.4 mL at 30 hPa (cmH_2O)
Soda lime filling volume for absorber container	
Reusable CO_2 absorber, filled	1500 mL
Disposable CO_2 absorber CLIC absorber 800+	1300 mL
Disposable CO_2 absorber CLIC absorber Free	1200 mL
Flexible arm for breathing bag	
Volume	0.13 L
Compliance	0.13 mL/hPa (mL/cmH_2O) corresponds to 3.9 mL at 30 hPa (cmH_2O)
Total system leakage	<150 mL/min at 30 hPa (cmH_2O) standardized to BTPS conditions
APL valve	
Setting range	Open, 5 to 70 hPa (cmH_2O)
Accuracy (in range from 15 to 30 L/min):	±20 % of the set value or ±3 hPa (the larger value applies), but not more than +10 hPa (cmH_2O)
Pressure drop at 30 L/min (ATPD), fully opened	Dry: 2.1 hPa (cmH_2O) Wet: 2.2 hPa (cmH_2O)

Breathing system (continued)

Breathing system resistance at 60 L/min (reusable CO_2 absorber or disposable CO_2 absorber, with or without flexible arm for breathing bag, normal operation, filled with Drägersorb 800 Plus)	
According to ISO 8835-2, dry, with adult breathing hose set M30146	Inspiratory: –3.5 hPa (cmH_2O) Expiratory: 4.1 hPa (cmH_2O)
According to ISO 8835-2, dry, without hoses	Inspiratory: –1.1 hPa (cmH_2O) Expiratory: 3.4 hPa (cmH_2O)
Recommendation for breathing hoses	
All compliances and volumes indicated include inspiratory and expiratory filters	
VT <50 mL	Maximum compliance: 2.0 mL/hPa (mL/cmH_2O)
VT =50 to 300 mL	Maximum compliance: 4.0 mL/hPa (mL/cmH_2O)
VT >300 mL	Maximum compliance: 6.0 mL/hPa (mL/cmH_2O)
Maximum length	200 cm (78.7 in) 350 cm (137.8 in) (with restrictions for compliance correction and pressure metering accuracy)
Maximum hose volume	1.6 L 2.7 L (with restrictions for compliance correction and pressure metering accuracy)
Recommendation for a breathing bag hose if no flexible arm is in use.	
Maximum resistance	1.5 hPa (cmH_2O) at 60 L/min 3 hPa (cmH_2O) at 60 L/min with increased fresh-gas consumption
Maximum length	180 cm (70.9 in) 350 cm (137.8 in) with increased fresh-gas consumption
Maximum hose volume	0.7 L 0.9 L with increased fresh-gas consumption
Recommendation for the bag size	
Volume	0.5 L to 5 L (should have at least double the applied tidal volume)

External fresh-gas outlet

Connection	22 mm outer taper / 15 mm inner taper (ISO)
Delivery	See "Fresh-gas delivery"
Pressure limitation	Not pressure-limited

Anesthetic gas receiving system

Suction flow	
Normal range	32 to 50 L/min
At lower end of restricted range	14 L/min
Maximum fresh-gas flow to prevent contaminating ambient air	
For external breathing systems (normal range)	16 L/min
For external breathing systems (restricted range)	5 L/min
For internal breathing systems (restricted range)	7 L/min

Measuring systems and displays

As Perseus uses more accurate values for internal calculation and alarming, small deviations due to rounding may occur.

Airway pressure	
Airway pressure	Paw
Plateau pressure	Pplat
Positive end-expiratory pressure	PEEP
Peak inspiratory pressure	PIP
Mean airway pressure	Pmean
Range	–20 to +120 hPa (cmH_2O)
Accuracy	±4 % of the measured value or ±2 hPa (cmH_2O) (the larger value applies)
Resolution of displayed value	1 hPa (cmH_2O)

Measuring systems and displays (continued)

Pressure gauge for indicating the pressure in the internal breathing system	
Range	–20 to +80 hPa (cmH_2O)
Accuracy	±5 % of the measured value or ±2 hPa (cmH_2O) (the larger value applies)
Resolution of displayed value	5 hPa (cmH_2O)
Volume	
Measured volumes are corrected by the determined breathing hose compliance. As soon as CO_2 respiratory phases are detected, measured volumes are also corrected by the suction flow of the integral patient-gas measurement module and according to the determined gas composition.	
Tidal volume	
Inspiratory	VTi
Expiratory	VT
Range	0 to 2500 mL
Accuracy	±8 % of measured value or ±15 mL (the larger value applies)
Resolution of displayed value	1 mL
ΔVT	
Range	0 to 2500 mL
Accuracy	±16 % of measured value or ±30 mL (the larger value applies)
Resolution of displayed value	1 mL
Minute volume	
Total	MV
Mandatory	MVmand
Spontaneous	MVspon
Range	0 to 40 L/min
Accuracy	±8 % of measured value or ±0.2 L/min (the larger value applies)
Resolution of displayed value	0.1 or 0.01 L/min
$T_{0...90}$	<45 s (RR ≥6 /min) <105 s (RR <6 /min)

Measuring systems and displays (continued)

Low-flow wizard	
Range	0 to 8 L/min
Accuracy	±25 % of measured value or ±100 mL/min (the larger value applies)
Respiratory rate	
Total	RR
Spontaneous	RRspon
Mandatory	RRmand
Range	0 to 150 /min
Accuracy	±1 /min or 10 % (the larger value applies)
Resolution of displayed value	1 /min
$T_{0...90}$	<45 s (RR ≥6 /min) <105 s (RR <6 /min)
Dynamic compliance	
Compliance	Cdyn
Mean compliance	Cdyn mean
Range	0 to 200 mL/hPa (mL/cmH_2O)
Accuracy	±30 % or ±3 mL/hPa (mL/cmH_2O) (the larger value applies) If during automatic ventilation there is still an inspiratory flow at the end of inspiration, the device will determine how much volume could not be applied. This volume will then be included with the normal volume in the compliance calculation. With increasing spontaneous breathing activity, the compliance values can be distorted. In this case the measurement accuracy may be reduced.
Resolution of displayed value	0.1 mL/hPa (mL/cmH_2O)
Resistance	R
Range	0 to 100 hPa / (L/s) (cmH_2O / (L/s))
Accuracy	±3 hPa / (L/s) (cmH_2O / (L/s)) or ±30 % of the measured value (the larger value applies) (With increasing spontaneous breathing activity, the R values can be severely distorted. Hence maintaining measurement accuracy cannot be guaranteed with spontaneous breathing).
Resolution of displayed value	1 hPa / (L/s) (cmH_2O / (L/s))

Measuring systems and displays (continued)

Elastance	E
Range	0.005 to 10 hPa/mL (cmH_2O/mL)
Resolution of displayed value	0.001 hPa/mL (cmH_2O/mL)
Gas measurement	Sidestream gas measurement (The sample gas is fed back into the breathing system and included in calculations for measurements and delivery); All values are measured under ATPS conditions; Sample gas flow standardized to STPD conditions. The measurement is corrected for ambient pressure. Due to the $T_{10...90}$ time and the sampling rate, the accuracies of the measured values for O_2, CO_2, N_2O, and anesthetic agent may deviate at respiratory rates of 75 /min or higher and an I:E ratio of 1:2. The influence of respiratory rate and the I:E ratio on the accuracy has been verified in a simulated breathing system using a rectangular waveform for the gas concentration. End-tidal measured values are calculated for each breath from the local maxima and minima of the real-time measurements during expiration.
Sample gas flow	200 mL/min ±10 %
Maximum time until emptying of the water trap is necessary	41 h (sample gas under BTPS conditions at 23 °C ambient temperature)
System response time	The system response time results from the typical delay and the gas type specific $T_{10...90}$ time.
Sensor sampling rate	<50 ms
Time after switch-on until the specified accuracy is attained	<500 s
Time until CO_2 measured values are displayed with reduced accuracy	<90 s
Typical delays	<5 s
Cross sensitivity	None with respect to alcohol (<3000 ppm in blood), Acetone (<1000 ppm), methane, water vapor, NO and CO

Measuring systems and displays (continued)

Drift	Compensated by automated cyclic zeroing Ambient air is fed into the breathing system during automatic zeroing
O_2	
Range	0 to 100 Vol%
Accuracy	±(2.5 Vol% + 2.5 % relative)
Resolution of displayed value	1 Vol%
$T_{10...90}$	<500 ms
CO_2	
Range	0 to 13.6 Vol% 0 to 13.6 kPa 0 to 102 mmHg
Accuracy	±(0.43 Vol% + 8 % relative) ±(0.43 kPa + 8 % relative) ±(3.3 mmHg + 8 % relative)
Resolution of displayed value	0.1 Vol% 0.1 kPa 1 mmHg
$T_{10...90}$	<350 ms
N_2O	
Range	0 to 100 Vol%
Accuracy	±(2 Vol% + 8 % relative)
Resolution of displayed value	1 Vol%
$T_{10...90}$	<500 ms
Anesthetic gases	
Range	
Halothane	0 to 8.5 Vol% (kPa)
Isoflurane	0 to 8.5 Vol% (kPa)
Enflurane	0 to 10 Vol% (kPa)
Sevoflurane	0 to 10 Vol% (kPa)
Desflurane	0 to 20 Vol% (kPa)
Accuracy	±(0.2 Vol% +15 % relative) ±(0.2 kPa +15 % relative)
Resolution of displayed value	0.1 Vol% (kPa) for desflurane 0.01 Vol% (kPa) for all other anesthetic gases
$T_{10...90}$	<500 ms

Measuring systems and displays (continued)

Detection	Automatic
Primary gas	At the latest at 0.3 Vol%
Secondary gas	At the latest at 0.4 Vol% or 0.1 xMAC (the larger value applies) With a desflurane concentration greater than 4 Vol%, mixture detection occurs at the latest when the concentration of the second anesthetic gas rises above 10 % of the desflurane concentration. The secondary gas becomes the primary gas when the expiratory xMAC value is more than 0.2 xMAC above that of the primary gas.
Minimum displayed concentration	The specified detection thresholds refer to rising anesthetic gas concentrations (e.g., at the start of an operation). If the anesthetic gas concentration falls, a concentration of down to 0.05 Vol% will be measured, based on the last anesthetic agent detected. Below this concentration, a value of 0 Vol% will be displayed.
xMAC	Based on patient age, anesthetic agent, and nitrous oxide concentration (the xMAC is corrected for ambient pressure)
Range	0 to 9.9
Accuracy	Corresponds to that of the gas measurement
Resolution of displayed value	0.1
Measurement of supply pressures	
Central supply	
Range	0 to 9.8 kPa x 100 0 to 140 psi 0 to 0.98 MPa
Accuracy	±4 % or ±0.2 kPa x 100 (the larger value applies) ±4 % or ±3 psi (the larger value applies) ±4 % or ±0.02 MPa (the larger value applies)
Resolution of displayed value	0.1 kPa x 100 1 psi 0.01 MPa
Gas cylinders	
Range	0 to 250 kPa x 100 0 to 3600 psi 0 to 25 MPa

Measuring systems and displays (continued)

Accuracy	±4 % or ±6 kPa x 100 (the larger value applies) ±4 % or ±87 psi (the larger value applies) ±4 % or ±0.6 MPa (the larger value applies)
Resolution of displayed value	1 kPa x 100 1 psi 0.1 MPa
Test results	
Total leakage	
Range	10 to 5000 mL/min
Resolution of displayed value	1 mL/min
Leakage in automatic ventilation	
Range	10 to 5000 mL/min
Resolution of displayed value	1 mL/min
Hose compliance	Compliance
Range	0 to 9.9 mL/hPa (mL/cmH_2O)
Resolution of displayed value	0.1 mL/hPa (mL/cmH_2O)

Display of calculated values

Measurement of consumption and production	
CO_2 production of the patient	
Range	0 to 9999 mL/min
Accuracy	±25 % or 100 mL/min (the larger value applies)
Resolution of displayed value	1 mL/min
O_2 uptake of the patient	
Range	0 to 9999 mL/min
Accuracy	±25 % or 100 mL/min (the larger value applies)
Resolution of displayed value	1 mL/min
Fresh-gas consumption	
Range	0 to 99999 L, only gas delivered by the gas mixer is measured
Accuracy	±15 %
Resolution of displayed value	1 L

Display of calculated values (continued)

Anesthetic agent	
Range	0 to 999.9 mL liquid
Accuracy	±25 %
Resolution of displayed value	0.1 mL
Waveforms	O_2 concentration Primary anesthetic agent concentration CO_2 concentration Airway pressure Volume (only for loops) Flow
Sweep speed	6.25; 12.5; 25 mm/s
Scale	
Airway pressure Paw (t)	–20 to 80 hPa (cmH_2O)
Flow (t)	–120 to 120 L/min
Volume (t)	0 to 2000 mL
O_2 (t)	0 to 100 Vol%
CO_2 (t)	0 to 100 mmHg (0 to 12 Vol%, 0 to 12 kPa)
Anesthetic agent (t)	
Halothane	0 to 5 Vol% (kPa)
Enflurane	0 to 6 Vol% (kPa)
Isoflurane	0 to 5 Vol% (kPa)
Sevoflurane	0 to 10 Vol% (kPa)
Desflurane	0 to 20 Vol% (kPa)
Loops	Pressure-Volume Flow-Volume

Operating characteristics

Mains power supply	
Electrical mains connection for the trolley version	
Without isolation transformer	100 to 240 V~ 50/60 Hz
With isolation transformer	100 to 127 V~ 50/60 Hz Or 220 to 240 V~ 50/60 Hz

Operating characteristics (continued)

Maximum power consumption	12 A
Electrical mains connection for the ceiling-mounted version	
Ceiling-mounted version (without isolation transformer)	100 to 240 V~ 50/60 Hz
Maximum power consumption	4 A
Power cable	
Maximum length	5 m (16.4 ft)
Protective ground resistance	Maximum 0.1 ohm
Operating voltage	≥250 V
Operating current	≥16 A
Power consumption	
At 230 V~	
Standby	0.30 A
Typical (without charging the internal battery)	0.35 A
Maximum (with auxiliary power sockets)	12 A
Maximum (ceiling-mounted version)	4 A
For 110 V~	
Standby	0.55 A
Typical (without charging the internal battery)	0.65 A
Maximum (with auxiliary power sockets)	12 A
Maximum (ceiling-mounted version)	4 A
Power consumption	
Standby	55 W
Typical	70 W
Maximum (trolley version)	2.2 kW
Maximum (ceiling-mounted version)	400 W
Inrush current (trolley version)	
With isolation transformer	Approx. 26 to 48 A peak Approx. 18 to 34 A quasi-RMS
Without isolation transformer	Approx. 8 to 14 A peak Approx. 6 to 10 A quasi-RMS

Operating characteristics (continued)

Inrush current (ceiling-mounted version)	
Without isolation transformer	Approx. 8 to 14 A peak Approx. 6 to 10 A quasi-RMS
Internal battery	
Type	Lead-gel battery Sealed, maintenance-free
Capacity	7.2 Ah
Voltage	24 V
Fuse	F15A 80V UL248-14, breaking capacity 1000 A, size 19.7 mm * 19 mm * 5 mm
Current	Maximum 15 A
Backup time with new and fully charged battery	
Minimum	30 minutes
Typical	150 minutes
Charging time (to reach full power)	At least 8 hours
Charging power	Max. 50 W
Gas supply	
Gas quality	
Oil content	<0.1 mg/m3
Dew point	5 °C (41 °F) at ambient temperature
Particle size	Dust-free air (filtered with pore size <1 µm)
Supply pressure for O_2, Air, N_2O	2.7 to 6.9 kPa x 100 39 to 100 psi 0.27 to 0.69 MPa
Maximum short-term peak inlet flows at 6.9 kPa x 100 (100 psi or 0.69 MPa) supply pressure	
O_2	135 L/min (applies only when there is no distribution piece for the central O_2 supply)
Air	
Without suction unit	50 L/min
Including a directly connected Dräger ejector suction unit	130 L/min
N_2O	40 L/min
Drive gas	Not needed

Operating characteristics (continued)

Gas supply connection	Depending on configuration: DIN, NIST, DISS, Air Liquide, SIS
Gas cylinders (dimensions)	
Diameter	100 to 140 mm (3.94 to 5.51 in) 102 to 106 mm (4.00 to 4.18 in) for versions with hanger yokes for gas cylinders with pin-index connection
Maximum height	830 mm (32.68 in) 750 mm (29.52 in) for versions with hanger yokes for gas cylinders with pin-index connection
Pressure reducers	
Version	Single-stage pressure reducers
Permissible inlet pressure range (P_V)	
Air, O_2	11 to 200 kPa x 100
N_2O	11 to 60 kPa x 100
Nominal outlet pressure (P_A)	Fixed setting See "Flow characteristics" Due to the design, the outlet pressure rises as the cylinder pressure falls.
Air, O_2	
With inlet pressure P_V = 11 kPa x 100 and nominal flow Q_N = 80 L/min	4.75 kPa x 100 ±50 kPa
With inlet pressure P_V = 200 kPa x 100 and nominal flow Q_N = 80 L/min	4.55 kPa x 100 ±50 kPa
N_2O	
With inlet pressure P_V = 11 kPa x 100 and nominal flow Q_N = 65 L/min	5.2 kPa x 100 ±50 kPa
With inlet pressure P_V = 60 kPa x 100 and nominal flow Q_N = 65 L/min	4.95 kPa x 100 ±50 kPa
Nominal flow	
Air, O_2	Q_N = 80 L/min
N_2O	Q_N = 65 L/min
Performance data	See "Flow characteristics"
Relief valve	
Opening pressure	(7.5+0.5) kPa x 100
Minimum flow	220 L/min Air

Operating characteristics (continued)

Input connections	Complying with either EN 850, ISO 407 DIN 477 T1 NF E 29-650 BS 341; Part 1 NBN 226 ISO 5145
Noise emissions from device	Free field measurements complying with ISO 3744
Average sound pressure level Leq(A) during ventilation with typical settings	≤42 dB(A)
Sound pressure level L(A) of the alarm tones at the workstation, measured according to IEC 60601-1-8 Edition 2.1:	
Alarm tone sequence	
Alarm tone volumes (all priorities)	Settable from >50 dB(A) to <75 dB(A)
Secondary acoustic alarm signal	≥55 dB(A) and ≤75 dB(A)
Mains power supply failure alarm	≥55 dB(A) and ≤75 dB(A)
Dimensions of trolley version (can deviate with accessory equipment)	
Width	1150 mm (45.23 in)
Height	1480 mm (58.27 in)
Depth	790 mm (31.1 in)
Dimensions of ceiling-mounted version without flexibility trolley (can deviate with accessory equipment)	
Width	1150 mm (45.23 in)
Height	1045 mm (41.14 in)
Depth	790 mm (31.1 in)
Dimensions of ceiling-mounted version with flexibility trolley (can deviate with accessory equipment)	
Width	1150 mm (45.23 in)
Height	1480 mm (58.27 in)
Depth	790 mm (31.1 in)
Work surface dimensions	
Width	approx. 850 mm (33.46 in)

Operating characteristics (continued)

Depth	approx. 350 to 500 mm (13.78 to 19.69 in)
	Suitable for paper size DIN A3
Weight of trolley version	
Nominal configuration consisting of trolley version with isolation transformer, electronic 3-gas gas mixer, screen mounted centrally on the column, plug-in connections for 2 vaporizers, Vapor View option, breathing system, CLIC adapter and CLIC absorber, breathing hoses, central supply hoses (5 m (16.4 ft)), scavenging hose (5 m (16.4 ft))	Approx. 160 kg (353 lbs)
Various attached parts (e.g., baskets, flexible breathing bag holder, handles, vaporizer parking holders, cylinder pressure reducers, cylinder holders)	Approx. 10 kg (22 lbs)
Hanger yokes with pin-index connection	+ approx. 3 kg (7 lbs)
Plug-in connection for 3 vaporizers with Vapor View option	+ approx. 3 kg (7 lbs)
Mechanically controlled gas mixer	+ approx. 3 kg (7 lbs)
Drawer module (standard)	+ approx. 12 kg (26 lbs)
Drawer module (large)	+ approx. 16 kg (35 lbs)
Bronchial suction with swivel arm and accessories	+ approx. 6 kg (13 lbs)
Permissible total weight	330 kg (728 lbs)
Weight of ceiling-mounted version	
Nominal configuration (no flexibility trolley)	approx. 100 kg (220.0 lbs) Nominal configuration consisting of ceiling-mounted version with electronic 3-gas gas mixer, screen mounted centrally on the column, plug-in connections for 2 vaporizers, lockable drawer, CLIC adapter and CLIC absorber, breathing hoses, central supply hoses (1.5 m (59 in)), scavenging hose (1.5 m (59 in))
Nominal configuration of the ceiling-mounted version on a flexibility trolley	165 kg (364 lbs)
Maximum configuration	approx. 200 kg (440.9 lbs)
Permissible total weight	Refer to the instructions for use of the ceiling supply unit and observe?the maximum load capacity.

Operating characteristics (continued)

RFID system	
Operating frequency	13.56 MHz ± 50 ppm (broadband)
Transmitter power	≤42 dBµA/m (200 mW ± 1 dB)
Modulation	ASK (Amplitude-Shift Keying)
Electromagnetic compatibility	Tested in compliance with IEC 60601-1-2
Protection classes	
Device	I, in compliance with IEC 60601-1
Applied parts (connections for breathing hoses)	TYPE BF
Penetration of liquids	IP20 according to IEC 60529, meets IEC 60601-2-13
Classification in compliance with Directive 93/42/EEC, Annex IX	II b
UMDNS Code Universal Medical Device Nomenclature System – nomenclature system for medical devices	10-134
Use of latex	Perseus is not made with natural rubber latex.

Device outputs

Serial interfaces	COM 1 and COM 2 Only connect devices that meet the requirements of IEC 60950-1/IEC 62368-1 for ungrounded SELV circuits and the requirements of IEC 60601-1 (as of the 2nd edition) for touchable secondary circuits with a maximum nominal voltage of 24 V DC.
Protocol	MEDIBUS.X
Alarm delay time (measured from time of query)	Typically <2 s
Connector	9-way Sub-D
Baud rate	1200, 2400, 4800, 9600, 19200, 38400 baud
Data bits	8
Parity	Even
Stop bits	1

Device outputs (continued)

Pin assignment	
Pin 1	n/c
Pin 2	RXD
Pin 3	TXD
Pins 4, 6	Pins 4 and 6 are connected internally
Pin 5	SHLD-GND
Pins 7, 8	Pin 7 and Pin 8 are connected internally
Pin 9	n/c
Housing	SHLD-GND
USB interface	Only connect USB storage media that do not have their own power supply. Do not connect any charging cables.
Type	USB type A connector; USB 1.1
Supported devices	USB flash drive formatted with FAT16 or FAT32 Dräger recommends storage media with FIPS 140-2 compatible encryption and their own encryption facility.
LAN interface	Only for Dräger Remote Service Only connect devices and/or networks that meet the requirements of IEC 60950-1/IEC 62368-1 for ungrounded SELV circuits and the requirements of IEC 60601-1 (as of the 2nd edition) for touchable secondary circuits with a maximum nominal voltage of 24 V DC.
Type	RJ45 plug
Transfer speed	10Base-T, IEEE 802.3 Clause 14. Requires at least a CAT3 cable.
Connection for external workstation light (optional)	Only for workstation lights approved by Dräger, see list of accessories.
Distribution piece for central O_2 supply (optional)	
Supply pressure	2.7 to 6.9 kPa x 100 39 to 100 psi 0.27 to 0.69 MPa
Maximum permissible extraction flow rate	40 L/min

Device outputs (continued)

Mains power sockets	Observe the maximum current for each power socket, the total current for all power sockets, and the total permissible leakage current. Mains power sockets have no battery back-up and are independent of the switch-on state of the device.
Power sockets (version without isolation transformer)	
Power socket type	IEC
Power sockets with protective ground	2 (maximum 3.15 A per power socket)
Power sockets without protective ground	2 (maximum 1 A per power socket)
Fuse type	Fuses, T3,15AH250V IEC 60127-2/V and T1AH250V IEC 60127-2/V, size 5 mm * 20 mm
Power sockets (version with isolation transformer)	
Power socket type	Country-specific
Fuse type	Electronic automatic circuit breakers: 4 x 3 A, slow-blow, for voltages up to 250 V and breaking capacity 2000 A. And 1 x 8 A, slow-blow, for voltages up to 250 V and breaking capacity 2000 A, in each case conforming to IEC 60934
Power sockets with protective ground	4 (maximum 3 A per power socket)
Total current	Max. 8 A Main switch for isolation transformer and all power sockets

Relevant standards

In addition to the standards listed here, this medical device also meets various other standards, e.g., standards concerning special national requirements.

IEC 60601-1 (2nd edition) Medical electrical equipment	Part 1: Requirements for safety
IEC 60601-1-2 Medical electrical equipment	Part 1-2: General requirements for safety; Collateral standard: Electromagnetic compatibility; Requirements and tests
IEC 60601-1-8 Medical electrical equipment	Parts 1-8: General requirements for safety; Collateral standard: General requirements, tests and guidance for alarm systems in medical electrical systems
IEC 60601-2-13 Medical electrical equipment	Parts 2-13: Particular requirements for the safety of anaesthetic systems
ISO 8835-2 Systems for inhalational anesthesia	Part 2: Anesthesia breathing systems
ISO 8835-3 Systems for inhalational anesthesia	Part 3: Transfer and receiving systems of active anaesthetic gas scavenging systems
ISO 8835-4	Part 4: Anesthetic vaporizers
ISO 8835-5 Systems for inhalational anesthesia	Part 5: Anesthesia ventilators
ISO 21647 Medical electrical equipment	Particular requirements for the basic safety and essential performance of respiratory gas monitors

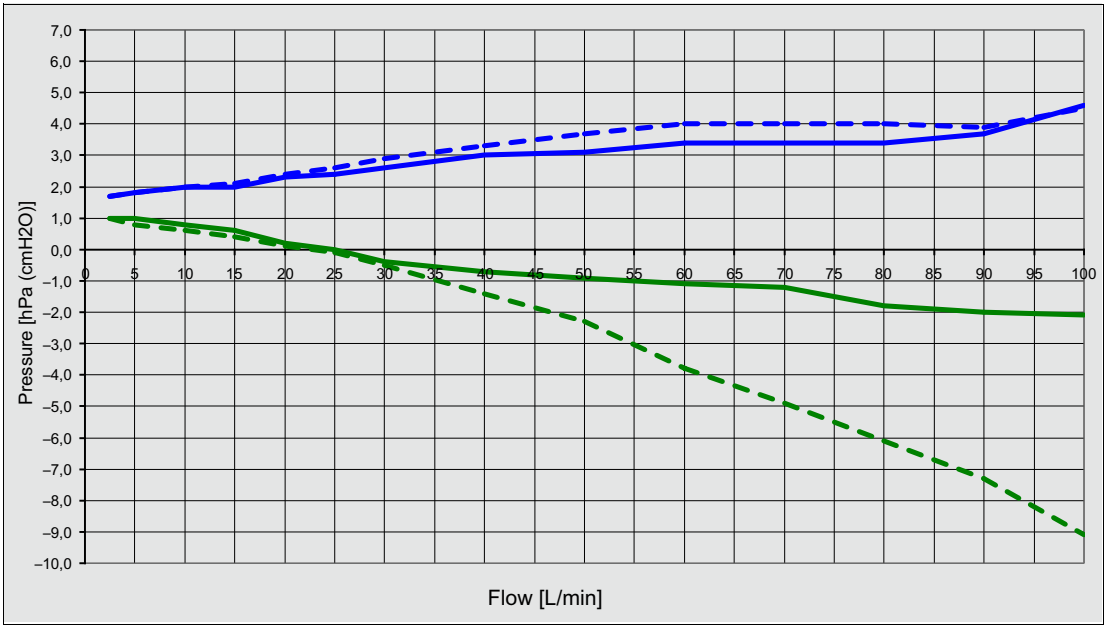
Relevant standards (continued)

For devices manufactured since July 2014, the following also apply:

IEC 60601-1 (3rd edition) Medical electrical equipment	Part 1: General requirements for basic safety and essential performance
ISO 80601-2-13 Medical electrical equipment	Parts 2-13: Particular requirements for basic safety and essential performance of an anaesthetic workstation
ISO 80601-2-55:2011 (devices with production date July 2014 - April 2017) ISO 80601-2-55:2018 (devices with production date from May 2017 onwards)	Parts 2-55: Particular requirements for basic safety and essential performance of respiratory gas monitors
IEC 60601-1-2 Medical electrical equipment	Part 1-2: General requirements for safety - Collateral standard: Electromagnetic compatibility - Requirements and tests
IEC 60601-1-8	Parts 1-8: General requirements for basic safety and essential performance - Collateral standard Alarm systems - General requirements, tests and guidance for alarm systems in medical electrical equipment and medical electrical systems

Diagrams

Pressure characteristics and flow characteristics of the breathing system without breathing hoses and filters (conforming to ISO 8835-2 and ISO 80601-2-13)



Pexsp [hPa (cmH2O)], ventilation drive inactive

Pexsp [hPa (cmH2O)] Man / Spon

Pinsp [hPa (cmH2O)], ventilation drive inactive

Pinsp [hPa (cmH2O)] Man / Spon

Breathing system, dry, with filled reusable CO_2 absorber and soda lime dust filter MX50115	**Peak flow in use [L/min]**	**Resistance [hPa (cmH2O)]**	
		Man / Spon	
		Inspiratory	**Expiratory**
No breathing circuit or inspiratory filter	60	–1.1	3.4
	30	–0.4	2.6
	15	0.6	2.0
	2.5	1.0	1.7
With breathing circuit for **adults** M30146, inspiratory filter MP01730	60	–3.5	4.1
	30	–1.1	2.9

Breathing system, dry, with filled reusable CO_2 absorber and soda lime dust filter MX50115	Peak flow in use [L/min]	Resistance [hPa (cmH_2O)]	
		Man / Spon	
		Inspiratory	Expiratory
With breathing circuit for **pediatric patients** M27542, inspiratory filter MP01735	15	–0.7	3.0
With breathing circuit for **neonates** MP00333, inspiratory filter MP01735	2.5	1.1	1.7

Response times in event of concentration changes

Typical response times ($T_{0..90}$) for an oxygen concentration change from 21 Vol% to 100 Vol% at the following fresh-gas flows:

	2 L/min	4 L/min	8 L/min	O_2 flush
Test lung for adults (MP02400), breathing circuit (MP00300), breathing bag 2 L (MP00222) ***VT***=500 mL, ***RR***=10 /min, ***I:E***=1:2	712 s	174 s	32 s	9 s
Test lung for neonates (8410079), breathing circuit (MP00333), breathing bag 1 L (MP00383) ***VT***=30 mL, ***RR***=30 /min, ***I:E***=1:1	91 s	64 s	46 s	7 s

Device combinations

This device can be operated in combination with other Dräger devices or with devices from other manufacturers. Follow the accompanying documents of the individual devices.

If a device combination is not approved by Dräger, the safety and the correct functioning of the individual devices can be compromised. The operating organization must ensure that the device combination complies with the applicable editions of the relevant standards for medical devices.

Device combinations approved by Dräger meet the requirements of the following standards:

– IEC 60601-1 (electrical safety, mechanical safety, software)
– IEC 60601-1-2 (EMC)
– IEC 60601-1-8 (alarm systems)

EMC declaration

General information

This device was tested for electromagnetic compatibility using accessories from the list of accessories. Other accessories may only be used if they do not compromise the electromagnetic compatibility. The use of non-compliant accessories may result in increased electromagnetic emissions or decreased electromagnetic immunity of the device.

This device may be used in the direct vicinity of other devices only if Dräger has approved this device arrangement. If no approval has been given by Dräger, it must be ensured that this device functions correctly in the desired arrangement before use. The instructions for use for the other devices must be followed.

Electromagnetic environment

This device may be used only in environments specified in section "Environments of use" on page 16.

Emissions	Compliance
Radiated emissions	Class A, group 1 (30 MHz to 1 GHz)
Conducted emissions	Class A, Group 1 (150 kHz to 30 MHz)

NOTE

The emissions characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required), this equipment might not offer adequate protection to radio-frequency communication services.
The user might need to take mitigation measures, such as relocating or re-orienting the equipment.

Immunity against	Test level and required electromagnetic environment
Electrostatic discharge (ESD) (IEC 61000-4-2)	Contact discharge: ±8 kV
	Air discharge: ±15 kV
Fast transient electrical disturbances (bursts) (IEC 61000-4-4)	Power cable: ±2 kV
	Longer signal input lines/output lines: ±1 kV
Impulse voltages (surges) (IEC 61000-4-5)	Voltage, external conductor – external conductor: ±1 kV
	Voltage, external conductor – protective ground conductor: ±2 kV
Magnetic fields at mains frequency (IEC 61000-4-8)	50 Hz: 30 A/m
Voltage dips and short interruptions in the supply voltage (IEC 61000-4-11)	Voltage dips of 30 % to 100 %, 8.3 ms to 5 s, different phase angles
Radiated high-frequency disturbances (IEC 61000-4-3)	80 MHz to 2.7 GHz: 3 V/m

Immunity against	Test level and required electromagnetic environment
Conducted high-frequency disturbances (IEC 61000-4-6)	150 kHz to 80 MHz: 3 V, ISM bands: 6 V
Electromagnetic fields in the vicinity of wireless communication devices	Various frequencies from 385 MHz to 5785 MHz: 9 V/m to 28 V/m

Recommended separation distances from wireless communication devices

To ensure that the full functional integrity of this device is not compromised, there must be a separation distance of at least 1.0 m (3.3 ft) between this device and wireless high-frequency communication equipment.

Emission of high-frequency energy

This medical device is equipped with an RFID module (radio frequency identification) to enable wireless communication with Infinity ID accessories.

This medical device has been designed and manufactured to comply with emission limit values for high-frequency energy. These limit values are incorporated in international safety standards such as IEC 60601-1-2 and standards for radio equipment such as EN 300330 and have been defined by regulatory authorities.

The RFID system of this medical device complies with Part 15 of the FCC regulations and the license-free RSS regulations of Industry Canada. Operation is subject to the following 2 conditions:

1. This medical device does not cause any harmful interference.
2. The medical device is not liable to damage caused by the reception of interference, including interference causing undesired operating conditions.

Changes and modifications that have not been expressly approved by Dräger may result in the user no longer being permitted to operate the device.

Dräger hereby declares that this medical device, including its radio equipment, is in compliance with Directive 2014/53/EU.

The complete EU Declaration of Conformity can be viewed at the following internet address: http://www.draeger.com/doc-radio

Connections to IT networks

In an IT network, data can be exchanged by means of wired or wireless technologies. An IT network can be any data interface (e.g., RS232, LAN, USB, printer interface) that is described in standards and conventions.

During operation, this device can exchange information with other devices by means of IT networks. The following functions are supported:

– Display of waveforms and parameter data
– Transmission of existing alarm conditions
– Transfer of device settings and patient data
– Service mode, access to logbooks

Connecting this device to a network that incorporates other devices or making subsequent changes to that network can lead to new risks for patients, users, and third parties. Before the device is connected to the network or the network is changed, these risks must be identified, analyzed, and evaluated by the hospital IT representative in accordance with the IEC 80001-1 standard (risk management for medical IT networks). Appropriate measures must be taken on the basis of the results.

Examples of subsequent changes to the network:

– Changing the network configuration
– Removing devices from the network
– Adding new devices to the network
– Performing upgrades or updates on devices that are connected to the network

LAN interface

Service

In conjunction with the Dräger SCG (ServiceConnect Gateway) or a DrägerService computer, the LAN interface enables the following functions:

– Using the SNMP protocol:
  Monitoring the service status of the device, querying the service status, support during the installation of device software and during software download, configuration support
– Using the FTP protocol (as a client):
  Querying the device status, support during the installation of device software and during software download, configuration support

The following personal data are transmitted unencrypted over the interface:

– Logbook with details of age, weight, and height of the patient

Time synchronization

The LAN interface allows synchronization with an NTP (Network Time Protocol) server using the NTP protocol.

Required characteristics

The LAN must ensure the connection between the device and the following destinations:

– Service Connect Gateway or DrägerService Computer
– NTP server

Connections between Perseus and the DrägerService computer or the NTP server						
Function	**Protocol**	**Perseus port**	**Direction**	**Remote port**	**Remote partner**	**Connection**
SNMP V3	UDP	161	⟷	>1023	SCG	
TCP SNMP V3 (trap)	UDP	>1023	→	162	SCG	
FTP (command)	TCP	>1023	→	21	SCG	New, established
FTP (command)	TCP	>1023	←	21	SCG	Established
FTP (data)	TCP	>1023	→	>1023	SCG	New, established
FTP (data)	TCP	>1023	←	>1023	SCG	Established
SNTP	UDP	>1023	⟷	123	NTP server	
DHCP	UDP	67	⟷	67	DHCP server	

Typical data volume:

– Update of the device firmware: typically 50 MB
– Help ticket (system log for service purposes): typically 3 MB

While using the service functions, the device typically causes an average network load of up to 150 KB/s. During normal use, the bandwidth used is negligibly low.

Hazardous situations

NOTE

Risk when using the device in an overloaded network

An overload of the device due to high network loading (e.g., caused by denial-of-service attacks) may lead to a shut-down of the device-side network interface. The interface will not be available again until the device is restarted. This function is used to protect the primary functions of the device against unauthorized intrusion.

RS232 interface

The RS232 interface supports the MEDIBUS.X protocol. MEDIBUS.X is a communication protocol for data exchange between Perseus and, e.g., the following external medical or non-medical equipment:

– Hemodynamic monitor
– Data management system
– Computer
– RS232 to Ethernet converter

The transferred data include the following information:

– Settings
– Measured values
– Waveforms
– Text messages
– Alarm status

Take note of the documentation for the following communication protocols before transferring the data:

– MEDIBUS.X, Rules and Standards for Implementation (9052607)
– MEDIBUS.X, Profile Definition for Data Communication V1.n (9052608)

The documents are only available in English.

The following personal data are transmitted unencrypted over the interface:

– Therapy data with details of age, weight, and height of the patient

WARNING

Risk due to incompletely transferred data

Data (e.g., measured values, alarms) which the anesthesia machine transfers to other systems such as patient monitors or EMR systems may be displayed there incompletely or incorrectly.

- **Only use these data for information purposes.**
- **Do not use these data for patient monitoring or device monitoring.**
- **Do not make diagnostic or therapeutic decisions on the basis of these data.**

With the aim of improving the clinical process, the data can be used to construct a distributed alarm system with unacknowledged alarm transmission conforming to IEC 60601-1-8. However, the data must not be used as a substitute for Perseus as the primary alarm source.

Alarm conditions are only transmitted in the network if they are present at the time of an active query by a connected device. An alarm history is not transmitted.

Note: Each connected device within the distributed alarm system must be marked with the following warning: No guaranteed reception of alarm signals.

Required characteristics

The RS232 interface is a point-to-point connection. A connected device must prevent access by unauthorized users to the data that are sent over the RS232 interface and must itself be protected from infections by malware and computer viruses.

USB interface

The USB interface supports the transfer of data to external storage media. Existing data on external storage media can be deleted during this operation.

The following personal data are transmitted unencrypted over the interface:

– User logbook with details of age, weight, and height of the patient

– Screenshots potentially showing information about the age, weight, and height of the patient

Required characteristics

A connected device must conform to the mass storage medium USB device class (e.g., connecting devices to charge the battery is not intended.). Dräger recommends the use of FIPS 140-2 compatible storage media with hardware encryption.

Hazardous situations

Connecting active devices to the Perseus USB interface can cause Perseus to restart.

Open-source software

Dräger devices that use software may use open-source software, depending on their setup. Open-source software may be subject to different terms of license. Additional information regarding the open-source software used in this device is available at the following web page:

www.draeger.com/opensource

Principles of operation

Description of the ventilation modes

Meaning and function of the therapy controls

<table>
<tr><th>Therapy controls</th><th>Meaning / Function</th></tr>
<tr><td>%Tplat</td><td>Plateau time as a percentage of the inspiratory time Ti in VC - CMV mode</td></tr>
<tr><td>RR</td><td>Respiratory rate</td></tr>
<tr><td>RRmin</td><td>Minimum respiratory rate at which supported breaths are applied in Pressure Support mode.</td></tr>
<tr><td>Insp. term.</td><td>When the flow falls below this flow value (in % of the measured peak flow), a supported breath is interrupted.</td></tr>
<tr><td>PEEP/CPAP</td><td>Positive end-expiratory pressure / Continuous Positive Airway Pressure
Pressure that is always maintained.</td></tr>
<tr><td>ΔPsupp</td><td>Pressure difference of a pressure-supported breath between PEEP level and inspiratory pressure.
This pressure support is only available if synchronization of spontaneous breathing (Sync. on) is switched on.
When pressure support is switched on, the naming of the following ventilation modes changes:
<table>
<tr><td>Without pressure support</td><td>With pressure support</td></tr>
<tr><td>PC - BIPAP</td><td>PC - BIPAP / PS</td></tr>
<tr><td>VC - SIMV</td><td>VC - SIMV / PS</td></tr>
<tr><td>VC - SIMV / AutoFlow</td><td>VC - SIMV / PS / AutoFlow</td></tr>
</table></td></tr>
<tr><td>Phigh</td><td>Upper pressure level in APRV</td></tr>
<tr><td>Pinsp</td><td>Inspiratory pressure</td></tr>
<tr><td>Plow</td><td>Lower pressure level in APRV</td></tr>
<tr><td>Pmax</td><td>Upper pressure limit in volume-controlled ventilation. When this pressure is reached, the breath is held at this level until the set inspiratory time Ti is reached.</td></tr>
<tr><td>Trigger</td><td>Flow that, when exceeded, triggers a supported breath</td></tr>
<tr><td>Thigh</td><td>Period of time in APRV during which the upper pressure level is maintained.</td></tr>
<tr><td>Ti</td><td>Inspiratory time</td></tr>
<tr><td>Tlow</td><td>Period of time in APRV during which the lower pressure level is maintained.</td></tr>
<tr><td>Slope</td><td>Period of time during which a pressure rise from the PEEP or CPAP pressure to the inspiratory pressure or PSV pressure takes place. This time determines the steepness of the rise in pressure from the lower to the upper level.</td></tr>
<tr><td>VT</td><td>Tidal volume</td></tr>
</table>

<table>
<tr><th>Therapy controls</th><th>Meaning / Function</th></tr>
<tr><td>Sync. on/Sync. off</td><td>Switching spontaneous respiratory support on / off
Switching the synchronization on or off causes the following change to the ventilation mode:
<table>
<tr><td></td><td>Pressure-controlled</td><td>Volume-controlled</td></tr>
<tr><td>Sync. on</td><td>PC - BIPAP</td><td>VC - SIMV</td></tr>
<tr><td>Sync. off</td><td>PC - CMV</td><td>VC - CMV</td></tr>
</table>
When synchronization is switched on, mandatory breaths are synchronized with the patient's breathing effort. In doing so, the respiratory rate RR is held constant by adapting the mandatory breaths and the expiratory time. At the end of the expiratory phase, an inspiratory trigger window is activated so that the mandatory breath can be initiated prematurely by up to 5 seconds (patient category Adult) or 1.5 seconds (patient categories Ped and Neo). If the spontaneous inspiratory flow reaches the set value of the flow trigger Trigger during this trigger window, a premature mandatory breath is triggered.
If no spontaneous breathing is detected within the inspiratory trigger window, a mandatory breath will be triggered immediately afterwards.</td></tr>
</table>

Degree of respiratory support

Respiratory support	Ventilation mode
None	Standby, Pause, Ext. FGO
Low	Man/Spon, CPAP, CPAP / PSV with ΔPsupp <5 hPa (cmH_2O)
Medium	CPAP / PSV with ΔPsupp ≥5 hPa (cmH_2O)
High	Volume-controlled modes Pressure-controlled modes

Ventilation modes and effective parameters

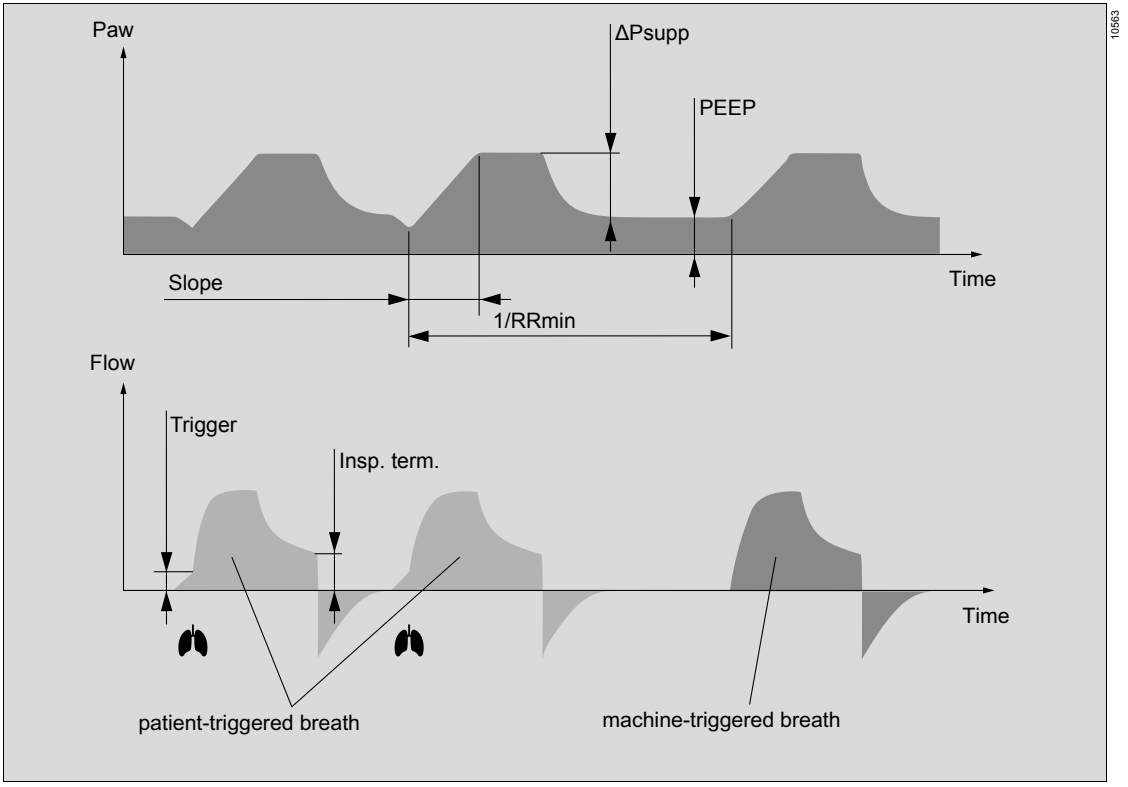
Group	Tab	Ventilation mode	Base parameters (normal therapy bar)	Additional parameters (expanded therapy bar)
Manual ventilation / Spontaneous breathing	Man/Spon	Manual / Spontaneous	CPAP[1)]	
Pressure-supported ventilation	PSV[1)]	CPAP / PSV	Trigger ΔPsupp RRmin PEEP Slope	Insp. term.
Pressure-controlled ventilation	PC	PC - CMV	Pinsp RR PEEP Ti Sync. off	Slope
		PC - BIPAP	Pinsp ΔPsupp[1)] = Off RR PEEP Ti Sync. on	Trigger Slope
		PC - BIPAP / PS[1)]	Pinsp ΔPsupp[1)] >0 RR PEEP Ti Sync. on	Trigger Insp. term.[1)] Slope
	APRV[2)]	PC - APRV	Phigh Thigh Slope Plow Tlow	

Group	**Tab**	**Ventilation mode**	**Base parameters (normal therapy bar)**	**Additional parameters (expanded therapy bar)**
Volume-controlled ventilation	VC - AF	VC - CMV / AutoFlow	Pmax VT RR PEEP Ti Sync. off	Slope
		VC - SIMV / AutoFlow	Pmax VT RR PEEP Ti Sync. on	Trigger ΔPsupp[1] = Off Slope
		VC - SIMV / PS / AutoFlow[1]	Pmax VT RR PEEP Ti Sync. on	Trigger ΔPsupp[1] >0 Insp. term.[1] Slope
	VC	VC - CMV	Pmax VT RR PEEP Ti Sync. off	%Tplat
		VC - SIMV	Pmax VT RR PEEP Ti Sync. on	Trigger ΔPsupp[1] = Off %Tplat
		VC - SIMV / PS[1]	Pmax VT RR PEEP Ti Sync. on	Trigger ΔPsupp[1] >0 Insp. term.[1] Slope %Tplat

1) Requires software option PSV
2) Requires software option APRV

Pressure-supported ventilation

PSV (optional)



CPAP / PSV (optional)

– Spontaneous breathing
– Spontaneous breathing with continuous positive pressure level with or without pressure support

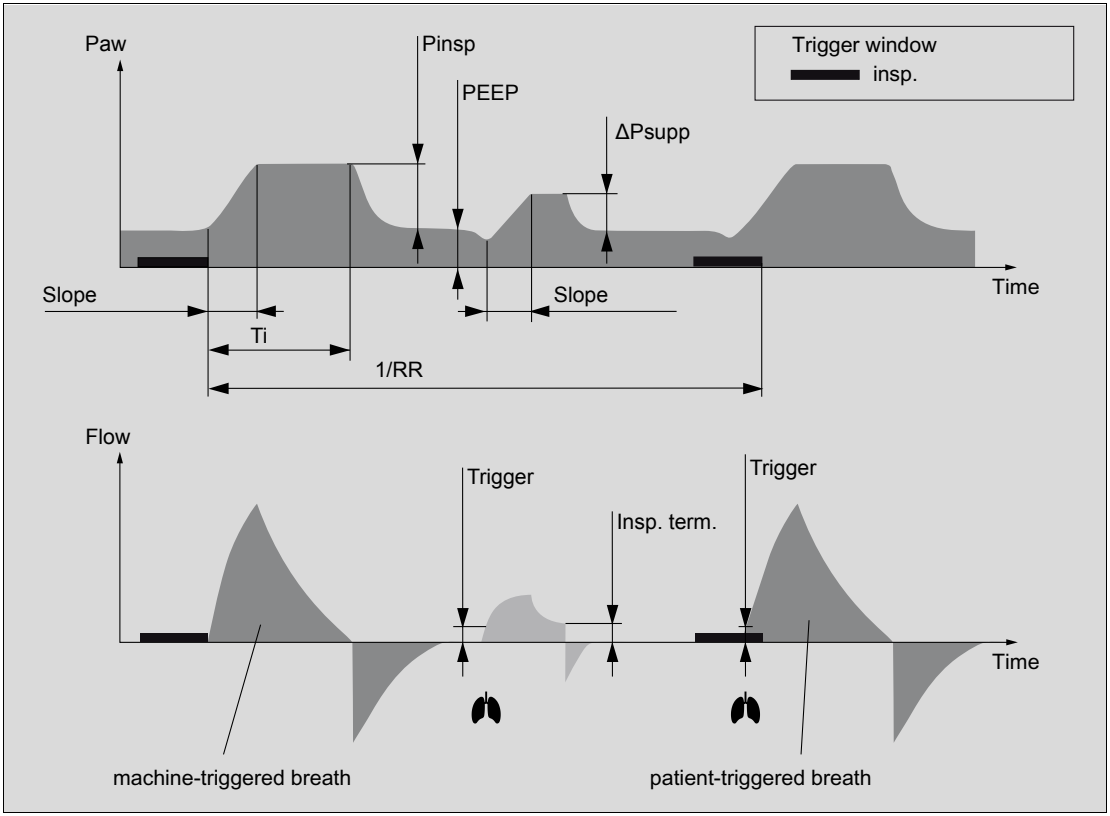
Each detected inspiratory effort at CPAP level induces a patient-triggered, flow-controlled, and pressure-supported breath. Point in time, number, and duration of pressure-supported breaths are determined by the patient. When no inspiratory effort is detected, mechanical breaths are delivered at the set minimum respiratory rate RRmin and pressure support ΔPsupp.

Patient-triggered breaths are ended as soon as the inspiratory flow falls below the flow defined by the Insp. term. setting. The duration of a machine-triggered breath is additionally determined by the patient category and the set minimum respiratory rate RRmin.

Purely spontaneous breathing at CPAP level is achieved by setting ΔPsupp=Off. In this case the patient does not receive any more machine-triggered breaths.

Pressure-controlled ventilation

PC



PC - CMV

– Pressure-controlled
– Time-controlled
– Machine-triggered

The mandatory breaths are machine-triggered and are not triggered by the patient.

PC - BIPAP

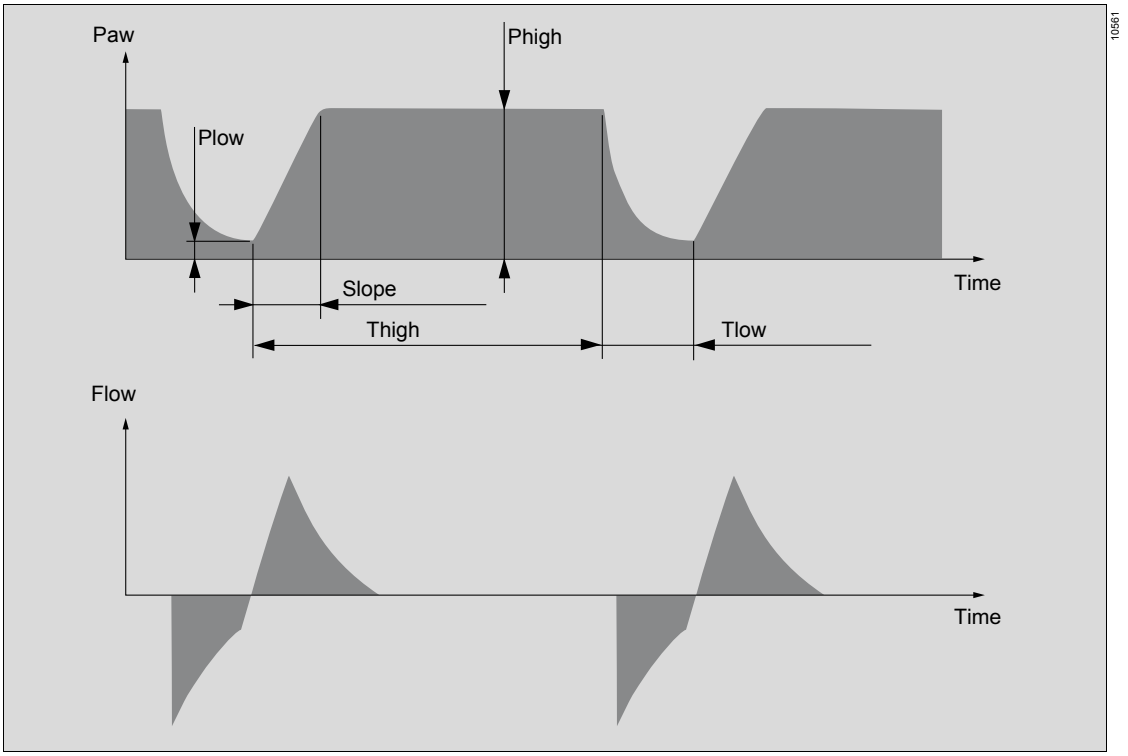
– Pressure-controlled
– Time-controlled
– Machine-triggered or patient-triggered
– Synchronized inspiration

In PC - BIPAP, the patient can breathe spontaneously at any time, while the number of mandatory breaths is predefined. When synchronization is switched on, the breaths are adapted to the spontaneous breathing efforts of the patient. If spontaneous breathing effort by the patient is detected during the inspiratory trigger window, a patient-triggered breath will be initiated.

PC - BIPAP / PS (optional)

This mode is similar to PC - BIPAP, except that the patient's spontaneous breathing at the PEEP level during the expiratory phase is pressure-supported with ΔPsupp when outside the trigger window.

APRV (optional)



PC - APRV

– Pressure-controlled
– Time-controlled
– Machine-triggered
– Spontaneous breathing at continuous positive airway pressure with short pressure releases

In PC - APRV, the patient's spontaneous breathing occurs at the upper pressure level Phigh. This pressure level is maintained for the duration of Thigh.

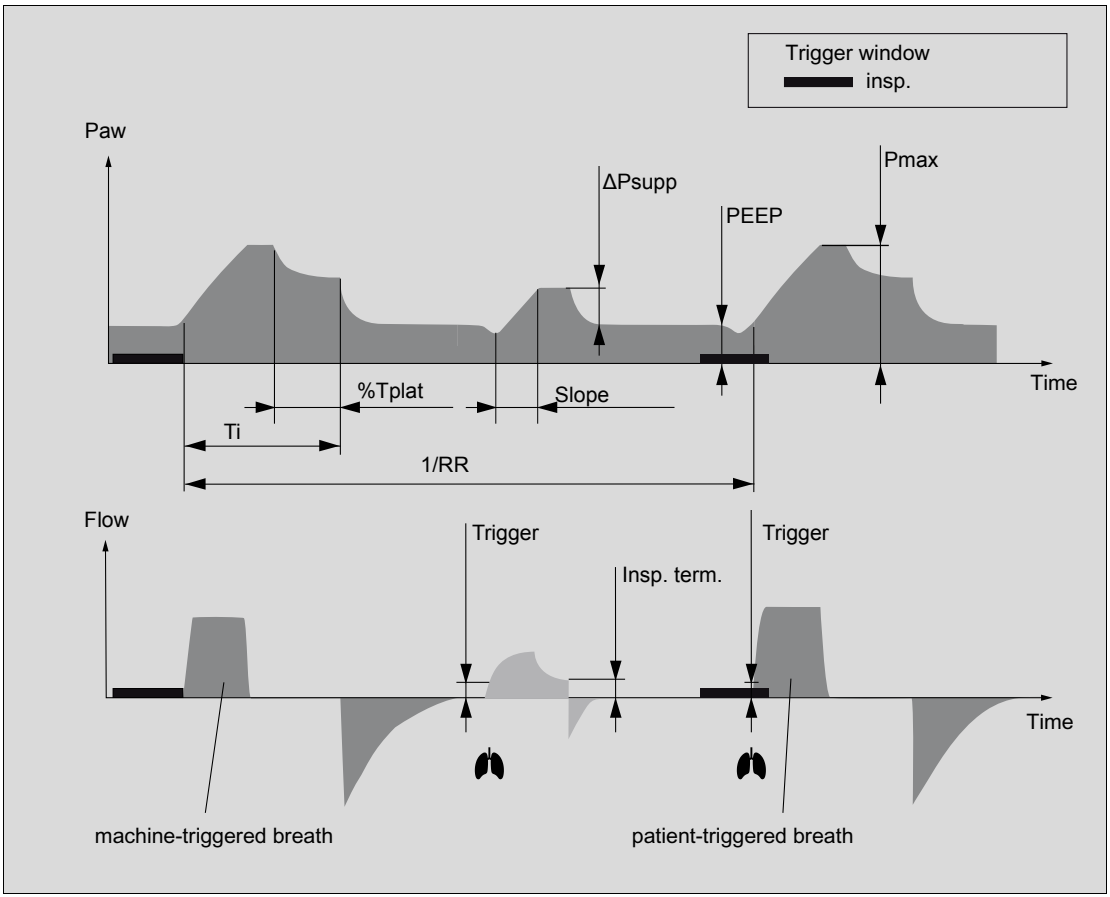
The number of pressure releases is determined by the Thigh and Tlow settings. The releases are time-controlled and are not triggered by the patient. The duration is determined by Tlow.

Volume-controlled ventilation

Compliance correction

The applied VT is corrected by the determined breathing hose compliance, i.e., an additional volume is delivered in order to ensure the application of the volume to the patient. The applied VT is also corrected by the sampling flow of the built-in patient-gas measurement module as soon as CO_2 respiratory phases are detected.

VC



VC - CMV

- Volume-controlled
- Pressure-limited
- Time-controlled
- Machine-triggered
- Constant inspiratory flow

In this volume-controlled ventilation mode, the patient receives the set tidal volume VT with each mandatory breath.

VC - SIMV

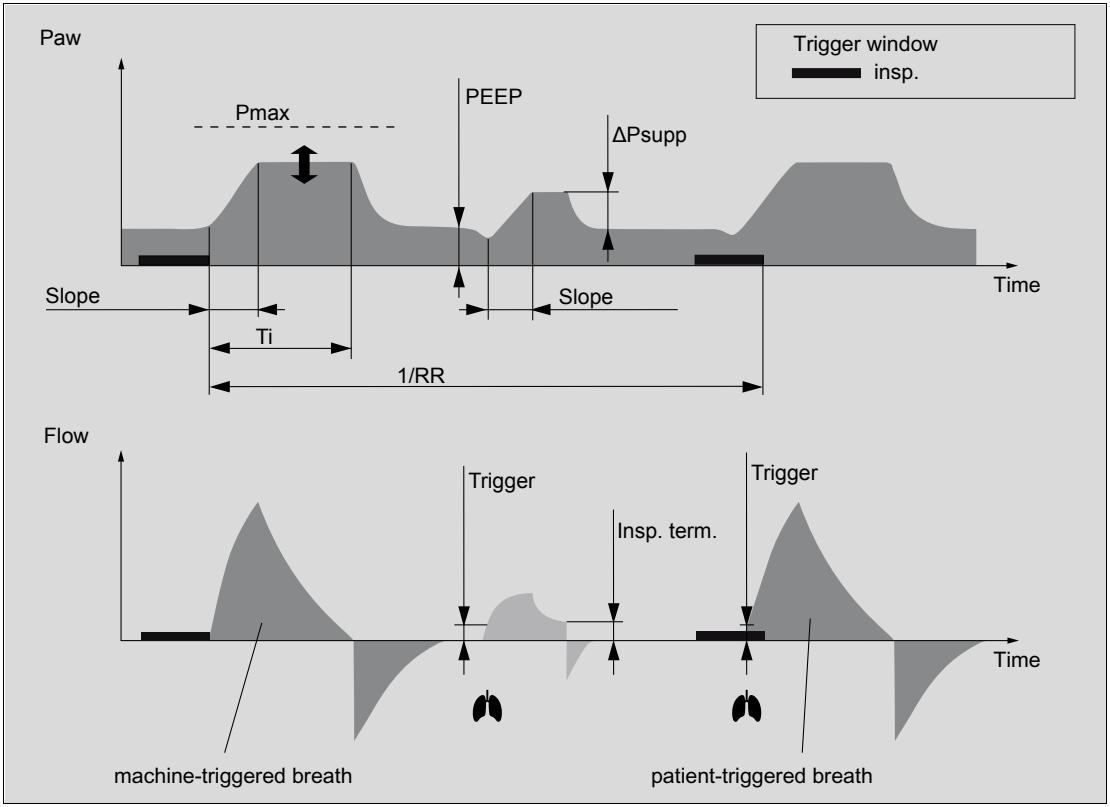
– Volume-controlled
– Pressure-limited
– Time-controlled
– Machine-triggered or patient-triggered
– Constant inspiratory flow
– Synchronized inspiration

In VC - SIMV, the patient can breathe spontaneously at any time, while the number of mandatory breaths is predefined. When synchronization is switched on, the breaths are adapted to the spontaneous breathing of the patient. If inspiratory effort by the patient is detected during the inspiratory trigger window, a patient-triggered breath will be initiated.

VC - SIMV / PS

This mode is similar to VC - SIMV, except that the patient's spontaneous breathing at the PEEP level during the expiratory phase is pressure-supported with ΔPsupp when outside the trigger window.

VC - AF



With AutoFlow, the set tidal volume VT is applied for all mandatory volume-controlled breaths with the lowest required pressure. The patient can breathe spontaneously throughout the entire respiratory cycle, during both inspiration and expiration. The pressure patterns and flow patterns of the mechanical inspiratory breaths correspond to those of pressure-controlled ventilation.

Due to the patient's spontaneous breathing efforts or compliance changes in the lungs, the tidal volume in an individual breath may deviate from the set tidal volume VT. However, averaged over time a tidal volume corresponding to the set volume VT is applied.

If no automatic ventilation has previously taken place, a volume-controlled test breath with constant inspiratory flow is performed when starting a ventilation mode with AutoFlow in order to estimate the lung parameters. The inspiratory pressure required at the start is determined from this test breath. Each additional breath-related readjustment of the inspiratory pressure is limited to ±3 hPa (cmH_2O). The pressure difference (inspiratory pressure - PEEP) is at least 5 hPa (cmH_2O) and the upper inspiratory pressure limit is set by Pmax. If the set value for VT is reduced, the inspiratory pressure will be reduced by a greater amount if necessary.

VC - CMV / AutoFlow

– Volume-controlled
– Pressure-limited
– Time-controlled
– Machine-triggered
– Decelerating inspiratory flow

The mandatory breaths are machine-triggered and are not triggered by the patient.

VC - SIMV / AutoFlow

– Volume-controlled
– Pressure-limited
– Time-controlled
– Machine-triggered or patient-triggered
– Decelerating inspiratory flow
– Synchronized inspiration

In VC - SIMV / AutoFlow, the patient can breathe spontaneously at any time, while the number of mandatory breaths is predefined. When synchronization is switched on, the breaths are adapted to the spontaneous breathing efforts of the patient. If spontaneous breathing effort by the patient is detected during the inspiratory trigger window, a patient-triggered breath will be initiated.

VC - SIMV / PS / AutoFlow

This mode is similar to VC - SIMV / AutoFlow, except that the patient's spontaneous breathing at the PEEP level during the expiratory phase is pressure-supported with ΔPsupp when outside the trigger window.

Minimum O_2 delivery

Gas mixer	Minimum FG-O_2 concentration		Minimum O_2 flow
	Carrier gas Air	Carrier gas N_2O	
Electronically controlled	21 %	25 %	Configurable for each patient category, see chapter "Vertical tab "Fresh gas" (only with electronically controlled gas mixer)" When the minimum O_2 delivery switches on, the ***FG O_2*** therapy control is selected in addition to the selected therapy control. When the active set value is changed, ***FG O_2*** changes automatically with it.
Mechanically controlled	21 %	21 %	Continuously adjustable with flow control valves. The minimum O_2 delivery interrupts the N_2O flow in the following cases: – N_2O flow control valve open and O_2 flow control valve closed – O_2 flow less than 200 mL/min O_2 will continue to be delivered in the event of an N_2O failure.

Influence of patient category, weight, and age on device behavior

Influence of patient category

– Alarm limits and start settings for therapy
– Volumeter scale
– Flow measurement and software algorithms to suppress artifacts
– Maximum duration of a pressure-supported breath

Influence of the ideal patient weight and patient height

Ideal patient weight describes the portion of the body that is relevant to setting the ventilation parameters (patient body weight minus assumed excess fat).

In the ***Adult*** and ***Ped*** patient categories, the ideal patient weight is calculated from the entered patient height.

In the ***Neo*** patient category, the ideal patient weight is equal to the entered patient weight.

The calculated ideal patient weight affects:

– Start settings for tidal volume ***VT***
– Start settings for respiratory rate ***RR***
– Start settings for ***VT*** and ***MV*** alarm limits
– Flow trigger

VT and ***RR*** are only dependent on the ideal patient weight when the ***Ideal body weight*** function is selected in ***System setup*** > ***Therapy***, see page 157.

Changing the patient weight during an automatic ventilation has no effect on the current ventilation settings.

Influence of the patient age

During operation, the set age influences:

– Calculation of MAC value

Infinity ID accessory support

Perseus can be operated with accessories with Infinity ID functionality.

– Infinity ID breathing circuit
– Infinity ID WaterLock 2 water trap
– Infinity ID flow sensors
– Infinity ID CLIC absorber

The Infinity ID functionality can be configured, see page 169.

Infinity ID functionality

WARNING

If no Infinity ID accessories are used, the additional functions such as exchange interval monitoring and anti-interchange security are not available.

CAUTION

Risk of incorrect values for resistance and compliance

If an unused Infinity ID accessory is in the immediate vicinity of the device, values may be transferred inadvertently from this accessory.

Do not keep unused Infinity ID accessories in the vicinity of the device.

CAUTION

Risk of inappropriate compliance values

When accessories are added to an Infinity ID breathing circuit, the values for compliance and leakage may deviate from those saved on the breathing circuit.

Always perform the leakage test before starting therapy in order to determine the actual values for compliance and resistance. If the test cannot be performed because the patient is already connected, particular attention is required during ventilation.

CAUTION

Malfunctions of the Infinity ID functionality

Particular EMC situations or defects in Infinity ID components can cause permanent alarms.

To prevent distracting the user under these circumstances, contact service personnel to deactivate the Infinity ID alarms.

Exchange interval monitoring

An automatic monitoring of the period of life is available for Infinity ID WaterLock 2 water traps, Infinity ID CLIC absorbers, Infinity ID breathing circuits, and Infinity ID flow sensors.

An exceeded period of use is signaled during the system test.

The exchange interval for the connected Infinity ID accessories can be adjusted.

This interval must be specified in accordance with the applicable hygiene regulations or the requirements stated in the instructions for use of the corresponding accessory.

WARNING

Risk of inappropriate operating life

Exchange monitoring only considers the absolute period of use and not the current condition of the Infinity ID accessory and therefore does not excuse the user from periodic checks of the accessory.

The exchange interval which can be set for the exchange monitoring does not represent a guarantee for the maximum period of use of the accessory.

Anti-interchange security

WARNING

Risk of interchanged or incorrect breathing hoses

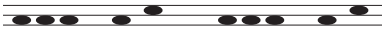
The Infinity ID function to prevent interchanging the breathing hoses does not excuse the user from checking the accessories.

The Infinity ID function to prevent interchanging does not represent a guarantee that the hoses are correctly connected.

When Infinity ID breathing hoses and Infinity ID breathing bags are used, the incorrect connection of breathing hoses and the breathing bag is detected and reported. Hoses that are incorrectly connected with the breathing system trigger an automatic alarm.

Schematic diagram of alarm tones

Tone sequence for various alarm priorities

Alarm priority	Standard (according to IEC 60601-1-8)	Repetitive
High	 Depending on the overall alarm situation, this tone sequence may be played as a 5-tone sequence due to the timing of the individual alarms.	Yes
Medium		Yes
Low		No

The described acoustic alarm signals are handled by a backup loudspeaker if the primary loudspeaker fails. This plays the tone sequences of the high and medium alarm priority with constant tone frequency and constant volume.

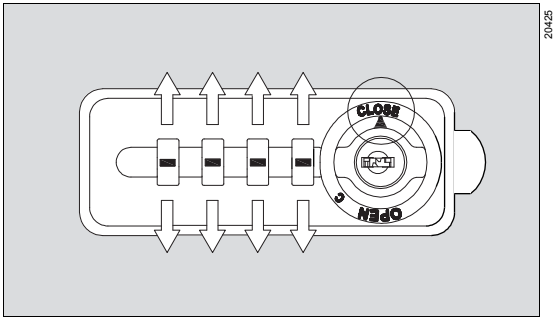
Tone signals during operation

When	Signal
Therapy start or change of ventilation mode	
Timeout	

Combination lock on the drawer (optional)

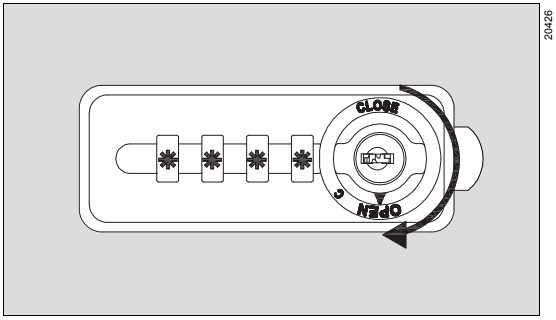
The lower drawer on the large drawer module is provided with a combination lock. When delivered, the combination on the lock is set to ***3333***.

Opening the combination lock



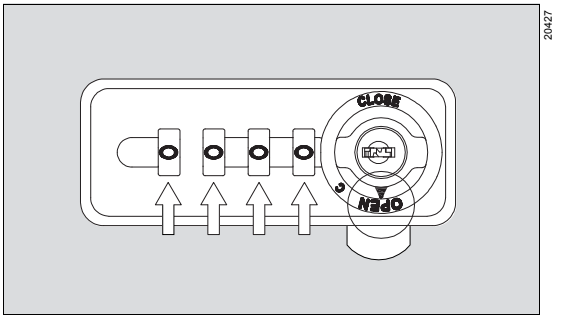
20425

1 Set the combination with the digit wheels.



20426

2 To open the combination lock, turn the knob to ***OPEN***.

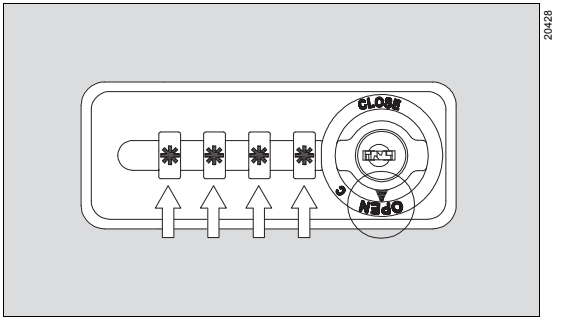


20427

The combination lock is opened. The digit wheels return automatically to ***0000***.

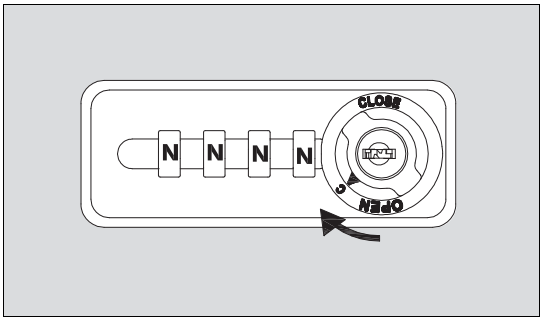
Alternatively, the combination lock can be opened with the supplied key. For information on the procedure, see "Loss of the combination" on page 273.

Changing the combination



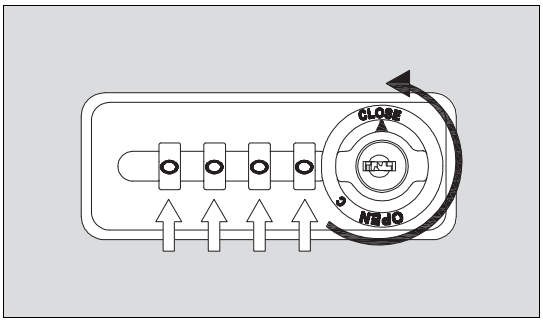
20428

1 While the combination lock is open, set the current combination.



2 Turn the knob to position ***C***.

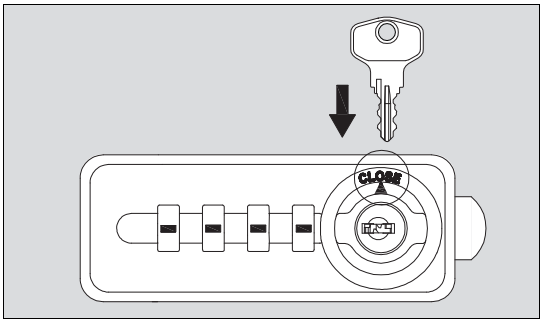
3 Set the new combination.



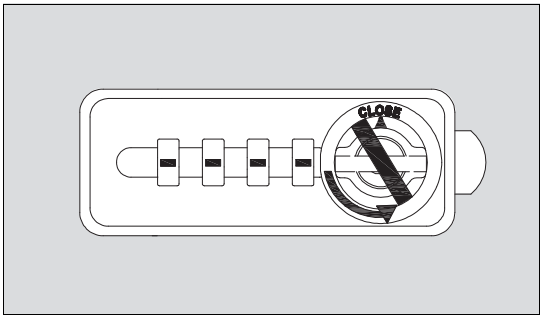
4 Turn the knob to ***CLOSE***.

The new combination is stored.

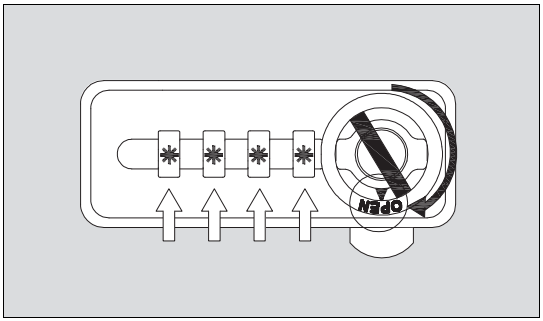
Loss of the combination



1 Insert the key.



2 Turn the key counterclockwise to the final position stop.



3 Turn the knob to ***OPEN***. The digit wheels show the current combination.

Annex

Abbreviations

Abbreviation	Explanation
%, Vol %	Percentage gas ratio, related to total volume
A	Ampere
Add. O_2	Emergency O_2 delivery
AGS	Anesthetic gas receiving system
AGSS	Anesthetic gas scavenging system
Air	Medical compressed air
APL	Adjustable Pressure Limitation, adjustable pressure limitation
APRV	Airway Pressure Release Ventilation
ASA	American Society of Anesthesiologists, american society of anesthesiologists
ATPS	Ambient Temperature and Pressure, Saturated Ambient temperature and ambient pressure, 100 % relative humidity
Aux. O_2	O_2 insufflation
BIPAP	Biphasic Positive Airway Pressure, spontaneous breathing under continuous positive airway pressure with 2 different pressure levels
BMI	Body mass index
BTPS	Body Temperature and Pressure, Saturated 37 °C (98.6 °F), ambient pressure, 100 % relative humidity
CAL	Display when a measurement value is calibrated.
CBM mode	Cardiac bypass mode
Cdyn	Dynamic compliance (patient)
CISPR	Comité International Spécial des Perturbations Radioélectriques International special committee on radio interference

Abbreviation	Explanation
cmH_2O	Centimeters of water
CMV	Controlled Mandatory Ventilation
CO	Carbon monoxide
CO_2	Carbon dioxide
COM	Serial port
CPAP	Continuous Positive Airway Pressure, continuous positive airway pressure
CSA	Canadian Standards Agency
dB(A)	Sound pressure level, A-weighted
Des	Desflurane
ΔO_2	Difference between inspiratory and expiratory O_2 concentration
ΔPsupp	Pressure support above ***PEEP***
EMC	Electromagnetic compatibility
Enf	Enflurane
ERR	Display when a measured value cannot be determined.
ESD	Electrostatic Discharge Electrostatic Discharge
FG	Fresh gas
FiO_2	Inspiratory oxygen fraction
FTP	File Transfer Protocol
GPL	General Public Licence
Hal	Halothane
HF	High-frequency
HME	Heat and moisture exchanger
HMEF	HME filter
hPa	Hectopascal
Hz	Hertz
I:E	Ratio of inspiratory time to expiratory time
ID	Identification

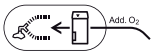
Abbreviation	Explanation
Insp. term.	Inspiration termination criterion in % based on peak inspiratory flow
Iso	Isoflurane
kg	Kilogram
kPa	Kilopascal
L	Liter
LAN	Local area network
lbs	Pound; unit of mass
LED	Light-emitting diode
LGPL	Lesser General Public Licence
MAC	Minimum Alveolar Concentration
Man/Spon Manual / Spontaneous	Manual ventilation / Spontaneous breathing
mbar	Millibar
MEDIBUS.X	Communication protocol for medical devices with uniform data definition for all devices
min	Minute
mL	Milliliter
mmHg	Millimeter of mercury
MPa	Megapascal
MV	Minute volume
N_2O	Nitrous oxide
NTP	Network Time Protocol, standard for synchronizing clocks
O_2	Oxygen
O_2+	***O_2*** flush
Pa	Pascal; unit of pressure
Paw	Airway pressure
PEEP	Positive end-expiratory pressure
Pinsp	Inspiratory pressure
PIP	Peak inspiratory pressure
Pmax	Maximum pressure
Pmean	Mean pressure

Abbreviation	Explanation
png	Graphics format
Pplat	Plateau pressure
ppm	Parts per million
R	Resistance
RFID	Radio Frequency Identification, radio frequency identification
RR	Respiratory rate
RRmin	Minimum respiratory rate
Sev	Sevoflurane
Slope	Pressure rise time
SNMP	Simple Network Management Protocol
STAPD	Standard Temperature, Ambient Pressure, Dry 20 °C (68 °F), ambient pressure, dry gas
STPD	Standard Temperature and Pressure, Dry 20 °C (68 °F), 1013 hPa, dry gas
TC	Time constant
Ti	Inspiratory time
UMDNS	Universal Medical Device Nomenclature System Nomenclature for medical devices
USB	Universal Serial Bus
V	Volt
VT	Tidal volume
xMAC	Accumulated multiple of the MAC values of anesthetic agents and N_2O

Symbols

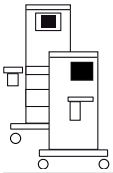
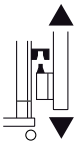
Symbol	Explanation
	Manufacturer
	Date of manufacture
	WEEE marking
	Observe the instructions for use
	Warning! Strictly follow these instructions for use
	Caution! Follow the accompanying documentation (Symbol)
	Attention! (safety sign)
	Group ***Views...***
	Group ***Trends/Data...***
	Group ***Alarms...***
	Group ***Procedures...***
	Group ***System setup...***
	Group ***Start.../Standby...*** Device on/***Standby***
	Main switch on
	Main switch off
	Patient category ***Neo***
	Patient category ***Ped***

Symbol	Explanation
	Patient category ***Adult***
	Temporarily suppress acoustic alarm signal
	***Audio paused*** Acoustic alarm signal is temporarily suppressed.
	Alarm inactive
	Alarm temporarily inactive
	Mains power
	Mains power unavailable
	Battery completely charged
	Battery empty
	Battery is charging.
	Central gas supply connected and pressure within specified range
	Central gas supply not connected or pressure not within specified range
	Gas cylinder full
	Gas cylinder empty or gas cylinder valve turned off
	Gas cylinder pressure sensor not connected
	Symbol for programmed Auto On

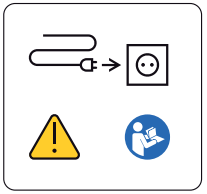
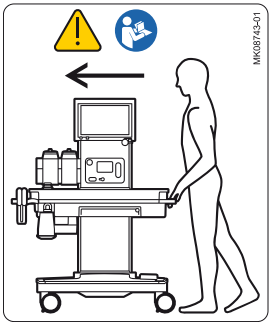
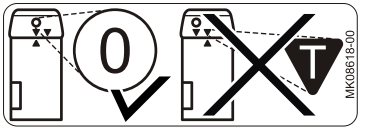
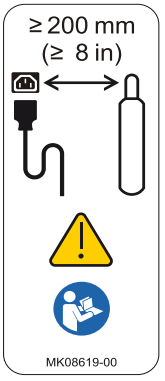
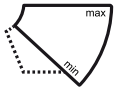
Symbol	Explanation
	Key for switching on and off and dimming the workplace illumination
	Emergency O_2 delivery (***Add. O2***)
	Applied part of type BF (body floating)
	Potential equalization connector
	Closes the dialog window
	Upper alarm limit
	Lower alarm limit
– –	No alarm limit
	Spontaneous breathing activity by the patient
	In lists: One line up
	In lists: One line down
	In lists: One page up
	In lists: One page down
	Risk of crushing
	ESD warning label, follow the information on electromagnetic compatibility.
	Locked
	Unlocked
	Inspiration Identification mark on the breathing system and the breathing system cover

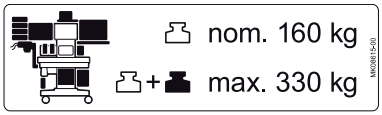
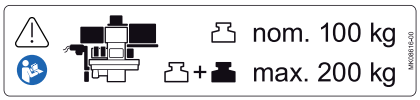
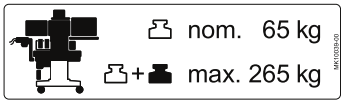
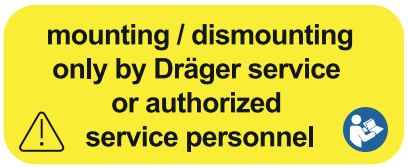
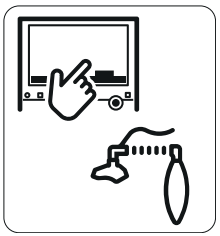
Symbol	Explanation
	Expiration Identification mark on the breathing system and the breathing system cover
	Breathing bag
	Vaporizer plug-in system, "fixed" position
	Auto Exclusion Plug-in connection
REF	Part number
SN	Serial number
LOT	Lot number
	Use by: YYYY-MM-DD Expiration date
	Keep away from sunlight
	Storage temperature
	Relative humidity
	Ambient pressure
	Do not use if package damaged
	Do not reuse
SPARE PART	Spare part
	LAN connection
	USB port
	Identifies the interface for the workstation light
	External fresh-gas outlet

Symbol	Explanation
	CO_2 absorber bypass
	Enter key
ECD	Connection for Embedded Control Display
*	Indicates a changed view which has not yet been saved
	Identifies the tabs that lead to the page with the language settings.
	Read the flow at the center of the float.
ACS	Advanced Cylinder Support
N_2O	Identifies N_2O cylinders. The color code conforms to the locally applicable standard.
O_2	Identifies O_2 cylinders. The color code conforms to the locally applicable standard.
AIR	Identifies Air cylinders. The color code conforms to the locally applicable standard.
	Gas outlet
	Gas inlet
Total	Display on the total flow tube indicating the cumulative value of the individual flows
	MR unsafe Do not use this device near MRI scanners.
	Exemplary representation of the weight distribution of the nominal weight and the maximum total weight, see "Technical data".
	Key for releasing the locking brake
	Key for releasing the locking brake

Symbol	Explanation
	***Up arrow*** key for lifting the ceiling supply unit
	***Down arrow*** key for lowering the ceiling supply unit
	Other Dräger devices
	Ceiling-mounted version of the Perseus
	Docking or undocking of Perseus

Product labels

Product label	Explanation
	When connecting auxiliary devices, be aware of the leakage current. Observe chapters "Connecting additional devices to the auxiliary power sockets" and "Technical data".
	Transport instructions, "Intrahospital transport" on page 56
	Ensure that the control dial of the vaporizer is correctly positioned. Do not leave the control dial in the "***T***" position while the vaporizer is connected to the medical device.
	Maintain the correct minimum distance of 200 mm (8 in) between the electrical connections and the gas cylinder.
	Observe the correct flow of the anesthetic gas receiving system, see 132.

Product label	Explanation
	Observe the weight of the nominal configuration and the permissible total weight, see "Technical data".
	Observe the weight of the nominal configuration and the permissible total weight, see "Technical data".
	Observe the weight of the nominal configuration for the ceiling-mounted version on the flexibility trolley and the total permissible weight, see "Technical data".
	Assembly and disassembly should only be performed by DrägerService or authorized service personnel.
	If a non-rebreathing system is used, make sure that the ***Ext. FGO*** operating mode is used. For additional information, see "Special forms of therapy" in chapter "Operation".

Overview of the menu structure

The following tables list the grouped buttons of the main menu bar with the resulting dialog windows of the same name and the tabs. For information on operation, see "Operating concept" on page 39.

Group

Button in main menu bar	Horizontal tab	Vertical tab	Description
Alarms...	***Limits***		Displaying or changing alarm limits
	Current alarms		Displaying information on active alarms
	Alarm history		Viewing the alarm history
	Settings		Setting the alarm tone volume Activating or deactivating CO_2 alarms[1)] Switching CBM mode on or off[1)]
CO_2 alarms off [1), 2)]			Deactivating CO_2 alarms
Autoset limits [1), 3)]			Automatically adapts alarm limits to current measured or set values
Exit CBM [1), 4)]			Exit CBM mode

1) Only during operation, not in ***Standby*** mode
2) Only in the modes: ***Manual / Spontaneous***, ***Ext. FGO***, ***Pause***
3) Only in the modes: ***PSV***, ***PC***, ***PC - APRV*** (optional), ***VC - CMV / AutoFlow***, ***VC - CMV***
4) Only in CBM mode

Group 

Button in main menu bar	Horizontal tab	Vertical tab	Description
Views...[1)]			Switching to other configured views Resetting current view to start settings Displaying alarm limits, units, mini-trends, and loops
View[1)] ***View***[1)] ***View***[1)]			Switching between the 3 configured views.
Export screenshot			Exporting screenshots to USB flash drive

1) Only during operation, not in ***Standby*** mode

Group

Button in main menu bar	Horizontal tab	Vertical tab	Description
Trends/Data...	***Graphical trends***	***Overview***	Displaying trends of measured values in graphic form
		Vent. 1	
		Vent. 2	
		Anesthesia	
	Tabular trends	***Overview***	Displaying trends of measured values in table form
		Vent. 1	
		Vent. 2	
		Anesthesia	
	Values	***Ventilation*** 1)	Displaying overview of current measured values
		Gases 1)	
		System	
	Logbook		Displaying the logbook
	Export 2)		Exporting data to USB flash drive

1) Only during operation, not in ***Standby*** mode
2) Only in ***Standby*** mode

Group

Button in main menu bar	Horizontal tab	Vertical tab	Description
Procedures...1)	***Insp./Exp. hold***		Starts a maneuver during ventilation.
	One-step recruitment		
	Multi-step recruitment		
Flush2)			Flushing the breathing system

1) Only during operation, not in ***Standby*** mode
2) Only in ***Standby*** mode

Group

Button in main menu bar	Horizontal tab	Vertical tab	Description
System setup...			Configuration of device functions and start settings, see page 150
Patient... 1)			Setting patient data
Tests... 2)			Displaying test results Testing the system Flushing the breathing system

1) Only during operation, not in ***Standby*** mode
2) Only in ***Standby*** mode

Group

Button in main menu bar	Horizontal tab	Vertical tab	Description
Start... 1)			Beginning or continuing a case
Standby...2)			Ending the case

1) Only in ***Standby*** mode
2) Only during operation, not in ***Standby*** mode

Password

Configuration password for Perseus A500 Software 2.0n

Cut-out from the instructions for use Perseus A500 Software 2.0n

To prevent unauthorized alteration, the start settings for Perseus A500 are protected by the following configuration password:

0000

Information for the configuration password

To prevent unauthorized alteration, the start settings for Perseus A500 are protected by a password with 0 to 8 digits. Information on the start settings, see page 150.

The configuration password appears on this page of the instructions for use. Cut out the area with the password and keep in a place which is safe from access by unauthorized persons.

The configuration password can only be reset by specialized service personnel.

This page has been left blank intentionally.

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These instructions for use are provided for customer information only and are only updated or exchanged upon customer request.

CE 0123

CE

Directive 2014/53/EU concerning radio equipment

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