

Instructions for use

Fabius MRI

WARNING

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

**Anesthesia workstation
Software 3.n**

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.

Any text shown on the screen and any labeling on the device are printed in bold and italics, e.g., **PEEP** or **Man/Spon**.

Use of terms

- The product Fabius MRI is also referred to as Fabius.
- Dräger uses the term "Accessory" not only for accessories in the sense of IEC 60601-1, but also for consumables, removable parts, and attached parts.

Screen layouts and illustrations of the device

The actual screen layout or the device may differ in appearance or in configuration from the illustrations.

Trademarks

Trademark	Trademark owner
Fabius®MRI	
DrägerService®	
Spirolog®	
SpiroLife®	
D-Vapor®	Dräger
Drägersorb®	
MEDIBUS®	
Vitalink®	
Vapor®	
Korsolex®	BODE Chemie
Neodisher Medi-clean®	Dr. Weigert
Gigasept FF®	Schülke & Mayr
Incidin®	Ecolab
Incidur®	

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.

Definition of target groups

For this product, users, service personnel, and experts are defined as target groups.

These target groups must have received instruction in the use of the product and must have the necessary training and knowledge to use, install, reprocess, maintain, or repair the product. The target groups must understand the language of the present document.

The product must be used, installed, reprocessed, maintained, or repaired exclusively by defined target groups.

Users

Users are persons who use the product in accordance with its intended use.

Service personnel

Service personnel are persons who are responsible for the maintenance of the product.

Service personnel must be trained in the maintenance of medical devices and install, reprocess, and maintain the product.

Experts

Experts are persons who perform repair or complex maintenance work on the product.

Experts must have the necessary knowledge and experience with complex maintenance work on the product.

Abbreviations and symbols

Explanations can be found in the sections "Abbreviations" and "Symbols" in chapter "Symbols".

MR Definitions (Magnetic Resonance)

Concept	Meaning
MR	Magnetic resonance
MRI	Magnetic resonance imaging
MR-safe	A device or object the use of which in an MR environment does not result in any known hazards. Objects classified as MR-safe include, e.g.: <ul style="list-style-type: none">– Non-conductive objects– Non-metallic objects– Non-magnetic objects
Non MR-safe	A device or object the use of which in an MR environment demonstrably results in hazards.
MR-conditional	A device or object the use of which under specified application conditions in a particular MR environment demonstrably does not result in any known hazards. The MR environment is characterized by, among other things, the following field properties: <ul style="list-style-type: none">– Intensity of the static magnetic field– Spatial gradient– dB/dt (for time-varying magnetic fields)– High-frequency fields (HF)– Specific absorption rate (SAR)

Concept	Meaning
MR environment	<p>This term is used to describe the general environment in the vicinity of a magnetic resonance scanner. This means specifically the area enclosed by the 5-gauss line around the scanner. The properties of the environment include the following:</p> <ul style="list-style-type: none"> – The static magnetic field and associated spatial gradients (values between 0.2 and 3 tesla are usual, but they can also exceed 4.0 tesla¹⁾). – Rapidly changing magnetic fields (imaging gradients ~kHz) – High-frequency electromagnetic pulses (in the range from several tens to several hundreds of MHz, i.e. in the FM (VHF) range). <p>The MR environment includes all areas in the MR room, including the center of the opening in the magnetic resonance scanner.</p>
Five-gauss line	<p>This line indicates the area around the magnetic resonance scanner within which the static magnetic field strengths are greater than five gauss. Five gauss and less are considered to be "safe" values for the degree of risk to the user and patient in a magnetic field.</p> <p>(5 gauss = 0.50 mT)</p>
Image artifact	<p>A general term referring to an incorrect image signal at a specific location in a room. Image artifacts that occur can be traced to:</p> <ul style="list-style-type: none"> – An increased signal intensity in an area where it is known that there are no signal-producing objects present. – A reduced signal strength (hole) in the area where a signal is generated.

1) 1 tesla = 10000 gauss

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For your safety and that of your patients

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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" on page 20 and in conjunction with an appropriate patient monitoring system (see page 12). 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.

Maintenance

WARNING

Risk of medical device failure and patient injury

The medical device must be inspected and serviced regularly by service personnel. Repair and complex maintenance carried out on the medical device must be performed by experts. If the above is not complied with, medical device failure and patient injury may occur. Observe chapter "Maintenance".

Dräger recommends DrägerService for a service contract and for repairs. Dräger also recommends using original Dräger parts for maintenance.

Safety checks

The medical device must be subject to regular safety checks. See chapter "Maintenance".

Accessories

WARNING

Risk due to incompatible accessories

Dräger has only tested the compatibility of accessories that appear in the current list of accessories or in separate declarations by Dräger. If other, incompatible accessories are used, there is a risk of patient injury due to medical device failure.

Dräger recommends using the medical device only with accessories from the current list of accessories.

WARNING

Risk of operating errors and incorrect use

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
- Endotracheal suction
- Vaporizer
- Manual resuscitator
- AGSS terminal unit

WARNING

Risk of device malfunction

This medical device can be operated in combination with other Dräger devices or with devices from other manufacturers. If a device combination is not approved by Dräger, the safety and the functional state 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.
- Strictly observe the assembly instructions and instructions for use of each connected device.

Connected devices

WARNING

Risk of electric shock and 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.

Before using the medical device, refer to and strictly comply with the instructions for use of all connected devices and device combinations.

No operation in potentially explosive areas

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.

Safe coupling with electrical equipment

CAUTION

Risk of patient injury

Coupling with electrical equipment that is not mentioned in these instructions for use or assembly instructions may only be done with the respective device manufacturer.

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 users, and that certain inherent characteristics of the medical device are known to the user. Instructions and WARNING and CAUTION statements are therefore largely limited to the specifics of the Dräger medical device.

These instructions for use do not contain references to various hazards which are obvious to users who operate this medical device as well as references to the consequences of medical device misuse, and to potentially adverse effects in patients with different underlying diseases. Medical device modification or misuse can be dangerous.

CAUTION

Risk of patient injury

Do not make therapeutic decisions based solely on individual measured values and monitoring parameters.

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.

Information on electromagnetic compatibility

General information on electromagnetic compatibility (EMC) according to the international EMC standard IEC 60601-1-2:

Medical electric equipment is subject to special precautionary measures concerning electromagnetic compatibility (EMC) and must be installed and put into operation in accordance with the EMC information provided (see page 186).

Portable and mobile RF communications equipment can affect medical electrical equipment.

WARNING

Risk of electric shock



Do not connect connectors with an ESD warning symbol and do not touch the pins of such connectors without implementing ESD protective measures. Such protective measures may include antistatic clothing and shoes, touching a potential equalization pin before and during connection of the pins, or using electrically insulating and antistatic gloves.

All relevant users must be instructed in these ESD protective measures.

WARNING

Risk of device failure

Electromagnetic fields, e.g., those generated by radio frequency communication equipment such as mobile phones, high-frequency electrical surgery equipment, defibrillators or shortwave therapy devices can disrupt the function of the medical device.

Only operate radio frequency devices at a sufficient safety clearance of at least 20 cm (7.9 in).

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 with the approval of the respective device 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.**

Installing accessories

CAUTION

Risk of device failure

Install the accessory on the basic device in accordance with the instructions of the basic device.

Check for secure connection to the basic device.

Strictly observe the instructions for use and assembly instructions.

Keeping the instructions for use

CAUTION

Risk of incorrect use

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

Training

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

Product-specific safety information

WARNING

Risk of excessive field strengths

The Fabius MRI anesthesia workstation is classified as MR-conditional. Fabius MRI has been tested in combination with magnets with field strengths of 1.5 tesla and 3 tesla at a maximum field line strength of 40 millitesla (400 gauss). Using the device in higher field strengths may result in malfunctions of the ventilator and the device. Furthermore, uncontrollable forces of attraction may cause injuries.

Only use the device in the tested field strengths.

WARNING

Risk of burns

Conductive breathing hoses or face masks can cause burns during HF surgery.

Do not use this type of hose and mask combined with HF surgery.

WARNING

Risk of malfunction

Device failure or user error can compromise the correct functioning of the device. The medical device does not react automatically to certain changes in the patient condition, operating errors, or failure of components.

Continuously monitor the medical device so that corrective measures can be initiated immediately.

WARNING

Risk of device failure

The device can fail if the power supply is interrupted.

Always connect the device on an uninterruptible power supply.

WARNING

Risk due to magnetic forces of attraction

If Fabius MRI is moved or parked too close to the magnetic resonance scanner, it may be pulled in towards the scanner.

Do not move or park Fabius MRI in areas with more than 40 millitesla (400 gauss).

WARNING

Risk of misinterpretation

Misinterpretation of measured values or other parameters or misdiagnosis 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.

WARNING

Risk of patient injury

Every user has the obligation to assess independently which components are required corresponding to the specific prerequisites for the anesthesia workstation. In accordance with the general safety standards for anesthesia systems, additional monitoring of the concentrations of CO₂ and anesthetic agent is required when operating the device. To guarantee patient safety, however, the following components must always be used:

- O₂ monitor
- Pressure monitor
- Volume monitor

WARNING

Risk of malfunction

Unallowed modifications to the medical device lead to malfunctions.

This medical device may not be changed without permission from Dräger.

WARNING

Risk due to magnetic forces of attraction

The device may move unintentionally as a result of magnetic forces of attraction.

- Always position Fabius MRI at the specified, marked location in the MR examination room.
- Always lock the central brake.

WARNING

Risk of fire

The flow sensor can ignite medications or other substances that are easily flammable.

- 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 combustible or explosive substances to enter the breathing system or 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.

WARNING

Risk of injury to the lungs

Endotracheal suction can cause negative pressure in the lungs. This pressure can injure the lungs.

Be careful during suction.

WARNING

Risk of tipping over during transport

The medical device may tip over if handled incorrectly. Observe the following points when transporting medical devices:

- The medical device may only be moved by people who have the physical ability to do so.
- To improve the maneuverability, transport the device with 2 persons.
- 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.
- Remove any devices mounted to the holding arms or the top of the device.
- Clear the writing tray and fold it down completely or slide it into the device.
- Do not pull the medical device over hoses, cables, or other obstacles lying on the floor.
- Do not activate the brake while the medical device is being moved.
- Always use the handles on the device to push or pull it.

WARNING

Risk of alarms not being heard or noticed

If the device is not positioned correctly, there is a risk that alarms may be noticed too late or not at all.

- Dräger recommends that the user remain in the vicinity of the anesthesia machine, i.e., within a distance of up to four meters (12 feet). This facilitates fast recognition and response in the event of an alarm.
- Position the device so that the alarm LED bars are visible from various viewing angles and from every location.
- Do not cover the alarm LED bars.

WARNING

Risk of crushing

If the writing tray is not correctly locked in place, objects can fall down or fingers and breathing hoses, for example, can be pinched.

Make sure that the writing tray is correctly locked when folding down or sliding into the device.

WARNING

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:

- 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 of insufficient ventilation

Device failure or operating errors can lead to ventilation failure.

- To ensure immediate remedial action in case of device failure, only operate the device under permanent supervision of users.
- The general safety standards for anesthesia systems require that a manual resuscitator be kept at the ready for emergency ventilation.

WARNING

Risk of electric shock

This device is only intended for use in rooms in which the power lines correspond to the national applicable safety standards for patient's rooms in hospitals. Observe the following points to avoid electric shock:

- The covers of the components must not be removed.
- Maintenance work must only be performed by DrägerService. Use only grounded electrical connections and power cables that meet hospital standards.
- Before connecting the medical device, make sure that external devices are grounded to meet the hospital standard (in accordance with national applicable regulations).
- Before cleaning work or maintenance work is performed, disconnect all plugs for the power supply.
- If the medical device has come in contact with liquids, let it dry completely before it is reconnected to the power supply.
- Check that the power cable is securely clamped to the power inlet.
- Only connect additional devices if they have been approved by Dräger.

WARNING

Risk due to magnetic forces of attraction

Objects placed on the device that are not intended for use with this anesthesia workstation may be strongly attracted by the magnetic field.

- Do not place any objects that are not approved for use with Fabius MRI or in MR environments on the device, on the writing tray, or in the drawer.
- Do not bring any ferromagnetic tools or devices into the MR environment.
- Handle power cables and mains plugs carefully as these contain ferromagnetic components.
- Do not service or maintain the device in an MR environment.

WARNING

Risk of malfunction

The D-Vapor is not approved for operation in MR environments.

In MR environments, use only vaporizers of type Vapor 2000.

WARNING

Risk of impaired imaging

Unspecified MR-compatible components that are used in an MR environment are not automatically considered to be MR-safe.

Fabius MRI is approved only as a stand-alone anesthesia system for use in an MR environment.

WARNING

Risk of device failures

If the anesthesia workstation is used in a tipped position, parts can be damaged or their function can be comprised.

Do not use the anesthesia workstation at an inclination angle over 5°.

CAUTION

Risk of disconnecting the patient

Negligent placement of hoses and cables can endanger the patient. When the device is moved, the patient may be disconnected.

- Use caution when establishing connections to the patient.
- Take care that the hoses are sufficiently long.
- When the device is moved, pay attention to the hoses and cables connected to the patient.

WARNING

Risk resulting from an emergency shutdown of the magnetic resonance scanner

If the patient table is moved to the starting position during an emergency shutdown of the magnetic resonance scanner, the patient may be unintentionally disconnected or extubated.

- Take care that the hoses are sufficiently long.
- Make sure that the hoses and cables connected to the patient cannot be pinched, kinked, or torn off.

NOTE

The device software of Fabius must be installed by experts. Dräger recommends having the software installation performed by DrägerService.

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Intended use

Fabius MRI is suitable for use as an anesthesia workstation for inhalation anesthesia in operating rooms, induction rooms, and recovery rooms.

Fabius MRI can also be used in an MR environment. In this case, it is absolutely essential to maintain the distance to the center of the magnetic field for a maximum field line strength of 40 mT (400 gauss).

The device may only be used with magnetic resonance scanners which have magnetic field strengths of 1.5 or 3 tesla.

Fabius is equipped with an electrically driven and electronically controlled ventilator. The following parameters are monitored:

- Airway pressure (**PAW**),
- Tidal volume (**VT**)
- Inspiratory oxygen concentration (FiO₂)

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. A Dräger anesthetic vaporizer is used to enrich the fresh gas with volatile anesthetic agents. The gas supply is done via a central gas supply system or via externally connected gas cylinders.

Fabius is equipped with a compact breathing system that offers fresh gas decoupling, PEEP, and pressure limitation.

The following ventilation modes are available:

- **Volume Control** (volume-controlled ventilation)
- **Pressure Control*** (pressure-controlled ventilation)
- **Pressure Support*** (pressure-supported ventilation)
- **SIMV/PS*** (synchronized intermittent ventilation with pressure support)
- **ManSpont** (manual ventilation/spontaneous breathing)

WARNING

Risk of patient injury

In accordance with the general safety standards for anesthesia systems, additional monitoring of the concentrations of CO₂ and anesthetic agent is required.

WARNING

Risk of insufficient ventilation

Device failure or operating errors can lead to ventilation failure.

- To ensure immediate remedial action in case of device failure, only operate the device under permanent supervision of users.
- The general safety standards for anesthesia systems require that a manual resuscitator be kept at the ready for emergency ventilation.

* optional

WARNING

Risk due to malignant hyperthermia

Volatile anesthetic agents may cause malignant hyperthermia.

For patients suspected of suffering from malignant hyperthermia: Do not use any volatile anesthetic agent or Fabius with residual concentrations of these gases above 5 ppm.

WARNING

Risk due to the accumulation of acetone in the patient

Do not perform low-flow anesthesia on patients with ketoacidosis or patients under the influence of alcohol. The risk of accumulation of acetone in the patient increases in such cases.

NOTE

If Fabius MRI is combined with an anesthetic gas monitor (e.g., Vamos) or a gas analyzer (e.g., Scio with Dräger patient monitor) outside the MR environment, it is possible to monitor CO₂ values and anesthetic gas concentrations.

NOTE

O₂ monitoring can be deactivated on site by an authorized service partner. More information can be found in chapter "Deactivating the O₂ monitoring" on page 123. If O₂ monitoring is deactivated, use external O₂ monitoring.

Indications/Contraindications

Indications

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

Contraindications

The device has no product-specific contraindications.

It is the responsibility of the user to select the appropriate treatment for the patient's underlying disease.

Patient status must be continuously monitored for potential changes.

NOTE

Fabius applies medical gases such as O₂, N₂O, or volatile anesthetic agents. For contraindications to the applied medical gases, strictly observe the instructions for use of the medical gas.

Further information on application

Environment of use

Fabius MRI is designed for use in rooms (even in MR environments) in which therapeutic or diagnostic interventions can be carried out.

WARNING

Do not use soda lime based on potassium hydroxide. Otherwise, there is a risk of CO formation.

WARNING

Risk of explosion

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.

Do not use Fabius MRI in the following environments:

- Outside of massive buildings
- In intensive care units
- During patient transport
- In vehicles, airplanes, or helicopters

The MEDIBUS and Vitalink protocols

MEDIBUS and Vitalink are software protocols for the transfer of data between Fabius and an external medical or non-medical product (e.g., hemodynamic monitors, data management systems, or Windows-based computers) via an RS232 interface (see instructions for use 9038530, 3rd edition or higher).

WARNING

For the protection of patients and users from electrical risk, it is required that all systems that consist of medical devices and other electrical devices, such as computers, printers, etc., are assembled exclusively by trained personnel.

WARNING

Risk of patient injury

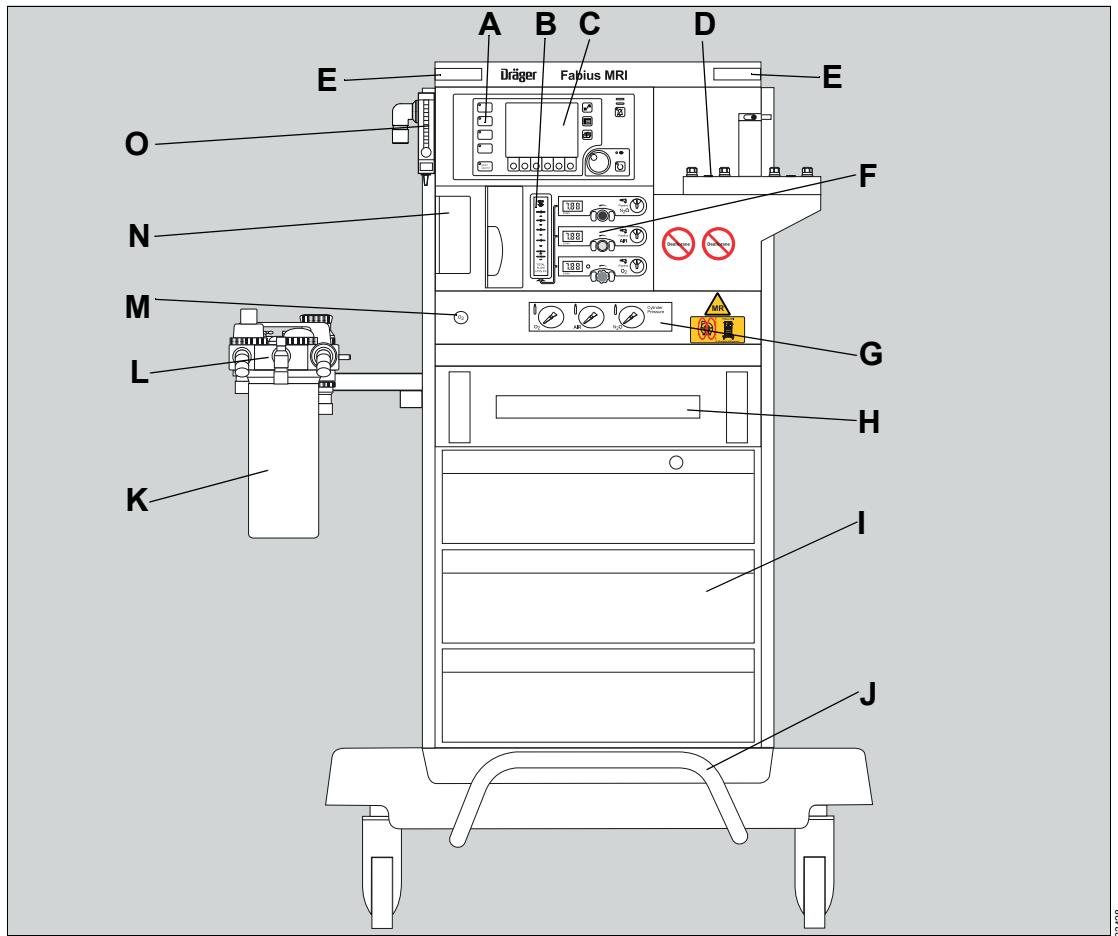
All data transferred via the MEDIBUS interface are for information only and must not be used as the sole basis for diagnostic or therapeutic decisions. The data accessible via this interface are not intended for use with a distributed alarm system in accordance with IEC 60601-1-8:2012 (in the sense of remote monitoring).

The system must meet the requirements of standards IEC 60601-1-1 and IEC 60601-1-2, or of IEC 60601-1:2005 for medical electrical equipment.

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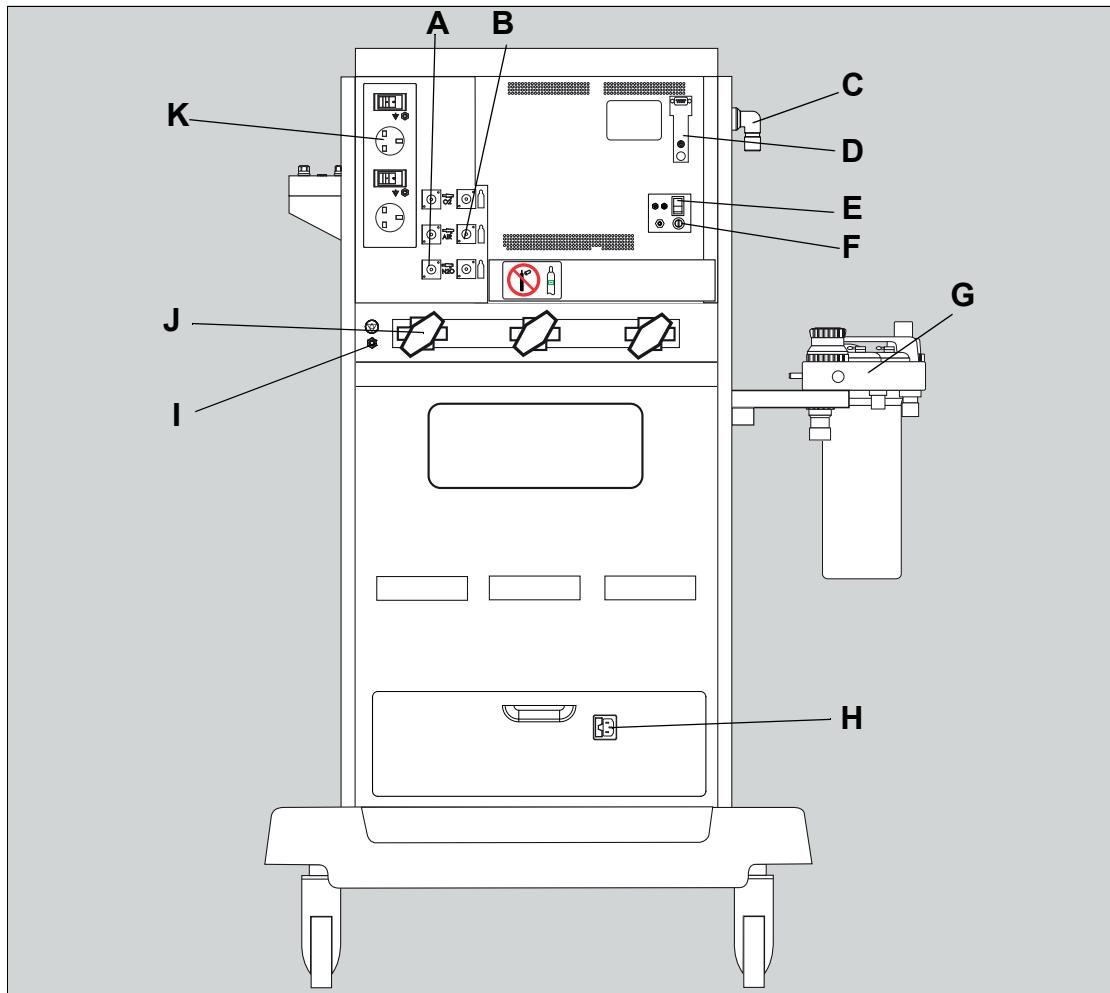
Fabius MRI (front view)



- A Ventilator control panel (settings for ventilation parameters and airway monitoring)
B Total flow tube
C Screen
D Vaporizer mount
E Additional LEDs for alarm indication
F Fresh-gas delivery
G Pressure gauges for gas cylinders (O₂, Air, or N₂O)
H Writing tray
I Drawers
J Central brake
K CO₂ absorber
L Compact breathing system (COSY)
M O₂ flush
N Ventilator
O Supplemental O₂ delivery for O₂ insufflation*

* optional

Rear view



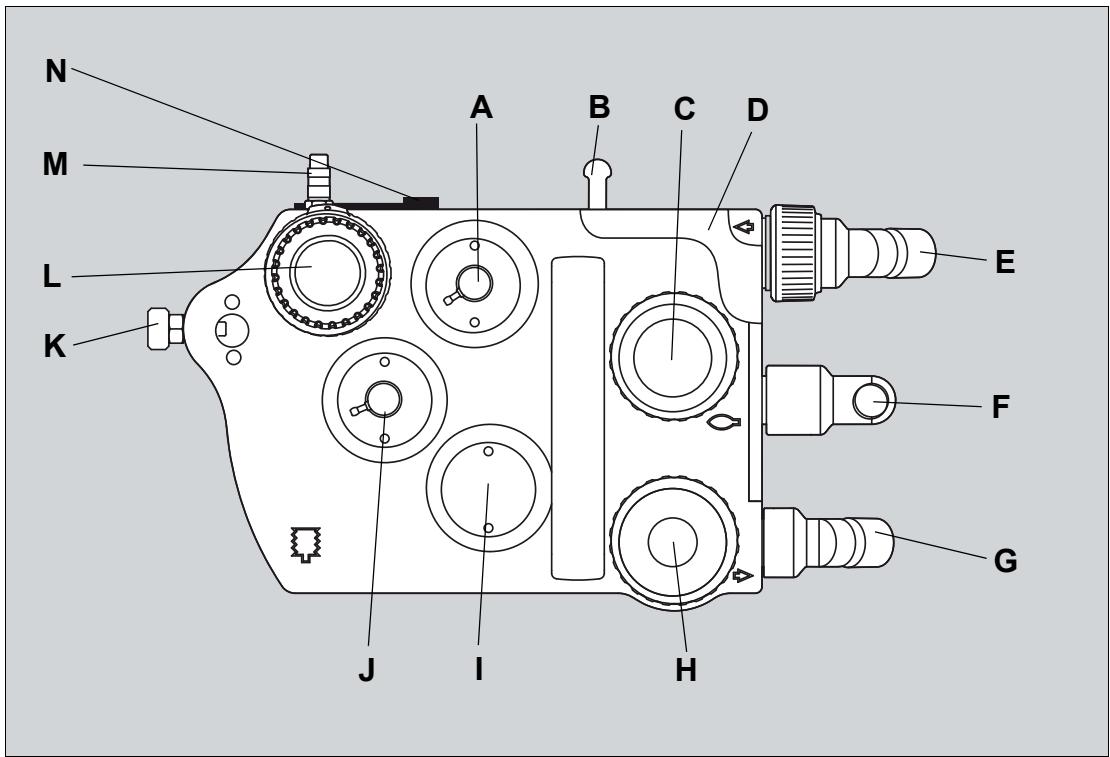
2340

- A** Connections for central supply hoses
- B** Connection for compressed gas hoses from the gas cylinders*
- C** Connection for ventilator hose
- D** Interface panel
- E** On/Off switch
- F** Battery fuse
- G** Compact breathing system (COSY)
- H** Power inlet with main fuses
- I** Potential equalization pin
- J** Pin-index connection**
- K** Auxiliary power sockets

* not on pin-index version

** applicable to CE pin-index version

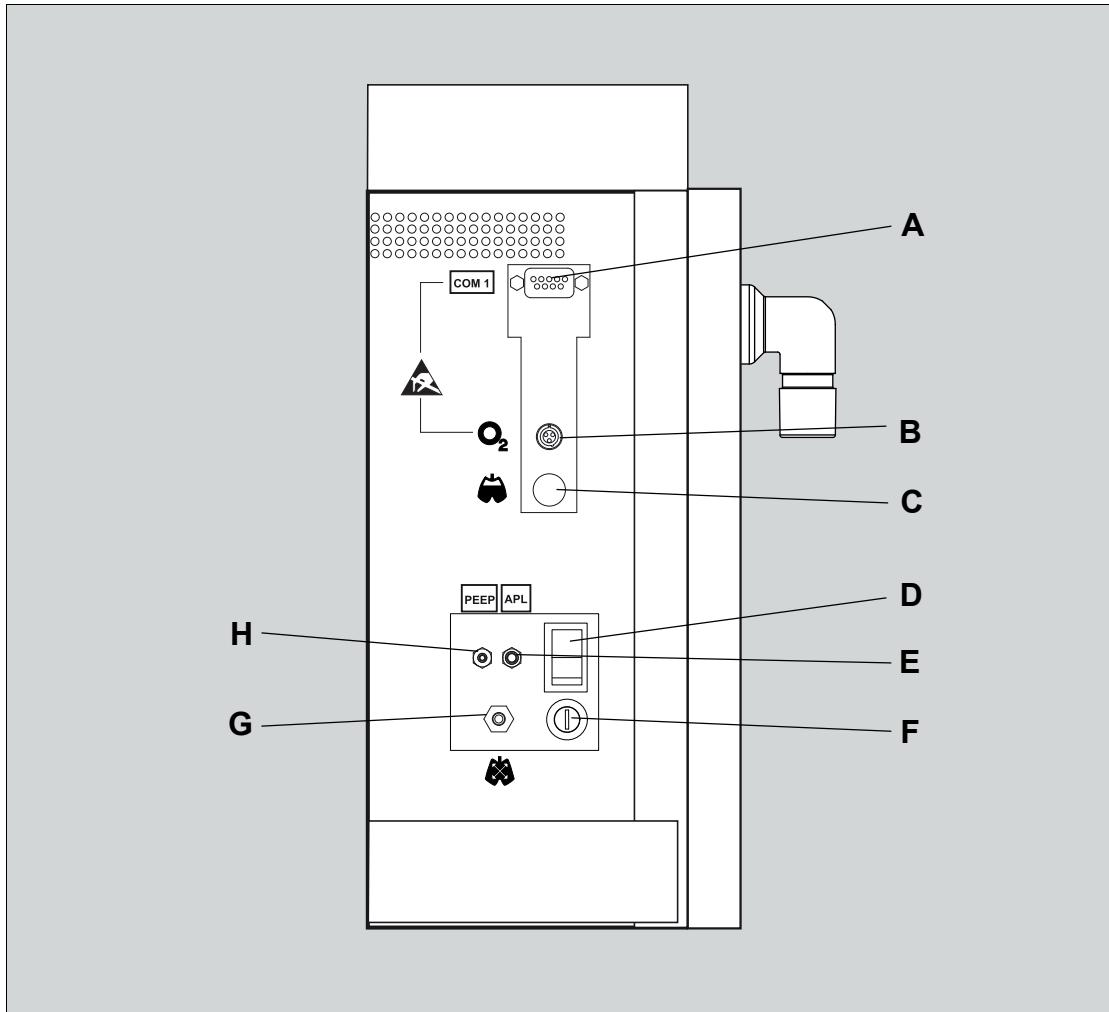
Compact breathing system COSY (top view)



21472

- A Connection for PEEP/PMAX valve
- B Breathing bag holder
- C Expiratory valve
- D Flow-sensor guard or COSY guard (not illustrated)
- E Expiratory port
- F Connection for breathing bag
- G Inspiratory port
- H Inspiratory valve
- I Fresh gas decoupling valve
- J Connection for APL bypass valve
- K Mount with locking pin
- L APL valve with selection for manual ventilation (**Man**) and spontaneous breathing (**Spont**)
- M Connection for sample line
- N Holder for sample line (optional)

Interface panel



23425

A COM 1 port

B Socket for O₂ sensor

C Socket for flow sensor

D On/Off switch

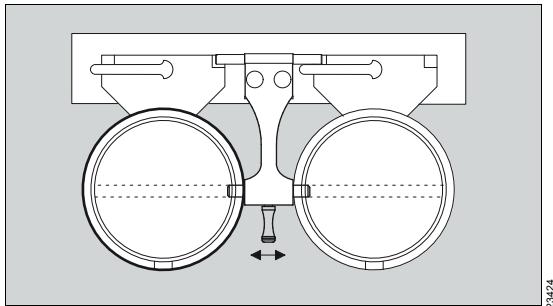
E Connection for APL hose

F Battery fuse

G Socket for airway pressure sensor

H Connection for PEEP hose

Vaporizer



23424

Anesthetic vaporizers are used to enrich fresh gas with a precisely delivered concentration of a volatile anesthetic agent.

Vaporizer	Anesthetic agent
Vapor 2000	Isoflurane
	Halothane
	Enflurane
	Sevoflurane

Vapor 2000 is an unheated, calibrated anesthetic vaporizer for enriching dry, medical fresh gas for an anesthesia workstation with a precisely delivered concentration of a volatile anesthetic agent.

There are various connector systems with which vaporizers can be connected to an anesthesia workstation.

Dräger recommends using only anesthetic vaporizers that are listed in the list of accessories.

More information can be found in the respective instructions for use of the anesthetic vaporizers used.

Supplemental O₂ delivery

WARNING

Risk due to overpressure

When the patient's connection to the supplemental O₂ delivery is made using a breathing circuit without relief valve, increased pressure may be applied to the patient.

When connecting the patient, only use a breathing circuit with relief valve or do not connect pressure-tight.

WARNING

Risk of fire

The oxygen can ignite when cauterizing near an oxygen source.

- Make sure that all connections (e.g., Y-piece, breathing hoses) do not leak.
- Before cauterizing, close the flow control valve.
- Remove mask.
- Wait a few moments.

The supplemental O₂ delivery supplies pure oxygen with an exact metered flow, e.g., for O₂ insufflation using a face mask during a regional anesthesia. The supplemental O₂ delivery is not only possible in standby mode and during operation, but also if Fabius is switched off.

The supplemental O₂ delivery can supply additional inspiratory oxygen for the patient for the following types of anesthesia:

- Spinal anesthesia
- Epidural anesthesia
- Other regional anesthesia

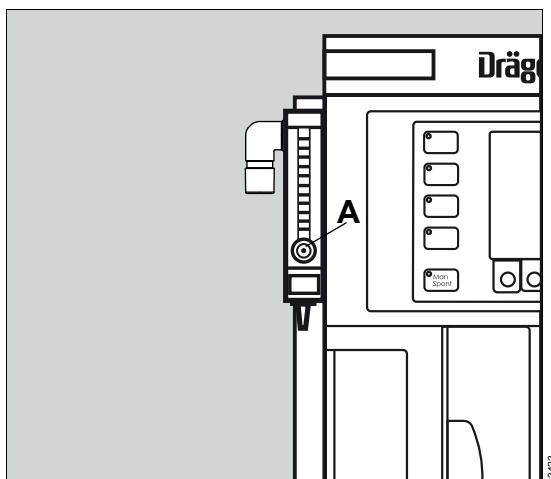
To increase the O₂ concentration in the breathing gas, the supplemental O₂ delivery can be used in combination with a breathing bag*.

Functional check of the supplemental O₂ delivery

- Turn the flow control valve (A) counterclockwise.
- Check that the float can move freely in the flow tube.

After the O₂ insufflation is ended, the flow control valve of the supplementary O₂ delivery must be completely closed:

- Turn the flow control valve (A) clockwise to the final position stop.



* ASTM F1850-22(2005) §76

APL valve

WARNING

Risk of patient injury

Wires and cables can get caught under the APL valve adjustment knob and block the APL valve.

Lay all cables and wires, e.g., sample line so that they do not get caught.

The APL valve has 2 functions:

- During manual ventilation, the maximum airway pressure is limited.
- During manual ventilation and spontaneous breathing, excess gas is discharged into the anesthetic gas scavenging system.

The functional state is only guaranteed if the ventilator is in ***ManSpont*** mode or is bypassed.

NOTE

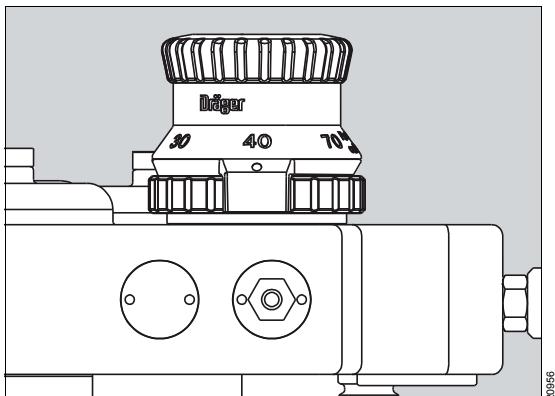
The APL valve is automatically separated from the breathing system as soon as an automatic ventilation mode is selected.

WARNING

Risk of excessively high airway pressures

If the ventilator fails, the device switches into the ***ManSpont*** ventilation mode.

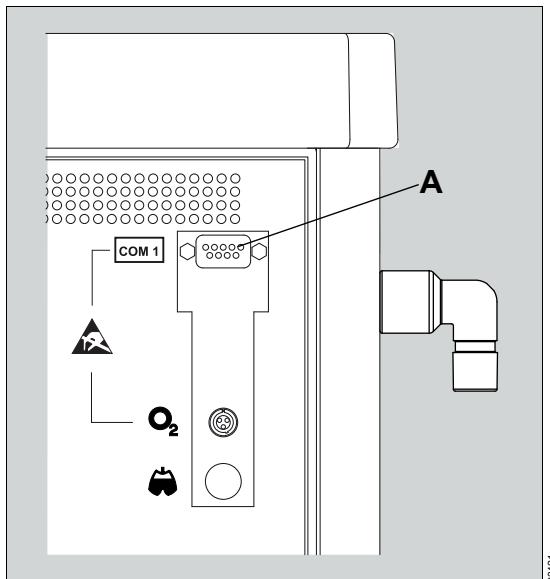
The APL valve should also be set to a pressure limitation value suitable for the patient when using automatic ventilation modes. If the ventilator fails, ventilate the patient manually.



Different settings can be made on the APL valve adjustment knob:

- Change between manual ventilation (***Man***) and spontaneous breathing (***Spont***)
- Setting of the maximum airway pressure for manual ventilation

Interfaces



- A** There is a port on the rear of Fabius MRI for communication with external devices. The port is labeled COM 1. This port is used for data communication using the Dräger MEDIBUS or Vitalink data protocols.

CAUTION

Risk of impaired imaging

To prevent artifacts during MR imaging in the MR examination room, do not use wired RS232 cables.

Use only the fiber optic cable approved by Dräger (part number 8608376).

WARNING

Risk of electric shock

Connecting devices to the MEDIBUS interfaces 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 with the approval of the respective device manufacturer.
- Have the leakage current checked by service personnel.
- If the permissible value is exceeded, disconnect the devices from the MEDIBUS interface.

CAUTION

Risk to electrical safety

To ensure electrical safety, only connect devices to the serial port (COM 1) with a maximum nominal voltage of 24 Vdc that meet one of the following standards:

- IEC 60950-1: Ungrounded SELV circuits
- IEC 60601-1 (as of 2nd edition): Exposed secondary circuits

WARNING

Risk of impaired imaging and impaired device function in an MR environment

Use only monitors, mounting parts, and connection cables approved by Dräger.

Integrated teslameter

A specific safety clearance must be maintained between Fabius MRI and the magnetic resonance scanner. The field line strength must not exceed 40 mT (400 gauss). This will ensure the following:

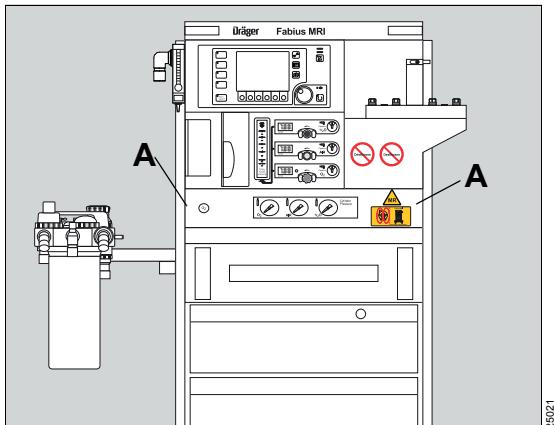
- Operating the Fabius MRI is safe.
- No occurrence of interference in the vicinity of the magnetic resonance scanner.
- The MR imaging will not be affected.

Fabius MRI can be moved during the treatment in the MR environment. If the limit of 40 mT is exceeded, 2 integrated magnetic field sensors will trigger an acoustic alarm signal. The acoustic alarm signal will be silenced when Fabius MRI is positioned at an adequate distance from the magnetic resonance scanner.

NOTE

Do not use the integrated teslameter to determine the operating location of Fabius MRI in the MR environment. Determination of the operating location must be carried out within the framework of the MRI planning documentation.

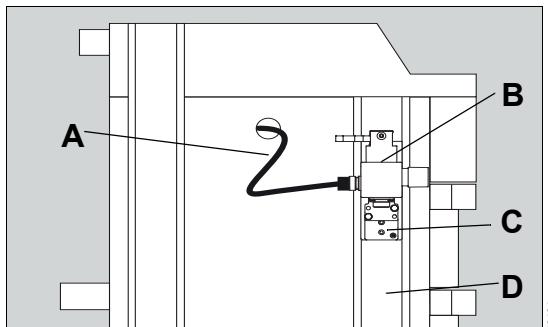
Position of the sensors



The two magnetic field sensors (A) are mounted on the inner side surfaces of the pedestal.

The magnetic field sensors are active when the device is connected to the mains power supply or is switched on in battery mode.

External fresh-gas outlet with an additional switch (optional)



WARNING

Insufficient gas supply to the patient

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

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

- A** Fresh-gas hose
- B** External fresh-gas outlet with an additional switch
- C** Holder
- D** Rail system

The external fresh-gas outlet is used for connecting a non-rebreathing system, e.g., Waters. It is attached to the lateral rail system by means of a holder.

The switch enables the simple switching of the fresh-gas supply from the compact breathing system to the non-rebreathing system.

WARNING

Risk of excessive airway pressure

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

Only connect non-rebreathing systems with breathing bag or pressure-relief valves that comply with applicable safety standards.

WARNING

Risk of misinterpretation of measured values

The values for O₂, pressure, and volume displayed on Fabius do not correspond to the values for the patient connected to external fresh-gas outlet as they are based on measurements taken at the compact breathing system.

When using the external fresh-gas outlet, change into the *Standby* mode.

WARNING

Risk of faulty gas delivery

O₂ and CO₂ and any anesthetic gases must also be monitored for non-rebreathing systems.

The sample line must be connected to the connector on the non-rebreathing system and to the connector on the gas analyzer.

WARNING

Risk of impaired imaging

The use of non-rebreathing systems (e.g., Magill, Kuhn, and Bain) that are not classified as "MR-safe" or "MR-conditional" will impair the diagnostic quality of the imaging.

Only use non-rebreathing systems that are classified as "MR-safe" or "MR-conditional".

Abbreviations

Abbreviation	Explanation	Abbreviation	Explanation
%, Vol %	Percentage gas ratio, related to total volume	kPa	Kilopascal
A	Ampere	<i>L/min</i>	Liters per minute
AGS	Anesthetic gas receiving system	lbs	Pound; unit of mass
AGSS	Anesthetic gas scavenging system	LED	Light emitting diode
Air	Medical compressed air	ManSpont	Manual ventilation/Spontaneous breathing
APL	Adjustable Pressure Limitation, adjustable pressure limitation	mbar	Millibar
bpm	Breaths per minute	MEAN	Mean airway pressure
BTSPS	Body Temperature and Pressure, Saturated 37 °C (98.6 °F), ambient pressure, 100 % relative humidity	MEDIBUS.X	Dräger communications protocol for medical devices with uniform data definition for all devices
CAL	Display when a measurement value is calibrated.	min	Minute
cmH ₂ O	Centimeters of water	mL	Milliliter
CO	Carbon monoxide	mmHg	Millimeter of mercury
CO ₂	Carbon dioxide	MRI	Magnetic resonance imaging
COM	Serial interface	MV	Minute volume
COSY	Compact breathing system	N ₂ O	Nitrous oxide, dinitrogen monoxide
CSA	Canadian Standards Agency	O ₂	Oxygen
dB(A)	Decibel, rated sound level unit	O ₂ +	O ₂ flush
EMC	Electromagnetic compatibility	PAW	Airway pressure
ESD	Electrostatic Discharge, electrostatic discharge	PEAK	Peak airway pressure
FiO ₂	Inspiratory oxygen fraction	PEEP	Positive end-expiratory pressure
Freq	Respiratory rate	PINSP	Inspiratory pressure
Freq Min	Mandatory minimal respiratory rate in Pressure Support mode	PLAT	Plateau pressure
HF	High-frequency	PMAX	Pressure limitation
hPa	Hectopascal	psi	pounds per square inch
Insp Flow	Inspiratory flow	SIMV	Synchronized Intermittent Mandatory Ventilation
		S-ORC	Sensitive Oxygen Ratio Controller, maintains a minimum O ₂ concentration

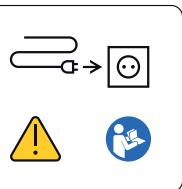
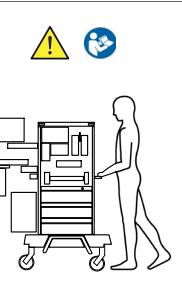
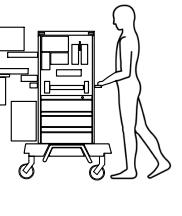
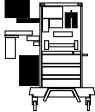
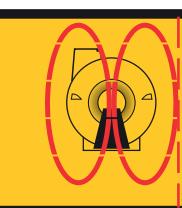
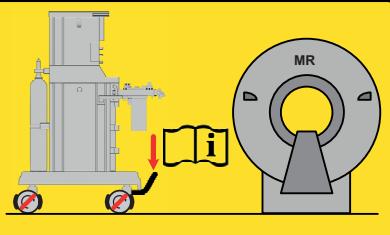
Abbreviation	Explanation
STAPD	Standard Temperature, Ambient Pressure, Dry 20 °C (68 °F), ambient pressure, dry gas
T_I, <i>T_{INSP}</i>	Inspiratory time
T_E	Expiratory time
T_I:T_E	Ratio of inspiratory time to expiratory time
T_{IP}:T_I	Ratio of inspiratory pause to inspiratory time
Trigger	Trigger
UMDNS	Universal Medical Device Nomenclature System, nomenclature for medical devices
USB	Universal Serial Bus, computer interface
VT	Tidal volume
ΔPPS	Differential pressure of the pressure support in Pressure Support mode

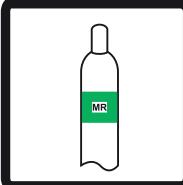
Symbols

Symbol	Explanation	Symbol	Explanation
	Manufacturer		No known hazards demonstrably present in an MR environment
	Date of manufacture		Do not use a D-Vapor in an MR environment
	Use by		Serial number
	WEEE label, Directive 2002/96/EC		Order number
	Consult instructions for use		Batch designation
	Warning! Strictly follow these instructions for use		Keep away from sunlight
	Caution! Observe the accompanying documentation!(symbol)		Storage temperature
	Attention! (safety sign)		Relative humidity
	Caution! Risk of electric shock. Do not remove cover.		Atmospheric pressure
	Applied part, protection class BF (Body Floating)		Do not use if package damaged
	Applied part of protection class B		Do not reuse
	ESD warning label, observe the warning statement, see "Information on electromagnetic compatibility" on page 12		Alarm inactive
	Risk of crushing		The alarm tone is suppressed for 2 minutes.
	Label on device surfaces where the risk of tipping is increased by e.g., leaning on or against the surface or pushing		Mains power
	No known hazards demonstrably present in a specific MR environment with defined application conditions		Partial power supply switched on
			Total power supply switched on
			Connection for potential equalization
			Auto Exclusion Plug-in connection
			Gas cylinder connection

Symbol	Explanation	Symbol	Explanation
	CO ₂ absorber bypass		Key to call up the configuration menu
	Read the flow at the center of the float.		Key for suppressing the acoustic alarm signal for 2 minutes
	Non-rebreathing system		Standby key
	Vaporizer plug-in system, "fixed" position		
	O ₂ flush		
	Connection to central gas supply		
	Breathing bag		
	Battery charge		
	Upper and lower alarm limits		
	Lower alarm limit		
	Upper alarm limit		
	Socket for O ₂ sensor		
	Socket for flow sensor		
	Socket for airway pressure sensor		
	Ventilator connection		
	Fuse		
	Do not oil!		
	Close menu		
	Key for access to alarm limits		
	Key to call up main screen		

Product labels

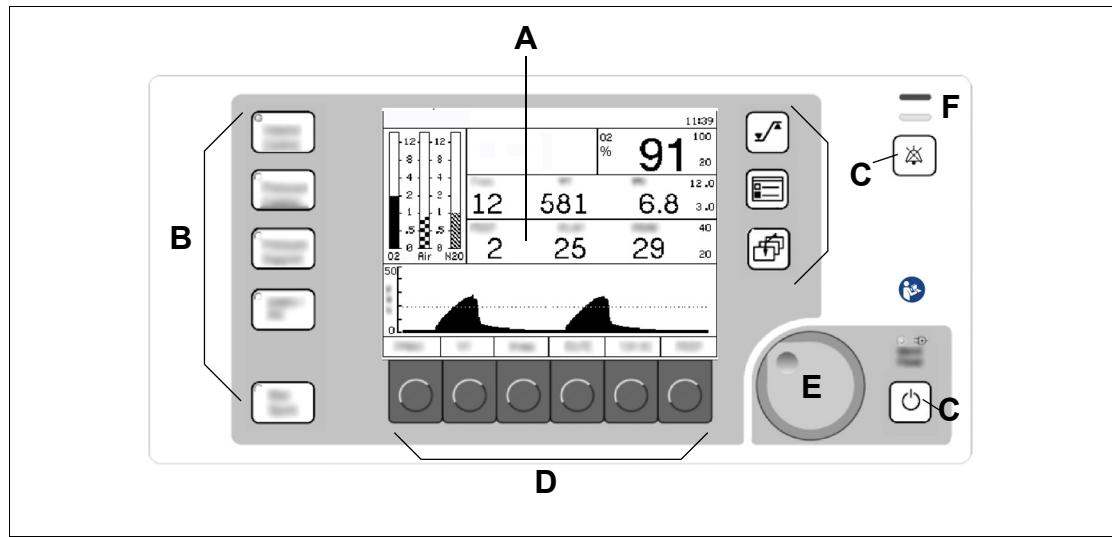
Product label	Explanation
 	When connecting auxiliary devices, be aware of the leakage current.
 	Transport instructions, see "Preparing for storage or transport" on page 114
 nom. 166 kg  max. 295 kg	Observe the weight of the nominal configuration and the total permissible weight, see "Technical data".
 <p data-bbox="306 1021 400 1038">Fabius MRI</p>  <p data-bbox="252 1185 431 1202">\leq 40 mtesla (400 gauss)</p>	Prescribed minimum distance from a magnetic resonance scanner or a magnetic source: \leq 40 mT (400 gauss)
	Use the central brake to lock the castors immediately after positioning the device in the MR environment.

Product label	Explanation
 	Only use with gas cylinders marked MR .

Operating concept

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Control panel



The control panel contains the following main elements:

- A** Screen
- B** Key to select ventilation modes
 - **Volume Control**
 - **Pressure Control**
 - **Pressure Support**
 - **SIMV/PS**
 - **ManSpont**
- C** Key for more functions

Key	Function
	Opens the window with alarm limits.

Key	Function
	<ul style="list-style-type: none"> ● In the mode Standby: Opens a menu for configuring the system settings and default settings, see chapter "Configuration in standby mode" on page 129 ● In a ventilation mode: Opens a menu for displaying and changing the monitoring settings, see chapter "Configuration during operation" on page 143
	Changes from displayed screen to the main screen.
	The alarm tone of all active alarms is suppressed for 2 minutes.
	Switches to Standby mode. Monitoring is switched off and the ventilator stops.

- D** Keys with variable functions (called "softkeys" in this document)
- E** Rotary knob to select and confirm screen settings
- F** LED indicators

Softkeys

The labeling on the softkeys depends on the active ventilation mode.

In all ventilation modes, the softkeys only display those ventilation parameters and ventilation functions that are available in the respective ventilation mode.

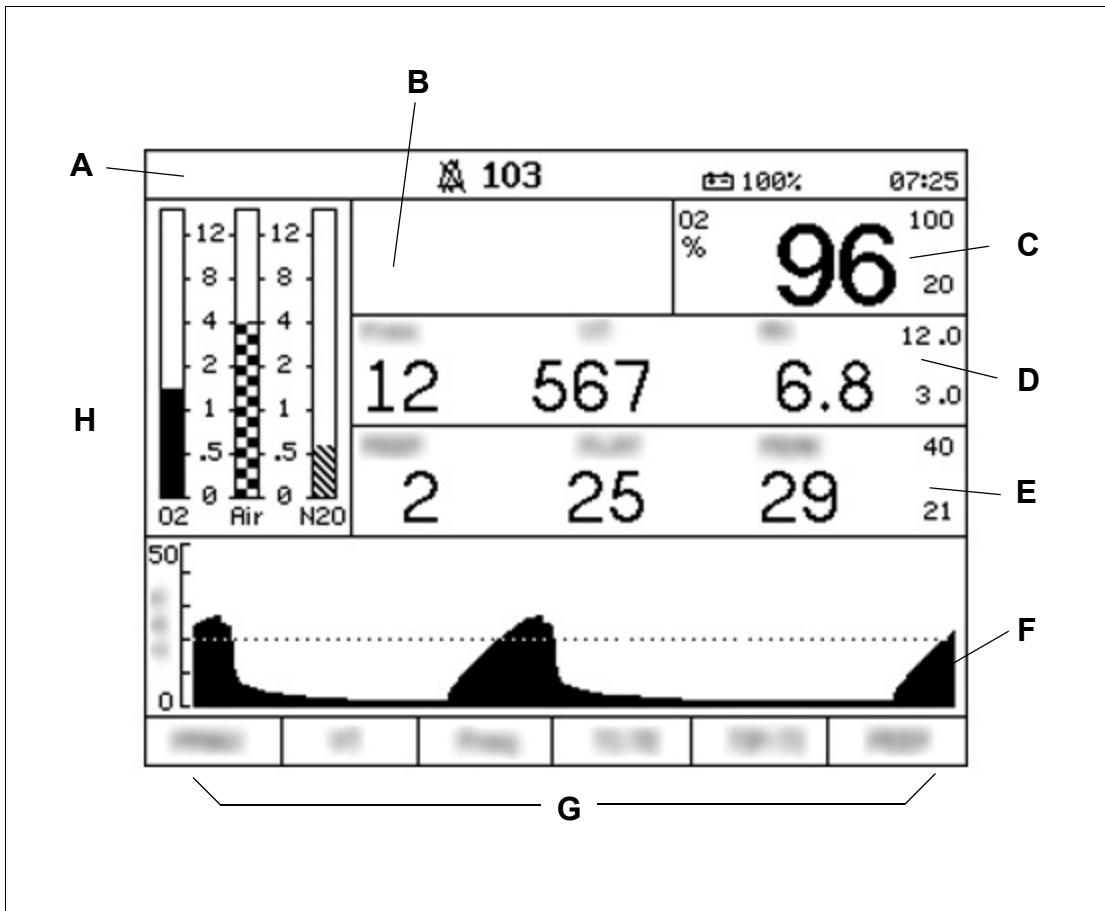
Example for **Volume Control** mode:

- **P_{MAX}**
- **VT**
- **Freq**
- **T_I:T_E**
- **T_{IP}:T_I**
- **PEEP**

More information can be found in chapter "Configuration in standby mode" on page 129.

Screen display

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



A Status bar

The following information is displayed in the status bar:

- Current ventilation mode
- Remaining time of alarm tone suppression
- Status of the desflurane compensation
- Remaining battery charge
- Current time

B Alarm message field

Display of maximum 4 alarm messages* with highest priority

C O₂ monitoring

Display of the inspiratory oxygen concentration in percent (%) as well as the upper and lower alarm limits

* for Japan and China maximum 3 alarm messages

D Volume monitoring

Display of:

- Respiratory rate of the patient in breaths per minute (**Freq**)
- Tidal volume (**VT**)
- Minute volume (**MV**)
- Upper and lower alarm limits of the minute volume

E Airway pressure monitoring

Display of:

- Positive end-expiratory pressure (**PEEP**)
- Mean airway pressure (**MEAN**)
- Plateau pressure (**PLAT**)
- Peak pressure (**PEAK**)

F Pressure waveform for airway pressure

G Softkeys (labeling depending on ventilation mode)

H Virtual flow tubes for O₂, Air, N₂O

Selecting and setting

Monitoring settings and system settings

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

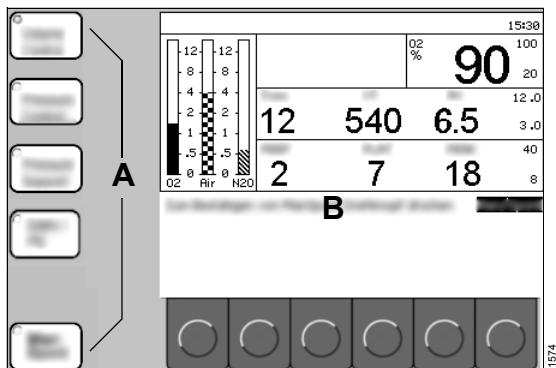
- To change a value or parameter or to navigate in the menus, turn the rotary knob.

In this document, these procedural steps are simply called "select."

- To confirm a value or a selection, press the rotary knob.

Without confirmation with the rotary knob the value or parameter is not changed. In this document, these procedural steps are simply called "confirm."

Changing the ventilation mode



1 Select a ventilation mode (A).

- The LED in the key flashes.
- The pressure waveform is replaced by a dialog window with ventilation settings.
- A message with further instructions (B) is displayed.

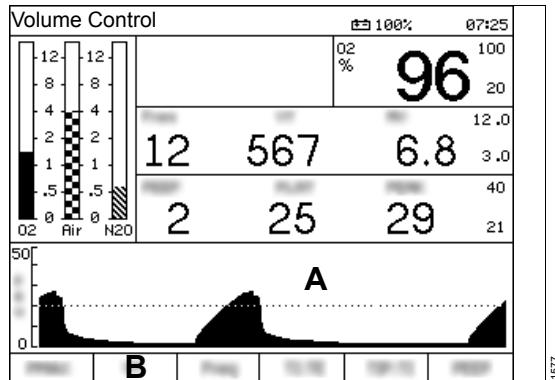
2 Confirm the ventilation mode.

- The LED in the key is continuously lit up.
- The pressure waveform is displayed again.

Selecting and setting the ventilation parameters

Example: Changing the parameter **VT** in **Volume Control** mode

Prerequisite: Fabius is in **Volume Control** mode

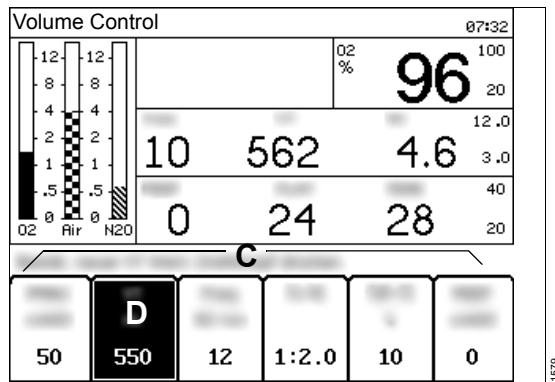


NOTE

The time limit for changes of ventilation parameters is 15 seconds. After 10 seconds, an acoustic signal consisting of 3 tones is sounded. If the new setting is not confirmed within the time limit, the current ventilation settings remain effective. Instead of the window with the ventilation settings, the pressure waveform is again displayed.

1 Press the **VT** softkey (B).

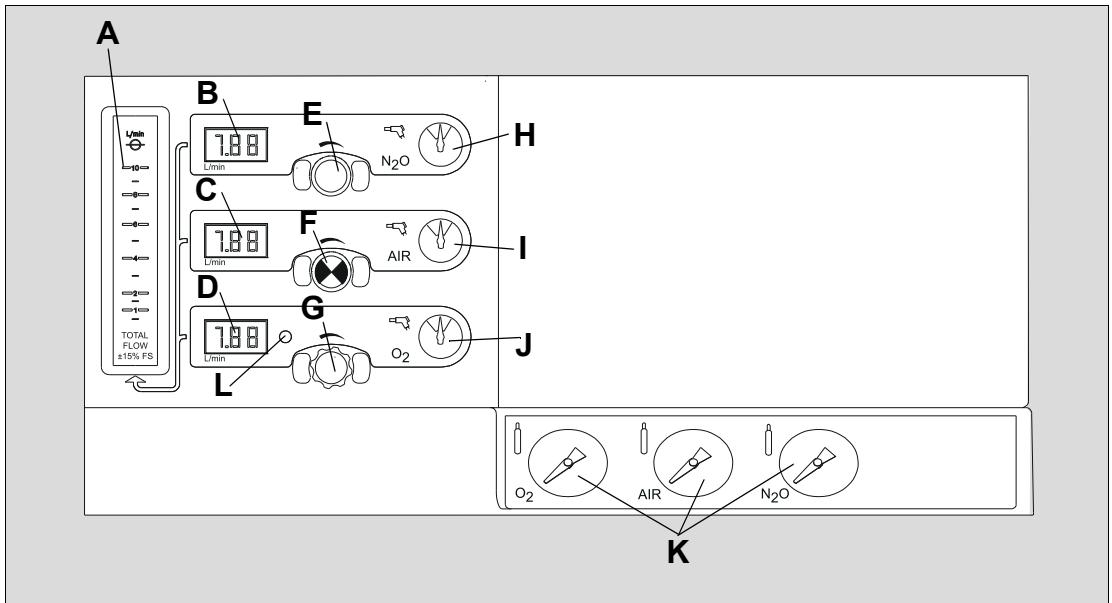
- The pressure waveform (A) is replaced by a dialog window with ventilation settings (C).
- The key (D) is highlighted.



2 Select new value and confirm.

- The pressure waveform is displayed again.

Fresh-gas delivery (version for 3 gases)



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The total flow tube and the pressure gauge are located on the front of the device below the screen.

There are 2 flow control valves for Air and O₂ on the gas mixer for 2 gases. There is a third flow control valve for N₂O on the gas mixer for 3 gases. All flow control valves are labeled and provided with a color coding, see chapter "Color coding for anesthetic agents and medical gases" on page 49.

The O₂ flow control valve is additionally provided with grooves on the gripping surface.

- A** Total flow tube that displays the sum of the individual flows of all used gases (O₂, Air, N₂O).
- B** Electronic N₂O fresh-gas flow display
- C** Electronic air fresh-gas flow display
- D** Electronic O₂ fresh-gas flow display
- E** N₂O flow control valve
- F** Air flow control valve
- G** O₂ flow control valve
- H** Pressure gauge for the central N₂O supply

I Pressure gauge for the central Air supply

J Pressure gauge for the central O₂ supply

K Pressure gauges for gas cylinders *

L LED warning indicator for low O₂ pressure

If the pressure drops below 20 psi (1.4 kPa x 100), the LED warning indicator lights up.

The displayed fresh-gas flow is in the range between 0 L/min and 12 L/min.

- If the value of the fresh-gas flow is higher than 12 L/min, the electronic fresh-gas flow display flashes (B, C, D).
- The electronic fresh-gas flow display shows "+".

NOTE

The electronic fresh-gas flow displays have an altitude adjustment.

* Use only with pin-index cylinder connections (not with screwed connections)

Total flow tube

NOTE

The total flow tube is calibrated for a mixture of N₂O and O₂ in a 50/50 ratio. The accuracy of the total flow tube might be reduced with other gas mixtures. More information can be found in chapter "Technical data" on page 186.

The total flow tube is used as a reference for the total volume of fresh gas that is introduced in the breathing system. The individual measured flow values for N₂O, Air, and O₂ are displayed on the respective electronic fresh-gas flow displays.

The total flow tube remains functional if the following faults occur:

- Fault in the electronic flow measurement
- Fault in the digital display
- Fault in the current switching circuit

In these cases, the measurement from the total flow tube indicates the total flow before the fault occurred.

To adapt the fresh-gas ratio during an exiting fault, close all flow control valves and reset the individual flows one after another. The O₂ valve can remain open.

Example: After the flow control valves are closed, the total flow tube indicates 2 L/min. This corresponds to an O₂ flow of 2 L/min.

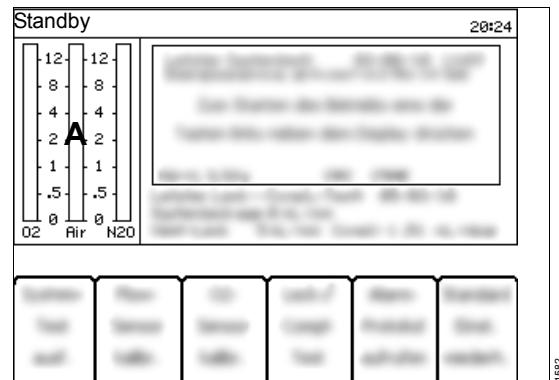
If 1 L/min N₂O is required, open the N₂O flow control valve until the total flow tube displays 3 L/min.

Monitoring resolutions for fresh-gas flow

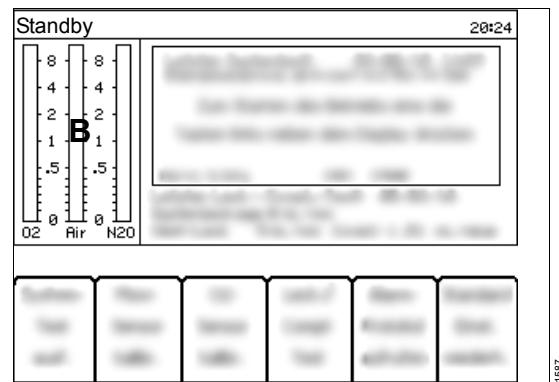
Fabius can be configured for the following resolutions of fresh-gas flow by DrägerService or the authorized local service partner:

- Standard resolution (A)
- High resolution (B)

If a flow is higher than 9.99 L/min, the standard resolution is activated.



If the standard resolution is configured, the electronic fresh-gas flow displays show the flow in increments of 100 mL/min (format xx.x L/min). The virtual flow tubes (A) of the screen indicate a range from 0 to 12 L/min.



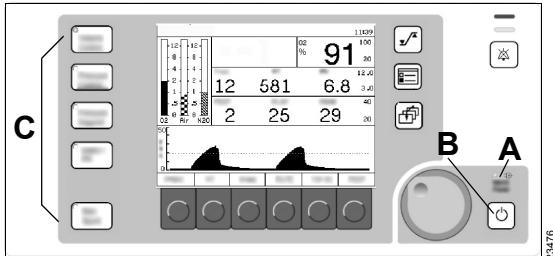
If a high resolution is configured, the electronic fresh-gas flow displays show the flow in increments of 10 mL/min (format x.xx L/min). The virtual flow tubes (B) of the screen indicate a range from 0 to 10 L/min.

If the respective flow again drops below 9.00 L/min, the high resolution is activated.

LED indicators

There are several LED indicators on the front of the device.

LEDs for operating status

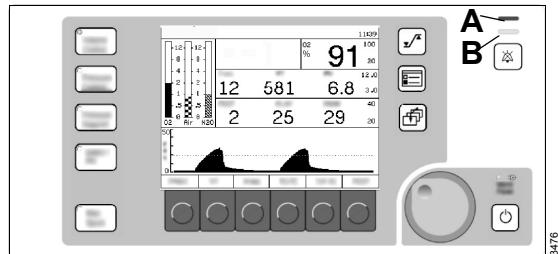


- If the device is connected to a mains power supply, the mains power LED (A) is lit up.
- In addition, the standby key (B) and all the keys for the ventilation modes (C) have small LEDs that light up when the respective mode is active.

LEDs for alarm status

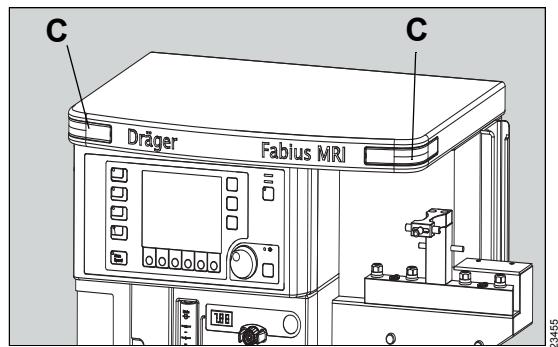
Fabius MRI has alarm LEDs and alarm LED bars which signal alarms and indicate the alarm priority. Further information can be found in the "Alarms" chapter.

Alarm LEDs



- Warning: Red LED (A) flashes
- Caution: Yellow LED (B) flashes
- Note: Yellow LED (B) lit constantly

Alarm LED bars



- The alarm LED bars are triggered by the same causes as the alarm LEDs (A and B).

Signaling in the event of a device failure

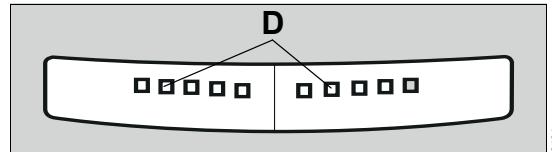
CAUTION

Risk of alarms not being noticed

If the device is not positioned correctly, there is a risk that alarms may be noticed too late or not at all.

- Position the device so that the alarm LED bars are visible from various viewing angles and from every location.
- Do not cover the alarm LED bars.

Example: Left-hand side of the device



- If the mains power supply and the battery fail, the device will no longer be ready for operation. Only the red LEDs (D) in the alarm LED bars (C) will be flashing.

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Color coding for anesthetic agents and medical gases

The standardized color coding specified in ISO 5359 / ISO 32 / ISO 5360 is used for anesthetic agents and medical gases.

The colors for O₂, Air, and N₂O are adapted according to locally applicable standards.

Screen colors

For improved visibility, Fabius displays the following screen elements in different colors:

- Softkeys (default)
- Alarm messages (see chapter "Alarm priorities")
- Virtual flow tubes (settings according to country-specific gas color codings)
- Screen background (bright/dark)

Assembly and preparation

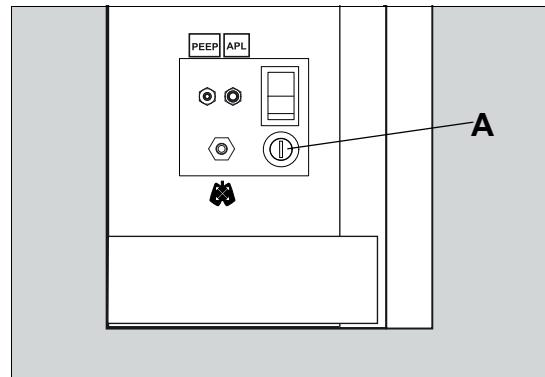
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Before first operation

WARNING

Risk of malfunctions and impaired imaging

The combination of anesthesia workstation (including vaporizers and accessories) and magnetic resonance scanner must be tested by trained service personnel in the operational environment before first operation. Otherwise there may be malfunctioning of the device or the imaging of the magnetic resonance scanner may be impaired.



23493

Activating the battery

To prevent discharging of the battery during transport and during storage, the fuse of the battery is not connected with the device.

- 1 Remove the packaging of the battery fuse.
- 2 Remove the fuse holder.
- 3 Insert fuse (A) in the fuse holder.
- 4 Screw the fuse holder in securely with a quarter turn clockwise.

WARNING

Risk of device malfunction

If the battery is not sufficiently charged and the mains power supply fails, operation cannot be maintained long enough.

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

WARNING

Risk due to reduced power supply from the internal battery

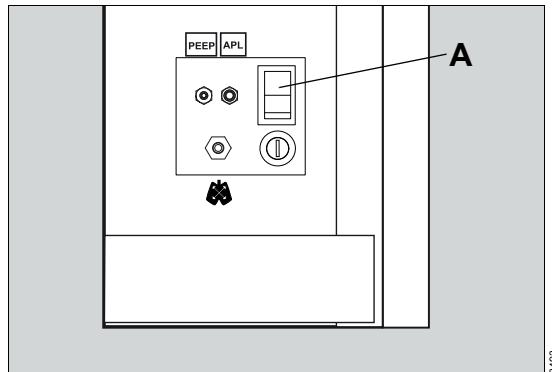
Batteries are wear parts. The capacity of the battery diminishes with the period of use.

Check the functional state of the battery by performing preventive maintenance on a regular basis.

Connecting the mains power supply

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

100 V to 240 V



- 1 Connect the power cable with the device.
- 2 Plug the power cable into the mains power socket on the wall.
LED on the front of the device lights up green.
- 3 Set On/Off switch (A) to position .
- 4 Check the status bar for the battery indicator.

23493

WARNING

Risk of electric shock and device malfunction

If the device is connected to a power socket with incorrect mains voltage or without a protective ground, the user can be injured and the device damaged.

Only connect the power cable to power sockets with a protective ground, see "Technical data".

WARNING

Risk due to magnetic forces of attraction

The power cable and the mains plug contain small ferromagnetic components.

Take care when handling mains plugs and power cables.

NOTE

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

Auxiliary power sockets

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 with the approval of the respective device 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 device malfunction

If the mains power fails, devices connected to the auxiliary power sockets are not supplied from the uninterruptible power supply.

- Do not connect any life-supporting devices to the auxiliary power sockets of the anesthesia workstation.
- Ensure an alternative power supply for connected devices.

WARNING

Risk of device malfunction

If high-frequency surgical devices are connected to the auxiliary power sockets, the leakage current can damage the electronics of the medical device and lead to a failure.

Do not connect any high-frequency surgical devices to the auxiliary power sockets of the medical device.

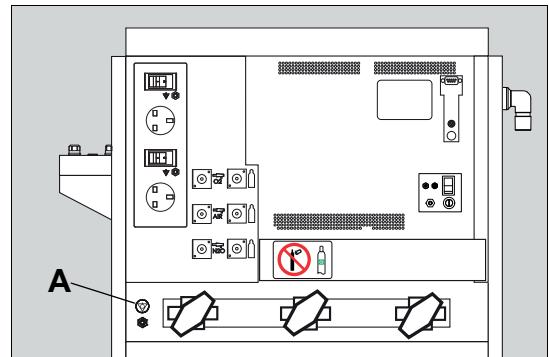
Establishing potential equalization

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

Potential equalization does not replace the protective ground connection.

In 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 (A) on the rear.
- 2 Connect the potential equalization cable to a potential equalization connector of the hospital (e.g., wall, ceiling supply unit, operating table).
- 3 Establish potential equalization to the auxiliary devices.

NOTE

If the good condition of the protective ground or its correct connection with the medical device cannot be ensured, the device must be operated via the internal power supply (battery).

Connecting 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

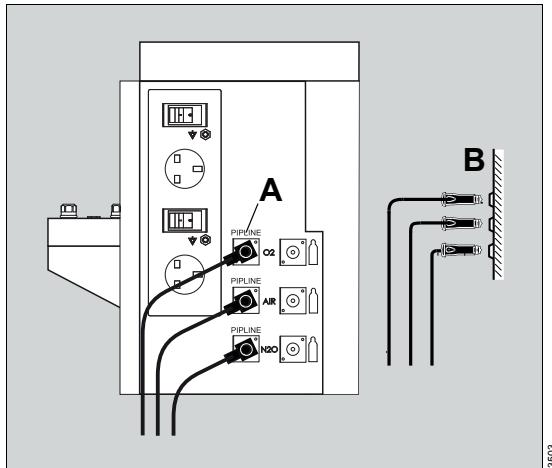
Risk of contamination of ambient air and risk of fire/explosion

O₂ or N₂O can get into the ambient air as a result of leakages.

- Make sure the compressed gas hoses are connected properly.
- Avoid and remedy all leakages.
- Ensure sufficient ventilation of the room.
- Use anesthetic gas scavenging system.

Central gas supply

Version for 3 gases



CAUTION

Risk of insufficient gas pressure

If the supply pressure of the central gas supply is too low, the functionality of the anesthesia workstation is compromised.

The pressure gauge of the individual gases must display a constant pressure between 41 and 87 psi (2.8 and 6 kPa x 100).

NOTE

A failure of the gas supply can lead to a failure of the connected devices.

WARNING

Risk to patient through incorrect gas connection

If the connections of the central gas supply hoses between the central gas supply and Fabius are interchanged, serious accidents can occur.

If Fabius is connected to the central gas supply, it must be checked whether the marks on the hoses agree with the connections of the central gas supply.

- 1 Screw the connection piece of every individual central gas supply hose hand-tight on the corresponding connection (A) on the device side.
- 2 Plug the probes of the central gas supply hoses in the appropriate wall terminal units (B).
- 3 Check if all central gas supply hoses are correctly connected.

Gas cylinders with pin-index system (optional)

WARNING

Risk due to magnetic forces of attraction

Steel cylinders will be attracted by the magnetic field and may become dangerous projectiles.

In MR environments, use only *MR* (*MR-safe*) marked cylinders (e.g., aluminum cylinders).

WARNING

Risk due to incorrect mounting of the gas cylinder

When using several sealing washers between the gas cylinder and the gas inlet of the cylinder holder, the pin-index safety system is compromised.

If a gas cylinder is connected, always check whether the pin-index pins are present. Never attempt to bypass the pin-index safety system.

WARNING

Risk of explosion

If the gas cylinder valves are opened too quickly, a sudden increase in pressure may occur.

- Open and close the gas cylinders valve slowly by hand.
- Do not use tools.

CAUTION

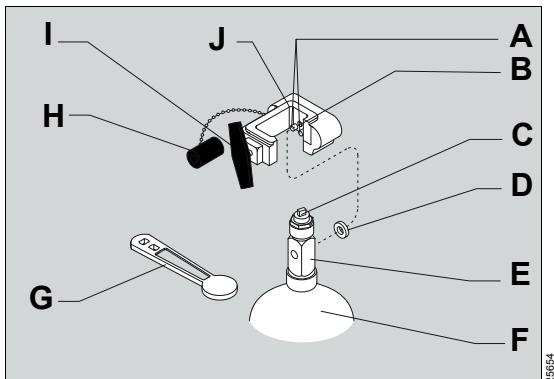
Risk due to gas supply failure

Leave gas cylinders as a backup at the anesthesia workstation, even if there is a connection to the central gas supply.

NOTE

Leaky and stiff gas cylinder valves must be repaired according to manufacturer's specifications.

Connecting the gas cylinders

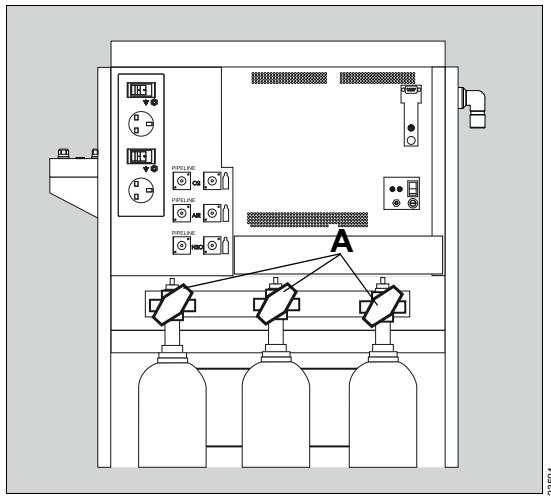


- 1 Remove the old sealing washer (D).
- 2 Insert a new sealing washer (D) at the cylinder holder (J).
- 3 Make sure that both pin-index pins (A) are present below the gas inlet (B).
- 4 Align the gas cylinder (F) so that the pin-index holes on the cylinder head (E) are pointing towards the pin-index pins (A) on the cylinder holder (J).
- 5 Insert the cylinder head (E) of the gas cylinder (F) from below into the cylinder holder (J).
- 6 Allow the pin-index pins (A) to engage in the pin-index holes.
- 7 Turn the handle (I) on the cylinder holder (J) 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 is suspended vertically.
- 8 Tighten the handle (I) of the cylinder holder (J).

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

If the gas cylinder is removed, insert the plug (H) in the mounted gas cylinder holder and tighten.

Checking the gas cylinders



The pressure specifications are based on gas cylinders of size E at 21 °C/70 °F. If the pressure in a gas cylinder does not reach the recommended minimum pressure (PSI - MIN), the gas cylinder must be replaced by a full gas cylinder.

Gas	PSI - FULL (kPa x 100 - FULL) (normal full load)	PSI - MIN (kPa x 100 - MIN)
Air	1900 (131)	1000 (69)
N ₂ O	745 (51)	600 (42)
O ₂	1900 (131)	1000 (69)

1 Open cylinder valves (A).

Make sure that the pressure gauges on the gas cylinders indicate the appropriate pressure recommended in the following table.

No hissing must sound when opening the cylinder valves.

In this case, the connection is leaking. The gas cylinder must be mounted again.

2 Close the cylinder valves again.

Maximum permissible dimensions of the gas cylinders

Type	Volume [L]	Ø [[mm] [in]]	Length [[mm] [in]]
PI size E	4.7	111 (4.3)	654 (25.5)
	4.0	111 (4.3)	654 (25.5)

Observe the following points:

- Do not exceed the maximum length of the gas cylinder including the pressure reducer / pin-index connection.
- The gas cylinders must not protrude over the lower edge of the trolley (observe maximum length of the gas cylinders).
- The O₂ cylinder must not be mounted on the right side (looking from the rear).

Gas cylinders with screw connections (optional)

WARNING

Risk due to magnetic forces of attraction

Steel cylinders will be attracted by the magnetic field and may become dangerous projectiles.

In MR environments, use only *MR* (*MR-safe*) marked cylinders (e.g., aluminum cylinders).

WARNING

Risk of explosion

When pressurized, O₂ is self-igniting in combination with oil or grease.

Do not oil or grease the gas cylinder valve or the pressure reducer of the O₂ cylinder. Do not touch with oily or greasy fingers.

WARNING

Risk of explosion

If the gas cylinder valves are opened too quickly, a sudden increase in pressure may occur.

- Open and close the gas cylinders valve slowly by hand.
- Do not use tools.

CAUTION

Risk due to gas supply failure

Leave gas cylinders as a backup at the anesthesia workstation, even if there is a connection to the central gas supply.

CAUTION

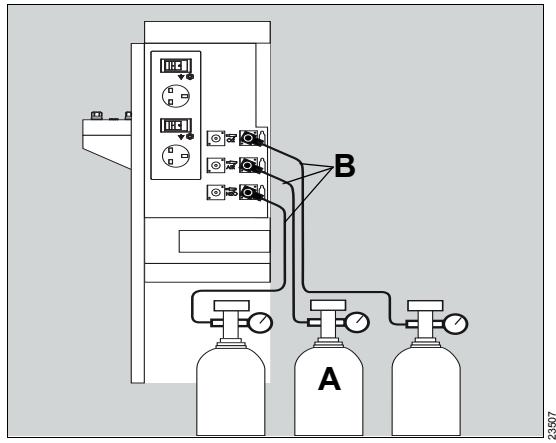
Risk of patient injury

Do not connect gas cylinders without the pressure reducers listed in the current list of accessories.

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

NOTE

Keep gas cylinders closed as long as they are not being used. There is the risk of accidental emptying of the gas cylinders.



WARNING

O₂ gas cylinders must not be mounted on the right side of the device (looking from the rear).

- 1 Place the full gas cylinders (A) in the cylinder holder and secure them.
- 2 Connect the pressure reducers to the cylinder valves. The connections must fit directly to each other. Do not use transition pieces.
- 3 Screw the compressed gas hoses (B) to the pressure reducers and to the connections of the gas supply block.
- 4 Open the cylinder valves.

Mounting the anesthetic vaporizers

Fabius MRI is operated in an MR environment with anesthetic vaporizers of type Vapor 2000 which have a plug-in adapter for the Interlock 2 connector system. The anesthetic vaporizers must be mounted in accordance with the respective instructions for use.

The vaporizers used must conform to the applicable safety standard.

If an independent gas measurement system is used, it must conform to the applicable safety standard.

CAUTION

Risk of impaired imaging

A vaporizer can affect the imaging of the magnetic resonance scanner.

Before first operation, a functional check must be performed.

The particular combination of vaporizer, anesthesia workstation, and magnetic resonance scanner must be tested for correct functioning in the magnetic field. When doing this, all positions of the anesthesia workstation and the vaporizer in which the devices are used in the course of daily work within the MR environment must be considered.

Furthermore, the check must investigate whether the imaging of the magnetic resonance scanner is impaired by the vaporizer and the anesthesia workstation.

The functional check must be performed by authorized technical service personnel for anesthesia workstations and magnetic resonance scanners who have been trained by the manufacturer, and are assisted by applications experts.

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.

- Strictly observe the instructions for use of the vaporizer.
- Compare the color coding on the vaporizer with the anesthetic agent bottle.

WARNING

Risk due to improperly mounted vaporizers

Incorrectly mounted vaporizers can cause leakage. This can cause the fresh-gas flow to be too low or contaminate the ambient air.

Patient and user can be endangered.

- Make sure that the vaporizers are mounted levelly.
- After mounting the vaporizers, perform a leakage test.

WARNING

Risk due to magnetic forces of attraction

During filling or emptying of Vapor 2000, ferromagnetic filling adapters and tools may be moved by the magnetic field.

Use only Dräger Fill filling adapters and filling adapters for the Dräger safety filling device that are marked as MR-safe.

WARNING

Risk due to magnetic forces of attraction

The vaporizer can be twisted out of the hand by the magnetic field, fall down, or be drawn into the magnetic resonance scanner.

Only remove or connect vaporizers outside the MR environment.

WARNING

Risk of leakage and incorrect delivery

If the vaporizer is not connected correctly, it may be moved out of its vertical position by the magnetic field. This may result in a malfunction of the interlock system and leaks may occur.

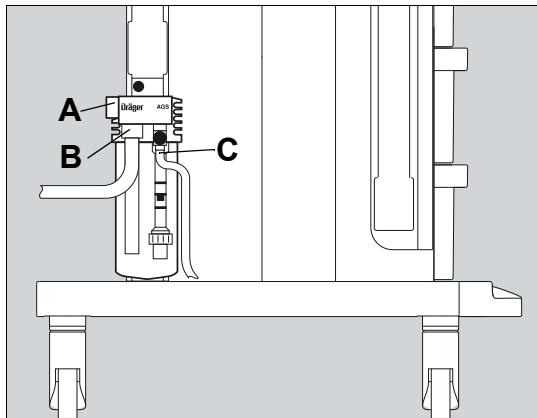
- Check that the vaporizer is correctly seated.
- Do not connect the vaporizer to Fabius MRI using hose connectors or conical connectors.

Ensuring the gas supply

Connecting the anesthetic gas receiving system (optional)

The anesthetic gas receiving system, in combination with Dräger anesthesia workstations and their modules, meets the requirements of general safety standards.

The anesthetic gas receiving system does not work as a stand-alone system, but is used as one of 3 components of an anesthetic gas scavenging system (AGSS).



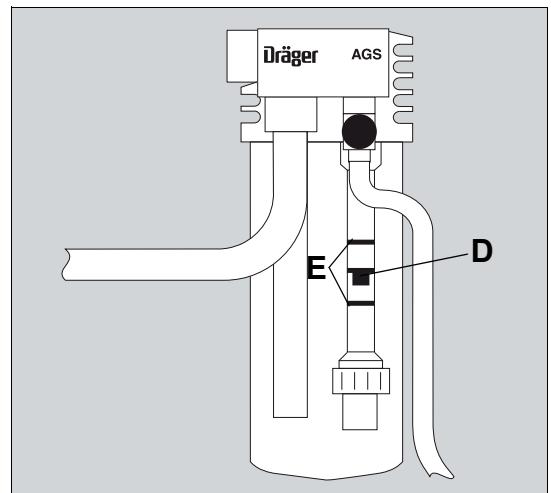
- 1 Fit the receiving system, with the slots resting on the corresponding pegs, on Fabius and slide down.
- 2 Use the screw plug (A) to seal the connection not in use.
- 3 Slide the transfer hose (B) to the provided port.
- 4 Connect the other end of the transfer hose to the exhaust port on the bottom of the COSY.
- 5 Connect the scavenging hose (C) to the corresponding port of the receiving system.
- 6 Connect the probe of the scavenging hose (C) to the terminal unit of the anesthetic gas scavenging system. Observe the associated instructions for use of the AGSS terminal unit.

WARNING

Risk of patient injury

If the side openings of the anesthetic gas receiving system are blocked, this can lead to a lack of fresh gas in the breathing system.

Make sure that the side openings of the receiving system are not blocked.



The top edge of the float (D) in the flow tube must move between the two marks (E).

More information can be found in the instructions for use (9038579) of the anesthetic gas receiving system.

Assembling the breathing system

WARNING

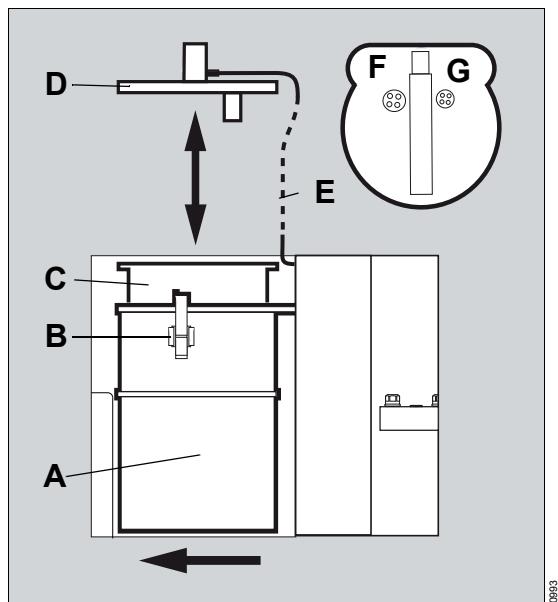
Risk of insufficient anesthetic gas concentrations

If the component connections of the breathing system are not leak-tight enough, ambient air may get into the breathing gas.

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

- 4 Insert the ventilator membrane (C). After assembly, the Dräger inscription must be visible.
- 5 Fit the cover (D) and close the 3 clamps (B).
- 6 Connect the pressure sensor line (E) of the ventilator chamber with the appropriate connector.
- 7 Close the ventilator door with the attached ventilator unit.

Preparing the ventilator



Only disinfected and sterilized components must be used.

- 1 Open the ventilator door (A) with the attached ventilator unit.
- 2 Release the 3 clamps (B).
- 3 Remove the cover (D).

Safety functions of the ventilator

- Overpressure safety valve (F)
- Underpressure safety valve (G)
- Pressure sensor in the ventilator chamber

Mounting the CO₂ absorber to the compact breathing system

WARNING

Risk of high inspiratory CO₂ values

If the soda lime is used too long, carbon dioxide can no longer be completely absorbed.

Check the color of the soda lime regularly, especially if the inspiratory CO₂ value increases unexpectedly. Replace if necessary.

WARNING**Risk due to soda lime drying out**

The soda lime loses moisture. If the moisture falls below the minimum moisture, the following adverse reactions occur independent of the type of soda lime and inhalational anesthetic used: Decreased CO₂ absorption, increased generation of heat in the CO₂ absorber resulting in increased breathing gas temperature, formation of CO, absorption and/or degradation of the inhalational anesthetics.

- Do not use unnecessarily high fresh-gas flows.
- Only use the supplemental O₂ delivery if necessary.
- Do not leave the flow control valves open unnecessarily long.

WARNING

Do not use soda lime based on potassium hydroxide. Otherwise, there is a risk of CO formation.

NOTE

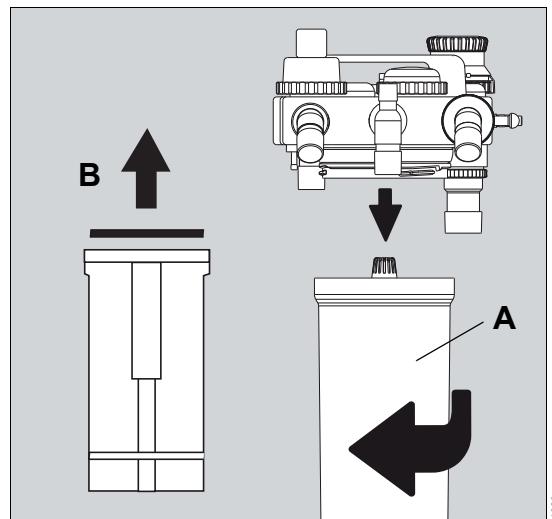
Only use pelletized soda lime. Otherwise, there is a risk of faulty measurement or incorrect delivery and progressive damage to the breathing system due to dust.

If conventional, non-pelletized soda lime is used, then a soda lime dust filter must be used.

Reusable CO₂ absorber**CAUTION****Risk of chemical burns**

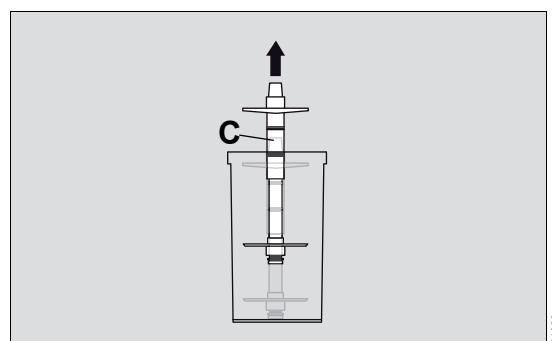
Soda lime is caustic and is a strong irritant for eyes, skin, and airway.

Handle the soda lime carefully and do not spill it.

Dismounting and emptying

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- 1 Turn the CO₂ absorber (A) clockwise and remove it from below.
- 2 Remove and dispose of the soda lime dust filter * (B).
- 3 Empty used soda lime and dispose of according to the instructions for use.

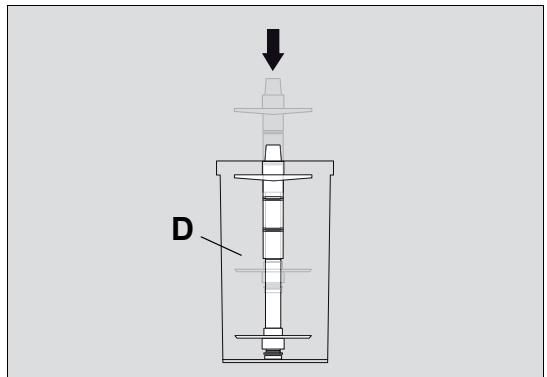


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- 4 If it is necessary to clean the absorber insert (C), remove the absorber insert from the absorber container. Leave the inner and outer sealing rings on the absorber insert.

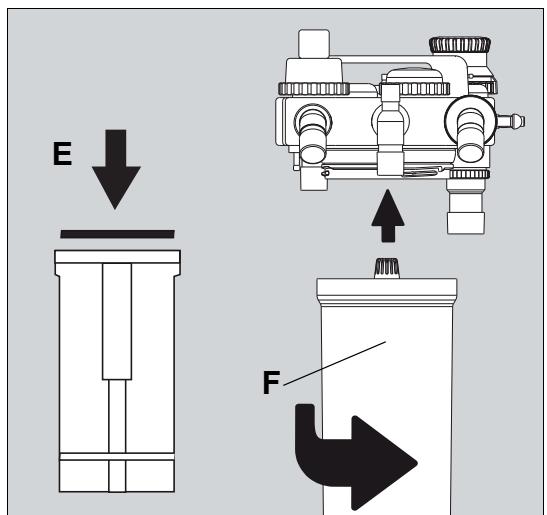
* optional

Filling and mounting



- 1 After any cleaning, push the absorber insert back into the absorber container (D) completely.
- 2 Fill CO₂ absorber with fresh soda lime to the upper mark.

Dräger recommends the use of Drägersorb 800 Plus or Drägersorb FREE.



- 3 Insert a new soda lime dust filter (E). Only use soda lime dust filters indicated in the list of accessories.

Only use undamaged filters, as exterior damage to the filter decreases protection!

- 4 Place the CO₂ absorber (F) below the compact breathing system in position and turn counterclockwise to the final position stop.

WARNING

Risk of hypoventilation

Reuse of the soda lime dust filter can increase filter resistance and impair the ventilation function of Fabius.

Replace the soda lime dust filter each time the soda lime is replaced.

NOTE

Make sure that no soda lime residues are between the seals and the seal surfaces. This type of residue can cause system leakages.

If conventional, non-pelletized soda lime is used, then a soda lime dust filter* must be used.

CAUTION

Risk of patient recovering consciousness

If the CO₂ absorber is not correctly locked into place, system leakage may occur.

Make sure that the absorber container is connected tightly to the compact breathing system during the ventilation.

* optional

Disposable CO₂ absorber with Drägersorb CLIC (optional)

As an alternative to reusable CO₂ absorbers, the disposable CO₂ absorber may also be used.

CLIC adapter allows the following single-use CO₂ absorbers to be used:

- CLIC Absorber 800+
- CLIC Absorber Free
- Infinity ID CLIC Absorber 800+
- Infinity ID CLIC Absorber Free

More information on the connection of Drägersorb CLIC-Adapters can be found in the associated instructions for use.

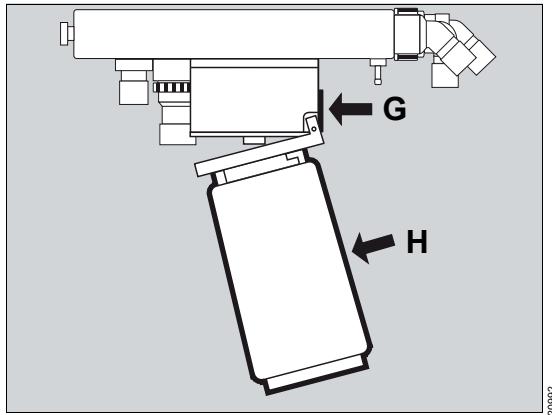
WARNING

Risk of insufficient ventilation

If the CO₂ absorber is not correctly locked into place, system leakage may occur. The CO₂ absorber must audibly engage before Fabius is switched on. This ensures that the CO₂ absorber is included into the leakage test and compliance test of the device.

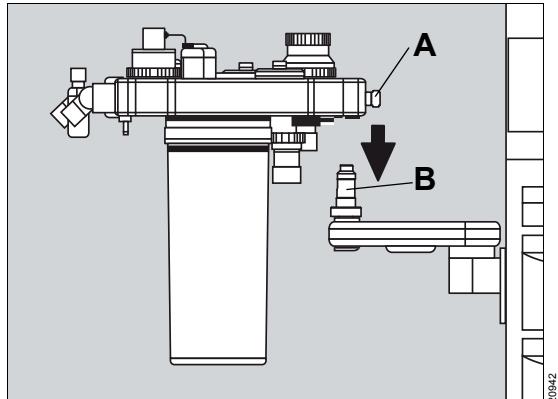
After mounting and replacing, make sure the CO₂ absorber is firmly locked into place.

- 1 Press the button (G): The CLIC adapter flips open.
- 2 Loosen the soda lime in the disposable CO₂ absorber, e.g., turn over the disposable CO₂ absorber a few times.
- 3 Remove the seal of the new disposable CO₂ absorber. Push the disposable CO₂ absorber in the Clic adapter.
- 4 Push the disposable CO₂ absorber (H) upwards into the CLIC adapter, until the CLIC adapter engages.

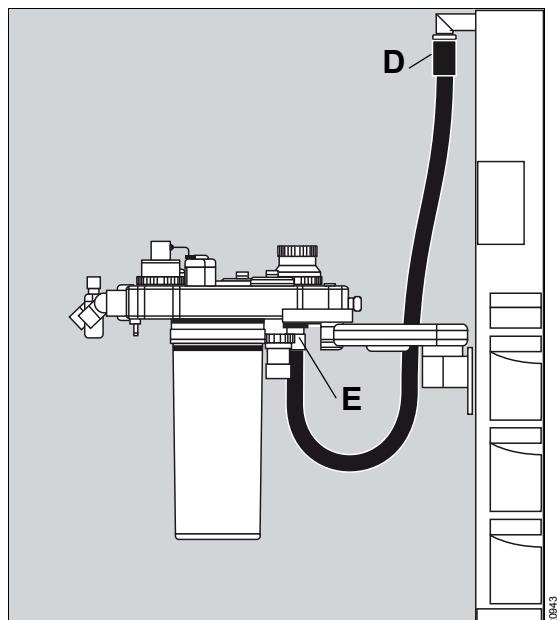


Connecting the compact breathing system

- 4 Connect the fresh-gas hose (C) to the corresponding connection of the compact breathing system.



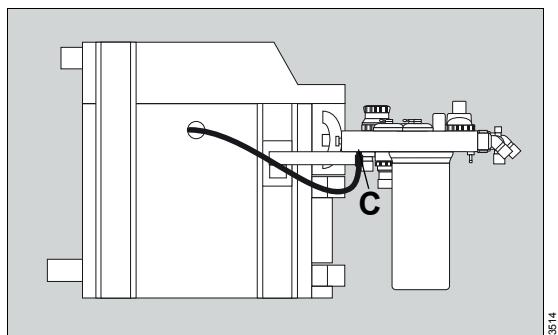
- 1 Completely pull out the locking pin (A) and hold it in that position.
- 2 Insert the assembled compact breathing system in the provided holder (B).
- 3 Release the locking pin again and turn the compact breathing system until the locking pin engages.



- 5 Connect the ventilator hose to the corresponding connector (D) on the anesthesia workstation.
- 6 Connect the other end of the ventilator hose to the ventilator connector (E) of the compact breathing system.

If Fabius has a screw connection, the sealing rings of this screw connection must be undamaged and clean.

Only hand-tighten the screw connection. Do not use tools.



Inserting the flow sensor

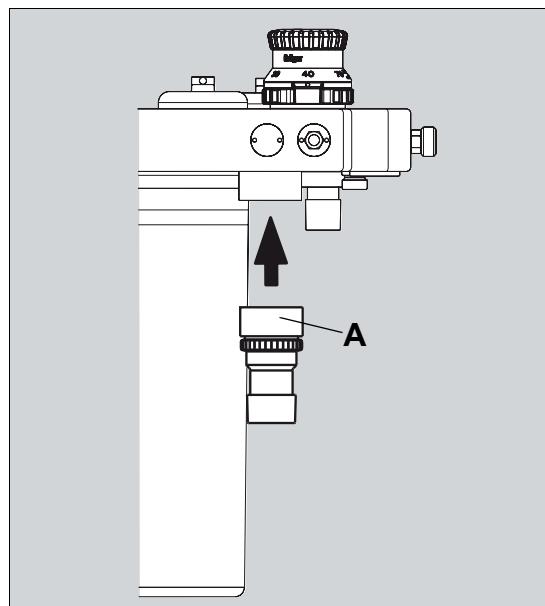
WARNING

Risk of fire

Residual vapors of easily flammable disinfectants (e.g., alcohols) and deposits that were not removed during reprocessing can ignite when the flow sensor is in use.

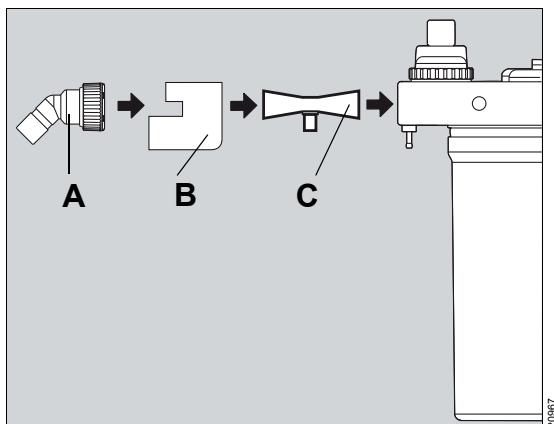
- Ensure particle-free cleaning and disinfection.
- After disinfection, allow the flow sensor to air for at least 30 minutes.
- Before inserting the flow sensor, check for visible damage and soiling such as residual mucus, medication aerosols, and particles.
- Replace flow sensors when damaged, soiled,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

Connecting the exhaust port



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- Screw on the exhaust port (A) in the compact breathing system from below.



- 1 Screw out the expiratory port (A).
- 2 Remove the flow-sensor guard* (B).
- 3 Insert the flow sensor (C).
- 4 Replace the flow-sensor guard* (B).
- 5 Screw the expiratory port (C) back on.

* optional

Connecting the breathing bag

WARNING

Risk of use of toxic or incompatible materials

The breathing bag used must comply with the current standards.

WARNING

Risk of too high airway pressure or insufficient fresh-gas

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

Attach and position the breathing bag so that it is not pinched and can inflate freely.

WARNING

Risk due to magnetic forces of attraction

The flexible breathing bag holder (part number 8606462) contains ferromagnetic parts and can be attracted by the magnetic resonance scanner.

- Do not use the breathing bag holder (part number 8606462).
- Use only breathing bag holders that are marked as MR-safe or MR-conditional.

CAUTION

Risk of patient recovering consciousness

A blocked or incorrectly positioned breathing bag can lead to lack of fresh gas for patients. Manual ventilation is also not possible.

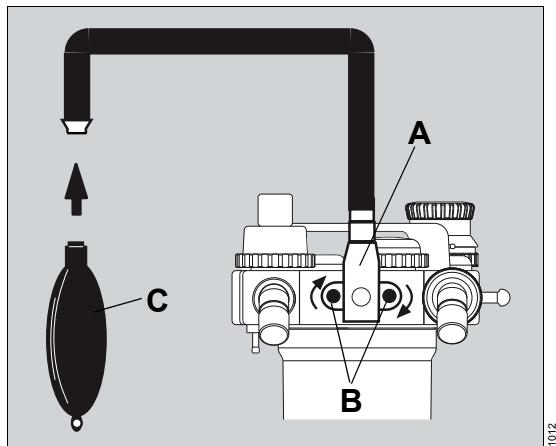
Make sure that the breathing bag is connected tightly to the bag holder during the ventilation.

The breathing bag can be mounted to the compact breathing system with the following variants:

- On a rigid arm
- On the bag elbow directly on the compact breathing system

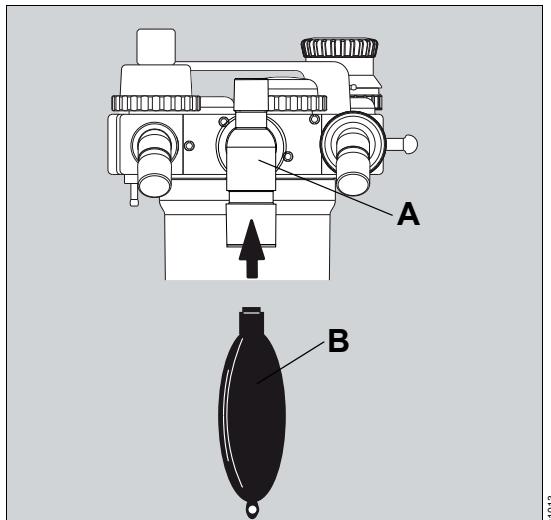
Mounting the rigid arm

Prerequisite: Before mounting the rigid breathing bag holder, the bag elbow on the compact breathing system must be removed.



- 1 Position and align the connection adapter (A) of the rigid arm on the connection of the compact breathing system.
- 2 Tighten the knurled screws (B). Check that the arm is fixed securely.
- 3 Fasten the breathing bag (C) at the other end of the rigid arm.

Mounting the bag elbow

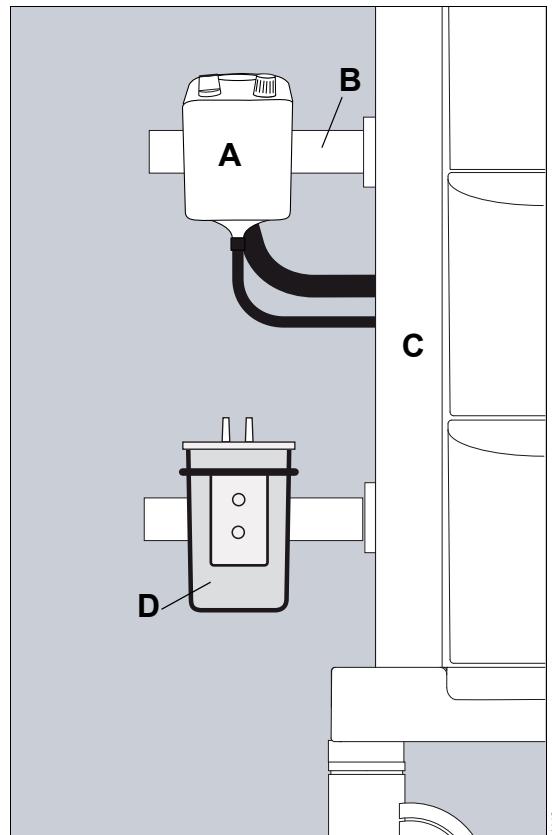


- 1 Attach the bag elbow (A) on the connection of the compact breathing system.
- 2 Attach the breathing bag (B) on the connector of the bag elbow.

Connecting the endotracheal suction system (optional)

The endotracheal suction system for Fabius consists of:

- Suction regulator (A)
 - Suction bottle (D)
- 1 The suction regulator (A) is attached to a holder (B). The holder is fastened on the side GCX rail (C) on Fabius.
 - 2 The suction bottle (D) is attached to a separate holder.



Suction systems used

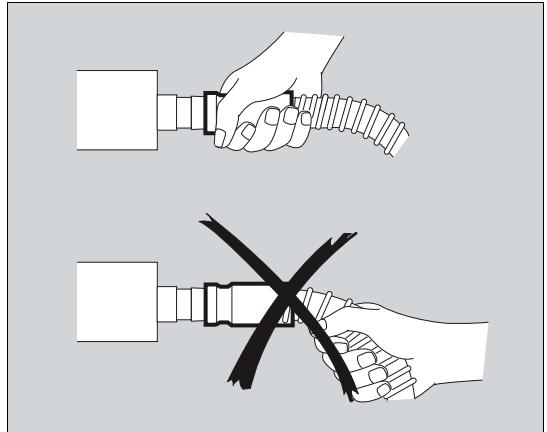
When using an ejector suction with drive gas:

- Connect the Air connection hose of the suction system via a 3-way adapter to the gas supply block or the central gas supply.

For vacuum suction:

- Connect the vacuum hose of the suction system directly to the central gas supply.

Prepare the suction system in accordance with the associated instructions for use.



WARNING

Risk of patient injury

Only use the suction system if the ventilation mode *ManSpont* is active or the patient is disconnected from the Y-piece.

Connecting the breathing hoses and the filters

WARNING

Risk of burns

Conductive breathing hoses or face masks can cause burns during HF surgery.

Do not use this type of hose and mask combined with HF surgery.

WARNING

Risk of impaired imaging

Silicone breathing hoses are visible as artifacts on tomography images.

Only disposable breathing circuits are approved.

CAUTION

Risk to patients by damaged breathing hoses

If the coil reinforcement of a breathing hose is damaged, there is risk of kinking or occlusion.

When attaching or removing the breathing hoses, always hold them at the connection sleeve and not at the coil reinforcement. Otherwise the coil reinforcement can become separated from the connection sleeve. Check the breathing hoses for damage before each use.

WARNING

Risk of strangulation

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

Use particular caution when establishing connections to the patient.

WARNING

Risk of use of toxic or incompatible materials

The breathing hoses must comply with the current standards.

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.

NOTE

If it is not possible to use an expiratory filter (e.g., due to an intrinsic PEEP due to air trapping), hygienically reprocess the device after use with this patient, see chapter Cleaning, disinfection and sterilization.

WARNING

Risk of infection

If no microbial filter is used, the breathing system may become contaminated with disease-causing germs.

In this case, hygienically reprocess the breathing system after each patient.

NOTE

Fabius contains no components made of natural rubber latex.

For latex-free use, use a latex-free breathing bag and breathing hoses.

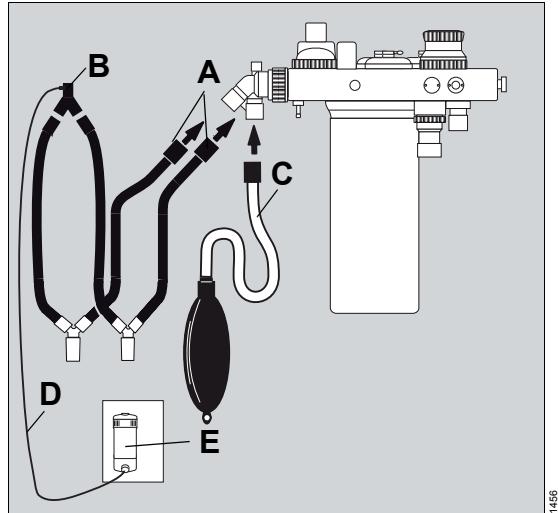
- 1 Select suitable accessories for the respective patient category.

	Adults		Pediatric patients	Neonates
Tidal volume	>700 mL	201 to 700 mL	50 to 200 mL	<50 mL
Breathing bag	3 L	2 L	1 L	0.5 L
Breathing circuit	Adults		Pediatric	Neonates (or pediatric)
Filter	Filter, HMEF, or HME		Use filters with low resistance and compliance.	

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.

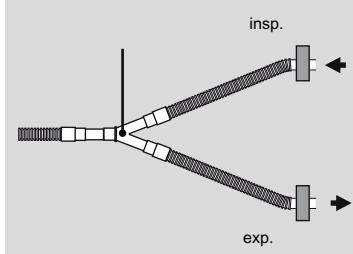
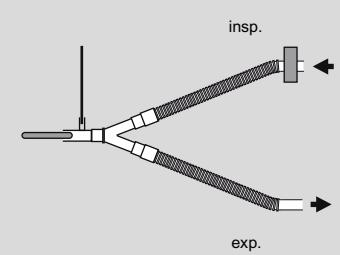
- 4 Connect the sample line (D) to the connector of the Y-piece (B) and to the connector of the water trap (E) on the patient-gas measurement module.
- 5 Connect the breathing bag hose (C) with the breathing bag to the corresponding connector.



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- 2 Connect a breathing hose (A) on each of the inspiratory port and expiratory port, optional with microbial filter installed.
- 3 Connect both breathing hoses on the Y-piece (B).

Table with recommended hose configurations*

Adults	Pediatric patients	Neonates
In MR environments, filters or HMEFs may only be connected on the device side:		Filter at inspiratory port, connection for sample line as close to patient as possible:  <p>Lateral connections for the sample line support CO₂ measurement and help to flush the dead-space between Y-piece and hose adapter.</p>

WARNING**Risk of underpressure in the lungs**

If filters are blocked, the sample gas flow can immediately cause underpressure in the lungs.

When ventilating pediatric patients and neonates, do not use HMEF or other filters at the Y-piece in connection with a hose adapter that have a patient-side connection for a sample line.

For measurement purposes, a permanent sidestream flow flows through the sample line to the patient-gas measurement module. With blocked HME filter or filter in this position on the Y-piece, the measurement system will cause underpressure situations in the patients lungs.

* The resistance of the breathing system and any connected accessories must be allowed for.

Observing the resistance and compliance

WARNING

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 using such configurations, the user must pay special attention to the measured values.

CAUTION

Risk due to misleading data

Replacing breathing hoses, filters, vaporizers, or soda lime can change the determined leakage values and compliance values of the anesthesia machine and thus affect therapy.

- Perform a leakage test and compliance test after replacing breathing hoses, particularly flex hoses, vaporizers, or soda lime.
- Perform a leakage test and compliance test after changing the length of extendable hoses.

CAUTION

Risk due to changed hose lengths

Changed hose lengths can change resistance and compliance. For neonates, this can cause increased or reduced breathing volumes.

For neonates in particular, do not use flex hoses.

WARNING

Risk of increased rebreathing

Leakages between the inner and outer hose of a coaxial breathing circuit cannot be detected during the leakage test.

To prevent insufficient gas exchange or CO₂ rebreathing, pay strict attention to the measured gas concentration.

CAUTION

Risk of impaired imaging

Patient-side filters are potentially visible as artifacts on tomography images.

Connect a 654 ST Isoclic reusable microbial filter (part number 6733895) to the inspiratory port and/or expiratory port of the breathing system.

Higher resistance values during spontaneous breathing lead to an increased work of breathing in the patient.

During volume-controlled ventilation, an increased resistance during inspiration has a slight effect on the applied volume. The peak pressure increases, however, with constant plateau pressure.

Therefore, the time constant increases during the expiratory phase. When applying too short expiratory times, this can lead to an incomplete emptying of the lungs. This leads to a dynamic overinflation of the lungs (airtrapping).

During pressure-controlled ventilation, an increased resistance can decrease the inspiratory and expiratory volumes.

Before the self test is carried out, the accessories^{*} provided for the application must be connected. Extendable hoses must be pulled out to the length intended by the user. Only in this way is the compliance correctly determined and with volume-controlled ventilation a correct tidal volume applied.

Calculating the resistance of the breathing system and connected accessories

To keep the patients' breathing effort as low as possible, according to the general safety standards a total resistance of 6.0 hPa (cmH₂O) at 60 L/min must not be exceeded during inspiration or expiration.

The chapter "Technical data" contains the inspiratory and expiratory resistance values of the breathing system without taking into consideration the breathing hoses. In this manner it is possible to determine the respective resistance of the patient when using different breathing hose sets and/or filters.

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

$$R_{\text{Insp}} = R_{\text{Breathing system_insp}} + R_{\text{insp hose}} + R_{\text{Breathing bag hose}} + R_{\text{insp filter(port)}} + R_{\text{insp filter(Y-piece)}}$$

$$R_{\text{Exsp}} = R_{\text{Breathing system_exsp}} + R_{\text{Exsp hose}} + R_{\text{Exsp filter(port)}} + R_{\text{Exsp filter(Y-piece)}}$$

Make sure that for the calculation of the resistance only the accessories resistance values and the peak flows are used for the respective accessory category and patient category, e.g., resistance values for adults at 60 L/min, for children at 30 L/min, and for neonates at 5 L/min.

Inserting a new O₂ sensor capsule

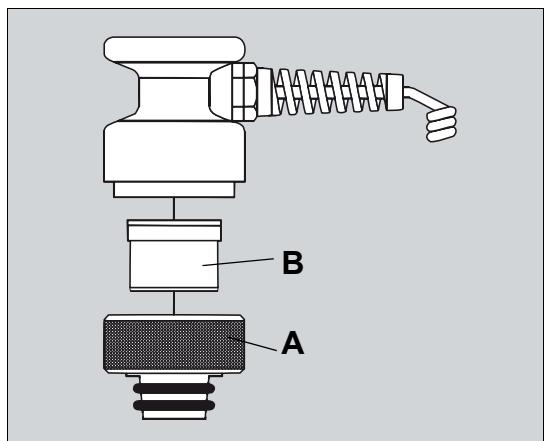
WARNING

Risk of electric shock

If the O₂ sensor is replaced during operation, it can lead to transferring of leakage current.

Do not touch the patient.

* If necessary, include additional parts such as water traps and additional hoses.



- 2 Unscrew the screw cap (A) from the O₂ sensor housing.
- 3 Take the new O₂ sensor capsule from the package.
- 4 Place the O₂ sensor capsule (B) in the housing so that the ring-shaped conductor touches the contacts in the housing.
- 5 Screw on the screw cap (A) tightly by hand.
- 6 Reinsert the O₂ sensor housing in the inspiratory valve.

WARNING

Danger of erroneous O₂ measurement.

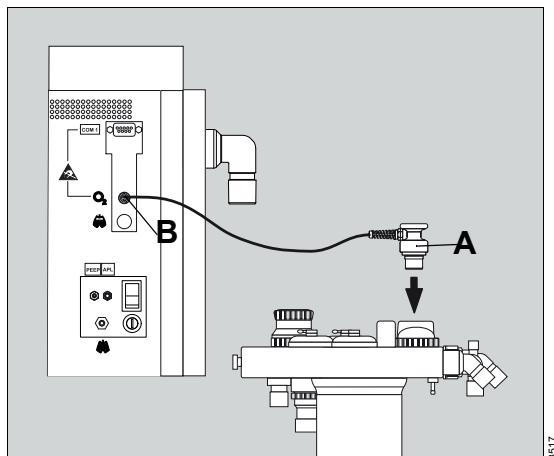
An incorrectly mounted O₂ sensor will lead to incorrect measurement results.

Make sure that the O₂ sensor is inserted correctly in the inspiratory valve, see page 26.

- 1 Remove the O₂ sensor housing from the inspiratory valve.

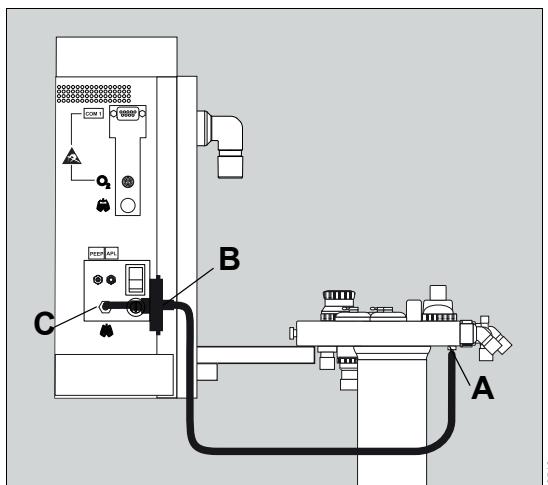
Connecting the sensors and measurement lines

Connecting the O₂ sensor



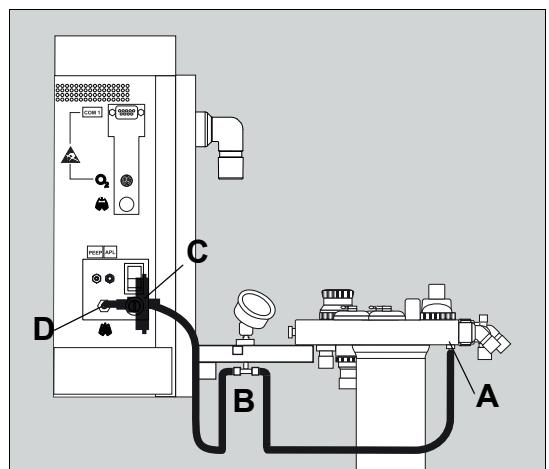
- 1 Insert the O₂ sensor (A) into the opening of the inspiratory valve on the compact breathing system.
- 2 Connect the plug (B) of the O₂ sensor cable with the connection marked with O₂ on the rear of the device.

Connecting the pressure sensor



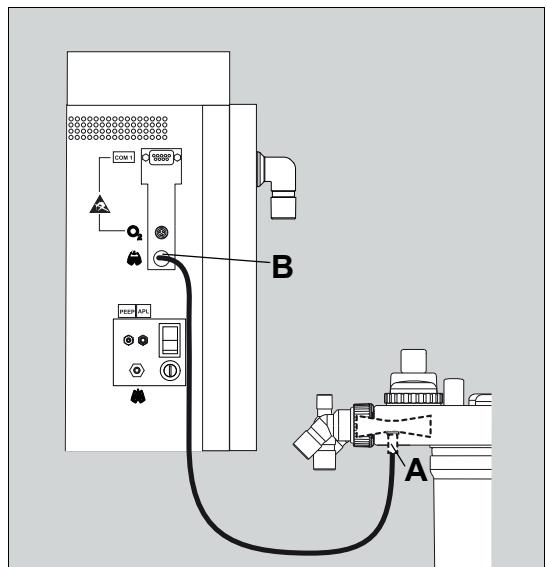
- 1** Connect the pressure measurement hose (C) to the corresponding connection on the bottom of the compact breathing system.
Make sure that the pressure measurement hose is not pinched.
- 2** Connect the other end of the pressure measurement hose with the bacterial filter (B).
- 3** Plug in the bacterial filter into the connection (C) marked with on the rear of the device.

Connection of the pressure gauge for measurement of the airway pressure (optional)



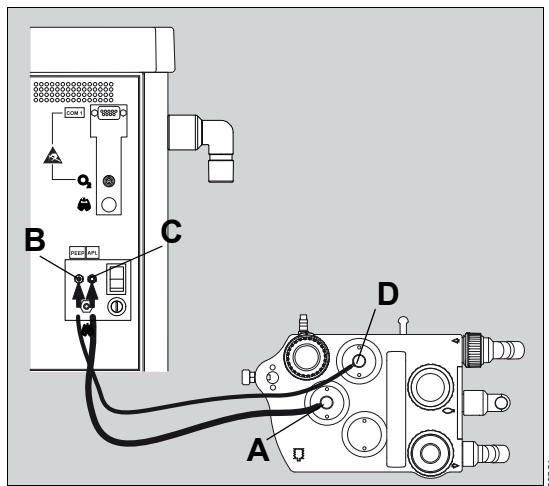
- 1** Connect the pressure measurement hose (C) to the corresponding connection on the bottom of the compact breathing system.
- 2** Connect the T-piece (B) with the pressure measurement hose and the pressure gauge.
- 3** Connect the other end of the pressure measurement hose with the bacterial filter (B).
- 4** Plug in the bacterial filter into the connection (D) marked with on the rear of the device.

Connecting the flow sensor



- 1 Connect the flow sensor cable to the corresponding connection (A) on the bottom of the compact breathing system.
- 2 Plug in the other end of the flow sensor cable into the connection (B) marked with on the rear of the device.

Connecting the APL bypass hose and PEEP/PMAX hose



- 1 Connect the APL bypass hose to the corresponding connection port of the APL bypass valve (A) on the compact breathing system.
- 2 Connect the other end to the hose on the connection marked with **APL** (C) on the rear of the device.
- 3 Connect the PEEP/PMAX hose to the corresponding connection port of the PEEP/PMAX valve (D) on the compact breathing system.
- 4 Connect the other end of the hose on the connection marked with **PEEP** (B) to the rear of the device.

NOTE

The APL bypass hose is thicker than the PEEP/PMAX hose.

Instructions for mounting the accessories

CAUTION

Observe the assembly instructions of the accessory.

WARNING

Risk of tipping and risk of injury

If the maximum permissible weight is exceeded or if monitors and other auxiliary devices are placed on the medical device, the device can fall. Especially if the medical device is rolled over door thresholds and similar obstacles.

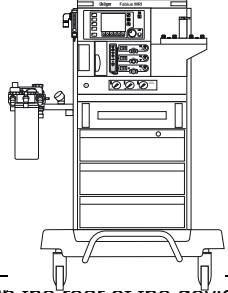
Before moving the device, remove the monitors and other additional devices.

CAUTION

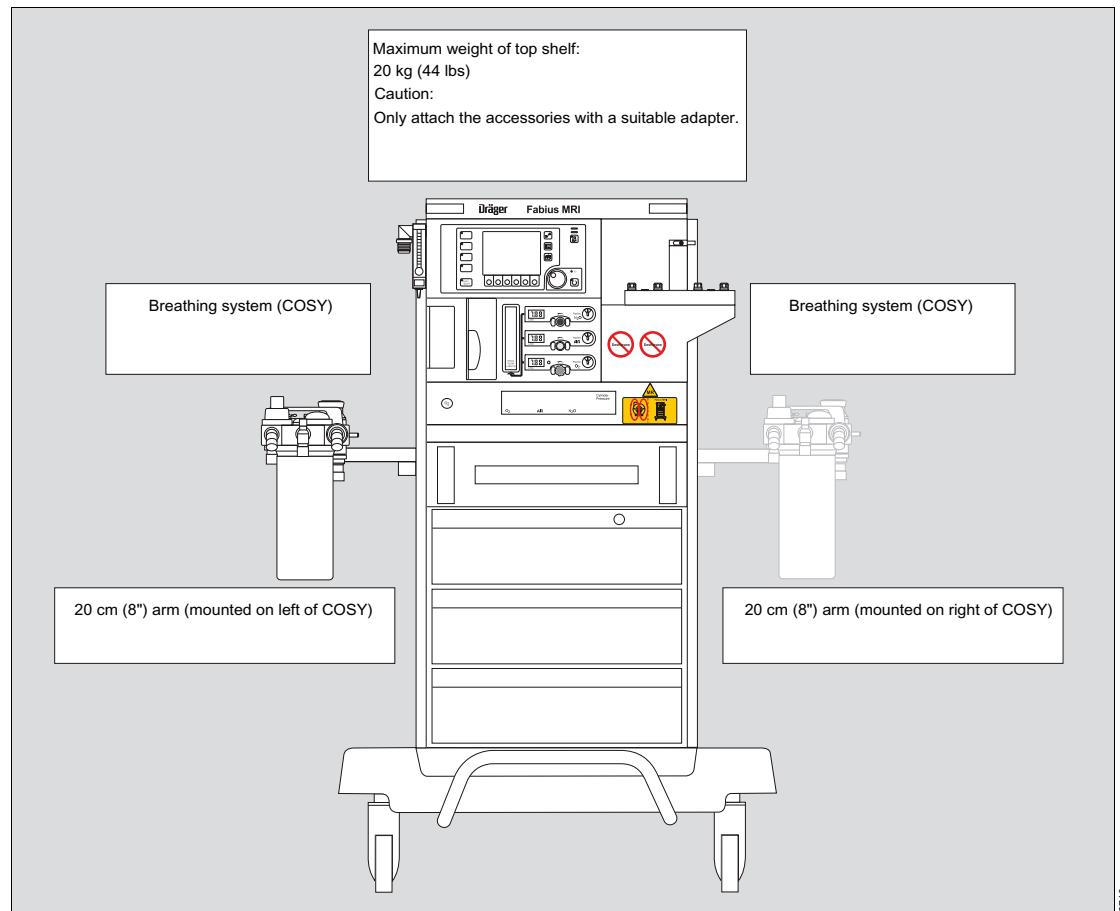
Risk of impaired imaging

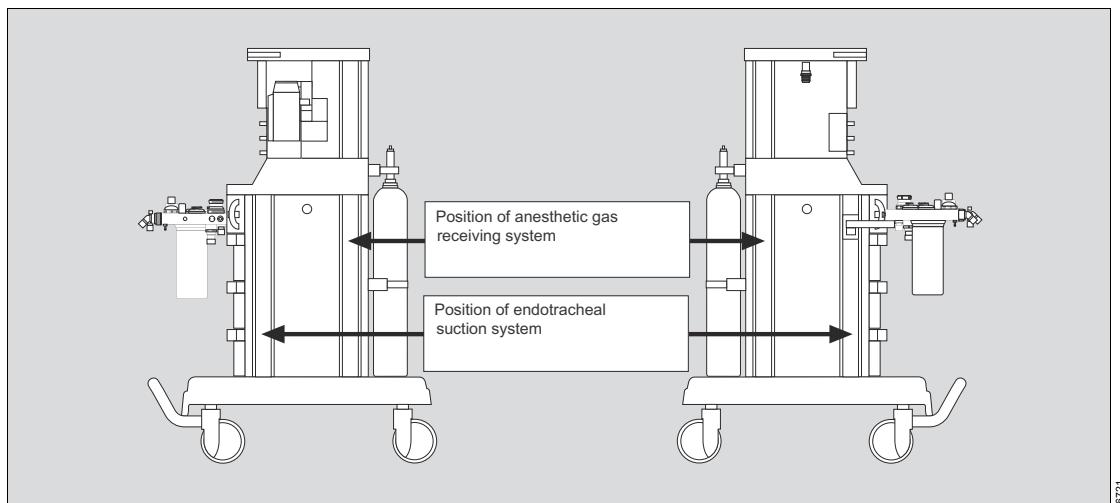
In an MR environment, wired RS232 cables cause artifacts in the tomography images.

Use only the fiber optic RS232 cable approved by Dräger (part number 8608376).

Left side	Top of device		Right side
<ul style="list-style-type: none"> – The maximum permissible weight of the accessories is 30 kg (66 lbs). – A max. of 15 kg (33 lbs) may be attached in the rear top GCX rail at a distance of max. 40 cm (16") at the top position. – The remaining weight must be attached with a distance of max. 10 cm (4"). 	<p>The maximum permissible weight of accessories on the monitor housing is 20 kg (44 lbs)</p>  <p>A maximum of 10 kg (22 lbs) can be set on the optionally available Fabius pull-out writing tray.</p> <p>The individual drawers in the trolley may be loaded with maximum 4 kg (8.8 lbs).</p> <p>On the rear of the device, a maximum of 35 kg (77 lbs) (gas cylinders, including holder and accessories) can be attached.</p>		<ul style="list-style-type: none"> – The maximum permissible weight of the accessories is 30 kg (66 lbs). – A max. of 15 kg (33 lbs) may be attached in the rear top GCX rail at a distance of max. 40 cm (16") at the top position. – The remaining weight must be attached with a distance of max. 10 cm (4").

Accessory positions





To increase the tipping stability:

- Remove all monitors and other additional devices from the top shelf.
- Dismount any additional devices mounted to the swivel arms or the top of the device (e.g., patient monitors, data management systems, syringe pumps).
- Clear the writing tray and slide it completely into the device.
- Position the holder for the breathing bag close to the device.

Prepare additional components as described in the respective instructions for use.

Positioning Fabius MRI

WARNING

Risk of excessive field strengths

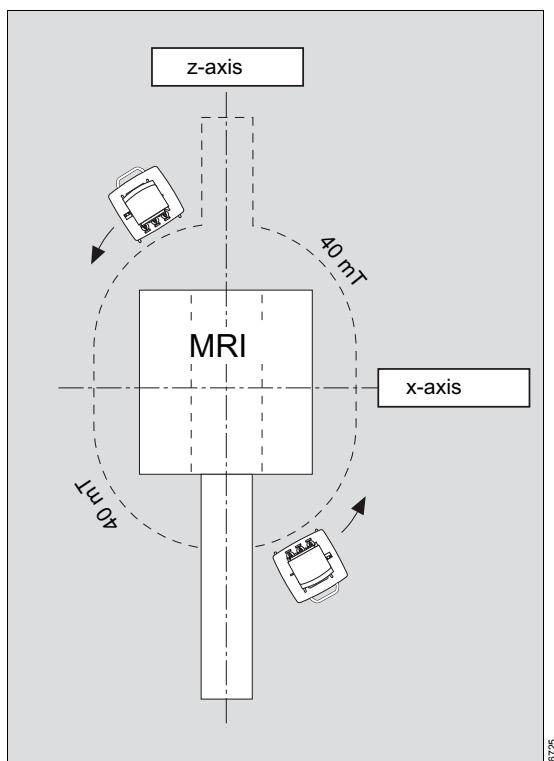
The Fabius MRI anesthesia workstation is classified as MR-conditional. Fabius MRI has been tested in combination with magnets with field strengths of 1.5 tesla and 3 tesla at a maximum field line strength of 40 millitesla (400 gauss). Using the device in higher field strengths may result in malfunctions of the ventilator and the device. Furthermore, uncontrollable forces of attraction may cause injuries.

Only use the device in the tested field strengths.

Marking the operating location

Perform the following steps before operating Fabius MRI in the MR environment for the first time:

- 1 Using a teslameter, determine the area in the x-y plane for which the field strength does not exceed 40 mT (400 gauss).
- 2 Position Fabius MRI outside the 40 mT area (e.g., to the left or right of the magnetic resonance scanner).
- 3 Use an anti-magnetic measuring tape to measure the position. Mark the position of Fabius MRI on the floor with black-yellow adhesive tape (part number 8607593).
- 4 Enter the values in the completion certificate.
- 5 Fill in the completion certificate and the verification for the positioning of the Fabius MRI, see "Completion certificate and verification for the positioning of Fabius MRI at the operating location", page 223



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Positioning at the operating location

WARNING

Risk due to magnetic forces of attraction

The device may move unintentionally as a result of magnetic forces of attraction.

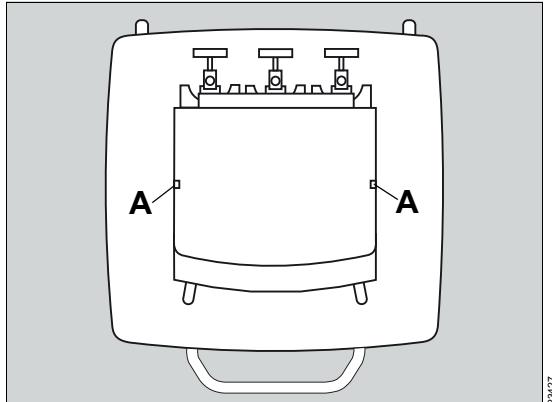
- Always position Fabius MRI at the specified, marked location in the MR examination room.
- Always lock the central brake.

CAUTION

Risk of impaired imaging

The anesthesia workstation can interfere with the imaging of the magnetic resonance scanner. To prevent interference, carry out an imaging test (page 222) in the following cases:

- After the initial setting up of the anesthesia workstation
- After connecting new accessories or new devices to Fabius MRI
- After maintenance work



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- 1 Position Fabius MRI as desired. If the field strength of 40 mT (400 gauss) is exceeded, the sensors (A) will trigger an acoustic alarm signal.
- 2 Make sure that the additional alarm LED bars in the top corners of the device are visible from the required viewing angles.
- 3 Carry out the steps for the test record, see page 222.

Checklist

Use the following checklist to ensure that all the required components are installed:

- Fasten the swivel arms for the ventilation system (left-hand side or right-hand side).
- Fit the "COSY" compact breathing system:
 - Attach "COSY" to the swivel arm.
 - Connect the fresh-gas hose and the ventilator hose.
 - Screw on the exhaust port.
- Fill the reusable CO₂ absorber and insert it or fit a disposable CO₂ absorber with Drägersorb CLIC (optional).
- Fit the breathing bag holder (optional) to the compact breathing system.
- Insert the flow sensor.
- Connect the flow sensor cable.
- Insert the O₂ sensor capsule.
- Connect the O₂ sensor cable.
- Connect the APL bypass hose and the PEEP/PMAX hose.
- Connect the pressure measurement hose.
- Connect the central supply hoses for Air, O₂, and N₂O.
- Connect the gas cylinders for Air, O₂, and N₂O.
- Connect the anesthetic gas scavenging system (AGSS):
 - Fit the holder to the side fixing rail.
 - Attach the anesthetic gas receiving system (AGS).
 - Connect the hoses:
 - Transfer hose from the AGS to the compact breathing system
 - and
 - Scavenging hose from the AGS to the terminal unit.



Connect the endotracheal suction system:

- Fit the mount for the suction regulator to the side fixing rail.
- Attach and connect the suction regulator (ejector suction or vacuum suction).
- Fit the mount for the suction bottle to the side fixing rail.
- Attach the suction bottle.



Connect the vaporizers.



Connect the breathing hoses.



Connect the sample line (optional).



Establish the mains power supply.

Getting started

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Daily checkout and pre-use checkout

After preparing the medical device, the daily checkout and the pre-use checkout must be performed according to the appendix to these instructions for use. This ensures that the medical device is ready for operation.

WARNING

Risk of device malfunction

Some safety systems are only checked during start-up.

- A selftest should be performed once daily.
- Switch the Fabius on and off or press the softkey *Run System Test*.

Switching on

Prerequisite: The device has been reprocessed (see chapter "Cleaning, disinfection and sterilization" on page 166) and assembled ready for operation (see chapter "Assembly and preparation" on page 50).

To prevent condensation and resulting failures of electrical components, do not switch on the device after abrupt temperature changes for 1 to 2 hours (e.g., after storage in unheated rooms).

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.

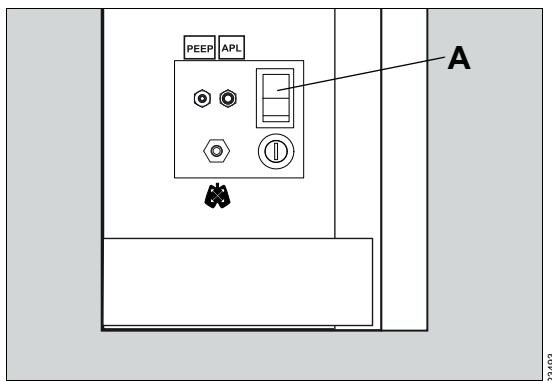
Stop oxygen supply and contact service personnel.

WARNING

Risk due to magnetic forces of attraction

The device may move unintentionally as a result of magnetic forces of attraction.

- Always position Fabius MRI at the specified, marked location in the MR examination room.
- Always lock the central brake.



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- Set the On/Off switch (A) to the position.

After switching on, the anesthesia workstation starts as follows:

- A system test is performed that checks various components. The entire results of the tests, as well as the test results for each component, are displayed on the screen.
- Passed: **Pass**
- Failed: **Fail**
- During the system test, 2 test tones are sounded to test the speakers. To hear these tones, do not stand any further than 4 meters (13 feet) from the device.
- After completion of the system test, the default settings for ventilation are loaded.

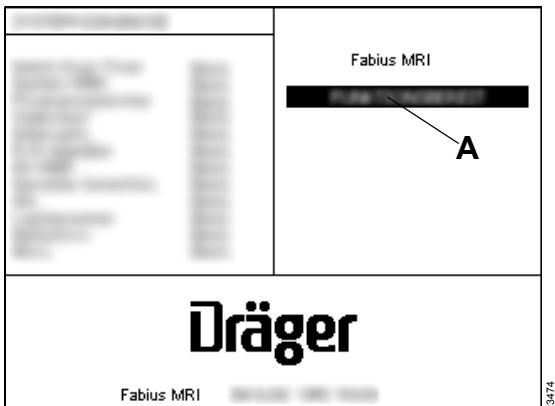
CAUTION

Malfunction of the device function

The user must check whether the test tones were actually sounded. The device only checks whether the speakers are connected. A complete loss of the ventilation function and monitoring function would possibly not be noticed if the speakers failed.

If no tone or only one tone is sounded, the device is only conditionally ready for operation. Contact DrägerService.

Checking the readiness for operation



NON-FUNCTIONAL

A serious malfunction was found and the operation of the monitoring functions and ventilation functions are blocked.

- Do not use the device.
- Immediately contact DrägerService or the authorized local service partner.

At the end of the system test, one of 3 possible results (A) are displayed on the screen:

- **FUNCTIONAL**
- **CONDITIONALLY FUNCTIONAL**
- **NON-FUNCTIONAL**

FUNCTIONAL

The device is ready for operation. After a short delay, the page **Standby** is displayed.

CONDITIONALLY FUNCTIONAL

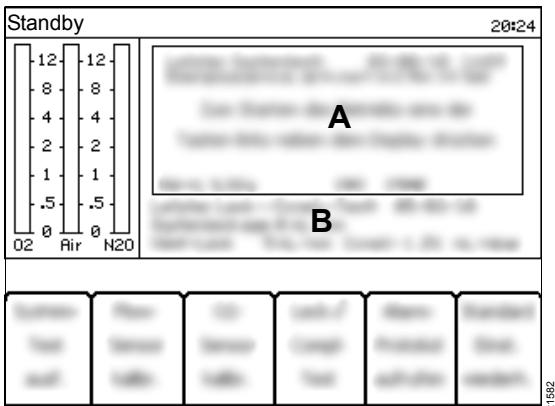
A non-critical malfunction was found. The anesthesia workstation can be used.

- To open the page **Standby**, press the rotary knob.
- Check if an alarm message is displayed.
- Contact DrägerService or the authorized local service partner.

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Standby page after start-up



In **Standby** mode, different instructions (A) and information (B) are displayed on the screen.

- A **To start operation press one of the keys located to the left of the display**
- B Last system test, last leakage/compliance test, system leakage, ventilator leakage, compliance

Setting the fresh-gas flow

The fresh-gas settings can be changed before a ventilation mode is selected.

- Set the fresh-gas flow.

S-ORC (Sensitive Oxygen Ratio Controller)

Fabius is equipped with a mechanical minimum O₂ delivery (S-ORC). This safety device prevents hypoxic gas mixtures if N₂O is selected as the carrier gas.

Starting at a flow of approx. 200 mL/min, the N₂O concentration in the fresh gas can be set to a value between 0% and 75%.

When a lack of O₂ is present, the S-ORC limits the N₂O concentration in the fresh gas so that the O₂ concentration will not fall below 23 Vol%.

S-ORC inhibits the N₂O flow under the following conditions:

- N₂O flow control valve is open, even though the O₂ flow control valve is closed.
- O₂ flow is below 0.2 L/min.

With an N₂O failure, O₂ can continue to be supplied. An alarm is not triggered. The float in the N₂O flow tube drops to zero.

S-ORC has no oxygen-specific monitoring function and offers no protection for the consequences of an accidental interchange of gases.

Therefore, the O₂ concentration must always be monitored.

CAUTION**Risk of inaccurate measured values**

When the O₂ supply is again established after a failure of the O₂ supply, a supply pressure of at least 2.7 kPa x 100 must be maintained for at least 20 seconds. New failure of the O₂ supply will only be detected if the supply pressure is stable for at least 20 seconds.

Do not use any functions during this time that require O₂, for example:

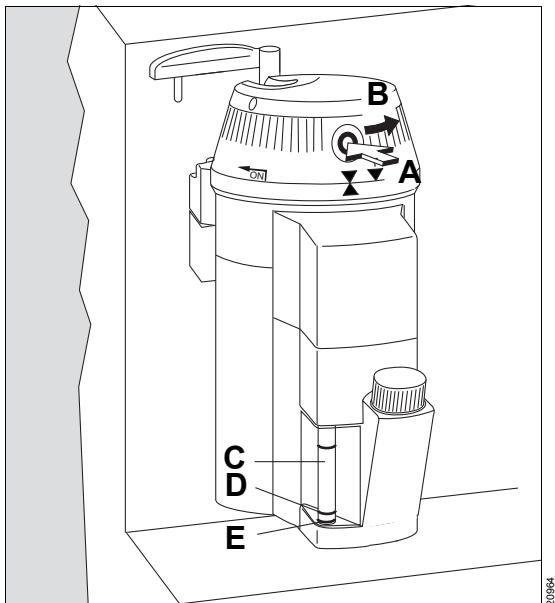
- O₂ flush
- O₂ fresh-gas flow
- Endotracheal suction

WARNING**Risk of material damage and risk to health**

A vaporizer must never remain in operation without a fresh-gas flow. High concentrations of the anesthetic gas flow into the ventilation circuit and the ambient air. This can lead to material damage and contamination of the ambient air with anesthetic gases.

Never cut off the fresh-gas flow before the vaporizer is switched off.

Setting the anesthetic gas concentration



If the control dial is in position T:

- 1 Press the 0 key (A) and engage the control dial (B) to position 0. To ensure pressure equalization, wait at least 15 seconds.
- 2 Press the 0 key (A) and set the control dial (B) counterclockwise to the desired anesthetic gas concentration.
- 3 Check the filling level on the sight glass (C) regularly. The filling level must be between minimum and maximum.
- 4 When the refill mark (D) is reached, 250 mL (normal anesthetic agent bottle) can be refilled.
- 5 Fill the vaporizer at the latest when the minimum mark (E) is reached, refer to instructions for use of the respective vaporizer.

Prerequisite: The vaporizer is mounted in accordance with the instructions for use of the respective vaporizer.

WARNING

Risk of patient injury

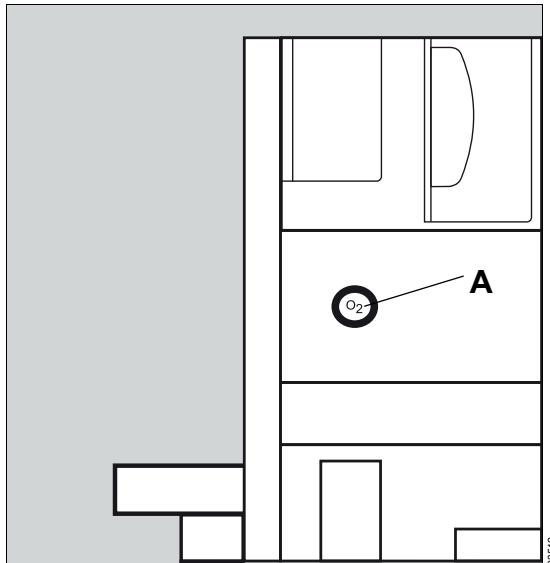
When the vaporizer is in the control dial position T, has heated up due to high ambient temperature, and is then used, a high anesthetic gas concentration might be delivered.

After connecting the vaporizer to the anesthesia workstation, always turn the control dial of the vaporizer to position 0 and wait at least 15 seconds to enable a pressure equalization.

The following section describes the operation of Vapor 2000.

- Set the fresh-gas flow on the anesthesia workstation.

O₂ flush



The O₂ flush is used for flushing and quickly filling the breathing system and breathing bag with O₂ while bypassing the vaporizer.

During this an unmetered flow of at least 35 L/min is given to the breathing system and the breathing bag.

- Press the **O₂+** (A) key. O₂ flows for as long as the key is held down.

Use of the O₂ flush can increase airway pressure very quickly and abruptly change the gas concentration.

NOTE

In **ManSpont** mode, the pressure can increase quickly and thus trigger the APL valve.

Low-flow anesthesia

In low-flow anesthesia (flow ≤ 1.0 L/min), moisture naturally condenses from the patient's exhaled air in the hoses. To prevent water collection in the hoses, a water trap must be integrated in the ventilator hose.

For longer low-flow anesthesia, the additional use of water traps in the expiratory hose is recommended. When the filling height exceeds the maximum mark, empty the water trap.

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.

If minimum-flow or low-flow settings are used, flush the breathing system regularly with the O₂ flush.

WARNING

Risk due to the accumulation of acetone in the patient

Do not perform low-flow anesthesia on patients with ketoacidosis or patients under the influence of alcohol. The risk of accumulation of acetone in the patient increases in such cases.

CAUTION

Risk of patient injury

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

Use suitable soda lime such as Drägersorb Free.

Nitrogen rinsing (as needed)

There is still air in the lungs of the patient and the breathing system during anesthesia introduction, which contains a fraction of approx. 77 % nitrogen. If the device is used for a low-flow anesthesia, press the O₂+ key. This removes the nitrogen.

Replacing the soda lime

Soda lime changes color if no more CO₂ can be absorbed. When 2/3 of the soda lime has changed color, the soda lime must be replaced.

Dräger recommends the use of Drägersorb 800 Plus or Drägersorb FREE.

Drägersorb 800 Plus and Drägersorb FREE change color from white to violet.

For instructions for replacing the CO₂ absorber, see chapter "Mounting the CO₂ absorber to the compact breathing system" on page 62.

WARNING

Risk due to soda lime drying out

The soda lime loses moisture. If the moisture falls below the minimum moisture, the following adverse reactions occur independent of the type of soda lime and inhalational anesthetic used: Decreased CO₂ absorption, increased generation of heat in the CO₂ absorber resulting in increased breathing gas temperature, formation of CO, absorption and/or degradation of the inhalational anesthetics.

- Do not use unnecessarily high fresh-gas flows.
- Only use the supplemental O₂ delivery if necessary.
- Do not leave the flow control valves open unnecessarily long.

CAUTION

Risk of chemical burns

Soda lime is caustic and is a strong irritant for eyes, skin, and airway. If soda lime has escaped, e.g., from damage of the disposable CO₂ absorber:

- Do not inhale or swallow lime dust.
- Wear protective gloves and safety glasses or face protection.
- In case of contact with the eyes, immediately rinse with water thoroughly and immediately see a doctor.
- In case of skin contact, immediately wash the skin.

NOTE

Follow the respective instructions for use for Drägersorb 800 Plus or Drägersorb FREE.

Note regarding children and neonates

If the disposable CO₂ absorber is removed, the compliance of the breathing system falls.

The patient will be supplied with a higher tidal volume and airway pressure in the **SIMV/PS** ventilation mode. The effect on the tidal volume and airway pressure can be disregarded for adults with a lung compliance of approx. 50 mL/cmH₂O. With neonates and children with a lung compliance of approx. 5 mL/cmH₂O or less, the tidal volume and airway pressure can rise considerably and lead to injury.

Perform the following step before removing the disposable CO₂ absorber:

- Set **P_{MAX}** to the current plateau pressure.

As soon as the disposable CO₂ absorber has been exchanged:

- Set **P_{MAX}** back to its original value.

Ventilation

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.

WARNING

Risk of strangulation

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

Use particular caution when establishing connections to the patient.

Ventilation mode *ManSpont*

ManSpont (Manual/Spontaneous, manual ventilation/spontaneous breathing) is a non-automatic ventilation mode. However, ventilation monitoring and alarm monitoring are still active.

The selection between manual ventilation and spontaneous breathing is made on the APL valve. If the APL valve is in the **Spont** position, spontaneous breathing is enabled.

WARNING

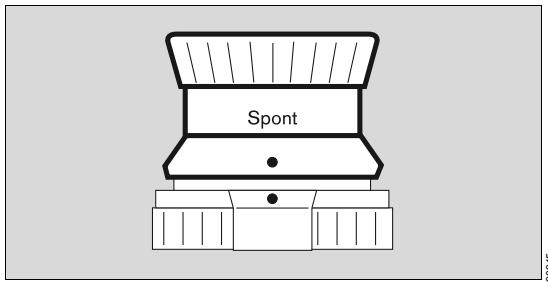
Risk of excessively high airway pressures

If the ventilator fails, the device switches into the *ManSpont* ventilation mode.

The APL valve should also be set to a pressure limitation value suitable for the patient when using automatic ventilation modes since in case of a ventilator failure the patient must be ventilated manually.

In the following examples and illustrations, the change from **Volume Control** mode to **ManSpont** mode is described:

Changing to spontaneous breathing



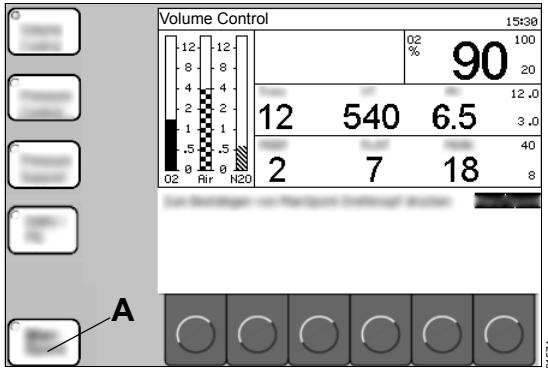
20945

- 1 Turn the APL valve head counterclockwise to its final position stop.

The label **Spont** and both points are vertical to each other. The valve head lifts.

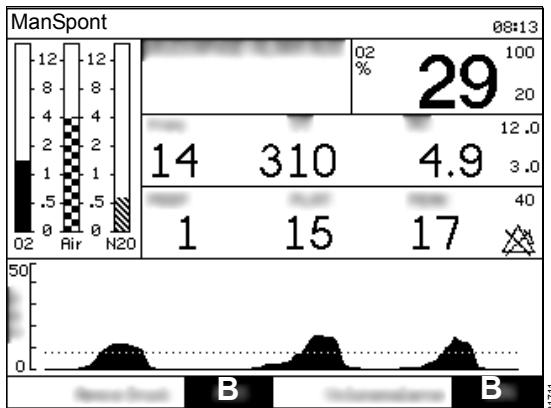
The pressure limitation is disabled and the valve is open for free spontaneous breathing.

- 2 Set suitable fresh-gas flow.



- 3 Press the **ManSpont** (A) key.

- 4 Confirm the new mode.



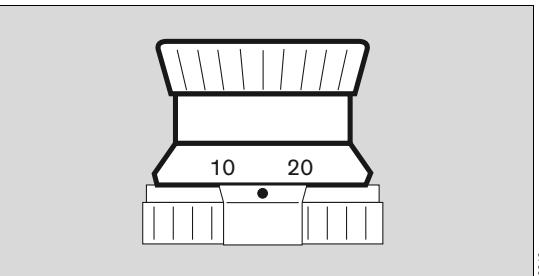
The following alarms can be activated or deactivated on the **ManSpont** screen with the **ON / OFF** key (B):

- **Apnoea Pressure** (see chapter "Pressure alarms in automatic ventilation modes" on page 126)
- **Volume Alarms** (see chapter "Volume alarms" on page 125)

Changing to manual ventilation

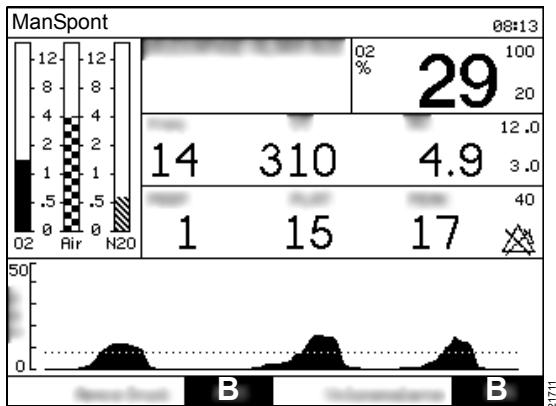
NOTE

In ***ManSpont*** mode, the apnea alarm time for triggering apnea volume alarms is extended from 15 seconds to 30 seconds (Caution category) and from 30 seconds to 60 seconds (Warning category).



20946

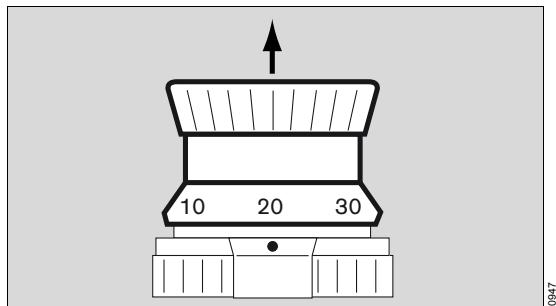
3 Confirm the new mode.



21711

The following alarms can be activated or deactivated in ***ManSpont*** mode with the **ON/OFF** key (B):

- **Apnoea Pressure** (see chapter "Pressure alarms in automatic ventilation modes" on page 126)
 - **Volume Alarms** (see chapter "Volume alarms" on page 125)
- 4 To refill the breathing bag, press the **Q+ key**.
 - 5 Set suitable fresh-gas flow.
 - 6 Start manual ventilation with the breathing bag. The pressure is limited to the value that is set on the APL valve.

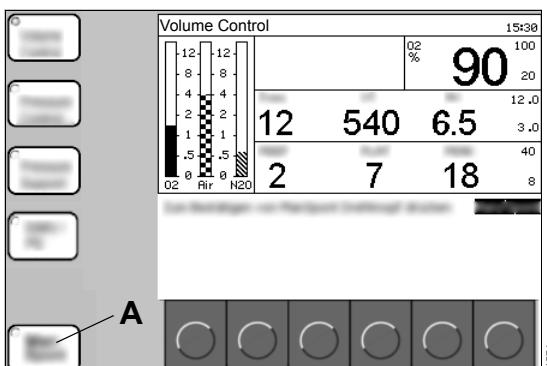
Pressure release

21574

In the ***ManSpont*** mode, lifting the valve head relieves pressure from the breathing system.

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

Settings between the grid marks are also possible.



21574

- 2 Press the ***ManSpont*** (A) key.

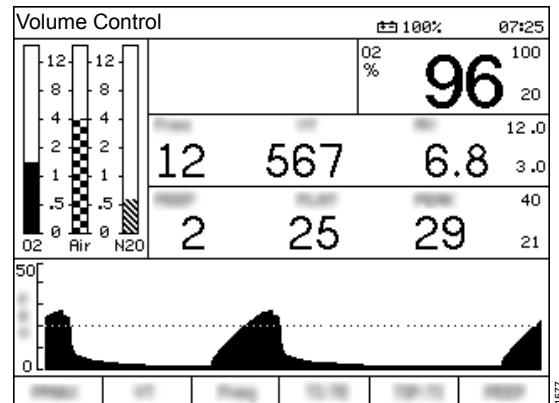
Ventilation mode **Volume Control**

Compensation of ventilator compliance

Ventilator compliance compensation is active in **Volume Control** mode so that the tidal volume administered to the patient (**VT**) corresponds to the tidal volume setting. The ventilator compliance is determined during the leakage test in **Standby** mode, see chapter "Leakage test" on page 132.

The breathing hoses used during the leakage test and compliance test must also be used during operation.

This guarantees an exact compliance compensation.

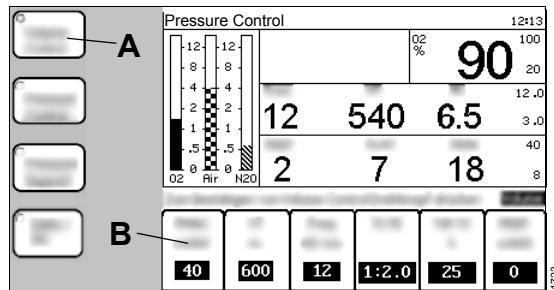


NOTE

If the ventilator works at its performance limit due to the volume control settings, Fabius cannot make the compliance compensation. If the performance limit of the ventilator is reached, it is not possible to increase the setting for tidal volume **VT**.

Changing to **Volume Control** mode

In the following examples and illustrations, the change from **Pressure Control** mode to **Volume Control** mode is described:



- 1 Press the **Volume Control** (A) key.
- 2 Adjust ventilation settings (B).
- 3 Confirm the new mode.

In the following table, all parameters (B) in **Volume Control** mode, together with the corresponding setting ranges and factory settings, are listed.

Parameter	Setting range	Factory setting
Pressure limitation P MAX [cmH ₂ O] ([hPa])	15 to 70, min. PEEP +10	40
Tidal volume VT [mL]	20 to 1400	600
Respiratory rate Freq [bpm] ([1/min])	4 to 60	12
Inspiratory time:expiratory time TI:TE	4:1 to 1:4	1:2
Inspiratory pause time:inspiratory time TIP:TI [%]	0 to 50	10
PEEP [cmH ₂ O] ([hPa])	0 to 20	0

inspiratory flow (**Insp Flow**). The set tidal volume is based on a defined respiratory rate (**Freq**) and a defined ratio of inspiratory time to expiratory time (**TI:TE**).

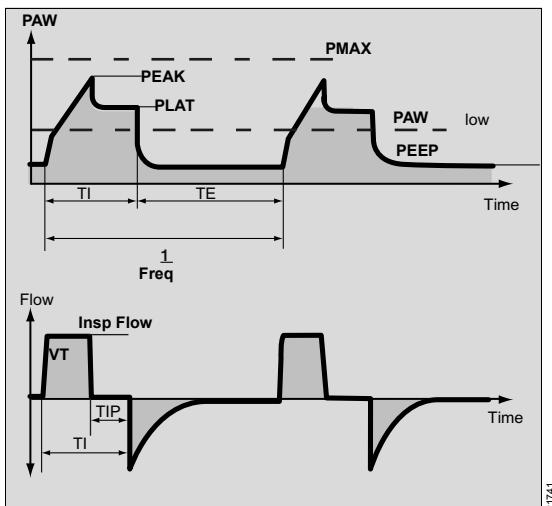
The inspiratory flow (**Insp Flow**) results from the tidal volume (**VT**) and the ratio of inspiratory pause to inspiratory time (**TIP:TI**).

If **TIP:TI** is set to 0, the tidal volume (**VT**) is supplied with the lowest inspiratory flow (**Insp Flow**) that is possible at the corresponding respiratory rate (**Freq**). In addition, a positive end-expiratory pressure (**PEEP**) can be set.

To prevent too high pressure, the alarm limit **P MAX** can be set corresponding to the physiological condition of the patient.

The lower alarm limit of the airway pressure (**PAW low**) is used for the airway pressure monitoring to detect apnea (disconnection) and continuous pressure.

If the pressure waveform does not cross the pressure threshold either from above or below, an alarm is sounded.

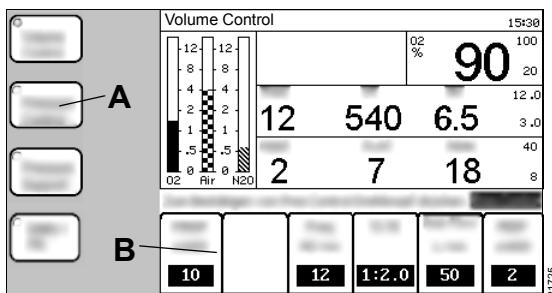


For every mandatory breath, the patient receives the set tidal volume (**VT**) with a constant

Ventilation mode **Pressure Control** (optional)

Changing to **Pressure Control** mode

In the following examples and illustrations, the change from **Volume Control** mode to **Pressure Control** mode is described:

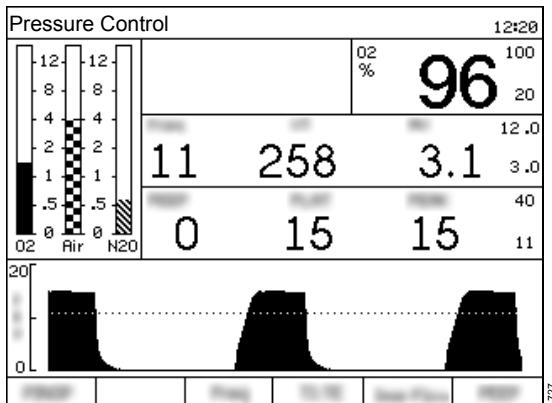


1 Press the **Pressure Control** (A) key.

2 Adjust ventilation settings (B).

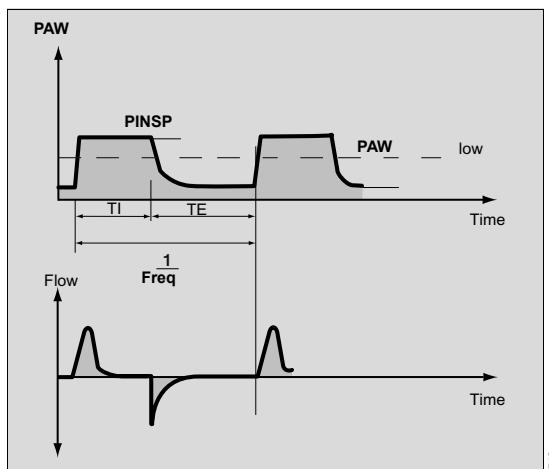
3 Confirm the new mode.

Due to the influence of compliance and resistance, the set value for **Freq Min** in **Pressure Control** mode might not exactly be applied.



In the following table, all parameters (B) in **Pressure Control** mode, together with the corresponding setting ranges and factory settings, are listed.

Parameter	Setting range	Factory setting
Inspiratory pressure PINSP [cmH ₂ O] ([hPa])	5 to 65, min. PEEP +5	15
Respiratory rate Freq [bpm] ([1/min])	4 to 60	12
Inspiratory time:expiratory time TI:TE	4:1 to 1:4	1:2
Inspiratory flow Insp Flow [L/min]	10 to 75	30
PEEP [cmH ₂ O] ([hPa])	0 to 20	0



A tidal volume is supplied based on a defined respiratory rate (**Freq**) and a defined ratio of inspiratory time to expiratory time (**TI:TE**).

This tidal volume is dependent on the set inspiratory pressure (**PINSP**) and from the patient compliance. The parameter **Insp Flow** is used to set the increase of the slope of the pressure waveform. In addition, a positive end-expiratory pressure (**PEEP**) can be set.

The lower alarm limit of the airway pressure (**PAW low**) is used for the airway pressure monitoring to detect apnea (disconnection) and continuous pressure.

If the pressure waveform does not cross the pressure threshold either from above or below, an alarm is sounded.

Ventilation mode **Pressure Support** (optional)

Pressure Support (Pressure Support) is a pressure-supported ventilation mode for patients with spontaneous breathing. Patients who make no inspiratory effort must not be ventilated with **Pressure Support**.

The ventilation mode **Pressure Support** is triggered by the inspiratory effort of the patient. Most anesthetic agents cause a reduced reaction of the patient to carbon dioxide and hypoxemia. Therefore ventilation modes, which are triggered by patients, do not ensure adequate ventilation in these conditions. In addition, the use of muscle relaxants negatively influences the triggering by the patient.

In **Pressure Support** ventilation mode, the apnea ventilation function is available, which can ensure a minimum ventilation. To activate apnea ventilation, for the setting **Freq Min** another setting must be selected than **OFF**. If the detected spontaneous respiratory rate of the patient drops under the set value for **Freq Min**, a mechanical breath is applied. Apnea ventilation is not intended to be a primary ventilation mode.

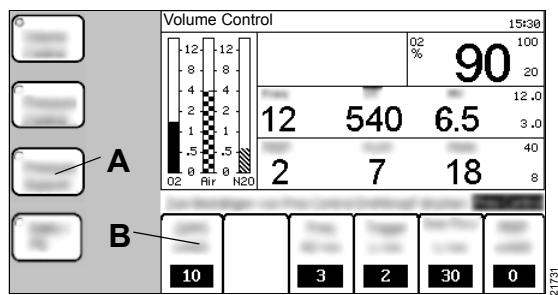
For apnea ventilation, Fabius uses the settings for the following parameters:

- **APPS**
- **Freq Min**
- **Insp Flow**
- **PEEP**

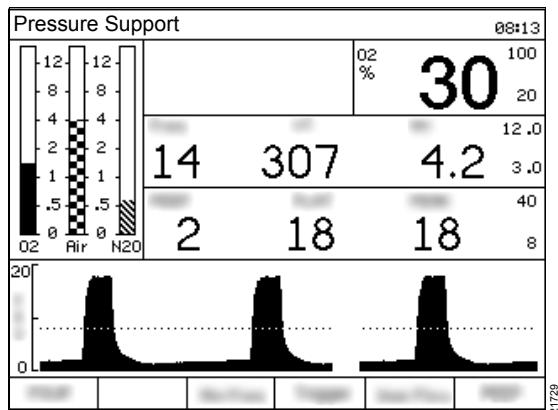
If 2 successive mechanical breaths occur with apnea ventilation, the alarm message **APNOEA VENTILATION !!** is displayed in the alarm message field. The alarm message is deleted as soon as a spontaneous breath is detected.

Changing to **Pressure Support** mode

In the following examples and illustrations, the change from **Volume Control** mode to **Pressure Support** mode is described:



- 1 Press the **Pressure Support** (A) key.
- 2 Adjust ventilation settings (B).
- 3 Confirm the new mode.



In the following table, all parameters (B) in **Pressure Support** mode, together with the corresponding setting ranges and factory settings, are listed.

Parameter	Setting range	Factory setting
Support pressure $\Delta APPS$ [cmH ₂ O] ([hPa])	3 to 20, OFF	10
Minimum respiratory rate for apnea ventilation Freq Min [bpm] ([1/min])	3 to 20, OFF	3
Trigger sensitivity Trigger [L/min]	2 to 15	2
Inspiratory flow Insp Flow [L/min]	10 to 85	30
PEEP [cmH ₂ O] ([hPa])	0 to 20	0

The set inspiratory flow (**Insp Flow**) defines how fast the $\Delta APPS$ pressure is reached. When 25 % of the maximum inspiratory flow (**Insp Flow**) is reached (or after maximum 4 seconds), the inspiration is automatically ended. The value **Freq Min** (e.g., 3 bpm (1/min)) defines a safety period (safety period = 1/**Freq Min**, e.g., 20 seconds). If no inspiratory effort is detected and the safety period has elapsed, the device generates a pressure-controlled breath with **PINSP=APPs**.

The lower alarm limit of the airway pressure **PAW low** is used for the airway pressure monitoring to detect apnea (disconnection) and continuous pressure.

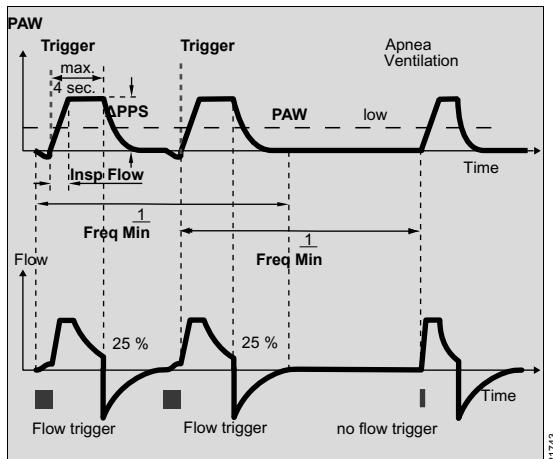
If the pressure waveform does not cross the pressure threshold either from above or below, an alarm is sounded.

Ventilation mode **SIMV/PS** (optional)

The ventilation mode **SIMV** (synchronized intermittent mandatory ventilation) is a mixture of ventilation and spontaneous breathing. In ventilation **SIMV** mode, the patient can breathe spontaneously. The ventilation is done synchronously to the inspiratory effort of the patient.

The mandatory breaths are defined based on the following parameters:

- **VT**
- **Freq**
- **TINSP**
- **TIP:TI**
- **PEEP**

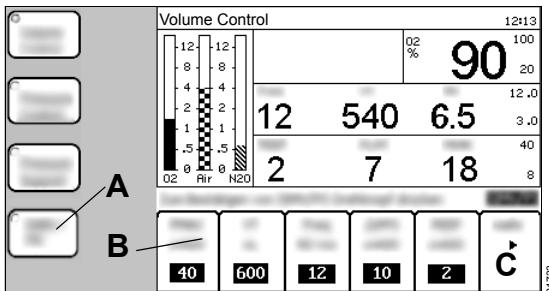


If the inspiratory flow (**Insp Flow**) during inspiratory effort is greater than the set trigger flow (**Trigger**), the device supports the patient with the setting $\Delta APPS$.

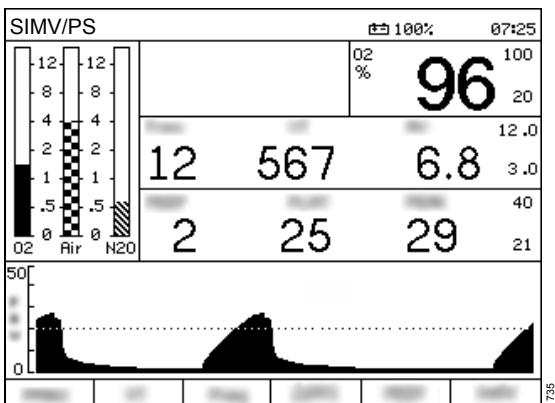
To support the inspiratory effort of the patient in ventilation **SIMV** mode, pressure support $\Delta APPS$ can be switched on. The setting of $\Delta APPS$ to another value than **OFF** activates the mode **Pressure Support**, see chapter "Ventilation mode Pressure Support (optional)" on page 102.

Changing to **SIMV** mode

In the following examples and illustrations, the change from **Volume Control** mode to **SIMV/PS** mode is described:

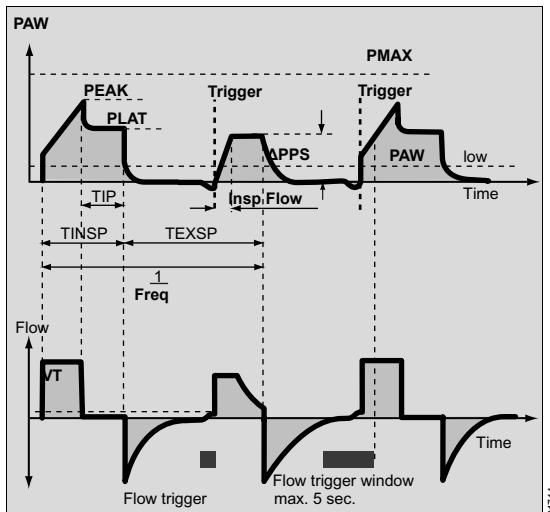


- 1 Press the **SIMV/PS** (A) key.
- 2 Adjust ventilation settings (B).
 - To set the following additional parameters, press the **MORE** (C) key:
 - **Trigger**
 - **Insp Flow**
 - **TINSP**
 - **TIP:TI**
- 3 Confirm the new mode.



In the following table, all parameters (B) in **SIMV/PS** mode, together with the corresponding setting ranges and factory settings, are listed.

Parameter	Setting range	Factory set- ting
Pressure limita- tion PMAX [cmH ₂ O] ([hPa])	15 to 70, min. PEEP +10 and $>\Delta\text{PPS} + \text{PEEP}$	40
Tidal volume VT [mL]	20 to 1100	600
Respiratory rate Freq [bpm] ([1/min])	4 to 60	12
Pressure sup- port ΔPPS [cmH ₂ O] ([hPa])	3 to 20 OFF	10
PEEP [cmH ₂ O] ([hPa])	0 to 20	0
Trigger sensitiv- ity Trigger [L/min]	2 to 15	2
Inspiratory flow- Insp Flow [L/min]	10 to 85	30
Inspiratory time TINSP [seconds]	0.3 to 4.0	1.7
Inspiratory pause time:inspiratory time TIP:TI [%]	0 to 50	10

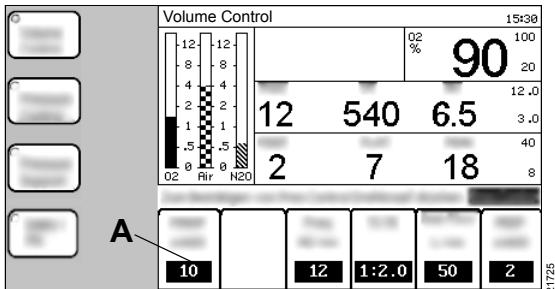


The respiratory rate **Freq** defines the time between the individual volume-controlled breaths. The synchronization of the mechanical breaths is done with a trigger sensitivity (**Trigger**) that is activated a specific time before administering a new mechanical breath: 5 s for respiratory rates (**Freq**) below 12 bpm (1/min). For higher respiratory rates, the synchronization is done immediately after the preceding expiration. Between these mandatory breaths, the patient can breathe spontaneously. Mandatory breaths are synchronized with the spontaneous breaths of the patient. These spontaneous breaths can be supported with **APPS**.

The lower alarm limit of the airway pressure **PAW low** is used for the airway pressure monitoring to detect apnea (disconnection) and continuous pressure.

If the pressure waveform does not cross the pressure threshold either from above or below, an alarm is sounded.

Adopting ventilation settings during mode change



The ventilation settings for the new ventilation mode are automatically derived from the settings of the previous ventilation mode. The corresponding settings (A) in the new ventilation mode are highlighted.

The settings for **Freq**, **TI:TE** and **PEEP** are adopted directly from the settings of the previous ventilation mode if necessary.

When changing from **Volume Control** to **Pressure Control**:

- **PINSP** is set to the plateau pressure (**PLAT**) that occurred in **Volume Control**.
- **Insp Flow** is set to the last used value or the factory setting.

When changing from **Pressure Support** to **Pressure Control**:

- **Insp Flow** is set to the last used value or the factory setting.

When changing from **Pressure Control** to **Volume Control**:

- **VT** is set to the value that results from the division of the last minute volume (**MV**) by the respiratory rate (**Freq**).
- **TIP:TI** is set to the last used value or the factory setting.
- **PMAX** is set to a value that lies 10 cmH₂O (hPa) above the plateau pressure (**PLAT**) that occurred in **Pressure Control**.

When changing from **Volume Control** to **Pressure Support**:

- **Insp Flow** is set to the last used value or the factory setting.
- **ΔPPS** is set to the last used value or the factory setting.
- **Trigger** is set to the last used value or the factory setting.

When changing from **Pressure Control** to **Pressure Support**:

- **Insp Flow** is set to the last used value or the factory setting.
- **ΔPPS** is set to the last used value or the factory setting.
- **Trigger** is set to the last used value or the factory setting.

When changing from **Volume Control** to **SIMV/PS**

- **PMAX** and **PEEP** are automatically adopted for the new ventilation mode from the previous mode.

When changing from **Pressure Support** to **SIMV/PS**:

- **ΔPPS**, **Insp Flow**, **Trigger**, and **PEEP** are automatically adopted for the new ventilation mode from the previous mode.

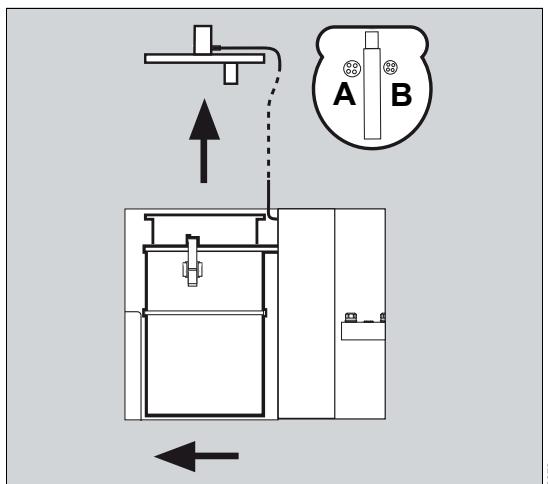
When changing from **SIMV/PS** with **Pressure Support** to **Pressure Support**:

- **ΔPPS** and **Insp Flow** are automatically adopted for the new ventilation mode from the previous mode.

When changing from **SIMV/PS** to **Pressure Support**:

- **Trigger** and **PEEP** are automatically adopted for the new ventilation mode from the previous mode.

Safety functions of the ventilator



- Overpressure safety valve (A)
- Underpressure safety valve (B)
- Pressure sensor in the ventilator chamber

- Since the ventilator does not contain sufficient fresh gas, the reserve volume is absorbed.

As long as there is insufficient fresh gas, the safety valve (B) for ambient air remains open during expiration.

CAUTION

Risk of patient recovering consciousness

If the gas supply fails completely, further operation of the anesthesia machine takes place with gas supply 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.

This allows for emergency ventilation with limited VT even with extremely low fresh-gas supply. There will be no sudden switch-off of the ventilator.

Behavior with too low fresh-gas supply

For very low fresh-gas flow or an extremely large leakage in the breathing system circuit, there can be insufficient fresh gas. This is detected by the gradual emptying of the breathing bag.

NOTE

To remedy this, the user must take actions, e.g., increasing the fresh-gas flow.

Behavior of Fabius if the user does not take any action

- Breathing bag empties completely little by little.
- After 2 more mechanical breaths, the **FRESH GAS LOW !!** alarm and other alarms are triggered.

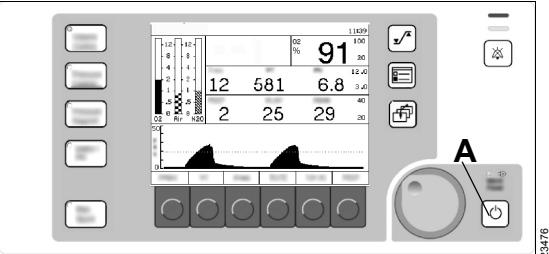
Patient change

WARNING

Risk due to incorrect settings

For anesthesia machines within the same care area, different standard alarm limits or ventilation settings might be configured. The user must observe the following points:

- Make sure that the values set for new patients are appropriate.
- 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.



Carry out the following steps when changing patients:

- 1 Press the  button (A) and confirm.
 - Ventilation monitoring and alarm monitoring are switched off.
 - The ventilator stops.
 - Fresh-gas monitoring is continued.
 - The current settings remain the same.
 - The **Standby** screen is active.
 - Default settings are activated.
- 2 Press the **Restore Site Defaults** key, see chapter "Restoring the default settings" on page 135.

- 3 Check all components. For details on the test steps, see chapter "Form for daily checkout and pre-use checkout" on page 215.

- 4 If necessary, perform the leakage test, see chapter "Leakage test" on page 132.

Dräger recommends performing the leakage test in the following cases:

- When the soda lime is replaced.
- When the breathing hoses are replaced.
- When a vaporizer is replaced or filled.

WARNING

Risk of patient injury

During the leakage test, the breathing system is pressurized.

To avoid patient injuries, disconnect the patient before the leakage test.

- 5 Set the ventilation mode and continue, see chapter "Ventilation" on page 96.

Using the external fresh-gas outlet with an auxiliary switch (optional)

WARNING

Risk of impaired imaging

The use of non-rebreathing systems (e.g., Magill, Kuhn, and Bain) that are not classified as "MR-safe" or "MR-conditional" will impair the diagnostic quality of the imaging.

Only use non-rebreathing systems that are classified as "MR-safe" or "MR-conditional".

WARNING

Risk of faulty gas delivery

O₂ and CO₂ and any anesthetic gases must also be monitored for non-rebreathing systems.

The sample line must be connected to the connector on the non-rebreathing system and to the connector on the gas analyzer.

WARNING

Risk of excessive airway pressure

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

Only connect non-rebreathing systems with breathing bag or pressure-relief valves that comply with applicable safety standards.

WARNING

Insufficient gas supply to the patient

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

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

WARNING

Risk of misinterpretation of measured values

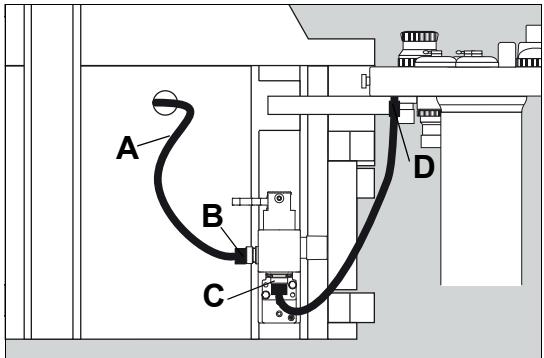
The values for O₂, pressure, and volume displayed on Fabius do not correspond to the values for the patient connected to external fresh-gas outlet as they are based on measurements taken at the compact breathing system.

When using the external fresh-gas outlet, change into the *Standby* mode.

Preparation

Connecting the external fresh-gas outlet

(e.g., on the left-hand side)



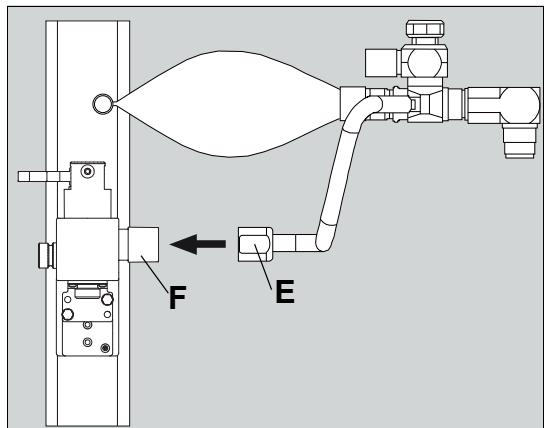
- 1 Connect the fresh-gas hose (A) to the side connector (B) on the external fresh-gas outlet.
- 2 Using a separate fresh-gas hose, connect the connector (C) on the underside of the external fresh-gas outlet to the fresh-gas connector (D) of the compact breathing system.

NOTE

Make sure that the external fresh-gas outlet with switch is completely fitted.

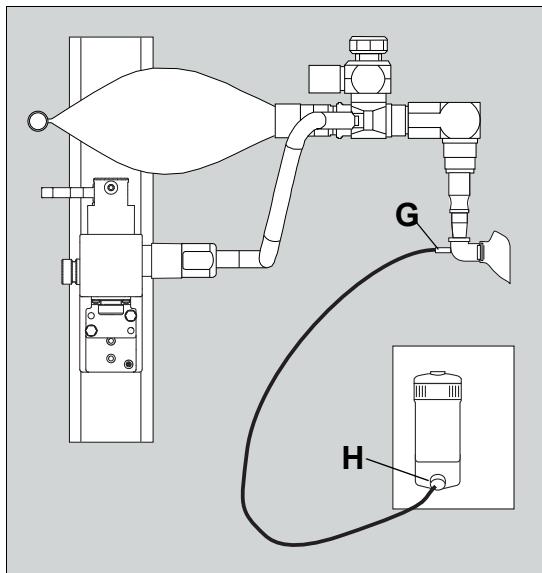
Connecting the non-rebreathing system

(e.g., Waters)



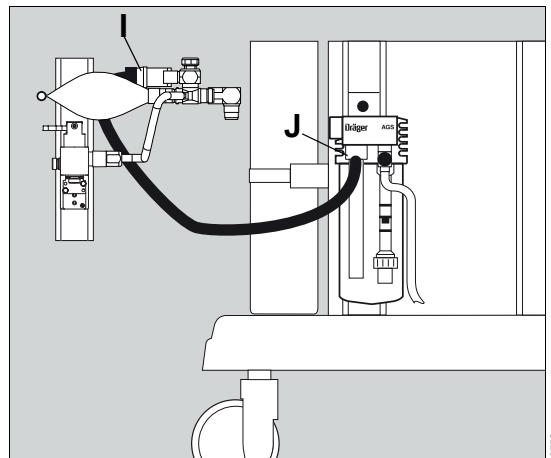
- 1 Connect the connector (E) of the non-rebreathing system to the connector (F) on the external fresh-gas outlet.

Connecting the sample line to an external fresh-gas monitor



- 1 Connect the sample line to the Luer Lock connector (G) on the mask and to the connector (H) for the water trap on the anesthetic gas monitor.

Connecting the anesthetic gas receiving system



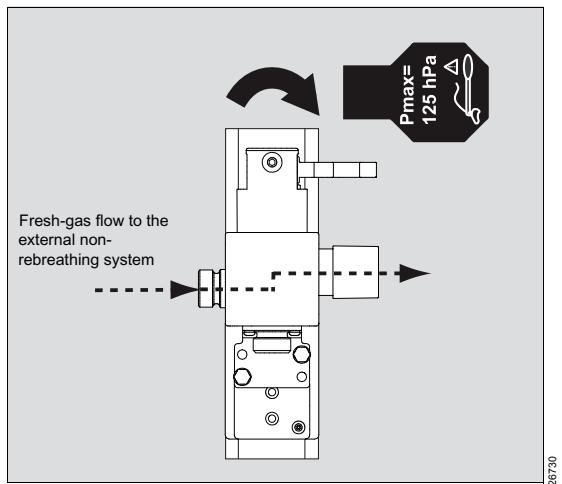
- 1 If required, connect the scavenging hose to the corresponding connector (I) on the non-rebreathing system. Plug the other end of the scavenging hose on to the port (J) provided on the AGS.

Observe the instructions for use of the non-rebreathing system and the anesthetic gas receiving system.

Operation

- 1 Change to **Standby** mode.
- 2 Set the fresh-gas flow.
To prevent rebreathing, the fresh-gas supply must be at least double the minute volume.
- 3 Operate the non-rebreathing system according to the corresponding instructions for use.

Operation with non-rebreathing system



Diverting the fresh-gas flow to the non-rebreathing system:

- 1 Place the switch lever to

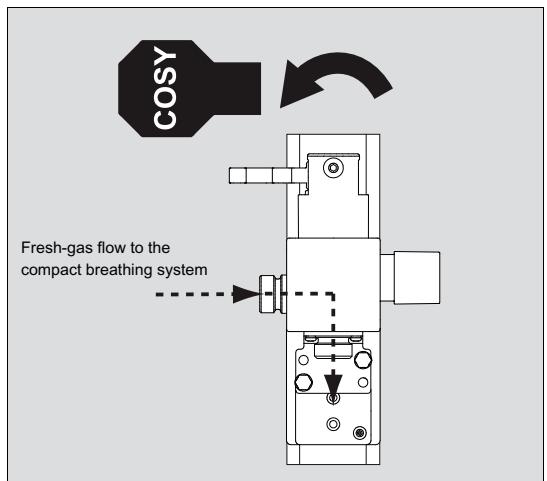
The lever points in the direction of the non-rebreathing system.

- 2 Set the fresh-gas flow.

To prevent rebreathing, the fresh-gas supply must be at least double the minute volume.

- 3 Operate the non-rebreathing system according to the corresponding instructions for use.

Operation with the compact breathing system (COSY)



Diverting the fresh-gas flow to the compact breathing system:

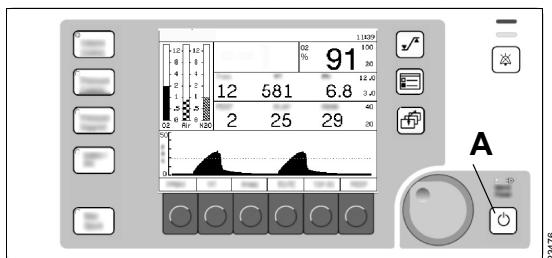
- 1 Place the switch lever to **COSY**.

The lever points in the direction of the fresh-gas inlet.

Ending operation

- 1 Close all flow control valves on the device.
- 2 Make sure that the switch lever is set to **COSY**.
- 3 Disconnect the non-rebreathing system from the external fresh-gas outlet.
- 4 Screw the sample line back to the Y-piece on the breathing circuit.

Ending operation



- Set the control dial (B) of the vaporizer until it engages on **0**.

WARNING

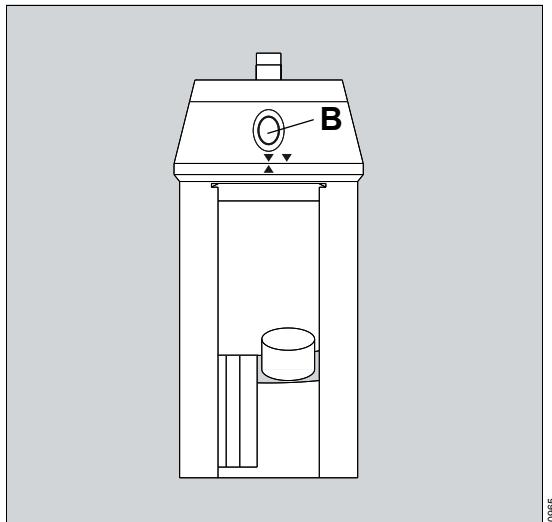
Risk of material damage and risk to health

A vaporizer must never remain in operation without a fresh-gas flow. High concentrations of the anesthetic gas flow into the ventilation circuit and the ambient air. This can lead to material damage and contamination of the ambient air with anesthetic gases.

Never cut off the fresh-gas flow before the vaporizer is switched off.

- Press the button (A) and confirm.

Ventilation monitoring and alarm monitoring are switched off. The ventilator stops.



- Close the flow control valves.

Power-saving mode is activated after 2.5 minutes.

- Close the cylinder valves.

NOTE

Leave Fabius connected to the mains power supply so that the battery is not discharged.

Preparing for storage or transport

WARNING

Risk of tipping over during transport

The medical device may tip over if handled incorrectly. Observe the following points when transporting medical devices:

- The medical device may only be moved by people who have the physical ability to do so.
- To improve the maneuverability, transport the device with 2 persons.
- 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.
- Remove any devices mounted to the holding arms or the top of the device.
- Clear the writing tray and fold it down completely or slide it into the device.
- Do not pull the medical device over hoses, cables, or other obstacles lying on the floor.
- Do not activate the brake while the medical device is being moved.
- Always use the handles on the device to push or pull it.

WARNING

Risk due to magnetic forces of attraction

Objects placed on the device that are not intended for use with this anesthesia workstation may be strongly attracted by the magnetic field.

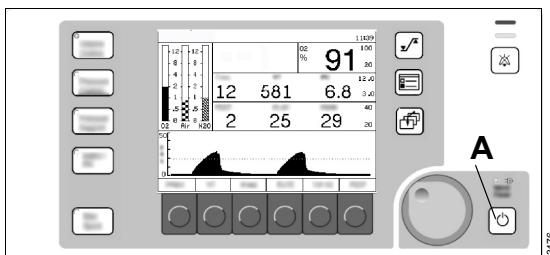
- Do not place any objects that are not approved for use with Fabius MRI or in MR environments on the device, on the writing tray, or in the drawer.
- Do not bring any ferromagnetic tools or devices into the MR environment.
- Handle power cables and mains plugs carefully as these contain ferromagnetic components.
- Do not service or maintain the device in an MR environment.

WARNING

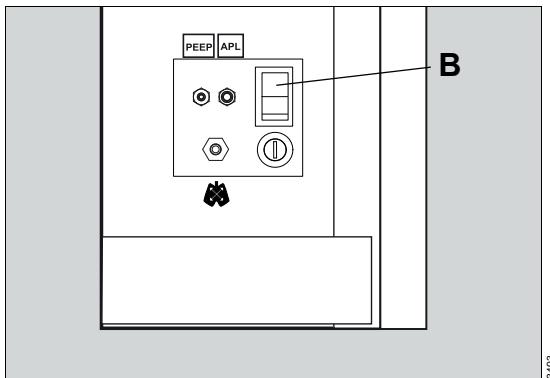
Risk due to magnetic forces of attraction

If Fabius MRI is moved or parked too close to the magnetic resonance scanner, it may be pulled in towards the scanner.

Do not move or park Fabius MRI in areas with more than 40 millitesla (400 gauss).

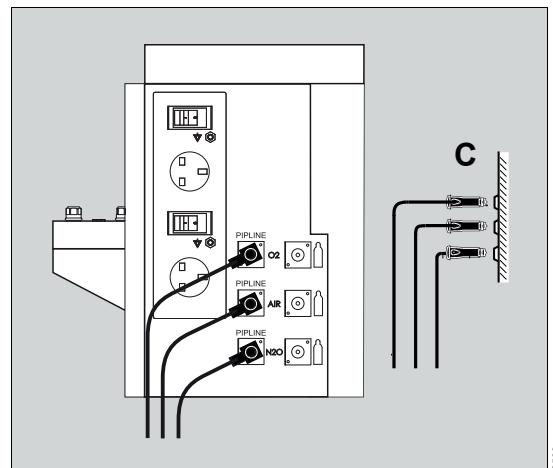


- 1 Press the button (A) and confirm.
Monitoring and alarm monitoring are switched off. The ventilator stops.
- 2 Set the control dial (B) of the vaporizer until it engages on **0**.
- 3 Close the flow control valves.
- 4 Close the cylinder valves of the gas cylinders.
- 5 Pull off the O₂ sensor from the inspiratory valve and expose to the ambient air.



- 6 Switch off Fabius with the On/Off switch (B) on the rear and pull out the plug.

- 7 Remove hoses of the anesthetic gas receiving system.



- 8 Remove central supply hoses (C).
- 9 To bring the entire system to normal pressure, press the .

Alarms

Alarm signaling	117
Display of alarms	117
Acoustic signal	117
Alarm priorities	118
Suppressing the alarm tone	119
Adjusting the alarm limits	119

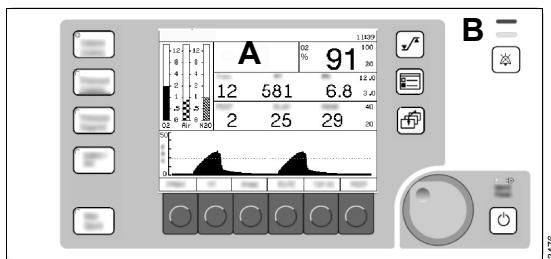
Alarm signaling

Alarms are signaled optically and acoustically.

Display of alarms

In the event of an alarm, the system displays the relevant alarm message in the alarm message field (A).

An LED indicator (B) lights up.



Alarm	Display
Caution	<ul style="list-style-type: none"> A message of caution category with 2 exclamation points (!!!) is displayed in the alarm message field (A). The yellow LED (B) flashes, accompanied by a repeating alarm tone sequence of 3 alarm tones: G-G-between G# and A
Note	<ul style="list-style-type: none"> A notice with 1 exclamation point (!) is displayed in the alarm message field (A). The yellow LED lights continuously, accompanied by a single alarm tone sequence of 2 alarm tones: E-E" <ul style="list-style-type: none"> with internal priority ≥ 6: alarm tone sequence of 2 tones with internal priority < 6: no tone

Acoustic signal

An alarm tone or alarm tone sequence sounds.

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 key is pressed.

Alarm	Display
Warning	<ul style="list-style-type: none"> A warning message with 3 exclamation points (!!!) is displayed in the alarm message field (A). The red LED (B) flashes, accompanied by a repeating alarm tone sequence: E-E-E--E-Bb----E-E-E--E-Bb The alarm tone sequence (2x5 alarm tones) sounds every 10 seconds.

Alarm priorities

Fabius assigns the appropriate priority to each alarm.

The background color of the alarm message field indicates the priority of the active alarm.

The alarm messages are only displayed on colored background if the option "Color display" is activated.

Color	Priority of the alarm message		Action required	
Red	Warning	Alarm with high priority	!!!	Immediate action is necessary in order to avert imminent danger.
Yellow	Caution	Alarm with medium priority	!!	Fast action is necessary in order to avert a danger.
	Note	Alarm with low priority	!	Attention is necessary, but a delayed response is sufficient.

The alarm messages are sorted according to these priorities and displayed corresponding to the internal priority system. Priority 31 has the highest and priority 1 the lowest priority. The priority numbers are listed in the table in chapter "Alarm – Cause – Remedy" on page 157.

A maximum of 4 alarm messages * can be displayed at the same time in a list. Alarm messages with higher priority are displayed before alarm messages with lower priority. Alarm messages with low priority are only displayed if the cause for a high-priority alarm is remedied.

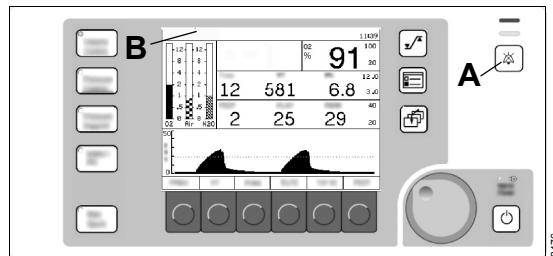
* optionally, 3 alarm messages for Japan and China

Example for sounding the alarm tone when several alarms are present

Priority of the existing alarm	Priority of the new alarm	Reaction from Fabius
(!!!) WARNING	(!!!) WARNING	<ul style="list-style-type: none"> – Alarm tone sequence starts from the beginning.
(!!!) WARNING	(!!) CAUTION	<ul style="list-style-type: none"> – Alarm tone sequence for the existing alarm is not interrupted. – No acoustic alarm signal for the new alarm
(!!) CAUTION	(!!) CAUTION	<ul style="list-style-type: none"> – Alarm tone sequence starts from the beginning.
(!!) CAUTION	(!!!) WARNING	<ul style="list-style-type: none"> – Alarm tone sequence for the new alarm is started.

Suppressing the alarm tone

The alarm tone can be suppressed for a maximum of 2 minutes.



- Press the (A) key.
The LED in the key (A) lights up.

In the status bar (B), the symbol and the remaining time for the alarm tone suppression are displayed.

During the alarm tone suppression, only the new alarms are acoustically signaled whose alarm priority or internal priority number is higher than the suppressed alarm, see chapter "Alarm – Cause – Remedy" on page 157.

Reactivating the suppressed alarm tone

- Press the (A) key again.
The LED in the key (A) goes out.

Adjusting the alarm limits

If an alarm is triggered due to a value falling below or exceeding the alarm limit, it might be necessary to adjust the standard alarm limits. More information for setting the alarm limits can be found in chapter "Changing the alarm limits" on page 138.

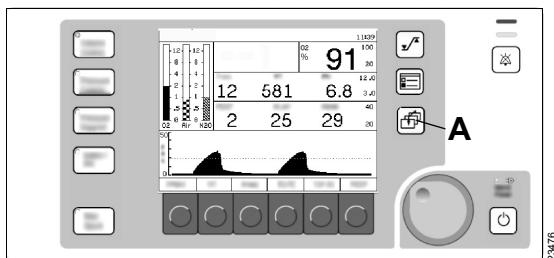
Setting the alarm limits in current ventilation mode:

- Press the key.
More information can be found in chapter "Monitoring" on page 120.

Monitoring

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Parameter field for O ₂ monitoring.....	121
Setting the O ₂ alarm limits.....	122
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Setting the upper alarm limit and the pressure threshold.....	127

Main screen



- Press the (A) key.

The current dialog window changes to the main screen.

The following information is displayed on the screen:

- Current alarm messages
- Data of the O₂ monitoring
- Data of the airway pressure monitoring
- Data of the breathing volume monitoring

O₂ monitoring

The inspiratory oxygen concentration is measured with a dual galvanic sensor, which is located in the cover of the inspiratory valve, see chapter "Compact breathing system COSY (top view)" on page 26.

CAUTION

Risk of inaccurate measured values

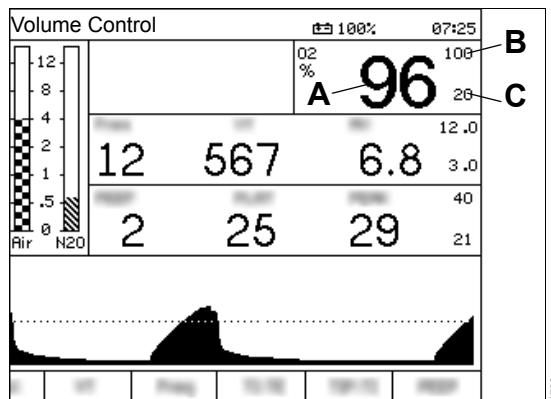
If the O₂ sensor is removed, this can lead to leaks in the breathing system.

When the O₂ sensor is replaced or removed, it must be recalibrated.

NOTE

If the anesthesia workstation is not used, remove the O₂ sensor from the cover of the inspiratory valve and insert the sealing plug provided.

Parameter field for O₂ monitoring



The following information is displayed in the parameter field for O₂ monitoring:

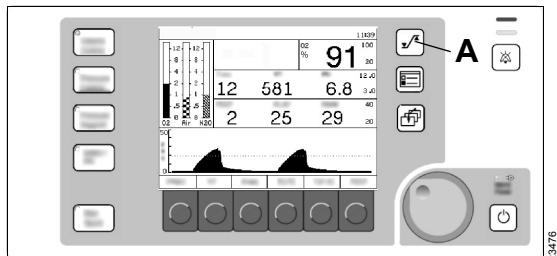
- A Numerical value for the inspiratory O₂ concentration in percent (%) in the range from 10 % to 100 %
- B Upper alarm limit for the O₂ concentration in (%)
- C Lower alarm limit for the O₂ concentration in (%)

Setting the O₂ alarm limits

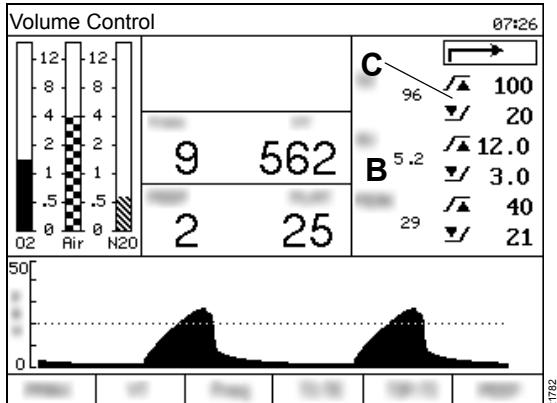
The standard alarm limits configured for the ventilation mode can be used unchanged, see chapter "Restoring the factory settings" on page 139.

or

The alarm limits can be set individually for the current case:



1 Press the (A) key.



The dialog window with the alarm limits (B) opens.

- 2** Adjust the upper and lower alarm limit values of the O₂ concentration (C), see setting ranges of the alarm parameters in chapter "Changing the alarm limits" on page 138.
- 3** Confirm new values.

Calibrating the O₂ sensor

The O₂ sensor must be exposed to the ambient air during the entire calibration. The calibration of the O₂ sensor is done in the scope of the daily checkout of the readiness for operation of Fabius.

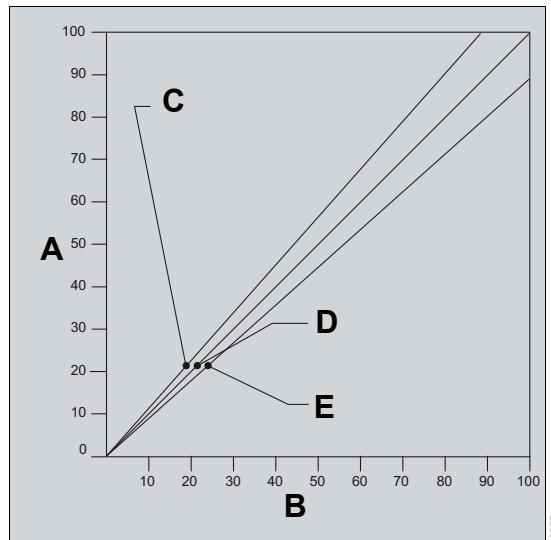
The O₂ sensor can be calibrated in the following ventilation modes:

- In **Standby** mode, see chapter "Calibrating the O₂ sensor" on page 131.
- During ventilation (in all available ventilation modes), see chapter "Calibrating the O₂ sensor" on page 145.

Consequences of incorrect O₂ calibration

If the O₂ sensor is not correctly calibrated, it can lead to faulty measurements. With an air mixture with too high or too low O₂ concentration, Fabius does not perform a calibration completely. However, if the deviating concentration is within defined limits, Fabius completes the calibration even with non-optimal conditions. This can have the consequence that the displayed, measured sensor values indicate an O₂ percentage that is higher or lower than the actual percentage. During the entire calibration, it must therefore be ensured that the O₂ sensor is only exposed to ambient air.

The diagram illustrates the correlation between the air mixture during calibration and the accuracy of the oxygen measurement.



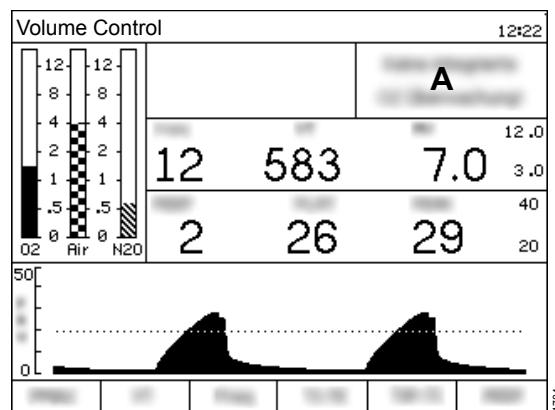
- A** Displayed O₂ percentage
- B** Actual O₂ percentage
- C** During calibration, the sensor was exposed to ambient air with <21 % O₂. Therefore, the displayed O₂ percentage is higher than the actual O₂ percentage.

- D** Correct calibration with ambient air (21 % O₂) during the entire calibration time period.

Displayed O₂ percentage = actual O₂ percentage

- E** During calibration, the sensor was exposed to ambient air with >21 % O₂. Therefore, the displayed O₂ percentage is lower than the actual O₂ percentage.

Deactivating the O₂ monitoring



If Fabius is configured by DrägerService for operation with deactivated O₂ monitoring, the following functions of the O₂ monitoring, are deactivated:

- Parameter field for O₂ monitoring
- Setting of O₂ alarm limits
- Calibration of O₂ sensor
- Alarms for the inspiratory O₂ concentration and the O₂ sensor

The message **No Integrated O₂ Monitoring!** is displayed in the O₂ monitoring window (A).

NOTE

If the internal FiO₂ monitoring is deactivated, an external FiO₂ monitoring must be available in accordance with general safety standards.

Breathing volume monitoring

The breathing volume is measured by the flow sensor based on thermal anemometry. The values of the flow sensor are converted in the following parameters and displayed:

- Minute volume (**MV**)
- Tidal volume (**VT**)
- Respiratory rate (**Freq**)

CAUTION

Risk of incorrect measured values

The breathing volume monitoring can be compromised by the operation of electrosurgical devices or short-wave and microwave diathermy devices in the immediate vicinity.

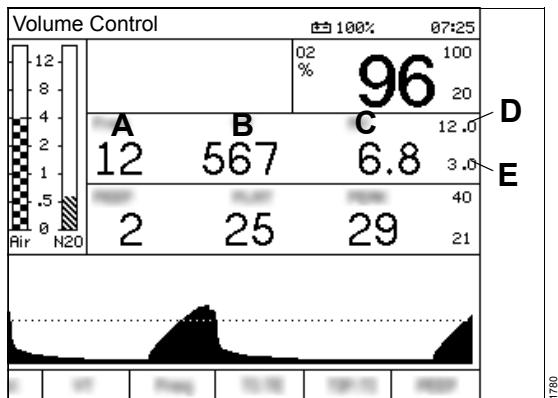
NOTE

Sudden, irregular expiratory flow can cause erratic changes in the display of the tidal volume and the respiratory rate. Before reading the display again, wait at least one minute.

The following information is displayed in the parameter field for breathing volume:

- A** The respiratory rate (**Freq**) indicates the breaths during the past minute in breaths per minute (bpm) (1/min).
The display is activated after 2 breaths.
The display range is between 2 bpm (1/min) and 99 bpm (1/min).
- B** The tidal volume (**VT**) indicates the expiratory volume for every breath in milliliters (mL).
The display range is between 0 mL and 1400 mL.
- C** The measured value for the minute volume (**MV**) continually indicates the volume of the gas breathed out in the past minute in liters per minute (L/min).
The display range is between 0.0 L/min and 99.9 L/min.
- D** Upper alarm limit of the minute volume in L/min
- E** Lower alarm limit of the minute volume in L/min

Parameter field for breathing volume



Volume alarms

Volume alarms in automatic ventilation modes

If the volume alarm messages are activated and Fabius does not detect a breath in a specific time period, the alarm **APNOEA FLOW !!** or **APNOEA FLOW !!!** is triggered, see chapter "Alarm – Cause – Remedy" on page 157.

Volume alarms in *ManSpont*

If the volume alarm messages are activated and Fabius does not detect a breath in a specific time period, after 30 seconds the alarm **APNOEA**

FLOW !! with the priority CAUTION is triggered. If this alarm is not remedied, the priority increases after a further 30 seconds to WARNING.

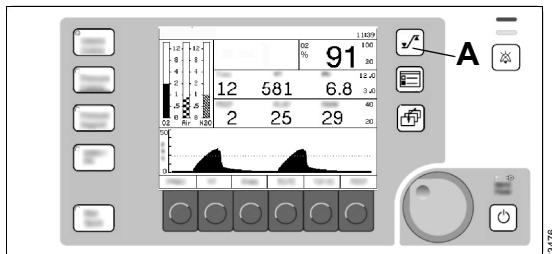
The volume alarm messages are automatically activated when changing from **Standby** mode in a ventilation mode.

Setting the minute volume alarm limits

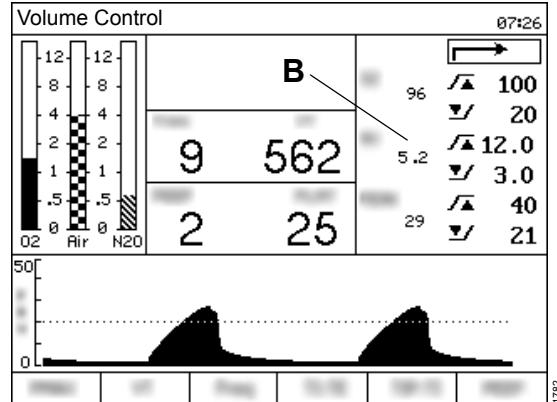
The standard alarm limits configured for the ventilation mode can be used unchanged, see chapter "Changing the alarm limits" on page 138,

or

the alarm limits can be set individually for the current case.



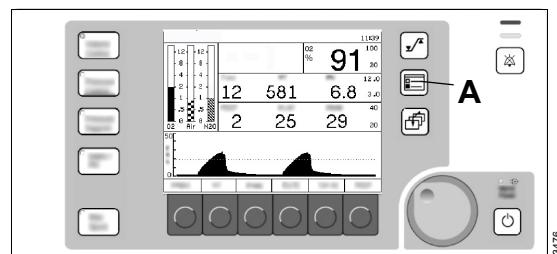
- 1 Press the (A) key.



The dialog window (B) with the alarm limits opens.

- 2 Adjust upper and lower alarm limit values of the minute volume (**MV**), see setting ranges of the alarm parameters in chapter "Changing the alarm limits" on page 138.
- 3 Confirm new values.

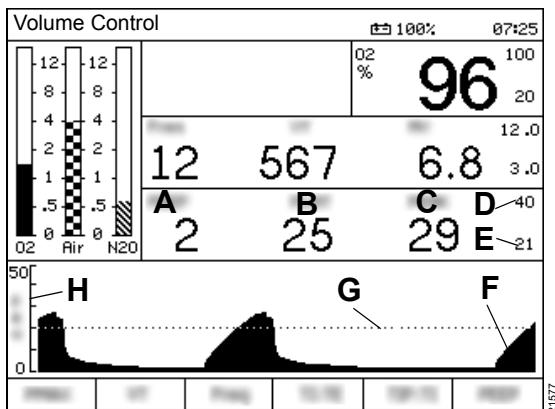
Deactivating the volume alarms



The volume alarms can be switched on and off during operation by pressing the key (A), see chapter "Switching the volume alarms on and off" on page 144.

Airway pressure monitoring

Parameter field and waveform window for airway pressure



The following parameters are displayed in numerical and graphical form in the parameter field and in waveform window for the airway pressure:

- A** The positive end-expiratory pressure (**PEEP**) indicates the airway pressure at the end of the expiration in cmH₂O (hPa). The display range is between 0 and 30 cmH₂O (0 and 30 hPa).
- B** The plateau pressure (**PLAT**) indicates the airway pressure at the end of the inspiration in cmH₂O (hPa). The display range is between 0 and 80 cmH₂O (0 and 80 hPa).

or

The mean airway pressure (**MEAN**) indicates the average of all pressure values that were recorded during a breath in cmH₂O (hPa). The display range is between 0 and 50 cmH₂O (0 and 50 hPa).

C The peak pressure (**PEAK**) indicates the highest pressure value of each breath in cmH₂O (hPa). The display range is between 0 and 80 cmH₂O (0 and 80 hPa).

D Upper alarm limit

E Pressure threshold

F Pressure waveform

G Pressure threshold as a line

The pressure threshold is used for the detection of apnea (disconnection) and continuous pressure. If the pressure waveform does not cross the pressure threshold either from above or below, an alarm is sounded.

H Scale of the pressure waveform with display range from 0 to 20, 0 to 50, or 0 to 100 cmH₂O (0 to 20, 0 to 50, or 0 to 100 hPa). The scaling is done automatically.

Pressure alarms in automatic ventilation modes

If Fabius does not detect a breath in a specific time period, the alarm **APNOEA PRESSURE !!** or **APNOEA PRESSURE !!!** is triggered, see chapter "Alarm – Cause – Remedy" on page 157.

Pressure alarms in *ManSpont*

If Fabius does not detect a breath in a specific time period, after 30 seconds the alarm **APNOEA PRESSURE !!** with the priority CAUTION is triggered. If this alarm is not remedied, the priority increases after a further 30 seconds to WARNING.

NOTE

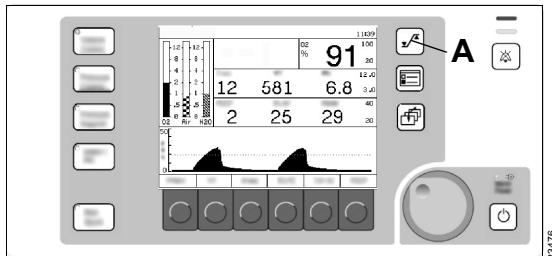
Fabius can be configured by DrägerService or an authorized local service partner so that the mean airway pressure (**MEAN**) is displayed instead of the plateau pressure (**PLAT**).

Setting the upper alarm limit and the pressure threshold

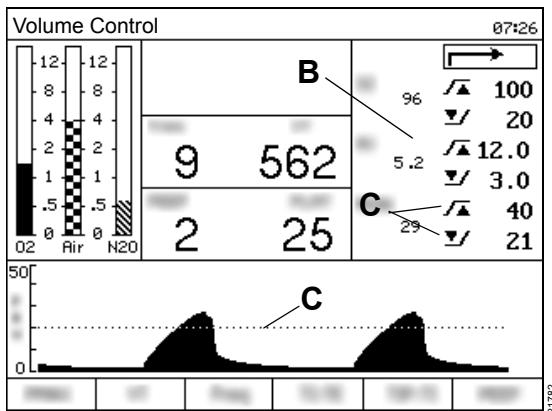
The standard alarm limits configured for the ventilation mode can be used unchanged, see chapter "Changing the alarm limits" on page 138.

or

The alarm limits can be set individually for the current case:



- 1 Press the (A) key.



The dialog window (B) with the alarm limits opens.

- 2 Adjust upper alarm limit and pressure threshold of the airway pressure (**PEAK**) (C), see chapter "Changing the alarm limits" on page 138.
- 3 Confirm new values.

NOTE

The pressure threshold is preferably to be set so that the value lies approx. 4 cmH₂O (hPa) under the current peak pressure.

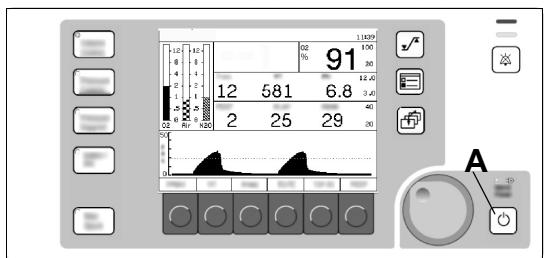
Configuration

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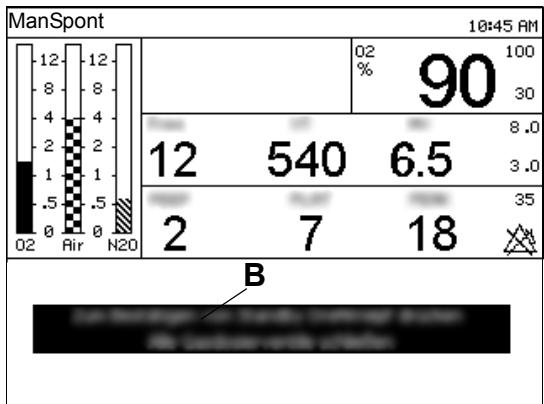
Configuration in standby mode

The following configuration functions are available in **Standby** mode:

- Calibrations
- System tests
- Management of default settings



- 1 Press the (A) key.



The pressure waveform window is replaced by a confirmation message (B) and instructions to turn off the flow.

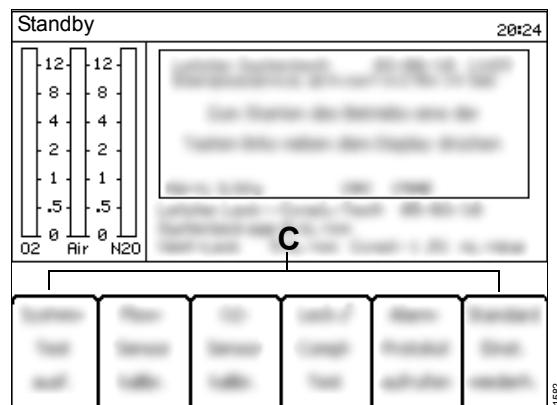
The LED of the key (A) starts flashing. It flashes until the **Standby** mode is confirmed.

NOTE

If the confirmation is not done within 15 seconds, the ventilator remains in the previous mode and the pressure waveform window is restored.

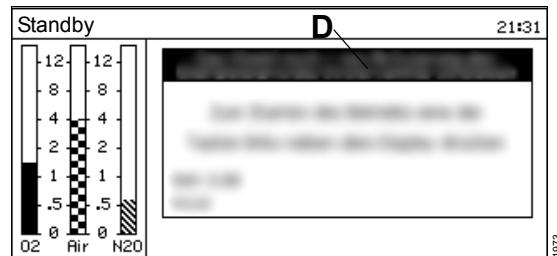
- 2 Confirm the new mode.

The ventilator changes to **Standby** mode. The previous screen is replaced by the start screen **Standby** and the standby LED is continually lit.



The following softkeys (C) are displayed on the start screen:

- **RunSystem Test**
- **CalibrateFlow Sensor**
- **CalibrateO2 Sensor**
- **Leak / Compl Test**
- **AccessAlarm Log**
- **Restore Site Defaults**



If the flow control valves are not closed before accessing **Standby** mode, the following message (D) is shown on the start screen:

Gas still flowing - shut off all gas flow control valves to activate Sleep Mode.

As soon as the flow control valves are closed, the message disappears.

3 Close the flow control valves.

Power-saving mode



When Fabius is in **Standby** mode and there is no user input for 2.5 minutes, the power-saving mode is activated. The screen is then replaced by the screensaver. Press any key to end the screensaver.

Performing the system test

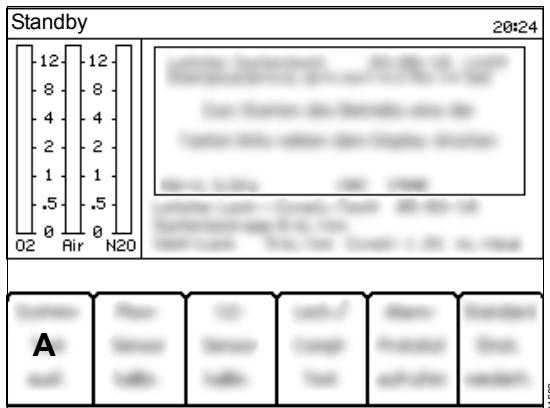
In **Standby** mode, a system test can be started. This test corresponds to the test that is performed automatically after switching on the anesthesia workstation. More information can be found in chapter "Switching on" on page 86.

WARNING

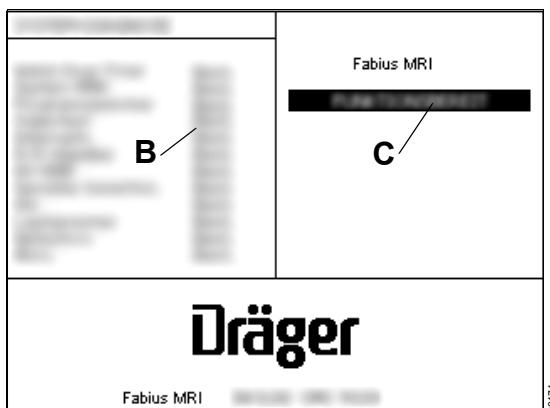
Risk of patient injury

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.

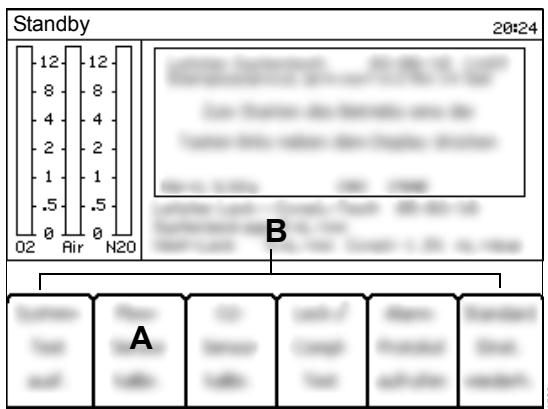


- 1 Press the **RunSystem Test** softkey (A).
 - Electrical system components are tested.
 - Default settings are restored.



The test results (B) are displayed on the screen. After completion of the system test, the total test results (C) are displayed, see chapter "Checking the readiness for operation" on page 88. If the system test was successful, the **Standby** mode is activated.

Calibrating the flow sensor



- 1 Press the **Calibrate Flow Sensor** softkey (A).
- 2 Follow the instructions on the screen.

At the start of the calibration, the instructions are hidden and the following message is displayed above the standby softkeys (B):

Flow Calibration in progress

After the calibration, one of the following two messages are displayed above the standby softkeys (B):

Flow Calibration completed - reconnect expiratory hose

or

Flow Calibration Failed

Troubleshooting with failed flow calibration

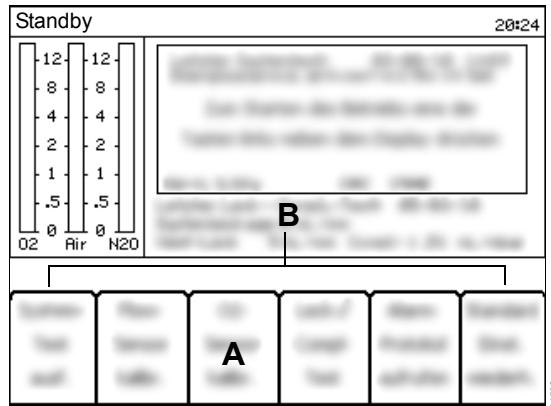
- Repeat the calibration.
- Replace the flow sensor.

If the calibration continues to fail, contact DrägerService or the authorized local service partner.

Calibrating the O2 sensor

In order for the O2 sensor to be correctly calibrated, it must be exposed to the ambient air during the entire calibration.

To avoid leakage, remove the O2 sensor from the cover of the inspiratory valve. Seal the cover of the inspiratory valve with the valve cover plug.



- 1 Press the **Calibrate O2 Sensor** softkey (A).
- 2 Follow the instructions on the screen.

At the start of the calibration, the instructions are hidden and the following message is displayed above the standby softkeys (B):

O2 Calibration in progress

After the calibration, one of the following two messages are displayed above the standby softkeys (B):

O2 Sensor Calibration completed - reinsert O2 sensor

or

O2 Sensor Calibration Failed

Troubleshooting with failed O₂ calibration

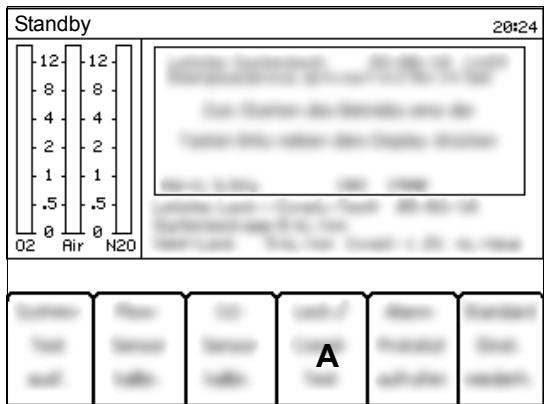
- Replace the O₂ sensor capsule in the O₂ sensor housing, see chapter "Inserting a new O₂ sensor capsule" on page 75.

If the calibration continues to fail, contact DrägerService or the authorized local service partner.

Leakage test

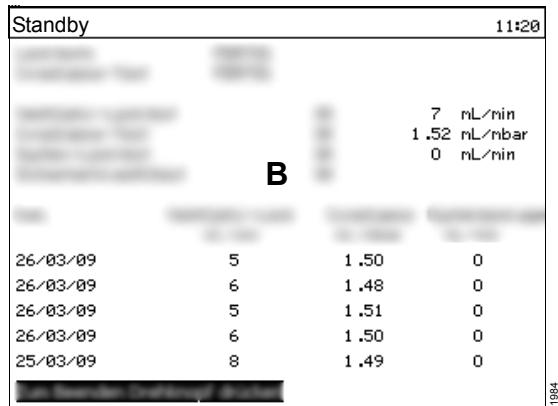
The following tests are initiated during the leakage test:

- Compliance Test**
- System Leak Test**
- Ventilator Leak Test**
- Safety Relief Valves Test**



- Press the **Leak /ComplTest** softkey (A).

- Follow the instructions on the screen.



After completion of the tests, the results (B) are displayed on the screen.

- To return to the start screen, press the rotary knob.

Results of the compliance test

This test determines the system compliance including breathing system, breathing hoses, filter, and Y-piece.

The system compliance is required to ensure in **Volume Control** mode that the applied tidal volume corresponds to the set tidal volume.

System compliance [mL/cmH ₂ O]	Displayed result [mL/cmH ₂ O]
≤6.5	Measured value and PASSED

The value of the compliance is displayed on the **Standby** screen.

Results of the ventilator leakage test

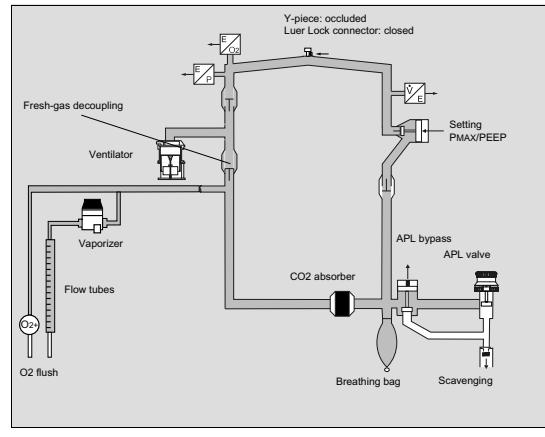
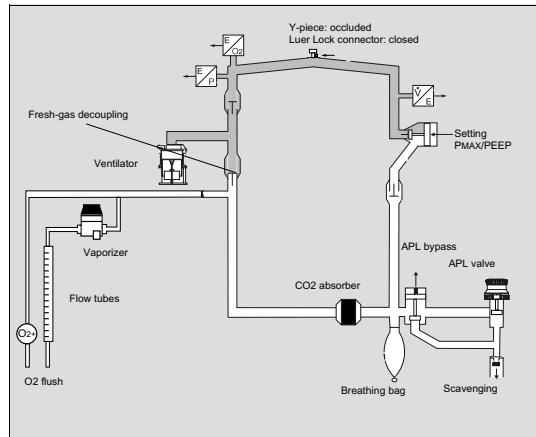
The test of the ventilator leakage can have the following results:

Ventilator leakage [mL/min]	Displayed result [mL/min]
150	Measured value and PASSED
151 to 250	Measured value and FAILED
>250	>250 and FAILED

Results of the system leakage test

The test of the system leakage can have the following results:

System leakage [mL/min]	Displayed result [mL/min]
250	Measured value and PASSED
251 to 350	Measured value and FAILED
>350	>350 and FAILED



Test of the overpressure safety valve

This test checks the functionality of the overpressure safety valve.

The test results are displayed on the screen with the leakage test results (B).

Troubleshooting with failed test of the overpressure safety valve

WARNING

Risk of unexpected occurring overpressure

A soiled or non-functioning overpressure safety valve is not able to compensate for suddenly occurring overpressure in the breathing system.

Perform the leakage test before start-up of the device. Observe the test results of the overpressure safety valve.

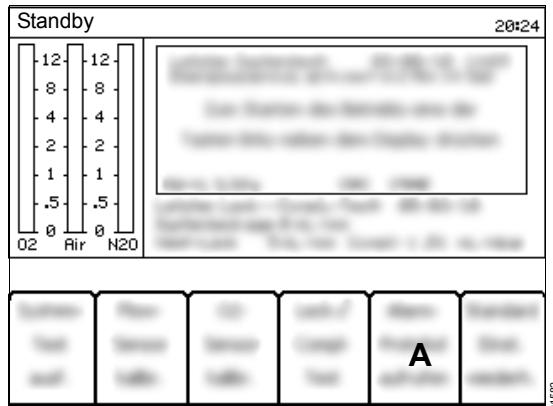
- Repeat leakage test. If the test of the overpressure safety valve continues to fail, contact DrägerService or the authorized local service partner.

Accessing the alarm logbook

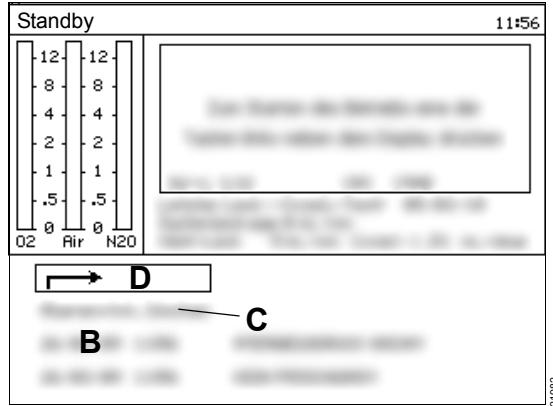
The alarm logbook lists all alarm messages with the respective date and time.

Up to a maximum of 100 entries can be saved.

When the storage limit is reached, the oldest entries are overwritten.



- 1 Press the **Access Alarm Log** softkey (A).



- 2 To scroll through the alarm logbook (B), turn the rotary knob.

Clearing the alarm logbook

- Select **Clear Alarm Log** (C) and confirm

Closing the alarm logbook

- Select the input arrow (D) and confirm.

The screen changes to **Standby** mode.

CAUTION

Risk of losing data

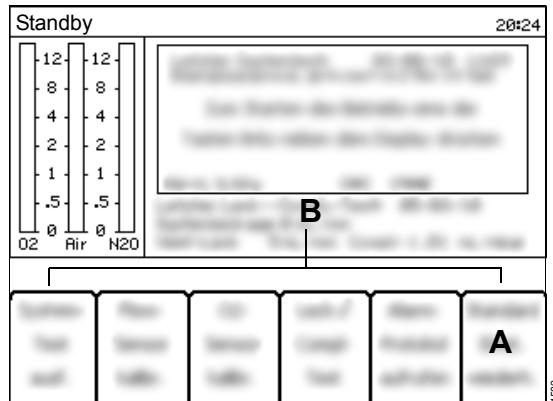
All data in the alarm logbook are cleared in the following cases:

- Fabius is switched off.
- The system test is started in standby mode.
- The power supply fails.

Restoring the default settings

The default settings are restored in the following cases:

- Switching Fabius on and off
- Performing the system test
- Pressing the softkey **Restore Site Defaults**



- 1 Press the **Restore Site Defaults** softkey (A).

The default settings are restored. The following message is displayed using the standby softkeys (B):

Site Default settings restored

The default settings can be adjusted on the **Standby Set-up** screen. Adjustment of the default settings is password-protected.

WARNING

Risk due to unsuitable ventilation settings

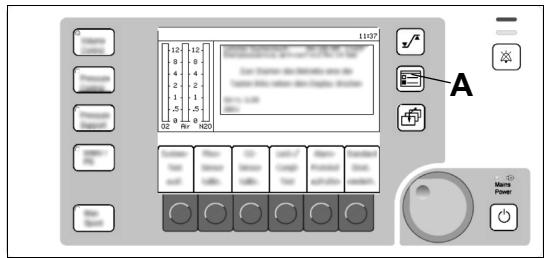
After the default settings are restored, check whether the settings for the ventilation and monitoring are suitable for the patient.

Page Standby Set-up

Pressing the  key in **Standby** mode provides access to various default settings and configuration settings.

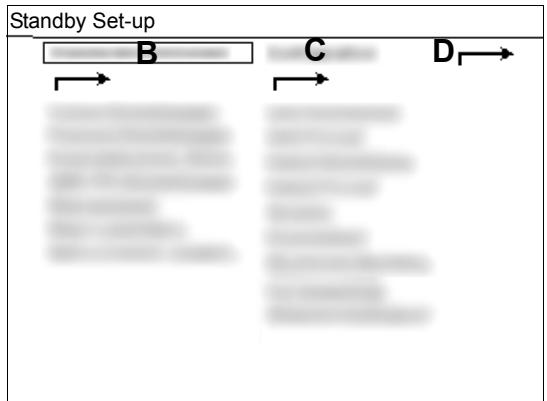
Access is password-protected. On request the password can be deactivated or a personal password can be defined.

The settings made are saved as default settings and configurations.



- 1 Press the  (A) key.

The **Standby Set-up** screen opens

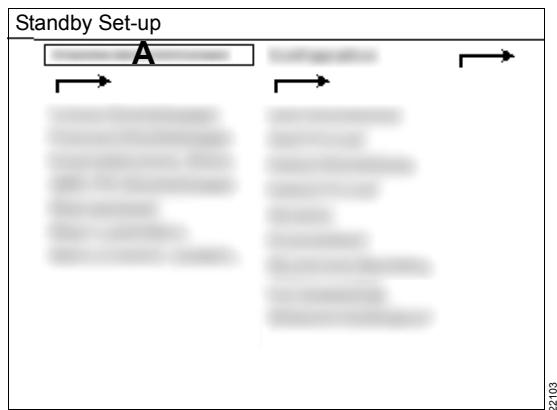


- 2 Select **Default Settings** (B) or **Configuration** (C) with the cursor.

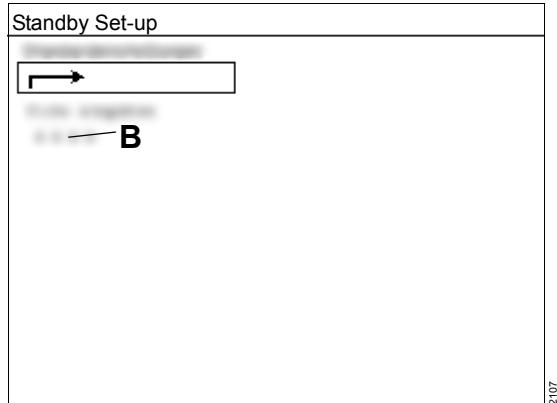
By selecting and confirming with the input arrow (D), the screen changes back to the **Standby** screen.

Changing the default settings

- 1 On the **Standby Set-up** screen, select **Default Settings** (A) and confirm.

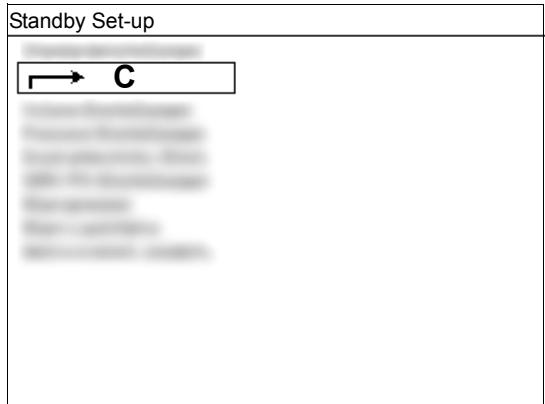


The screen with the password query opens.



- 2 In the displayed row, select the digits in sequence and confirm.

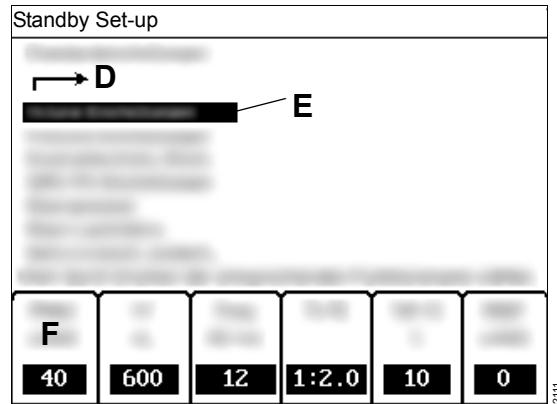
The screen with the default settings opens.



The following settings can be changed:

- **Volume Settings**
- **Pressure Settings***
- **Pressure Support Settings***
- **SIMV/PS Settings***
- **Alarm Limits**
- **Minimum Alarm Volume**
- **Restore Factory Defaults**
- To return to the **Standby Set-up** screen, select the input arrow (C) and confirm.

Default settings for Volume Control



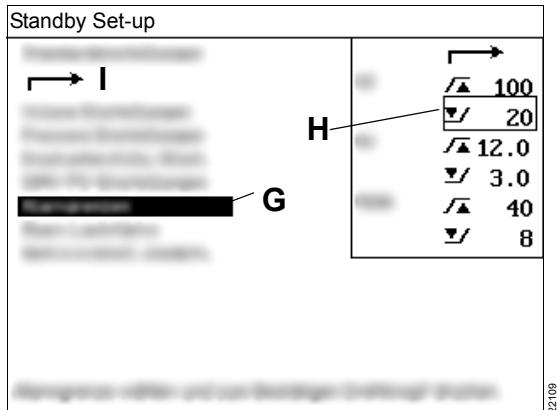
- 1 Select **Volume Settings** (E) and confirm.
- 2 Press softkey (F) of the parameter to be changed.
- 3 Select new value and confirm.
- 4 If necessary, repeat steps 2 and 3 for other parameters.
- 5 Finally, confirm all changes once again.

The window is closed, the cursor is on the input arrow (D).

Default settings for Pressure Control, Pressure Support, and SIMV/PS

- Change the parameters (see description in section "Default settings for Volume Control" on page 137).

* optional

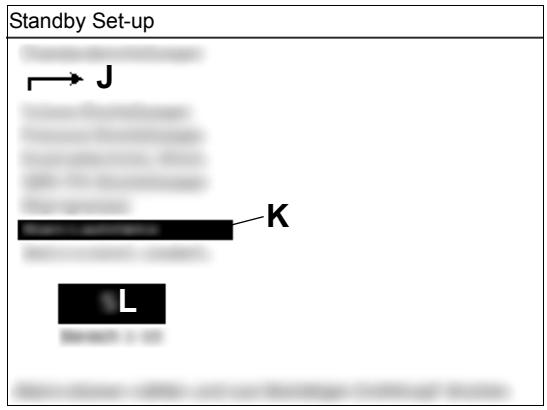
Changing the alarm limits

- 1 Select **Alarm Limits** (G) and confirm.
- 2 Select the alarm limits (H) to be changed and confirm.
- 3 Select new value and confirm.
- 4 If necessary, repeat steps 2 and 3 for other alarm limits.
- 5 Select the input arrow (I) and confirm.

The window is closed.

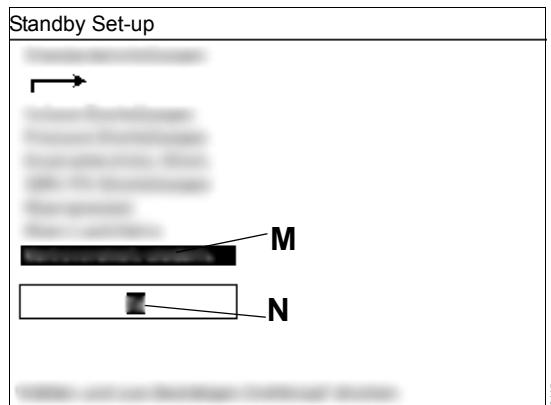
In the following table, the values for the setting ranges and factory settings are listed for all alarm limits of Fabius.

Alarm parameter	Setting range	Factory setting
O ₂ [%]	/▲ 19 to 100 ▼ 18 to 99	100 20
MV [L/min]	/▲ 0.1 to 20.0 ▼ 0.0 to 19.9	12.0 3.0
Pressure [[cmH ₂ O] (hPa)]	/▲ 10 to 70 ▼ 5 to 30	40 8

Changing the minimum alarm volume

- 1 Select **Minimum Alarm Volume** (K) and confirm.
The current minimum alarm volume (L) is displayed on the screen.
- 2 Set the new minimum alarm volume to a value between 1 (minimum) and 10 (maximum) and confirm.
The window is closed, the cursor is on the input arrow (J).

Restoring the factory settings



- 1 Select **Restore Factory Defaults** (M) and confirm.
- 2 Select **Yes** or **No** (N) and confirm.

If **Yes** is selected, the factory settings are restored. The factory settings replace the current default settings.

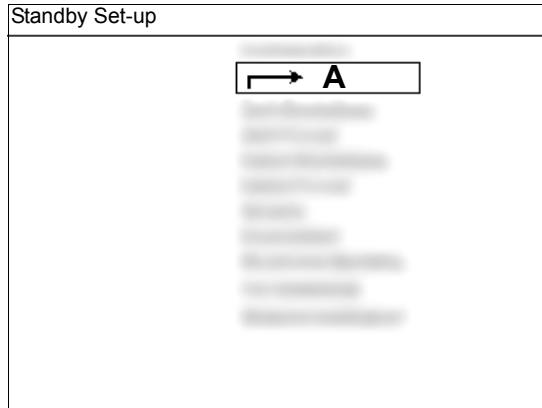
The values for the factory settings for Fabius are listed in the following table.

Parameter	Factory setting
Volume Control	PMAX = 40 VT = 600 Freq = 12 TI:TE = 1:2.0 TIP:TI = 10 PEEP = 0
Pressure Control	PINSP = 15 Freq = 12 TI:TE = 1:2.0 Insp Flow = 30 PEEP = 0

Parameter	Factory setting
Pressure Support	APPS = 10 Freq Min = 3 Trigger = 2 Insp Flow = 30 PEEP = 0
SIMV/PS	PMAX = 40 VT = 600 Freq = 12 APPS = 10 PEEP = 0 Trigger = 2 Insp Flow = 30 TINSP = 1.7 TIP:TI = 10
Alarm limits for O ₂	Upper value = 100 Lower value = 20
Alarm limits for MV	Upper value = 12.0 Lower value = 3.0
Upper alarm limit and pressure threshold for PEAK	Upper value = 40 Lower value = 8
Minimum Alarm Volume	Volume = 5

Changing the configurations

- 1 On the **Standby Set-up** screen, select **Configuration** and confirm.

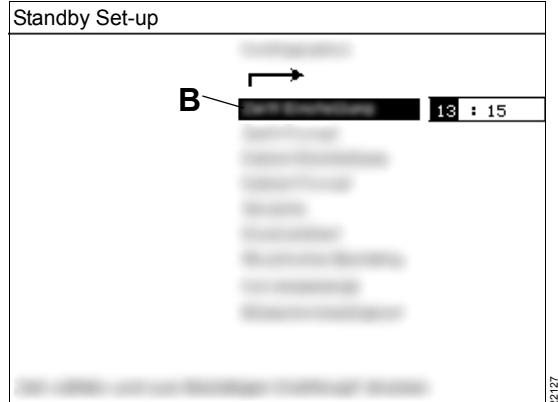


The screen with the configuration settings opens.

The following settings can be changed:

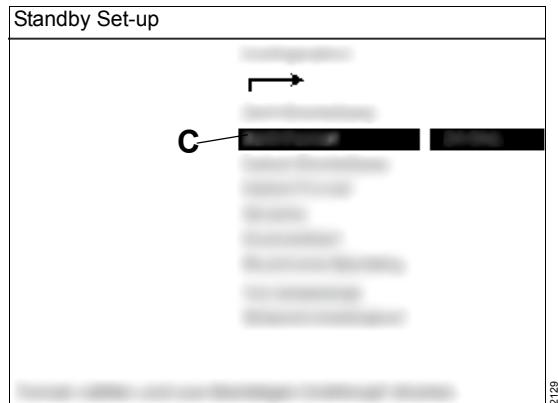
- **Time Set**
 - **Time Format**
 - **Date Set**
 - **Date Format**
 - **Language**
 - **Pressure Unit**
 - **Acoustic Confirmation**
 - **Waveform Display**
 - **Display Background**
- To return to the **Standby Set-up** screen, select the input arrow (A) and confirm.

Changing the time

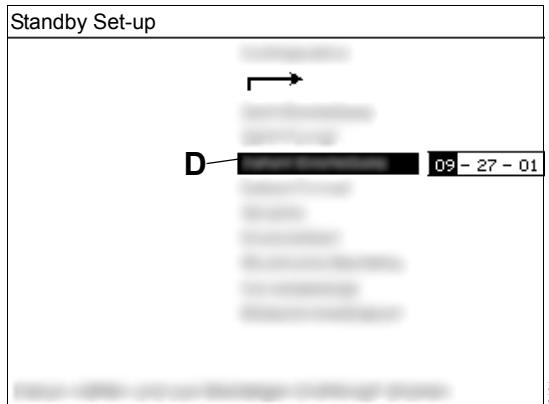


- 1 Select **Time Set** (B) and confirm.
The cursor is in the hour field.
- 2 Select new value and confirm.
The cursor moves to the minute field.
- 3 Select new value and confirm.
The window is closed.

Changing the time format

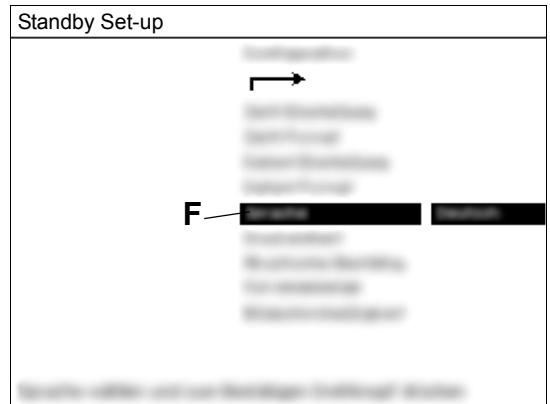


- 1 Select **Time Format** (C) and confirm.
- 2 Select new format and confirm.
The window is closed.

Changing the date

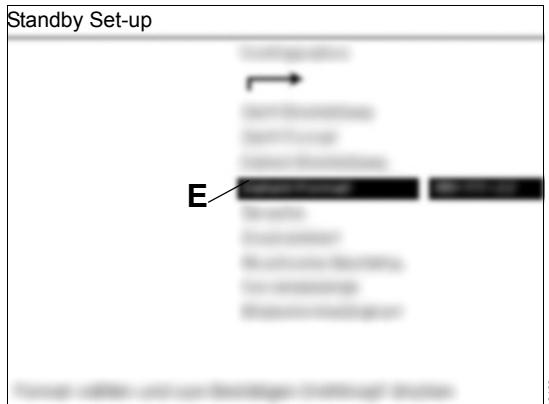
- 1 Select **Date Set** (D) and confirm.
- 2 Select new value and confirm.

The window is closed.

Changing the language

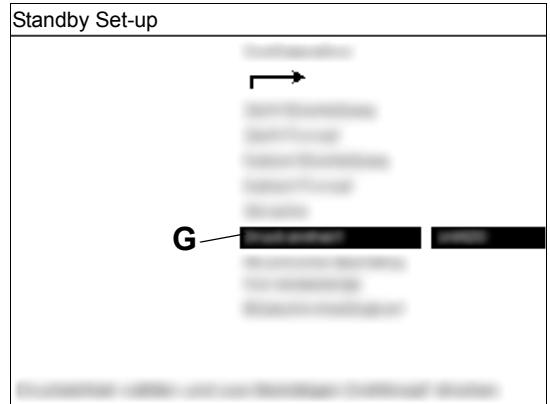
- 1 Select **Language** (F) and confirm.
- 2 Select language and confirm.

The window is closed.

Changing the date format

- 1 Select **Date Format** (E) and confirm.
- 2 Select new format and confirm.

The window is closed.

Changing the pressure unit

- 1 Select **Pressure Unit** (G) and confirm.
- 2 Select new unit and confirm.

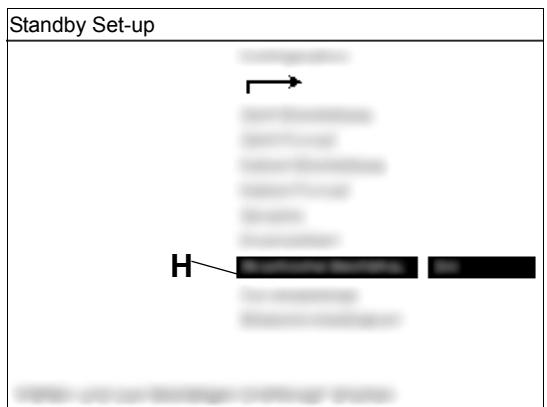
The following units can be selected:

- **hPa**
- **cmH₂O**
- **mbar**
- **kPa**

- 1 Select new unit and confirm.
- 2 Select new unit and confirm.

The window is closed.

Activating the acoustic confirmation



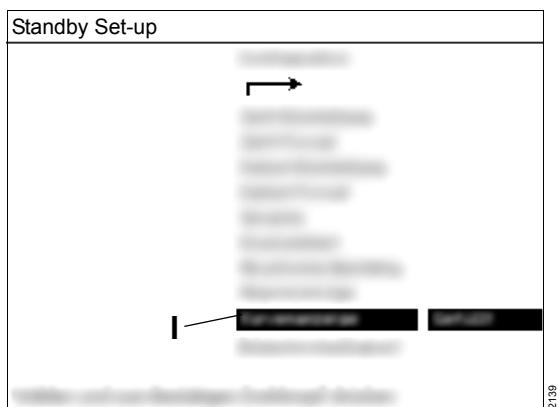
When the function **Acoustic Confirmation** is switched on, a tone is sounded when pressing the rotary knob.

- 1 Select **Acoustic Confirmation** (H) and confirm.

- 2 Select **On** or **Off** and confirm.

The window is closed.

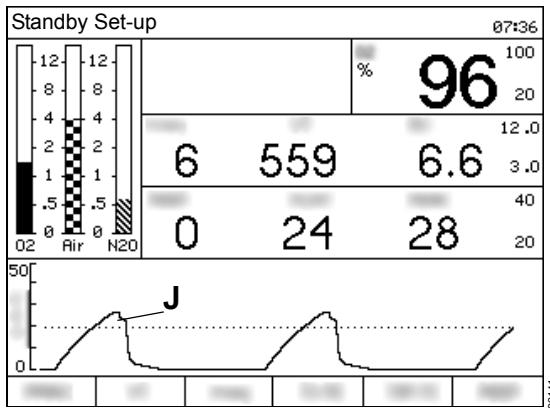
Changing the waveform display



- 1 Select **Waveform Display** (I) and confirm.

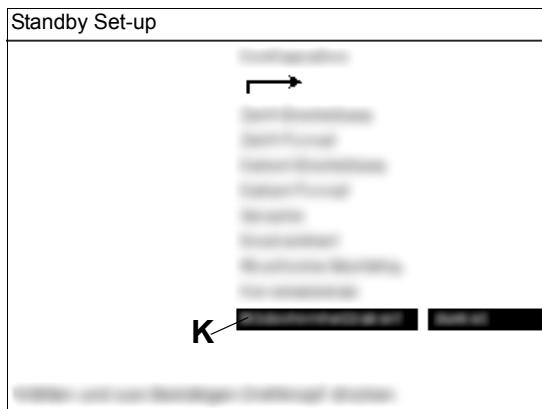
- 2 Select **Normal** or **Filled** curve display and confirm.

The window is closed.



When the setting **Normal** is selected, the pressure waveform (J) is not shown as a filled area, but as a line.

Changing the screen brightness*



- 1 Select **Display Background** (K) and confirm.

- 2 Select **Light** or **Dark** screen brightness and confirm.

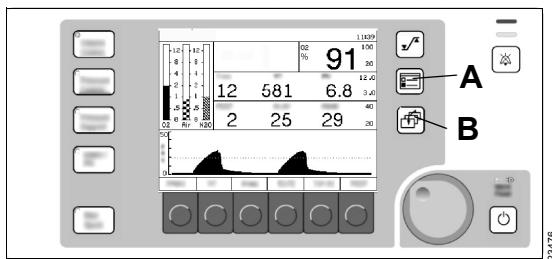
The window is closed.

* available only with optional color screen

Configuration during operation

If Fabius is in one of the ventilation modes, the following configuration functions can be performed:

- Calibration of the O₂ sensor
- Displaying and changing the monitoring settings
- Changing configurations



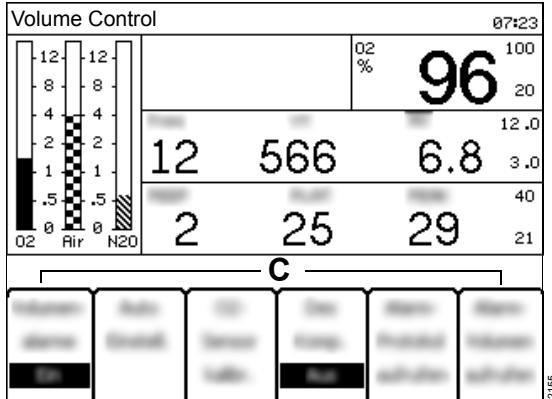
The following softkeys (C) are displayed on the screen, e.g., in **Volume Control** mode:

- **VolumeAlarms ON/OFF**
- **Auto Set**
- **CalibrateO₂ Sensor**
- **DesComp ON/OFF**
- **AccessAlarm Log**
- **AccessAlarm Volume**

If no change is made within 15 seconds, the pressure waveform is displayed again.

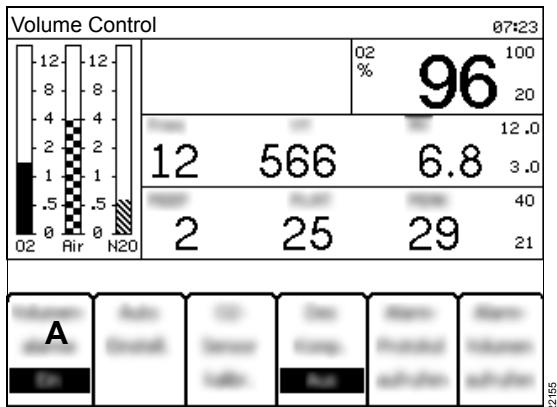
Pressing the key (B) will also cause the pressure waveform window to be displayed again.

- 1 Press the (A) key.



The pressure waveform is no longer displayed.

Switching the volume alarms on and off



- 1 Press the **VolumeAlarms ON/OFF** softkey (A).

The key label changes from **Volume Alarms ON** to **Volume Alarms OFF**.

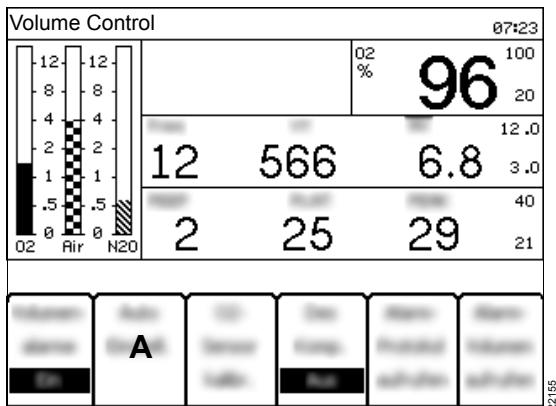
Instead of the upper and lower alarm limits, the symbol appears, indicating the alarm is deactivated.

The volume alarms are deactivated.

NOTE

The function **Volume Alarms ON/OFF** is available in the standard view of the **ManSpont** mode. If the key is pressed in **ManSpont** mode, the softkey **Volume Alarms ON/OFF** is not displayed.

Automatic setting of the pressure threshold



- 1 Press the **AutoSet** softkey (A).

The pressure threshold for the peak pressure (**PEAK**) is set to 4 cmH₂O (hPa) below the current plateau pressure (**PLAT**).

NOTE

The pressure threshold must not be below 5 cmH₂O (5 hPa) or above 30 cmH₂O (30 hPa).

NOTE

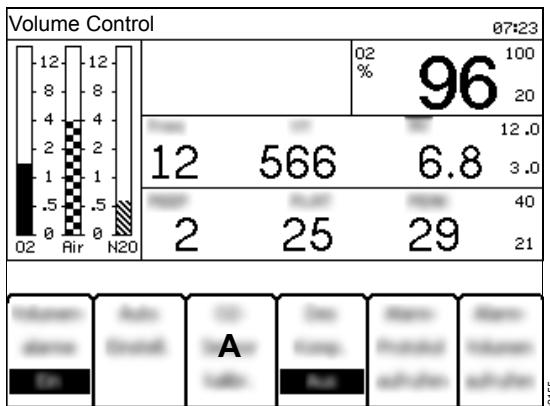
If no current measured value is available for the plateau pressure (**PLAT**), pressing the softkey has no effect.

NOTE

In **SIMV/PS** mode, the pressure threshold depends on the pressure of the mandatory breaths.

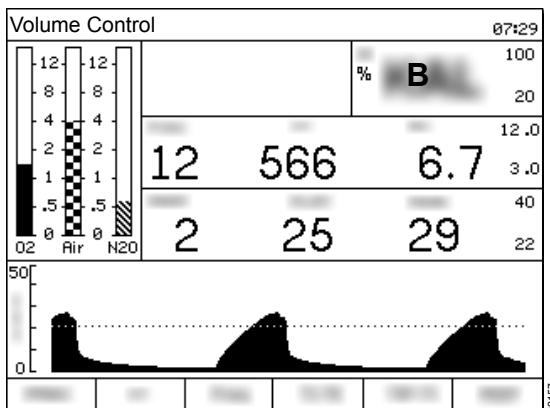
Calibrating the O₂ sensor

If the calibration continues to fail, contact DrägerService or the authorized local service partner.



- 1 Press the **CalibrateO₂ Sensor** softkey (A).
- 2 Follow the instructions on the screen.

To calibrate the O₂ sensor, proceed as described in chapter "Calibrating the O₂ sensor" on page 131.



During the calibration, the O₂ value in the window (B) of the O₂ monitoring is replaced by the word **CAL**. The calibration time is approx. 15 seconds. After successful calibration, the O₂ measured value is again displayed.

- If the calibration was not successful, replace the O₂ sensor capsule in the O₂ sensor housing, see chapter "Inserting a new O₂ sensor capsule" on page 75.

Switching the desflurane compensation on and off

The desflurane compensation optimizes the volume measurement when desflurane is used.

Operation in MR environments

WARNING

Risk of malfunction

The D-Vapor is not approved for operation in MR environments.

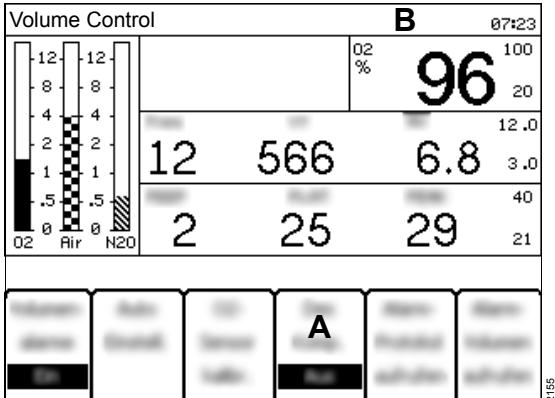
In MR environments, use only vaporizers of type Vapor 2000.

CAUTION

Risk of inaccurate measured values

The accuracy of the volume measurement can be affected if the desflurane compensation is activated, even though desflurane is not being used.

The corresponding softkey must indicate **DesComp OFF**.



If the softkey (A) for switching on the desflurane compensation is showing **DesComp ON**:

- 1 Press the **DesComp ON** softkey (A).

The key label changes from **DesComp ON** to **DesComp OFF**.

The message **Des on** in the status line (B) is no longer displayed. The desflurane compensation is deactivated.

Operation outside MR environments

CAUTION

Risk of inaccurate measured values

If the activation of the desflurane compensation is forgotten during the use of desflurane or if the desflurane compensation is activated even though desflurane is not being used, the accuracy of the volume measurement can be influenced.

Only switch on desflurane compensation if desflurane is used.

CAUTION

Risk of inaccurate measured values

If anesthetic gas monitor is used, the automatic desflurane compensation is activated. Faulty anesthetic gas monitors can influence the accuracy of the measured volume.

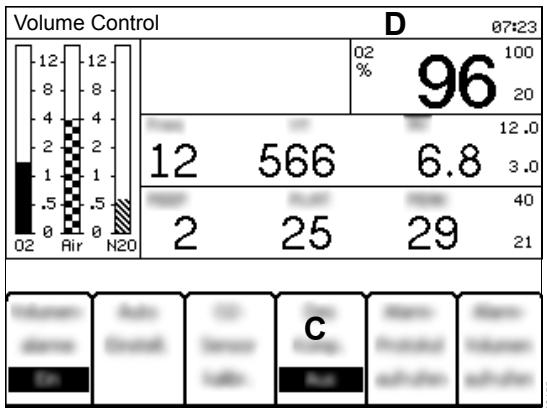
Make sure that the anesthetic gas monitor functions correctly.

CAUTION

Risk of inaccurate measured values

Desflurane influences the measurement accuracy of the flow sensor.

If desflurane is used, activate the desflurane compensation.

**NOTE**

If data for anesthetic gas concentration is available via the communication with an external gas analyzer, Fabius compensates desflurane automatically. In this case, the transmitted data cancel the function of the softkey for desflurane compensation.

- 1 Press the **DesComp OFF** softkey (C).

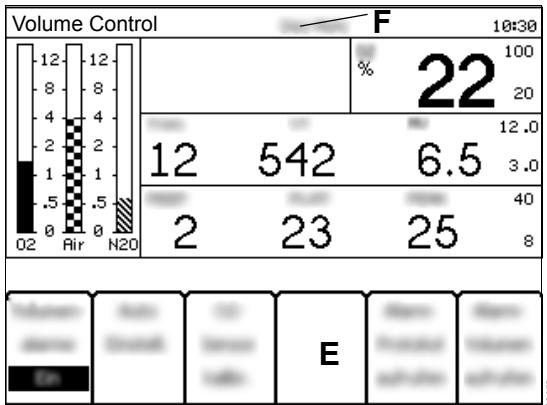
The key label changes from **DesComp OFF** to **DesComp ON**.

The message **Des on** is displayed in the status bar (D). The desflurane compensation is activated.

Automatic desflurane compensation

Prerequisite:

- Fabius MRI is being used outside the MR environment.
- External gas analyzer is connected to Fabius MRI via the RS232 interface.



If the connected anesthetic gas monitor detects desflurane, Fabius reacts as follows:

- **Des auto** is displayed in the status bar (F).
- The softkey **DesComp ON/OFF** (E) is no longer displayed.

If the communication to the anesthetic gas monitor fails, Fabius reacts as follows:

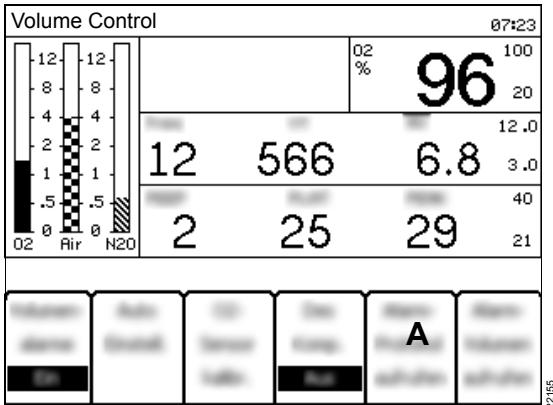
- The automatic desflurane compensation is switched off.
- The message **Des auto** in the status bar (F) is no longer displayed.
- The softkey **DesComp OFF** (E) is displayed.

To switch the desflurane compensation back on:

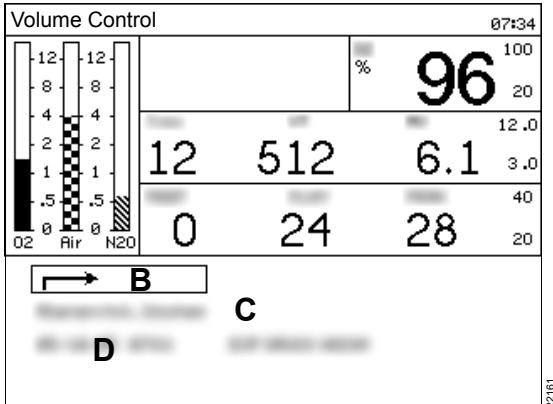
- 1 Press the **DesComp OFF** softkey (E).

The lettering on the softkey (E) changes to **DesComp ON**.

Accessing the alarm logbook



- 1 Press the **AccessAlarm Log** softkey (A).



- 2 To scroll through the alarm logbook (D), turn the rotary knob.

Clearing the alarm logbook

- Select **Clear Alarm Log** (C) and confirm.

Closing the alarm logbook

- Select the input arrow (B) and confirm.

The pressure waveform and softkeys are displayed again.

Changing the alarm volume

WARNING

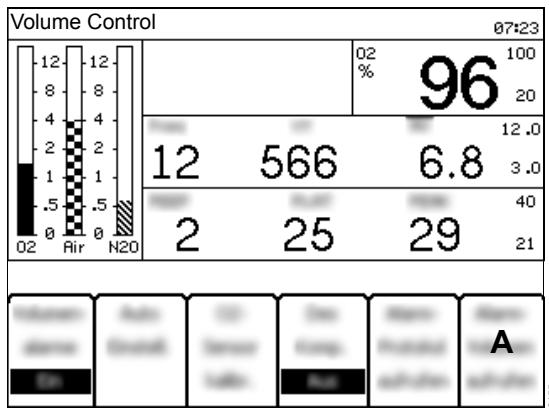
Risk of not hearing the alarm tone

When operating in a loud environment, the acoustic alarm signals may not be heard.

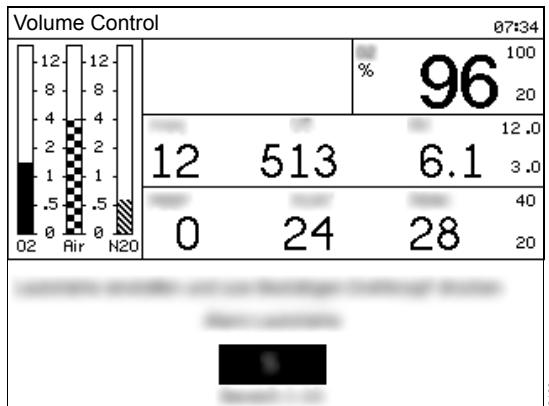
Always set the alarm tone to a sufficient volume.

The lower value is limited by the setting in the standby configuration (see chapter "Changing the minimum alarm volume" on page 138).

The pressure waveform and softkeys are displayed again.



- 1 Press the **AccessAlarm Volume** softkey (A).



- 2 Set the new alarm volume to a value between 1 (minimum) and 10 (maximum) and confirm.

Troubleshooting

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Locating and remedying leakages

Leakages can lead to a failure of the system test or the leakage test and must be remedied.

CAUTION

Risk due to contamination

Anesthetic gas can get into the ambient air as a result of leakages.

- Perform the leakage test before using the device.
- Remedy all leakages.

CAUTION

Risk due to leakage at the valves

Leakages at valves can allow ambient air to enter the breathing system and alter the composition of the breathing gas.

- Perform the leakage test before using the device.
- Check all valves for leakage.

CAUTION

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 CO₂ 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 (cmH₂O).
- The breathing bag, the breathing hoses, the Y-piece, or the microbial filter is incorrectly fitted or damaged.
- The holder for the breathing bag is incorrectly mounted 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 sensor is incorrectly installed or damaged. The rear O-ring is missing.
- The valves or seals of the breathing system are damaged.
- The cone for occluding the Y-piece 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 in 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. Occlude 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 the leakage test, see chapter "Leakage test" on page 132.
- 2 Contact service personnel if the leakages cannot be localized.

Power supply failure

Mains power supply failure

If mains power fails, Fabius automatically switches to the internal battery. With a fully charged battery the supply of the ventilator and the internal monitor functions are maintained for up to 2 hours.

The remaining battery charge is displayed in the status bar.

The operating time of the battery depends on the ventilation settings and the condition of the battery (age and battery charge). A completely charged battery can ensure supply for at least 45 minutes.

In battery operation and in case of decreasing battery charge, the following information is displayed:

- The battery symbol  is displayed in the status bar and the LED indicator for mains power supply goes out.
- The note **POWER FAIL !** is displayed in the alarm window.
- When the remaining battery charge drops below 20 %, the note **BATTERY LOW !** is displayed in the alarm window.
- When the remaining battery charge drops below 10 %, the note in the alarm window is replaced by the alarm **BATTERY LOW !!**.
- Shortly before the battery is empty, the ventilator is switched off and the alarm **VENTILATOR FAIL !!!** is displayed in the alarm window.
- If no manual ventilation follows, the following alarm messages are displayed:
 - **APNOEA PRESSURE !!!**
 - **APNOEA FLOW !!!**
 - **MINUTE VOLUME LOW !!**

The monitoring functions remain in operation until the battery is completely discharged and all electronic components are switched off.

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.

WARNING

Insufficient ventilation of the patient

If the alarm message **BATTERY LOW !!** (remaining battery charge 10%) is displayed for the first time, the ventilator still remains in operation for up to 10 minutes.

Restore mains power supply. Afterwards, the automatic ventilation is available again.

WARNING

Risk of patient injury

When the battery is empty, Fabius switches off automatically.

Never completely discharge the battery. However, if there is a complete discharge of the battery, charge the battery immediately. The device must not be used until the battery is completely charged again.

When the battery is fully discharged, Fabius switches off and generates an optical alarm signal (red LEDs in the alarm LED bars flash, see page 49). All customized settings, including the alarm limits, that deviate from the default settings are lost.

The following ventilation modes are still possible:

- Manual ventilation
- Spontaneous breathing

All pneumatic functions of Fabius are still available:

- APL valve
- Pressure gauge for the airway pressure
- Pressure gauge for gas cylinders and central gas supply
- Fresh-gas supply and anesthetic agent delivery
- S-ORC
- Flow control valves for O₂, Air, and N₂O

WARNING

Incorrect patient settings

When the power supply is restored and Fabius is restarted, all ventilation and alarm settings are reset to default settings.

After the restart of Fabius, check all settings and adjust to the patient if necessary.

Ventilator failure

Alarm VENTILATOR FAIL !!!

If the ventilator does not return to its initial state, the alarm **VENTILATOR FAIL !!!** activates.

Only manual ventilation or spontaneous breathing is possible.

No other ventilation modes can be selected.

In this case, proceed as follows:

- 1 Change to ***ManSpont*** ventilation mode.
- 2 Set the APL valve to position ***Man***.
- 3 Set the APL valve to the desired pressure.
- 4 Fill the breathing bag, if necessary with the aid of the O₂ flush key.
- 5 Manually ventilate the patient.

4 Fill the breathing bag, if necessary with the aid of the O₂ flush key.

5 Manually ventilate the patient.

Before starting the ventilation with an automatic ventilation mode, contact DrägerService or the authorized local service partner.

Bypassing the ventilator

In the following cases, the ventilator must be bypassed so that the ventilation can be continued.

- The ventilator does not return to its initial state after a malfunction.
- and
- The spontaneous breathing mode cannot be activated.

To bypass the ventilator, proceed as follows:

- 1 Set the On/Off switch on the rear of Fabius to  (off).
- 2 Set the On/Off switch back to  (on).

Fabius restarts and performs a selftest. More information on the selftest can be found in section "Checking the readiness for operation" on page 88.

- 1 Select ventilation mode ***ManSpont***.
- 2 Set the APL valve to position ***Man***.
- 3 Set the APL valve to the desired pressure.

Failure of the O₂ sensor

Causes for faulty calibration

The calibration was not successful if, after the calibration of the O₂ sensor, the alarm message **O₂ SENSOR FAIL !** is displayed.

Possible causes and remedial measures are described in the following table.

Cause	Remedy
During the calibration, the O ₂ sensor was exposed to an air mixture with extremely high or low oxygen concentration.	Make sure that the O ₂ sensor is exposed to ambient air during the entire calibration.
During the calibration, the O ₂ sensor was exposed to an air mixture with fluctuating oxygen concentration.	Make sure that the O ₂ sensor is exposed to ambient air during the entire calibration.
The O ₂ sensor was not exposed to ambient air long enough before the calibration.	Expose the O ₂ sensor to ambient air for 2 minutes. When a new O ₂ sensor is connected, expose the new sensor to ambient air for 15 minutes.
The maximum period of use of the O ₂ sensor has elapsed.	Replace the O ₂ sensor. Expose the new O ₂ sensor to ambient air 15 minutes before calibration.
The O ₂ sensor is not connected.	Check the O ₂ sensor. Connect the O ₂ sensor correctly and recalibrate.

Alarm – Cause – Remedy

Alarm messages are displayed in hierarchical form in the alarm message field of the main screen, see chapter "Screen display" on page 43.

The priority of the alarm messages is marked by exclamation points.

The alarm messages are only displayed on colored background if the option "Color display" is activated.

Warning	!!!	Red
Caution	!!	Yellow
Note	!	White

Within an alarm priority, the alarm messages are assigned internal priorities. In the following table, these internal priorities are indicated as numbers.

The alarm message with the highest priority has the number 31. The lower the priority, the lower the number.

The table shows possible causes for an alarm and corresponding remedies. Causes and remedies must be worked through in the order listed until the alarm has been resolved. The alarm messages are listed in alphabetical order.

Some alarms appear in this table several times with different alarm priorities because their priority can change under certain conditions.

Alarm priority	Alarm	Cause	Remedy
(31)	AIRWAY PRESSURE HIGH !!!	The upper alarm limit for the airway pressure was exceeded, the breathing hose is kinked.	Check the breathing circuit connected to the anesthesia workstation.
		The alarm limit was set too low.	Check the breathing system or the alarm limit.

Alarm priority	Alarm	Cause	Remedy
(23/31)	APNOEA FLOW !!	<p>The apnea flow alarm based on a time staggering.</p> <p>In the Volume Control, Pressure Control, SIMV/PS modes with Freq \geq 6 or in Pressure Support mode with apnea ventilation deactivated:</p> <p>Caution = VT <20 mL for >15 seconds</p> <p>In the ManSpont, SIMV/PS modes with Freq < 6 or in Pressure Support mode with apnea ventilation activated:</p> <p>Caution = VT <20 mL for >30 seconds</p>	<p>Breathing/ventilation stopped. Check ventilator.</p> <p>Leakage or disconnection in the breathing system. Check breathing system.</p>

Alarm priority	Alarm	Cause	Remedy
(23/31)	APNOEA FLOW !!!	<p>The apnea flow alarm based on a time staggering.</p> <p>In the Volume Control, Pressure Control, SIMV/PS modes with Freq ≥ 6 or in Pressure Support mode with apnea ventilation deactivated:</p> <p>Warning = VT <20 mL for >30 seconds</p> <p>In the ManSpont, SIMV/PS modes with Freq < 6 or in Pressure Support mode with apnea ventilation activated:</p> <p>Warning = VT <20 mL for >60 seconds</p>	<p>Breathing/ventilation stopped. Check ventilator.</p> <p>Leakage or disconnection in the breathing system. Check breathing system.</p>

Alarm priority	Alarm	Cause	Remedy
(23/31)	APNOEA PRESSURE !!	<p>The apnea pressure alarm is based on a time staggering.</p> <p>In the Volume Control, Pressure Control, SIMV/PS modes with Freq ≥ 6 or in Pressure Support mode with apnea ventilation deactivated:</p> <p>Caution = PAW did not exceed the pressure threshold value for a duration of >15 seconds.</p> <p>In the ManSpont, SIMV/PS modes with Freq < 6 or in Pressure Support mode with apnea ventilation activated:</p> <p>Caution = PAW did not exceed the pressure threshold value for a duration of >30 seconds.</p>	<p>Breathing/ventilation stopped. Check ventilator.</p> <p>Leakage or disconnection in the breathing system. Check breathing system.</p>

Alarm priority	Alarm	Cause	Remedy
(23/31)	APNOEA PRESSURE !!!	<p>The apnea pressure alarm is based on a time staggering.</p> <p>In the Volume Control, Pressure Control, SIMV/PS modes with Freq \geq 6 or in Pressure Support mode with apnea ventilation deactivated:</p> <p>Warning = PAW did not exceed the pressure threshold value for a duration of >30 seconds.</p> <p>In the ManSpont, SIMV/PS modes with Freq < 6 or in Pressure Support mode with apnea ventilation activated:</p> <p>Warning = PAW did not exceed the pressure threshold value for a duration of >60 seconds</p>	
		Breathing/ventilation stopped.	Check ventilator.
		Leakage or disconnection in the breathing system.	Check breathing system.
(20)	APNOEA VENTILATION !!	<p>Breathing/ventilation stopped.</p> <p>Leakage or disconnection in the breathing system.</p> <p>If two or more successive breaths of the apnea ventilation are automatically triggered, the settings for Pressure Support are not correct.</p>	<p>Check ventilator.</p> <p>Check breathing system.</p> <p>Fabius detects a spontaneous breath of the patient. Check settings for Pressure Support.</p>
(7)	BATTERY LOW !	No mains power and battery <20 %	Restore mains power supply.
(17)	BATTERY LOW !!	No mains power and battery <10 %	Restore mains power supply.

Alarm priority	Alarm	Cause	Remedy
(26)	CHECK APL VALVE !!!	Fault in APL bypass valve.	Check membrane of the ventilator and close cover. Check the connection of the APL bypass valve and for leakage. Select Standby mode and then switch to the previous ventilation mode. Check APL valve setting.
(7)	CHECK BATTERY !	The backup power is 0 % of the full charge.	Replace fuse. Contact DrägerService or the authorized local service partner.
(31)	CONTINUOUS PRESSURE !!!	Airway pressure above threshold value for more than 15 seconds.	Check breathing system. Check fresh-gas flow in mode ManSpont . Check the set limit value <input checked="" type="checkbox"/> for the pressure threshold value.
(5)	EXP PORT LEAKAGE !!	In mode Volume Control , Pressure Control , or Pressure Support an expiratory flow of more than 15 mL was measured during the inspiration.	Check expiratory valve and valve disk. Check hose line of the expiratory control line. Check flow sensor. Perform the procedure for calibration of the flow sensor (see page 131). Contact DrägerService or the authorized local service partner.
(16)	EXP PRESSURE HI !!	In an automatic ventilation mode PEEP is more than 4 cmH ₂ O (hPa) above the setting for PEEP .	Check PEEP/PMAX hoses and other hoses for kinks.
(4)	FLOW SENSOR CAL DUE !	More than 18 hours have passed since the last sensor calibration. The cable was removed and reconnected.	Perform the procedure for calibration of the flow sensor (see page 131).
(8)	FLOW SENSOR FAIL !	Sensor cable is not connected.	Reconnect the sensor cable to the sensor of the breathing system.

Alarm priority	Alarm	Cause	Remedy
(8)	FLOW SENSOR FAIL !	The flow sensor was not correctly calibrated. Sensor error.	Perform the procedure for calibration of the flow sensor (see page 131). Replace sensor and calibrate. Contact DrägerService or the authorized local service partner.
(21)	FRESH GAS LOW !!	Insufficient fresh-gas supply in all ventilation modes.	Ensure sufficient fresh-gas supply.
		Hose blocked/kinked.	Check hoses.
		Leakage or disconnection in the breathing system.	Check breathing system.
(13)	INSP O₂ HIGH !!	Inspiratory O ₂ concentration is above the upper alarm limit.	Check the setting of the flow control valve and upper O ₂ alarm limit.
(31)	INSP O₂ LOW !!!	Inspiratory O ₂ concentration is below the lower alarm limit.	Check O ₂ supply. Check the setting of the flow control valve and lower O ₂ alarm limit.
(11)	INSP PRES NOT REACH !!	The plateau pressure during ventilation in Pressure Control , Pressure Support , or SIMV/PS mode is more than 3 cmH ₂ O (hPa) below the PINSP setting and the expected PLAT value.	Check the ventilator settings, patient circuit and settings for PINSP .
(14)	MINUTE VOLUME HIGH !!	The minute volume has exceeded the upper alarm limit.	
	The flow sensor was not calibrated.	Calibrate the flow sensor (see page 131).	
	Sensor error.	If necessary, replace the flow sensor (see page 67).	

Alarm priority	Alarm	Cause	Remedy
(22)	MINUTE VOLUME LOW !!	The minute volume is below the lower alarm limit. Hose blocked/kinked. Leakage in breathing system. Check breathing system. Reduced volume due to pressure limitation. Reduced lung compliance.	Check the breathing system and alarm limit. Check breathing system. Check setting for PMAX . Check ventilator settings.
		Flow sensor not calibrated or faulty.	Perform the procedure for calibration of the flow sensor (see page 131). Replace sensor and calibrate.
(31)	NO FRESH GAS !!!	Insufficient fresh-gas supply. Valve for fresh-gas delivery is closed. Underpressure safety valve is automatically opened.	Ensure sufficient fresh-gas supply. Open valve for fresh-gas delivery.
(6)	O₂ SENSOR CAL DUE !	More than 18 hours have passed since the last O ₂ sensor calibration.	Perform the procedure for calibration of the O ₂ sensor (see page 131).
(8)	O₂ SENSOR FAIL !	The O ₂ sensor was not correctly calibrated. O ₂ sensor replaced and/ or not calibrated. O ₂ sensor used up. O ₂ sensor not connected. Sensor cable faulty.	Perform the procedure for calibration of the O ₂ sensor (see page 131). Perform the procedure for calibration of the O ₂ sensor (see page 131). Replace the sensor capsule and calibrate the O ₂ sensor (see page 131). Connect O ₂ sensor unit. Replace O ₂ sensor housing unit.
(30)	O₂ SUPPLY LOW !!!	The value for the O ₂ supply line has dropped below the permissible minimum pressure (approx. 20 psi) (approx. 1.4 kPa x 100).	Check O ₂ supply and backup cylinder.
(9)	PEEP HIGH !	In ManSpont mode, PEEP is above 8 cmH ₂ O (hPa).	Check APL valve setting and/or fresh-gas flow.

Alarm priority	Alarm	Cause	Remedy
(7)	POWER FAIL !	Fabius not connected to mains power. General power failure.	Plug in the mains plug.
(1)	PRES APNOEA ALARM OFF !	Pressure alarm messages are deactivated in mode ManSpont .	Activate the pressure alarm messages.
(2)	PRES THRESHOLD LOW !	The ventilation parameters are modified without changing the alarm settings (see chapter "Changing the alarm limits" on page 138).	Press AutoSet softkey and check ventilator settings.
(9)	PRESSURE LIMITING ! (Mode Volume Control)	The measured pressure is the same as the ventilator setting for PMAX or exceeds it.	Check the ventilator settings and settings for PMAX .
(25)	PRESSURE NEGATIVE !!!	The measured PAW value is $\leq 6.5 \text{ cmH}_2\text{O}$ (hPa).	Check the breathing system and ventilator settings.
(8)	PRESSURE SENSOR FAIL !	Sensor faulty or pressure not calibrated.	Contact DrägerService or the authorized local service partner.
(1)	RS232 COM1 FAIL !	External monitor cable not connected with external communication connector 1.	Check connection cable of the monitor.
(1)	SPEAKER FAIL !	Speaker is not ready for operation.	Contact DrägerService or the authorized local service partner.
(28)	VENTILATOR FAIL !!!	Ventilator not mounted correctly.	Check membrane and close cover. Check whether the PEEP/PMAX line is connected and without leakage. Select Standby mode and then switch to the previous ventilation mode.
(1)	VOLUME ALARMS OFF !	Volume alarms deactivated by user.	Reactivate the volume alarms.

Cleaning, disinfection and sterilization

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Disassembly

Observe before disassembling

- Switch off the device and accessory devices and remove their mains plugs.

Sequence of disassembly

- 1 Unscrew the sample line and dispose of.
- 2 Remove the flow sensor cable.
- 3 Remove the O₂ sensor and the O₂ sensor cable.
- 4 Remove the pressure measurement hose.
- 5 Remove the APL bypass hose and the PEEP/PMAX hose.
- 6 Remove the water trap.
- 7 Disassemble the CO₂ absorber:
 - CLIC absorber (disposable) or
 - Reusable CO₂ absorber:
 - Unscrew the CO₂ absorber from the breathing system.
 - Remove and dispose of the soda lime dust filter (optional).
 - Empty the CO₂ absorber.
 - Remove the absorber insert from the absorber container. Leave the inner and outer sealing rings on the absorber insert.
- 8 Remove the breathing bag.
- 9 Disassemble the breathing circuit and the filters.
- 10 Unscrew the holder for the breathing bag.

11 Remove the compact breathing system:

- Remove the breathing system cover (optional).
- Remove the inspiratory valve.
- Remove the expiratory valve.
- Unscrew the exhaust port.
- Unscrew the inspiratory port and the expiratory port.
- Remove the flow sensor.
- Unscrew the APL valve.

WARNING

Risk of damage to breathing system

If the APL valve is not disassembled before the breathing system is reprocessed, this can lead to leakages in the breathing system.

Always remove the APL valve prior to reprocessing.

12 Remove the ventilator parts.

NOTE

To prevent accidental penetration of soda lime into the breathing system, do not transport the breathing system with a filled reusable CO₂ absorber.

Information concerning dismounted accessory parts and attached devices

Observe the instructions for use of the following accessory parts:

Accessory parts

- Flow sensor
- CLIC adapter
- CLIC absorber, Infinity ID CLIC absorber
- Breathing hoses
- Filter
- Breathing bag
- Masks
- Water trap
- Vaporizer

CAUTION

Material damage due to disinfectants

When the sample line is disinfected and residues of the agent remain in the sample line, these residues can get into the water trap and the gas measurement module later. This may result in faulty measurements.

Sample lines are single-use items and may not be disinfected.

Attached devices

- Endotracheal suction
- Hinged arms
- Monitors
- Sensors and cables
- IT systems
- AGS

Single-use articles without instructions for use

- Soda lime dust filter (optional)
- Sample line

WARNING

Risk of infection

Used sample lines may be infectious due to the breathing gases that passed through them.

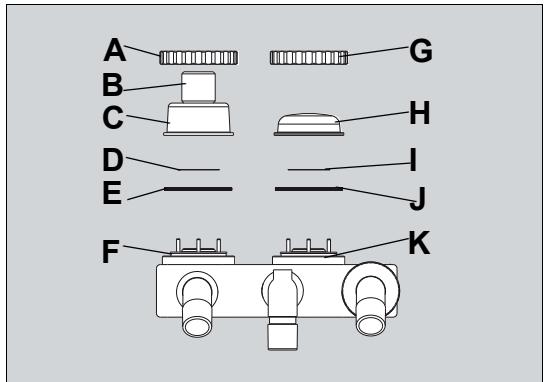
Replace the sample lines regularly, see table "Semi-critical medical devices".

Removing the compact breathing system

Before removing the compact breathing system, the following hoses and cables must be removed:

- Flow sensor cable
- O₂ sensor cable and O₂ sensor capsule
- Pressure measurement hose
- APL bypass hose
- PEEP/PMAX hose

Removing the inspiratory valve

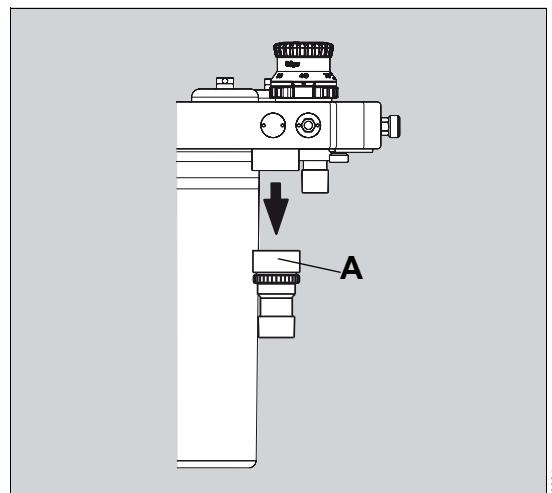


- 1 Remove the valve cover plug (B) or the O₂ sensor from the dome (C) of the inspiratory valve.
- 2 Screw off the cap nut (A).
- 3 Remove the dome (C).
- 4 Take out the valve plate (D).
- 5 Remove the sealing ring (E) from the socket (F).

Removing the expiratory valve

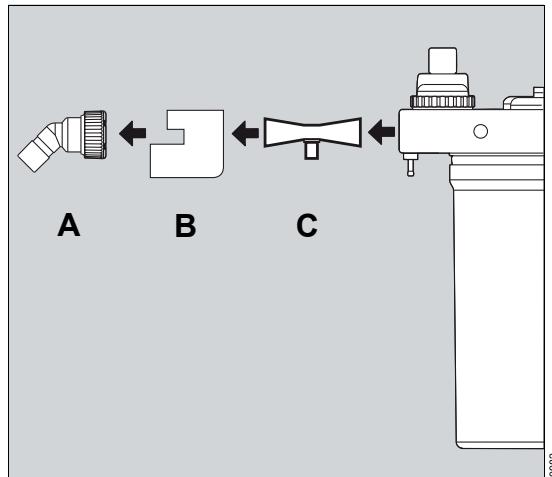
- 1 Screw off the cap nut (G).
- 2 Remove the sight glass (H).
- 3 Take out the valve plate (I).
- 4 Remove the sealing ring (J) from the socket (K).

Removing the exhaust port



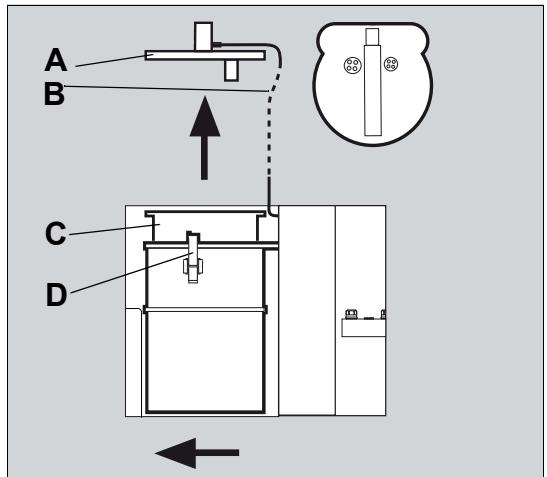
- Screw off the exhaust port (A).

Removing the flow sensor



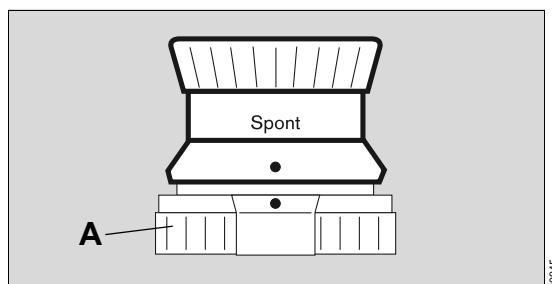
- 1 Loosen the expiratory port (A) and remove.
- 2 Remove the flow-sensor guard (B).
- 3 Remove the flow sensor (C).

Removing the ventilator parts



- 1 Open the ventilator door.
- 2 Remove the pressure sensor line (B) of the ventilator chamber from the corresponding connection.
- 3 Release the 3 clamps (D).
- 4 Remove the cover (A).
- 5 Remove the ventilator membrane (C).

Removing the APL valve



- 1 Loosen the knurled nut (A).
- 2 Remove the valve.

Removing the anesthetic gas receiving system

To disassemble, follow the steps in reverse order as listed in chapter "Connecting the anesthetic gas receiving system (optional)" on page 61.

Removing the endotracheal suction system

- Remove the suction regulator and suction bottle, see the associated instructions for use.

WARNING

Risk of infection

The contents of the suction bottle can be highly infectious.

- When emptying the suction container, wear protective gloves.
- Follow the hospital hygiene regulations.

Reprocessing procedures

WARNING

Risk of infection

Use validated reprocessing procedures when reprocessing the device and accessories.

Classification of medical devices

For reprocessing, the medical devices and their components are classified according to their type of application and the resulting risks:

- Non-critical medical devices: Surfaces accessible to the user and patient, e.g., device surfaces, cables
- Semi-critical medical devices: parts conducting breathing gas, e.g., breathing hoses, masks

Testing of procedures and agents

The cleaning, disinfection, and sterilization of medical devices were tested using the following procedures and agents. The following agents showed good material compatibility and effectiveness at the time of the test:

Non-critical medical devices

Manual disinfection with simultaneous cleaning:

- Incidin Extra N from Ecolab
- Incidur from Ecolab

Semi-critical medical devices

Manual cleaning:

- Neodisher FA, Neodisher Medizym from Dr. Weigert

Manual disinfection:

- Korsolex extra from Bode Chemie
- Gigasept FF from Schülke & Mayr

Machine cleaning:

- Neodisher FA, Neodisher Medizym from Dr. Weigert

Machine disinfection:

- Thermal, 93 °C (199.4 °F) for 10 minutes

Sterilization:

- Hot steam, 134 °C (273.2 °F) for 5 minutes

Non-critical medical devices

Manual disinfection with simultaneous cleaning

When selecting a suitable disinfectant, adhere to the country-specific lists of disinfectants. The list of the German Association for Applied Hygiene (Verbund für Angewandte Hygiene VAH) applies in German-speaking countries.

Strictly observe the manufacturer's specifications on the disinfectants. Manufacturers may change the composition of disinfectants over time.

Procedures:

- 1 Remove soiling immediately with a cloth soaked in disinfectant.

WARNING

Risk of electric shock or device malfunction

Liquid that enters into the device can cause the device to malfunction or may damage the device and endanger the patient.

Only scrub-and-wipe-disinfect device surfaces and cables and make sure no liquids penetrate into the device.

- 2 Perform surface disinfection by scrubbing and wiping.
- 3 Remove disinfectant residues after the contact time has elapsed.

Semi-critical medical devices

Manual cleaning

Perform manual cleaning preferably under flowing water and with commercially available cleaning agent (pH value ≤ 12).

Procedures:

- 1 Wash off surface soiling under flowing water.
- 2 Use cleaning agents in accordance with manufacturer's specifications. Make sure that all surfaces and interior spaces to be cleaned can be reached. Use suitable brushes if necessary.
- 3 Thoroughly rinse components under running water until cleaning agent residues are no longer discernible.
- 4 Inspect components for visible soiling and damage. Repeat manual cleaning if necessary.

Manual disinfection

When selecting a suitable disinfectant, adhere to the country-specific lists of disinfectants. The list of the German Association for Applied Hygiene (Verbund für Angewandte Hygiene VAH) applies in German-speaking countries.

Strictly observe the manufacturer's specifications on the disinfectants. Manufacturers may change the composition of disinfectants over time.

Procedures:

- 1 Disinfect components by immersing.
- 2 After the contact time has elapsed, rinse the components thoroughly under running water until disinfectant residues are no longer discernible.
- 3 Inspect components for visible soiling and damage. Repeat manual disinfection if necessary.
- 4 Shake off all excess water. Allow components to dry thoroughly.

Machine cleaning and disinfection

Perform machine cleaning and disinfection with a washer-disinfector in accordance with EN ISO 15883, preferably with a cart for anesthesia accessories and ventilation accessories.

Procedures:

- 1 Strictly observe the instructions for use of the washer-disinfector.
- 2 Position the parts in the basket in a stable position. Make sure that all interior spaces and surfaces are completely flushed and water can drain off freely.
- 3 Use a suitable cleaning agent.
- 4 Select a suitable program, preferably anesthesia program.
 - Cleaning must be performed at 40 °C to 60 °C (104 °F to 140 °F) for at least 5 minutes.
 - Thermal disinfection must be performed at 80 °C to 95 °C (176 °F to 203 °F) and with corresponding contact time.
- 5 Carry out final rinsing with demineralized water.
- 6 Immediately remove the components from washer-disinfector.
- 7 Inspect components for visible soiling and damage. If necessary, repeat the program or perform manual cleaning or manual disinfection.
- 8 Allow components to dry thoroughly.

WARNING

Risk of device failure

If the control areas located in the valve plate are not sufficiently dried, this may compromise the device function or may lead to failure of the medical device.

After cleaning, the breathing system must be sterilized with steam until it is completely dry.

Visual inspection

Check all parts for damage and external wear such as cracking, brittleness or severe hardening, and remnants of contamination.

CAUTION

Risk from faulty accessories

Even reusable accessories have a limited maximum period of use, e.g., residues from disinfectants can attack the material in the autoclave. Signs of external wear can show up, e.g., cracks, deformation, discoloration, or delamination).

If signs of external wear occur, replace the affected accessory.

CAUTION

Risk of failure of flow measurement

Improper reprocessing and soiling, such as deposits or particles, can damage the flow sensor.

- No machine cleaning or disinfection
- No plasma sterilization or radiation sterilization
- No water jets, compressed air, brushes or the like
- No ultrasonic bath
- No hot-steam sterilization with Spirolog and Infinity ID flow sensors
- Clean and disinfect the flow sensor in accordance with the corresponding instructions for use.
- For disinfecting the flow sensor use only clean disinfectant solutions.

WARNING

Risk of fire

Residual vapors of easily flammable disinfectants (e.g., alcohols) and deposits that were not removed during reprocessing can ignite when the flow sensor is in use.

- 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.**

Sterilization

Sterilization eliminates living microorganisms from semicritical medical devices and dries residual water in the interior of components.

- Sterilize only components that have been cleaned and disinfected.**

For sterilization, use a vacuum steam sterilizer (in accordance with DIN EN 285), preferably with fractional vacuum.

Reprocessing list

Applicable to non-infectious patients.

The reprocessing list contains approximate values only. The instructions of the hospital's infection control officer responsible have priority.

Uncritical medical devices

Items which can be reprocessed	Recommended reprocessing intervals	Manual	
		Cleaning	Disinfection
Control elements and device surfaces including: <ul style="list-style-type: none">– Screen– Softkeys– Rotary knob– O₂ flush key– Flow control valves– APL valve– Writing tray– Grip bar on trolley– Drawer handles– Standard rails on both sides– Clic adapter, Clic absorber	After each patient	Outside	Outside

Items which can be reprocessed	Recommended reprocessing intervals	Manual	
		Cleaning	Disinfection
Other surfaces which are frequently touched: <ul style="list-style-type: none"> - Side parts of the housings of the screen and of other patient monitors - Accessory parts: <ul style="list-style-type: none"> - Storage trays - Shelf - Hinged arms - Probes of compressed gas hoses - Mains plug - Gas cylinder valves - Transfer hose of the anaesthetic gas receiving system - Cables and hoses that lie on floor - Brake 	Daily	Outside	Outside
Surfaces which are touched less frequently: <ul style="list-style-type: none"> - Network cables and data cables - Compressed gas hoses - Pressure reducers - Gas cylinders - Drawer surfaces, outside and inside - Anaesthetic gas receiving system - Holder for sample line 	Weekly	Outside	Outside

Semicritical medical devices

Items which can be reprocessed	Recommended reprocessing intervals	Pre-cleaning	Machine cleaning and disinfection	Manual		Sterilization
				Cleaning	Disinfection	
Breathing system: – Breathing system housing – Inspiratory/expiratory ports, APL valve – Inspiratory valve, expiratory valve – Bag elbow – Rigid arm for breathing bag (optional) – Breathing hoses	Weekly After each patient	Yes	Yes	Possible	Possible	Possible
Absorber container and absorber insert	Weekly	Yes	Yes	Possible	Possible	Possible
Soda lime dust filter (optional)	Replace each time soda lime is changed.	No	No	No	No	No
Sample line	Replacement only	No	No	No	No	No
– When the sample line is fitted to the filter on the Y-piece.	Daily					
– When the sample line is fitted directly to the Y-piece and the filters are fitted on the breathing system	After each patient					

Items which can be reprocessed	Recommended reprocessing intervals	Pre-cleaning	Machine cleaning and disinfection	Manual		Sterilization
				Cleaning	Disinfection	
Ventilator lid	After each patient	Yes	Yes	No	Yes	Yes
Ventilator membrane	After each patient	Yes	Yes	No	Yes	Yes
Ventilator hose	After each patient	Observe the associated instructions for use.				
Flow sensor	Weekly	Observe the associated instructions for use.				

Before using on patients again

- 1 Assemble the device components, see "Assembly and preparation" on page 50.
- 2 Mount the parts in the reverse order of the disassembly, see "Disassembly" on page 167.
- 3 Check readiness for operation, see "Checking the readiness for operation" on page 88.

Maintenance

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Overview

This chapter describes the required maintenance measures required to maintain the proper functioning of the medical device. Maintenance measures must be performed by the personnel responsible.

WARNING

Risk of infection

The responsible personnel may be infected by pathogenic germs.

Disinfect and clean device or device parts before any maintenance measures and also before returning the medical device for repair.

WARNING

Risk of electric shock

There are conducting components under the housing cover.

- Do not remove the housing cover.
- Maintenance measures must be performed by the personnel responsible. Dräger recommends DrägerService for repairs and complex maintenance tasks.

WARNING

Risk of fire

When replacing the battery, short-circuits or excessive temperatures can occur, resulting in fire or explosion.

The battery must only be replaced by experts.

Definitions of maintenance terms

Term	Definition
Maintenance	All measures (inspection, preventive maintenance, repair) intended to maintain and restore the functional condition of a medical device
Inspection	Measures intended to determine and assess the actual state of a medical device
Service	Recurrent specified measures intended to maintain the functional condition of a medical device
Repair	Measures intended to restore the functional condition of a medical device after a device malfunction

Inspection

Inspections must be carried out regularly according to the following guidelines and within the specified intervals. Technical documentation is available on request.

Checks	Interval	Personnel responsible
Inspection and safety checks ¹⁾	Every 12 months	Experts

- 1) Designation applies to the Federal Republic of Germany; corresponds to the "Recurring safety inspection" in the Federal Republic of Austria

Safety checks

The safety checks are no substitute for service measures indicated by the manufacturer, including the preventive replacement of wearing parts.

WARNING

Risk of medical device failure

If safety checks are not performed on a regular basis, the proper operation of the medical device can be compromised.

Perform safety checks at the indicated intervals.

- 1 Check accompanying documents:
 - Latest instructions for use are available
- 2 Perform a functional test of the following features according to the instructions for use:
 - Check the proper function of the flow measurement.
 - Check the function of the pressure measurement based on parameters **PAW**, **PEEP**, **PMAX**.
 - Check the proper function of the O₂ measurement.
 - Check the function of the anesthetic vaporizer according to the associated instructions for use.
 - Check the function of the O₂ flush.

- Check the function of the pressure reducer (optional) of the compressed gas cylinder.
- 3 Check that the device combination is in good condition:
 - All labels are complete and legible
 - There is no visible damage
 - Fuses which are accessible from the outside are in compliance with the specified values
 - Country-specific labeling of gas types
 - 4 Using the instructions for use, check that all components and accessories needed to use the product are available.
 - 5 Check for electrical safety in compliance with IEC 62353.
 - 6 Check safety features:
 - Check the functional state of the optical and acoustic alarm generators.
 - Check the functional state of the O₂ failure alarm.
 - Check the locking device of the anesthetic vaporizer.
 - Check the function of the power failure alarm and the battery function.
 - Check S-ORC functionality.

Preventive maintenance

WARNING

Risk of faulty components

Device failure is possible due to wear or material fatigue of the components.

To maintain the function of all components, this device must be inspected and serviced at the intervals specified by the manufacturer.

WARNING

Risk of electric shock

Before performing any service work, disconnect all electrical connections and gas connections from power and gas supplies.

The following table shows the preventive maintenance intervals:

Component	Interval	Measure	Personnel responsible
CO ₂ absorber	If colored violet	Replace	Users
Water trap	As needed or if soiled	Replace	Users
Flow sensor	As needed or if calibration is no longer possible	Clean/Replace	Users
Internal lithium battery	Every 36 months	Replace	Experts
Fabius MRI	Every 12 months	Inspection and service	Experts
Breathing system	Every 12 months	Inspection and service	Service personnel
Vaporizers	Every 12 months	Inspection and service	Service personnel
Sensors	Every 12 months	Inspection and service	Service personnel
Lead-gel battery	Every 3 years	Replace	Experts
Cylinder pressure reducer for high-pressure cylinders ¹⁾	After 6 years	Basic overhauling	Experts
Pressure reducer for Pin-index1)	After 6 years	Replace	Experts

1) optional

Repair

For repairs, Dräger recommends DrägerService and the use of original Dräger parts.

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Disposing of the medical device

WARNING

Risk of infection

The device and its components must be disinfected and cleaned before disposal!

At the end of its service life:

- Have the medical device appropriately disposed of in accordance with applicable laws and regulations.

For countries subject to the EU Directive 2002/96/EC

This device is subject to EU Directive 2002/96/EC (WEEE). In order to comply with its registration according to this directive, this device may not be disposed of at municipal collection points for waste electrical and electronic equipment. Dräger has authorized a company to collect and dispose of this device. To initiate collection or for further information, visit Dräger on the Internet at www.draeger.com. Use the search function with the keyword "WEEE" to find the relevant information. If access to the Dräger website is not possible, contact the local Dräger organization.

Disposal of accessories

When disposing of the following accessory parts, observe the hospital hygiene regulations and the respective instructions for use:

- Flow sensor
- 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
- Soda lime dust filter
- Anesthetic gas receiving system

Disposal of non-rechargeable batteries

WARNING

Risk of explosion and chemical burns

Improper handling of batteries can result in explosions and chemical burns.

- Do not throw batteries in the fire.
- Do not force batteries open.

- Do not recharge batteries.

The following applies to the Federal Republic of Germany: According to the battery law, the end user is obligated to return batteries containing toxic material to the distributor or the public waste management organization. The battery used in this device must therefore be removed by experts prior to disposal of the device. In countries other than Germany the respective national regulations must be complied with.

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General information

Units of measurement for pressure

1 hPa = 1 mbar = 1 cmH₂O

100 kPa = 0.1 MPa = 1 bar = 1 kPa x 100

All specified tolerances apply for 20 °C (68 °F),
60 % relative humidity, and 1013 hPa (760 mmHg).

The accuracies indicated below change according to atmospheric 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 pressure measurement value: ±4 % at 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 normalized to the conditions in the lungs. (BTPS)

MR environment

Field strength of the MRI

1.5 tesla or 3 tesla

Distance to the center of the magnetic field (field line strength)

≤40 mT (400 gauss)

Ambient conditions

During operation

Temperature	10 to 35 °C (50 to 95 °F)
Air pressure	700 to 1060 cmH ₂ O (hPa)
Relative humidity	20 to 80 % (without condensation)
Height	Up to 3000 m (9843 ft)

During storage and transport

Temperature	-10 to 60 °C (14 to 140 °F)
Air pressure	700 to 1060 cmH ₂ O (hPa)
Relative humidity	10 to 90 % (without condensation)

The conditions for use when using additional devices can limit the environment of use of a system as a whole. Vaporizers and anesthetic agents can limit the use of an anesthesia workstation with regard to its temperature range and maximum fresh-gas flow. Therefore when using additional devices, follow the associated instructions for use.

Device data

Medical gas supply through central gas supply

Pressure range on device connection	
O ₂ , N ₂ O, Air	41 to 87 psi (2.8 to 6 kPa x 100) Note: Pressure fluctuations in the central gas supply must not exceed ±10 %
Gas supply connection	NIST or DISS (if required)
(Every gas inlet is equipped with a non-return valve)	
Accuracy of the pressure displays	±3 % within the measurement range from 40 to 120 psi (2.7 to 8.3 kPa x 100)

GMDN Code Global Medical Device Nomenclature - worldwide nomenclature for medical devices 37710

Use of latex Not made with natural rubber latex.

Penetration of liquids IP20 in accordance with IEC 60529

Power supply

Power rating cannot be configured 100 to 240 VAC, 50/60 Hz, 9.3 A max, including auxiliary power sockets

Internal battery

Power rating	24 V; 3.5 Ah
Type	Closed, lead/acid, gel
Charge time	16 hours on mains power for full operating time
Backup time with fully charged battery	Minimum 45 minutes

Weight

Basic unit with COSY; no additional devices	165.8 kg(365.5 lb)
Basic unit with COSY and two vaporizers; no additional devices	182.8 kg(403 lb)

Dimensions W x H x D

Basic unit with central brake released	78 x 140 x 90 cm (30.7 x 55 x 35.5 in)
Basic unit with central brake locked	78 x 140 x 92 cm (30.7 x 55 x 36.3 in)
Basic unit with compact breathing system ¹⁾	99 x 140 x 90/92 cm (39 x 55 x 35.5/36.3 in)

Height of writing tray	86 cm (38.5 in)
Height of magnetometer sensors	96 cm (37.8 in)

1) Width varies depending on the position of the breathing system arm

Fuses

Main fuses

For 100 to 240 V power supply
2x T2.5AH 250 V IEC 60127-2/V

Size: Length 20 mm, ø5 mm (glass 4.4 mm)

Battery fuse

1x T3.15AH 250 V IEC 60127-2/V

Size: Length 20 mm, ø5 mm (glass 4.4 mm)

External fresh-gas outlet

Connection

22 mm outer taper / 15 mm inner taper (ISO)

Pressure limitation

Max. 80 cmH₂O (hPa) at 18 L/min

Fresh-gas flow

0 and 0.2 to 18 L/min

Electrical safety

In compliance with

UL 60601-1

IEC 60601-1

CAN/CSA C22.2 No. 601.1-M90

General safety standards for anesthesia workstations

Relevant standards

In addition to the standards listed here, this medical device meets various other standards, e.g., standards concerning special national requirements.

IEC 60601-1 2nd ed.

Medical electrical equipment

Part 1:

General 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 60601-1-4

Medical electrical equipment

Part 1-4

General requirements for safety, collateral standard: Programmable electrical medical systems

IEC 60601-1-8

Medical electrical equipment

Part 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

Part 2-13:

Particular requirements for the safety of anaesthetic systems

ISO 8835-2

Systems for inhalational anaesthesia

Part 2:

Anaesthetic breathing systems

ISO 8835-3

Systems for inhalational anesthesia

Part 3:

Transfer and receiving systems of active anesthetic gas scavenging systems

ISO 8835-4

Systems for inhalational anesthesia

Part 4:

Anesthetic vapor delivery devices

ISO 8835-5

Systems for inhalational anesthesia

Part 5:

Anesthetic ventilators

Relevant standards (continued)

ISO 21647
Medical electrical equipment

Particular requirements for the basic safety and essential performance of respiratory gas monitors

The following also apply for devices manufactured from July 2014 on:

IEC 60601-1 3rd ed.
Medical electrical equipment

Part 1:
General requirements for basic safety and essential performance

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

Part 1-8:
General requirements for basic safety and essential performance – collateral standard: General requirements, tests, and guidance for alarm systems in medical equipment and medical electrical systems

ISO 80601-2-13
Medical electrical equipment

Part 2-13:
Particular requirements for basic safety and essential performance of an anaesthetic workstation

ISO 80601-2-55

Part 2-55:
Particular requirements for basic safety and essential performance of respiratory gas monitors

Ventilator

In compliance with	ISO 80601-2-13
Control ranges	
Pressure limitation (P_{MAX})	15 to 70 cmH ₂ O (resolution: 1 cmH ₂ O) (15 to 70 hPa (resolution: 1 hPa)) (Setting must be at least 10 cmH ₂ O (10 hPa) above PEEP ; in SIMV/PS mode, the P_{MAX} set- ting must be greater than ΔPPS+PEEP)
Tidal volume (VT)	20 to 1400 mL (resolution: 10 mL)
Tidal volume (VT)	20 to 1100 mL (resolution: 10 mL), in SIMV/PS mode
Respiratory rate (Freq)	4 to 60 bpm (resolution: 1 bpm) (4 to 60 1/min (resolution: 1/min))
Ratio of inspiratory time to expiratory time (TI:TE)	4:1 to 1:4
Inspiratory pause (TIP:TI)	0 % to 50 % (resolution: 1 %)
Positive end-expiratory pressure (PEEP)	0 to 20 cmH ₂ O (resolution: 1 cmH ₂ O) (0 to 20 hPa (resolution: 1 hPa))
Inspiratory pressure (P_{INSP})	5 to 65 cmH ₂ O (resolution: 1 cmH ₂ O) (5 to 65 hPa (resolution: 1 hPa)) (Setting must be at least 5 cmH ₂ O (5 hPa) above PEEP)
Inspiratory flow (Insp Flow)	10 to 75 L/min (resolution: 1 L/min) in Pressure Control mode 10 to 85 L/min (resolution: 1 L/min) in Pressure Support and SIMV/PS modes
Support pressure (ΔPPS)	3 to 20 cmH ₂ O (resolution: 1 cmH ₂ O) (3 to 20 hPa (resolution: 1 hPa)), in Pressure Support mode
Support pressure (ΔPPS)	3 to 20 cmH ₂ O, OFF (resolution: 1 cmH ₂ O) (3 to 20 hPa, OFF (resolution: 1 hPa)), in SIMV/PS mode
Minimum respiratory rate for apnea ventilation (Freq Min)	3 to 20 bpm (resolution: 1 bpm) and OFF (3 to 20 1/min (resolution: 1/min) and OFF)
Trigger value (Trigger)	2 to 15 L/min (resolution: 1 L/min)
Inspiratory time (T_{INSP})	0.3 bis 4.0 sec.

Ventilation mode **Pressure Support**

The **Pressure Support** ventilation mode has been tested under the following simulated patient conditions:

Size of the endotracheal tube: 4.5 mm to 8 mm (0.18 in to 0.32 in)

Lung compliance of the patient: 10 mL/cmH₂O to 100 mL/cmH₂O
(10 mL/hPa to 100 mL/hPa)

Tidal volume (**VT**) without **Pressure Support** 50 mL to 1000 mL

Respiratory rate (**Freq**) 10 to 35 bpm (1/min)

Accuracy

Pressure limitation (**PMAX**) ± 5 cmH₂O (± 5 hPa) of the setting

Tidal volume (**VT**) ± 5 % of the setting or 20 mL, depending on which value is higher (discharged to atmosphere, no compliance correction)

Respiratory rate (**Freq**) ± 1 bpm (± 1 1/min) of the setting or ± 5 %, depending on which value is higher

Ratio of inspiratory time to expiratory time (**TI:TE**) ± 5 % of the setting

Inspiratory pause (**TIP:TI**) ± 25 % of the setting

Positive end-expiratory pressure (**PEEP**) ± 2 cmH₂O (± 2 hPa) or ± 20 % of the setting, depending on which value is higher

Inspiratory pressure (**PINSP**) ± 2 cmH₂O (± 2 hPa) or ± 20 % of the setting, depending on which value is higher

Overpressure safety valve 75 ± 5 cmH₂O (75 ± 5 hPa)

Underpressure safety valve (inlet valve for ambient air) -7.5 to -9 cmH₂O (-7.5 to -9 hPa)

Minimum pressure limit -9 cmH₂O (-9 hPa)

Measuring the system compliance 0.2 to 6.0 mL/cmH₂O (0.2 to 6.0 mL/hPa)
 ± 0.2 mL/cmH₂O (± 0.2 mL/hPa) or ± 10 % of the actual compliance depending which value is higher

Anesthetic gas supply module

Fresh-gas flow indicators

O₂, N₂O, Air

Range and accuracy:
0.0 to 12.0 L/min ±10 % of the measured value or
±0.12 L/min, depending which value is higher,
against atmospheric pressure of 14.7 psi
(1.013 kPa x 100) at 20 °C (68 °F).
Resolution: 0.1 L/min

Fresh-gas flow stability

O₂ and N₂O: ±10 % of the setting for supply pressures of 41 to 87 psi (2.8 to 6 kPa x 100)

Air: ±10 % of the setting for supply pressures of 50 to 55 psi (3.4 to 3.8 kPa x 100).

Outside of 50 to 55 psi (3.4 to 3.8 kPa x 100), the Air flow varies in proportion with the supply pressures.

Total flow tube

Range and accuracy

0 to 10 L/min ±10 % of the measurement range at
standard temperature and standard pressure, cal-
ibrated with a gas mixture of 50% O₂ and
50% N₂O
0 to 10 L/min ±15% of the measurement range at
standard temperature and standard pressure for
all other gas mixtures

Resolution

0.5 L/min at 0.5 to 2 L/min 1.0 L/min at
2 to 10 L/min

O₂ flush

at 87 psi (6 kPa x 100): max. 75 L/min
at 41 psi (2.8 kPa x 100): min. 25 L/min

Pressure limit of the common gas outlet

Maximum 13 psi (0.9 kPa x 100) ±5 %

Flow tube for O₂ supplemental delivery (optional)

Connection

Stepped connection for use with hoses of different
diameters

Flow

0 to 10 L/min

Accuracy

±5 % of the measurement range

Resolution

0.5 L/min

Vaporizer interface

The anesthesia workstation is equipped with an interlock system.

When removing the vaporizer, the connection is automatically closed and sealed.

The following vaporizers can be used:

- Dräger Vapor 2000 for halothane
- Dräger Vapor 2000 for enflurane
- Dräger Vapor 2000 for isoflurane
- Dräger Vapor 2000 for sevoflurane

Technical data of the vaporizers are contained in the corresponding instructions for use.

Measured value or waveform	Range	Resolution	Accuracy	Condition
PAW	Airway pressure (numeric) –20 to 99 cmH ₂ O (hPa)	1 cmH ₂ O (hPa)	±4 % ¹⁾	
	Airway pressure (waveform) 0 to 99 cmH ₂ O (hPa)			
	Pressure gauge (mechanical) –20 to 80 cmH ₂ O (hPa)	2 cmH ₂ O (hPa)	1.28 cmH ₂ O (hPa)	
MVe	Expiratory minute volume 0 to 32.0 L/min	0.1 L/min	±15 % or ±0.2 L/min, depending on which value is higher ²⁾	Based on 20 °C (68 °F) Ambient pressure and saturated gas
VTe	Expiratory tidal volume 0 to 1500 mL	1 mL	±15 % ²⁾ or ±20 mL, depending on which value is higher	
Note: If the endtidal desflurane concentration increases to above 12 %, the measurement accuracy of the tidal volume and minute volume can deviate by more than 15 %.				
Freq	Respiratory rate 2 to 99 bpm (1/min)	±1 bpm (1/min)	±1 bpm (±1 1/min) of the setting or ±5 %, depending on which value is higher	
FiO₂	O ₂ measurement in the mainstream 10 to 100 Vol%	1 Vol%	±2.5 Vol% +2.5 % of the measured values in accordance with ISO 21647 and ISO 80601-2-55	Based on the ambient pressure during calibration

1) Max. ±4 % of the measured value or ±2 cmH₂O (±2 hPa), depending on which value is higher.

2) Under standard test conditions in accordance with ISO 80601-2-13.

O₂ sensor

Response time (T90)	Less than 16 seconds	Measured values are not pressure compensated.
Heat-up time	after 5 minutes	Error with ≤3 % of the measured value
Drift sensitivity		±1 % of the measured value/ 8 h
Cross sensitivity		1 Vol% O ₂ at 70 Vol% N ₂ O and 5 Vol% CO ₂
		With 4 Vol% halothane
		or with 5 Vol% enflurane
		or with 15 Vol% desflurane
		or with 5 Vol% isoflurane
		or with 10 Vol% sevoflurane
Measurement deviation due to humidity	Max. ±0.02 % of the measured value per % relative humidity	
Maximum period of use of O ₂ sensor cell	>12 months at 25 °C (77 °F), 50 % relative humidity, 50 % O ₂ in fresh gas (or >5000 hours at 100 Vol% O ₂)	

Breathing system

**Volume with Dräger reusable CO₂ absorber
(including absorber volume, measured in Man-Spont)**

Filled, without hoses	typically 4000 mL + volume of the breathing bag
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**Volume with Drägersorb CLIC adapter
(including absorber volume, measured in Man-Spont)**

Filled, without hoses	typically 3700 mL + volume of the breathing bag
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Absorber volume

Reusable CO ₂ absorber, filled	1500 mL
Disposable CO ₂ absorber CLIC absorber Free	1200 mL
Disposable CO ₂ absorber CLIC Absorber 800 Free	1200 mL

Compliance

including ventilator hose (without breathing hoses)	0.8 mL/cmH ₂ O (0.8 mL/hPa)
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Rigid arm for breathing bag (optional)

Volume	0.11 L
Compliance	0.11 mL/cmH ₂ O (0.11 mL/hPa)

Resistance

In accordance with ISO 80601-2-13, dry, with adult breathing hose set M30146 ¹⁾	Inspiratory: Expiratory: -4.7 cmH ₂ O (-4.7 hPa) 4.4 cmH ₂ O (4.4 hPa)
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In accordance with ISO 80601-2-13, dry, without hoses ¹⁾	Inspiratory: Expiratory: -3.7 cmH ₂ O (-3.7 hPa) 3.7 cmH ₂ O (3.7 hPa)
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Typical leakage	<50 mL/min
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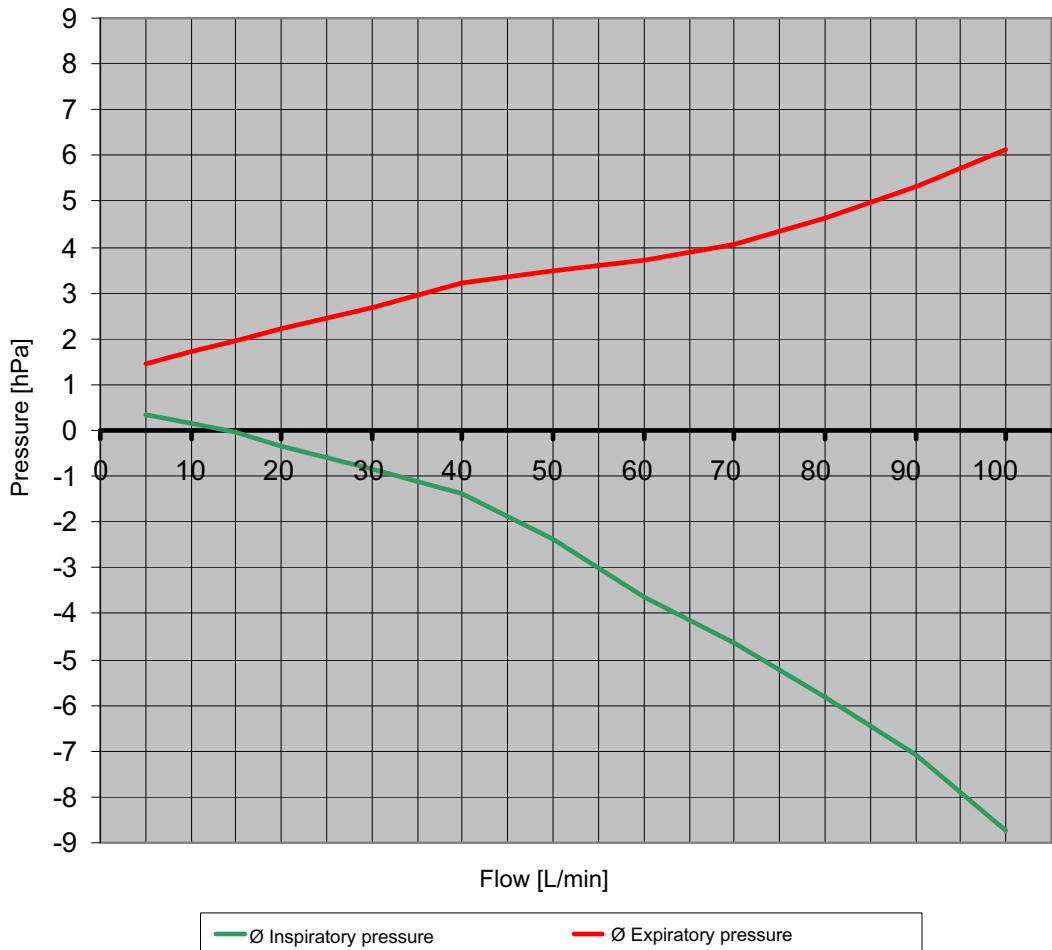
Control ranges

APL valve

Manual ventilation mode	5 to 70 cmH ₂ O (hPa)
Spontaneous breathing mode	1.5 cmH ₂ O (hPa)
Accuracy from 5 to 15 L/min	±15 % of the set value or ±3 cmH ₂ O (hPa) (the higher value applies)
Pressure drop at 30 L/min	3.4 cmH ₂ O (hPa) (wet and dry)

- 1) Depending on the current ventilation settings, the indicated values may deviate by ±0.3 cmH₂O (0.3 hPa)

ISO 80601-2-13: Pressure/flow characteristics of the compact breathing system COSY 2.6
(average resistances without breathing hoses)



Alarm for low oxygen supply pressure

Alarm limit	Warning signal (continuous tone 10 s, adjustable from approx. 40 dB(A) to 53 dB(A)) as soon as the pressure drops below 20 ±4 psi (1.4 ±0.3 kPa x 100).
Alarm priority	High priority (warning)
Optical alarm signal	The red LED next to the O ₂ flow control valve flashes.

Alarm tone sequence IEC

Sound pressure level L(A) of the alarm tones at the workstation, measured in accordance with IEC 60601-1-8

Alarm volume (high priority)	Settable from approx. 52 dB(A) to approx. 64 dB(A)
Alarm volume (medium priority)	Settable from approx. 44 dB(A) to approx. 57 dB(A)
Alarm volume (low priority)	Settable from approx. 42 dB(A) to approx. 56 dB(A)

Characteristics of additional acoustic signals

Confirmation of selection using rotary knob	Single tone when rotary knob is pressed (approx. 47 dB(A) at max. alarm tone volume)
Time exceeded when changing ventilation mode	3 tones adjustable from 31 dB(A) to approx. 42 dB(A)
Selection of alarm volume	Single tone per level (corresponds to volume of alarm tone)
Tesla sensor	Single tones (approx. 52 dB(A)) sound when the Fabius MRI is in a magnetic field of greater than 40 mT

S-ORC (Sensitive Oxygen Ratio Controller)

At a flow of approx. 200 mL	Set the N ₂ O concentration in the fresh gas between 0 and 75 %.
In case of insufficient O ₂	S-ORC limits the N ₂ O concentration in the fresh gas so that the O ₂ concentration does not drop below 23 Vol%.
N ₂ O flow control valve is open and at the same time the O ₂ flow control valve is closed or set at less than 0.2 L/min.	S-ORC prevents N ₂ O flow.
In case of N ₂ O failure	O ₂ can continue to be supplied. No alarm.

Device outlets

Serial interfaces	COM 1
Protocol	Only connect to devices that meet the requirements of IEC 60950-1 for ungrounded SELV circuits and the requirements of IEC 60601-1 (as of the 2nd edition) for exposed secondary circuits with maximum 24 Vdc nominal voltage.
Connector	Vitalink, MEDIBUS
Baud rate	9-pole Sub-D, galvanically isolated with 1.5 kV against internal electronics, 0.5 kV against housing
Data bits	1200, 2400, 4800, 9600, 19200, 38400 baud
Parity	7 or 8
Start bit	Uneven, even, none
Stop bit	1
	1 or 2

Pin assignment

Pin 1	n/c
Pin 2	TXD
Pin 3	RXD
Pin 4	n/c
Pin 5	GND
Pin 6	n/c
Pin 7	n/c
Pin 8	n/c
Pin 9	n/c

Essential performance characteristics

The essential performance features comprise:

- Supplying the anesthesia workstation with O₂
If the O₂ 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 O₂, an alarm is issued.
- Monitoring of the airway pressure and the expiratory minute volume
Alarms are issued depending on the set alarm limits.
- Measurement accuracy of the O₂ measurement.
Alarms are issued depending on the set alarm limits. If the O₂ sensor fails, an alarm is issued.

NOTE

In accordance with general safety standards, additional components are required for a complete anesthesia workstation.

EMC declaration

General information

The EMC compliance of the product has been evaluated with the external cables, transducers, and accessories specified in the list of accessories. Other accessories which do not affect EMC compliance may be used if no other reasons forbid their use (see other sections of the instructions for use). The use of noncompliant accessories can result in increased emissions or decreased immunity of the medical device.

The medical device must only be used adjacent to or stacked with other devices if this configuration is approved by Dräger. If adjacent or stacked use of configurations not approved by Dräger is inevitable, verify correct functioning of the medical device in this configuration before it is used. In any case, strictly observe the instructions for use of the other devices.

Detailed radio frequency characteristics

Communication devices in accordance with IEEE 802.11b:

- 2412 to 2472 MHz
- DSSS (direct-sequence spread spectrum) limited to 100 mW
- Applicable to access points and client adapters

Communication devices in accordance with IEEE 802.15.1:

- 2400 to 2485 MHz
- FHSS (frequency-hopping spread spectrum) limited to 2.5 mW

See the instructions for use of the wireless devices for further details.

Electromagnetic emissions

When using wireless networking, be aware that the system operates at 2.4 GHz range. Other equipment, even if compliant with CISPR emission requirements, can interfere with reception of wireless data. When selecting wireless systems (wireless communication media, pager systems, etc.) for use in installations where wireless networking is used, care must always be used to ensure that operating frequencies are compatible. For example, selecting wireless communication media that operate at 2.4 GHz will likely cause difficulty with the networking components. Low-level signals such as ECG signals are particular susceptible to interference from electromagnetic energy. Even if the equipment meets the test requirements described below, smooth operation cannot be guaranteed – the ‘quieter’ the electrical environment the better. In general, increasing the distance between electrical devices decreases the likelihood of interference.

Electromagnetic environment

The medical device is intended for use in an electromagnetic environment as specified below.

The user must ensure its use in such an environment.

Emissions	Compliance according to	Electromagnetic environment
Radio frequency emissions (CISPR 11)	Group 1	The medical device uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
	Class B	The medical device is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions (IEC 61000-3-2)	Class A	
Voltage fluctuations/flicker emissions (IEC 61000-3-3)	Complies	

Electromagnetic immunity

The medical device is intended for use in an electromagnetic environment as specified below. The user must ensure that the medical device is used in such an environment.

Immunity against	IEC 60601-1-2 test level	Compliance level (medical device)	Electromagnetic environment
Electrostatic discharge (ESD) (IEC 61000-4-2)	Contact discharge: $\pm 6 \text{ kV}$	$\pm 6 \text{ kV}$	Floors should be wood, concrete, or ceramic tiles. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
	Air discharge: $\pm 8 \text{ kV}$	$\pm 8 \text{ kV}$	
Electrical fast transients/bursts (IEC 61000-4-4)	Power supply lines: $\pm 2 \text{ kV}$	$\pm 2 \text{ kV}$	Mains voltage quality should be that of a typical commercial or hospital environment.
	Longer input lines/output lines: $\pm 1 \text{ kV}$	$\pm 1 \text{ kV}$	
Surges (IEC 61000-4-5)	Common mode: $\pm 2 \text{ kV}$	$\pm 2 \text{ kV}$	Mains voltage quality should be that of a typical commercial or hospital environment.
	Differential mode: $\pm 1 \text{ kV}$	$\pm 1 \text{ kV}$	
Magnetic field with supply frequency (50/60 Hz) (IEC 61000-4-8)	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical commercial or hospital environment.
Voltage dips and short interruptions of supply voltage (IEC 61000-4-11)	Voltage dip >95 %, 0.5 periods	>95 %, 0.5 periods	Mains voltage quality should be that of a typical commercial or hospital environment.
	Voltage dip 60 %, 5 periods	60 %, 5 periods	
	Voltage dip 30 %, 25 periods	30 %, 25 periods	If the user of the medical device requires continued operation during mains power supply interruptions, it is recommended that the medical device is powered from an uninterruptible power supply or a battery.
	Voltage dip >95 %, 5 seconds	>95 %, 5 seconds	

Immunity against	IEC 60601-1-2 test level	Compliance level (medical device)	Electromagnetic environment
Radiated radio frequency disturbance (IEC 61000-4-3)	80 MHz to 2.5 GHz: 10 V/m	10 V/m	<p>Recommended minimum distance to portable and mobile radio frequency transmitters with transmission power PEIRP to the medical device including its lines.¹⁾</p> $1.84 \text{ m} \times \sqrt{\text{PEIRP [watts]}}$ $(6.04 \text{ ft} \times \sqrt{\text{PEIRP [watts]}})$
Conducted radio frequency disturbance (IEC 61000-4-6)	150 kHz to 80 MHz: 10 V inside ISM bands ²⁾	10 V	<p>Recommended minimum distance from portable and mobile radio frequency transmitters with transmission power PEIRP to the medical device including its lines: ¹⁾</p> $1.84 \text{ m} \times \sqrt{\text{PEIRP [watts]}}$ $(6.04 \text{ ft} \times \sqrt{\text{PEIRP [watts]}})$
	150 kHz to 80 MHz: 3 V outside ISM bands ²⁾	3 V	

- 1) For PEIRP, insert the highest possible "equivalent isotropic radiated power" of the adjacent radio frequency transmitter. In the vicinity of equipment marked with the symbol (W), interference can occur. Field strengths from fixed, portable, or mobile radio frequency transmitters at the location of the medical device should be less than 3 V/m in the frequency range from 150 kHz to 2.5 GHz and less than 1 V/m above 2.5 GHz.
- 2) ISM bands in this frequency range are: 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; 40.66 MHz to 40.70 MHz.

Recommended safety clearance for portable and mobile high-frequency communication equipment

The safety clearances listed in the following comply with IEC 60601-1-2.

Max. PEIRP (watts)	150 kHz to 2.5 GHz	All other frequencies	Examples
0.03	0.32 m (1.1 ft)	0.96 m (3.2 ft)	WLAN 5250 / 5775 (Europe)
0.10	0.58 m (1.9 ft)	1.8 m (5.9 ft)	WLAN 2440 (Europe)
0.17	0.76 m (2.5 ft)	2.3 m (7.6 ft)	Bluetooth, RFID 2.5 GHz
0.20	0.82 m (2.7 ft)	2.5 m (8.2 ft)	WLAN 5250 (not in Europe)
0.25	0.92 m (3.0 ft)	2.8 m (9.2 ft)	UMTS mobiles
0.41	1.2 m (3.9 ft)	3.5 m (12 ft)	Cordless DECT devices
0.82	1.7 m (5.6 ft)	5.0 m (16 ft)	RFID 13.56 MHz
1.00	1.8 m (5.9 ft)	5.5 m (18 ft)	WLAN 5600 (not in Europe)
1.64	2.4 m (7.9 ft)	7.1 m (23 ft)	GSM 1800 / GSM 1900
3.3	3.3 m (11 ft)	10 m (33 ft)	GSM 900 mobile phones, RFID 868 MHz

Reduced safety clearance for portable and mobile high-frequency communication equipment

The safety clearances listed in the following are the result of tests that Dräger has performed to determine the minimum necessary safety clearances. These reduced safety clearances apply only to mobile high-frequency communication equipment that uses the standards specified.

Mobile high-frequency communication equipment with ...	Safety clearance
GSM 850, GSM 900, RFID 868 MHz (limited to 2 W ERP)	0.30 m (12 in)
GSM 1800, GSM 1900 (limited to 1 W ERP)	0.30 m (12 in)
UMTS, DECT (limited to 0.25 W ERP)	0.15 m (6 in)
Bluetooth, WLAN 2450, RFID 2450 (limited to 0.1 W ERP)	0.30 m (12 in)

Device combinations (outside the MR environment)

This device can be operated in combination with other Dräger devices or with devices from other manufacturers. Observe the accompanying documents of the individual devices.

WARNING

Risk of impaired imaging and impaired device function in an MR environment

Use only monitors, mounting parts, and connection cables approved by Dräger.

If a device combination is not approved by Dräger, the safety and the functional state 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 (where applicable):

- IEC 60601-1, 3rd edition (general requirements for safety, device combinations, software-controlled functions)
 - IEC 60601-1-2 (electromagnetic compatibility)
 - IEC 60601-1-8 (alarm systems)

Or:

- IEC 60601-1, 2nd edition (general requirements for safety)
 - IEC 60601-1-1 (device combinations)
 - IEC 60601-1-2 (electromagnetic compatibility)
 - IEC 60601-1-4 (software-controlled functions)
 - IEC 60601-1-8 (alarm systems)

Connections to IT networks

In an IT network, data can be exchanged using wired or wireless technologies. An IT network includes any data interface (e.g., RS232) that is described in standards and conventions.

During operation, this device can exchange information with other devices by means of IT networks and supports the following functions:

- Display of waveforms and parameter data
- Signaling of alarms

Information on connecting to the IT network

Prerequisites

This device must only be connected to the network by service personnel. The IT representative for the hospital must be consulted in advance.

The following documents must be followed:

- Accompanying documents of this device
- Descriptions of the network interface
- Description of the network-based alarm systems

Dräger recommends observing IEC 80001-1 (Risk management for IT networks with medical devices).

Serial interfaces

The following interfaces are supported:

- RS232 interfaces complying with EIA RS-232 (CCITT V.24/V.28) for the following applications:
 - MEDIBUS
 - Connections to medical devices from other manufacturers

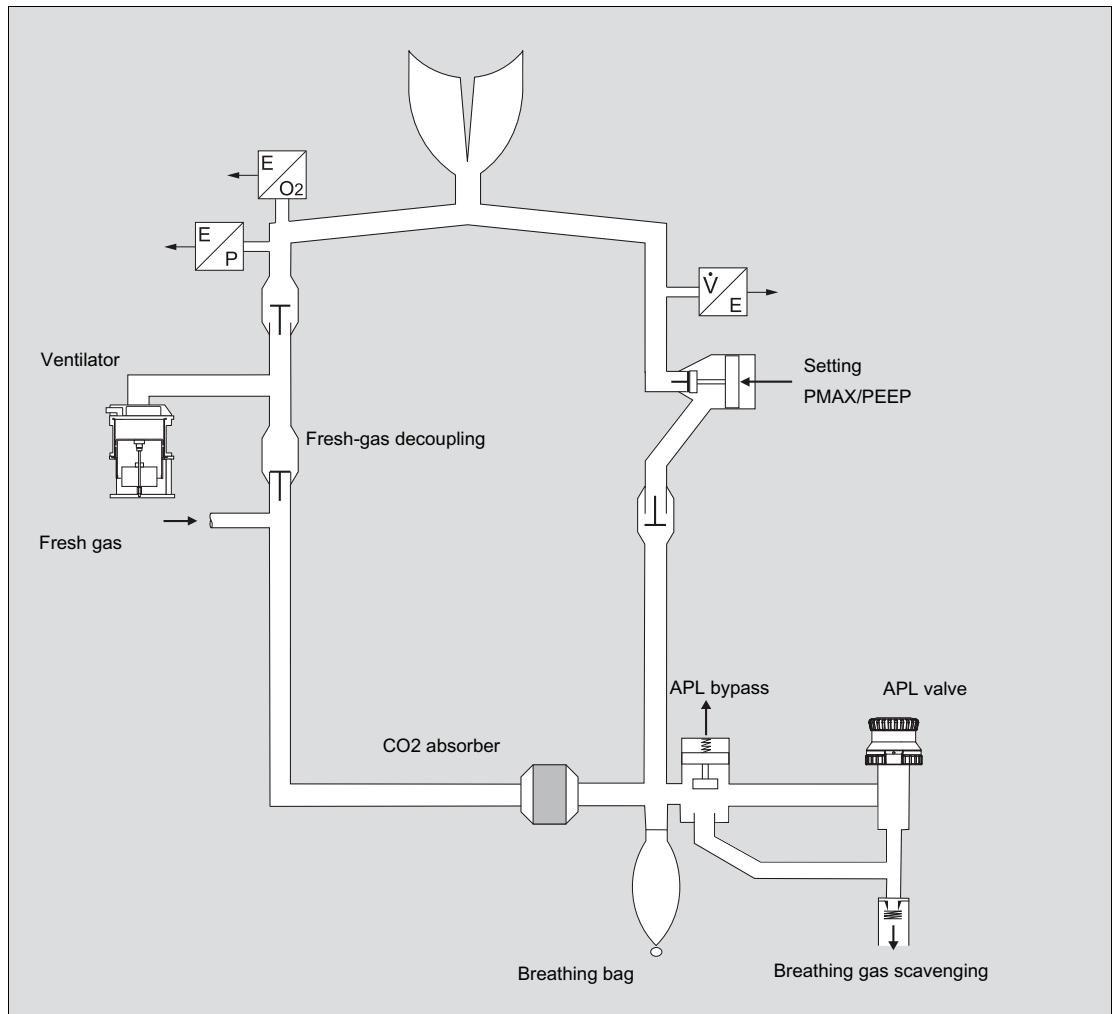
Required electrical characteristics of connected devices and networks

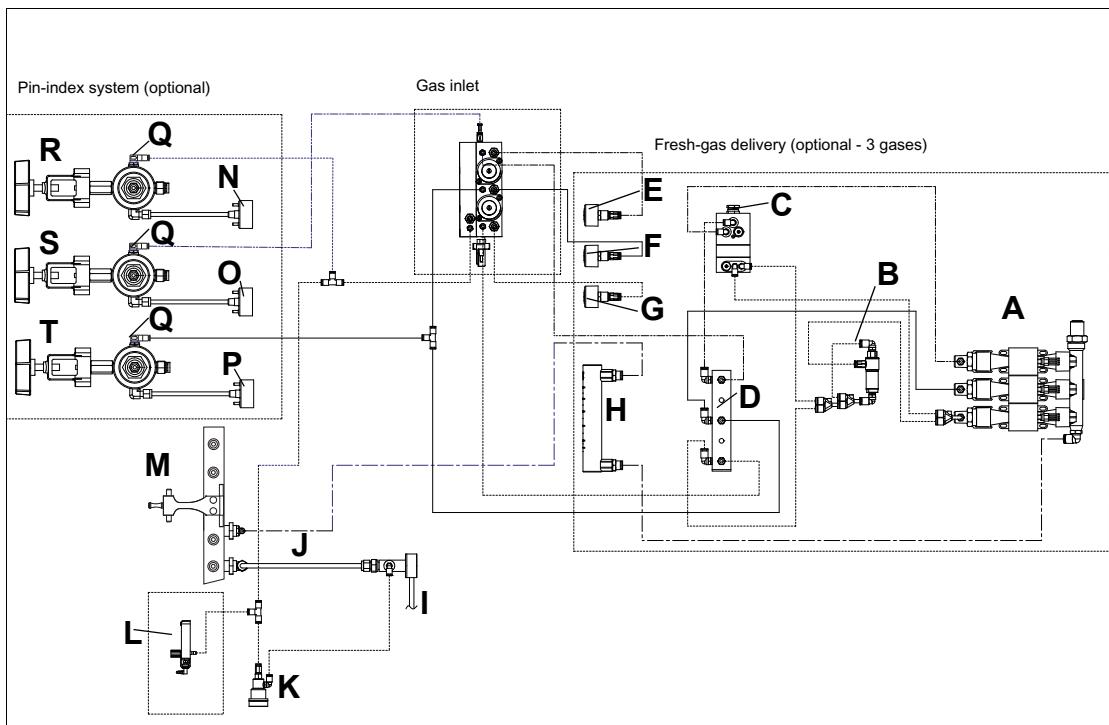
The serial interface is only suitable for connecting devices or networks which have a nominal voltage of at most 24 V DC on the network side and which meet the requirements of one of the following standards:

- IEC 60950-1: Ungrounded SELV circuits
- IEC 60601-1 (as of 2nd edition): Exposed secondary circuits

Illustrations

Gas flow plan of the breathing system





26742

- A** Flow sensors
- B** SORC bypass (ASM)
- C** SORC
- D** Flow control valve block
- E** Pressure gauge for the central N₂O supply
- F** Pressure gauge for the central Air supply
- G** Pressure gauge for the central O₂ supply
- H** Total flow tube
- I** Fresh gas
- J** Vaporizer holder for the fresh-gas line
- K** O₂ flush
- L** Supplemental O₂ delivery for O₂ insufflation*
- M** Vaporizer holder*
- N** Position of O₂ pressure gauge
- O** Position of N₂O pressure gauge
- P** Position of Air pressure gauge
- Q** Shut-off valves
- R** O₂ connection*
- S** N₂O connection*
- T** Air connection*

* optional

Annex

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Form for daily checkout and pre-use checkout

To ensure that Fabius is ready for operation, the following form must be filled in before start-up. After starting the check, no additional components may be added and no changes may be made to the anesthesia workstation.

This is a recommendation. The checking guidelines of the respective healthcare facility must be followed.

CAUTION

If one of the checks does not pass, the device must not be used.

Contact DrägerService or the responsible service partner.

NOTE

The following applies in this section: cmH₂O = mbar = hPa.

Checklist

The checklist for daily checkout before using the medical device takes into consideration all possible configurations of Fabius. If a test point does not apply to the Fabius to be tested due to configuration deviations, skip the respective test point.

All checks must be performed daily before use of the device. Personnel who perform the checks must be fully familiar with the instructions for use.

- P** This test point must be performed before each patient change.
 Box to check if the test point passed.

Mark off the individual functions after successful check.

Make copies of these pages so that they can be used as a daily record for the device check.

Fabius MRI

Part number:

Prerequisites

- The maintenance intervals of the device and accessories have not been exceeded.
- P** The device is completely assembled and connected.
- All monitoring functions (e.g., O₂ monitoring) and external monitors (e.g., breathing gas monitor) are switched on and functioning.
- The system test for Fabius has been performed.
- P** The sample line for gas monitoring (if present) is connected to the Luer Lock connection on the Y-piece.
- P** An appropriate anesthetic agent was selected.

Battery

- P** Make sure that the battery is completely charged. (Battery operation of 45 minutes is only guaranteed with a completely charged battery.)

Gas supply

- Visually inspect the central gas supply and the gas cylinders. Connect all hoses.
 Makes sure that the hoses are tightly connected.
- Make sure that the supply pressures of the central gas supply lie within the permissible range.

Gas cylinders (for PIN index only)

- Open the gas cylinders (if present).
- O₂ pressure is higher than 1000 psi (70 kPa x 100).
- N₂O pressure is higher than 600 psi (43 kPa x 100).
- Air pressure is higher than 1000 psi (70 kPa x 100).
- Close the gas cylinders.

O₂ flush

- Press the O₂ flush key: Check whether a strong gas flow escapes from the patient connection on the Y-piece.
- Release the O₂ flush key: Check that the gas flow stops.

Fresh-gas delivery and S-ORC

- Activate the **ManSpont** mode.
 - Open the O₂ flow control valve completely. Check whether the electronic O₂ fresh-gas flow display shows at least 10 L/min.
 - Close the Air flow control valve. Open the N₂O flow control valve completely. Check whether the electronic N₂O fresh-gas flow display shows at least 10 L/min.
 - Check whether the float of the total flow tube moves upward.
 - Shut off O₂ supply:
 - Remove the O₂ connector of the central gas supply.
 - Close the O₂ cylinder valve.
 - Check whether the red LED for low O₂ supply pressure is flashing.
 - N₂O flow is interrupted.
 - Check whether the float of the total flow tube shows 0 L/min.
 - Restore O₂ supply:
 - N₂O flow is present.
 - Set the O₂ flow control valve to 1.5 L/min. N₂O gas delivery = 3 L/min to 5 L/min.
 - Close the O₂ flow control valve:
 - N₂O flow is interrupted.
 - Open the Air flow control valve. Check whether the electronic air fresh-gas flow display shows at least 10 L/min.
- Close all flow control valves.

Calibration of the sensors

- Remove the O₂ sensor housing from the cover of the inspiratory valve.
- Expose the O₂ sensor to ambient air for 2 minutes.
- Start the calibration.

- Insert the O₂ sensor housing back in the cover of the inspiratory valve.

- Calibrate the flow sensor.

Check type of gas

- Set the O₂ flow control valve to 3 L/min.
- Check whether the measured O₂ concentration is at approx. 90 to 100 Vol%.
- Close the O₂ flow control valve.

Vapor 2000

- P Vaporizer is firmly connected, locked, and is hanging vertically.
- P Control dial is in position **0**.
- P Filling level is between the minimum mark and the maximum mark.
- P Safety filling device:
 - Sealing block is inserted and closed tightly.
 - Filling inlet is locked.
 - Drain valve is closed.
- P Filling device Quik Fil:
 - Drain valve is closed.
 - Sealing cap is tightly closed.
- P Dräger Fill filling system:
 - Drain valve is closed.
 - Sealing cap is tightly closed.

Soda lime

- P CO₂ absorber is present on the device and is adequately filled.
- P Maximum 50 % are discolored.

Airway pressure sensor

Change to standby mode and start the leakage test.

- Close all flow control valves.
- Set the Y-piece on the circuit plug on the bag elbow for the breathing bag.
- If necessary, occlude the sample line.
- Remove the pressure measurement hose from the socket for the airway pressure sensor on the rear of the device.
- The pressure displayed in the leakage test is at "0". Up to ± 2 is permissible. If the deviation is larger, contact DrägerService.
- Reconnect the pressure measurement hose to the socket for the airway pressure sensor on the rear of the device

Localizing leakages in the breathing circuit

The check must be performed once without vaporizer and once with vaporizer. Control dial is in the zero position.

- Change to **Standby** mode and then press the **Leak /ComplTest** softkey. Follow the instructions on the screen.

If the system has leakage (the pressure drops):

- Check all plug connections and screw connections for a tight seat.
- Replace missing or damaged seals. If necessary, contact DrägerService or the authorized local service partner

Inspiratory valve and expiratory valve

- Press the **ManSpont** key and confirm.
- Set the APL valve to position **Man** and to 30 cmH₂O (hPa).
- Press O₂ flush.
- P** The breathing bag fills.
- P** When the breathing bag is squeezed and released, the valve plates in the inspiratory valve and expiratory valve move.

APL valve

- P** Set the APL valve to position **Man** and to 30 cmH₂O (hPa). Set the fresh-gas flow to 20 L/min.
- P** Press the **ManSpont** key and confirm.
- P** When the pressure waveform has stabilized (e.g., in the shape of a flat line), set the APL valve to **Spont** to release the pressure.
- P** The displayed measured value for the peak pressure (**PEAK**) is between 24 to 36 cmH₂O (hPa).

Ventilator

- P** Connect the breathing bag to the Y-piece.
- P** Press the **Pressure Control** key and confirm.
- P** The measured values of the ventilation parameters are displayed.
- P** The ventilator piston functions.
- P** The valve plates in the inspiratory valve and expiratory valve move.
- P** The breathing bag fills and empties.
- P** Press the standby key and confirm.

Monitoring functions and alarms

The alarm function can be checked by setting an alarm limit that causes an alarm message for certain. The alarm limits can be adjusted at the start and during a check.

- Check the settings of the alarm limits.
- Simulate alarm conditions and check whether the correct alarm signals are triggered.
- Check O₂ display and alarm.
- Check volume display and alarm.
- Check pressure display and alarm.
- P** Press the standby key and confirm.

When Fabius is restarted, the default settings for the alarm limits are automatically restored.

- Check the default settings and adjust if necessary.

Other monitors (optional)

Make sure that external monitors (if present) are connected correctly and have been tested in accordance with the associated instructions for use.

- Test the alarm functions on all monitors.
- CO₂ monitor and alarm module are functional.
- Anesthetic agent monitor and alarm module are functional.

Anesthetic gas scavenging system

- P Hoses are correctly connected.
- P Set the flow control valve on the anesthetic gas receiving system so that the float is located between the "Min." and "Max." marks.
- P Occlude the Y-piece. Close all flow control valves.
- P Change to the **Standby** screen.

Set the APL valve to spontaneous breathing:

- Turn the APL valve head counterclockwise until the **Spont** mark is reached.
- Press the O₂ flush key and hold it pressed.
- With the Y-piece occluded, the airway pressure is less than 10 cmH₂O (hPa).
- Release the O₂ flush key.
- The airway pressure is higher than or equals 0 cmH₂O (hPa).

Manual resuscitator

- When squeezing the bag an audible and noticeable air flow must escape from the mask connection (cone). After releasing, the bag must quickly assume its original shape.
- Close off the mask connection (cone) with the ball of the hand: The bag must only be able to be slightly squeezed.

P Before connecting to the patient

- All vaporizers are switched off (the control dials are in the **0** position).
- The APL valve is set to the desired pressure.
- All electronic fresh-gas flow displays and the total flow tube indicate **0**.
- The scavenging flow of the endotracheal suction is present.
- The breathing system is ready for operation (the breathing bag is correctly positioned and all hoses are correctly connected).
- CO₂ absorber is present on the device and is adequately filled.

If any one of the test points is not passed, the device must not be used. Contact DrägerService or the authorized local service partner.

Signature for the daily checkout

Name

Date

Signature for pre-use checkout

Name

Signature for pre-use checkout

Name

Date

Signature for pre-use checkout

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Protocol for the imaging tests

Overview

Before the installation is completed, tests must be carried out to determine whether Fabius MRI impairs the diagnostic quality of the tomography images. During the test, it will be necessary for the magnetic resonance scanner to be in operation for 30 minutes. The test comprises 4 scan procedures:

- 3 scans with gradient echo (GE, FEE)
- 1 scan of any type

First scan

This scan checks whether image artifacts occur in the MR environment that cannot be attributed to Fabius MRI.

Prerequisite: Fabius MRI is not situated in the MR environment.

Perform the scan:

- 1 Position an MRI phantom centrally at the level of the head coil.
- 2 Using the head coil, perform a gradient echo scan with a small angle (e.g., 10°).

Result:

If image artifacts occur, these will be traceable to external sources of interference (e.g., high-frequency equipment) or a non-optimum performance of the magnetic resonance scanner.

Second scan

This scan checks whether artifacts occur during a scan with the head coil when Fabius MRI is located in the MR environment.

Prerequisite: Fabius MRI is situated at the operating location in the MR environment.

Perform the scan:

- 1 Perform the scan with the same parameters as for the first scan.

Result:

If image artifacts occur, Fabius MRI is possibly not optimally positioned.

Third scan

This scan checks whether artifacts occur during a scan with the body coil when Fabius MRI is located in the MR environment.

Prerequisite: Fabius MRI is situated at the operating location in the MR environment.

Perform the scan:

- 1 Remove the head coil from the magnetic resonance scanner.
- 2 Position an MRI phantom centrally at the level of the body coil.
- 3 Perform the scan with the body coil.

Result:

If image artifacts occur, Fabius MRI is possibly not optimally positioned.

Fourth scan

This scan checks whether artifacts occur during a scan with any chosen coil when Fabius MRI is located in the MR environment. If this scan is to be performed with the head coil, perform the scan before the third scan. In this way, the same test setup as for the second scan can be used.

Prerequisite: Fabius MRI is situated at the operating location in the MR environment.

Perform the scan:

- 1 Perform any chosen scan, e.g., a scan that is particularly sensitive to high-frequency interference.

Result:

If image artifacts occur, remove Fabius MRI from the MR environment. Repeat the scan so that the source of the interference can be localized.

Completion certificate and verification for the positioning of Fabius MRI at the operating location

Fabius MRI for the magnetic resonance scanner

Manufacturer of Fabius MRI

Dräger Medical GmbH

Manufacturer of the magnetic resonance scanner:

Device type (magnetic resonance scanner):

Location:

Date of installation of the anesthesia machine:

Signatures

Dräger representative:

User:

Field line definition for 40 mT (400 gauss)

Distance from magnetic center:

Y-axis in feet/inches or cm

X-axis in feet/inches or cm

or

Distance from MRI housing in the direction of the

Fabius MRI position:

Y-axis in feet/inches or cm

X-axis in feet/inches or cm

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Password

Configuration password for Fabius MRI Software 3.n

Cut out from the instructions for use for
Fabius MRI Software 3.n

To prevent unauthorized alteration, the start
settings of Fabius MRI are protected by the
following configuration password:

8088



Information for the configuration password

To prevent unauthorized alteration, the default
settings of Fabius MRI are protected by a 4-digit
password. For information on the default settings,
see page 136.

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.

Upon request, DrägerService can customize the
password or deactivate the password function.

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Directive 93/42/EEC concerning medical
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