# Evita 2 dura

1-251-96

**Intensive Care Ventilator**
**Instructions for Use**
**Software 4.n**

# Working with these Instructions for Use

**Header line – the title...**
**of the main chapter**

The title of the specific sub-section is printed underneath the main header – to help you find your way quickly from subject to subject.

**Page body...**
**the Instructions for Use**

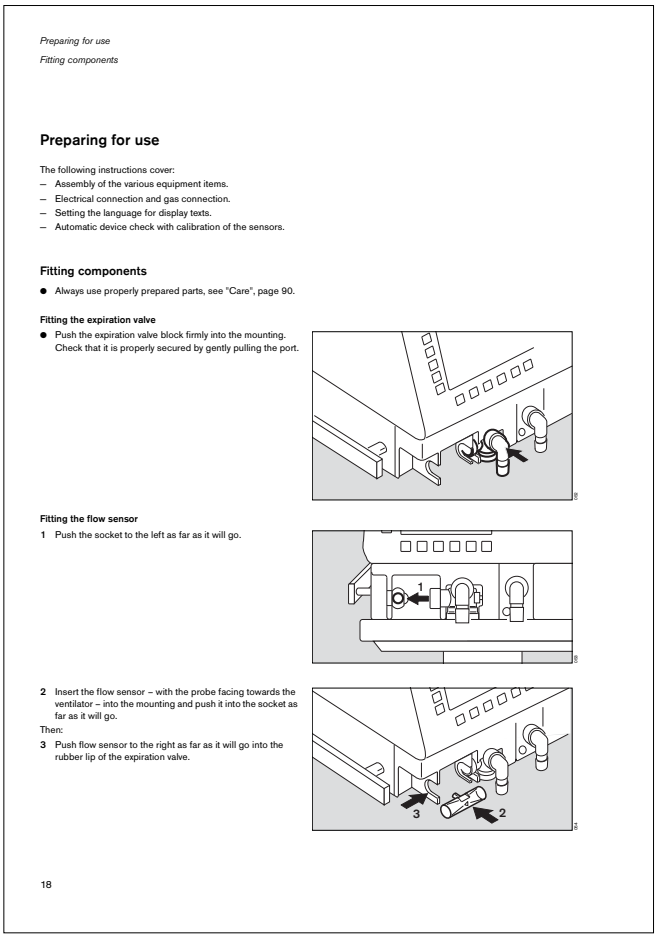
in combined text/illustrations. The information is expressed in the form of practical actions, giving the user direct hands-on experience in learning how to use the machine.

**Left-hand column...**
**the text**

provides explanations and instructs the user step-by-step in the practical use of the product, with short, clear instructions in easy-to-follow sequence.
Bullet points indicate separate actions. Where several actions are described, numbers are used both to refer to the relevant details in the illustrations and to specify the sequence of actions.

**Right-hand column...**
**the illustrations**

provide the visual reference for the text and make it easier to locate the various parts of the equipment. Elements mentioned in the text are highlighted. Unnecessary details are avoided. Screen displays prompt the user to proceed and confirm correct actions.



*Preparing for use*

*Fitting components*

**Preparing for use**

The following instructions cover:
– Assembly of the various equipment items.
– Electrical connection and gas connection.
– Setting the language for display texts.
– Automatic device check with calibration of the sensors.

**Fitting components**

● Always use properly prepared parts, see "Care", page 90.

**Fitting the expiration valve**

● Push the expiration valve block firmly into the mounting. Check that it is properly secured by gently pulling the port.

**Fitting the flow sensor**

**1** Push the socket to the left as far as it will go.

**2** Insert the flow sensor – with the probe facing towards the ventilator – into the mounting and push it into the socket as far as it will go.

Then:

**3** Push flow sensor to the right as far as it will go into the rubber lip of the expiration valve.

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# What's new in Evita 2 dura software 4.n

**Specification of the humidifier used**

— »Active humidifier«
or
— »HME/Filter« (artificial nose)
— for more accurate measurement of the volume parameters

**Apnoea ventilation On/Off**

— can be selected as starting configuration

**Extended range of settings for the alarm time $T_{Apnoea}$**

— from 5 to 60 seconds
(formerly 15 to 60 seconds)

**Ventilation mode BIPAP$_{Assist}$**

— for pressure-controlled assisted ventilation

**Patient mode »prev. patient« can be selected**

— to adopt the settings, including alarms, which were effective before switching off the equipment

**Leakage compensation On/Off**

— for activation and deactivation of the automatic leakage compensation function

**Monitoring of tube blockages**

— New alarm message »Tube blocked !!!«

**Additional weaning parameters**

available as software version 4.n plus upgrade
in addition to the parameter occlusion pressure P 0.1
Evita 2 dura 4.n also determines the parameters

— RSB Rapid Shallow Breathing index
and
— NIF Negative Inspiratory Force Index
— $f_{spn}$ and $MV_{spn}$ as trend

**External flow source**

available as software version 4.n plus upgrade

— The amount of external flow is calculated by Evita 2 dura 4.n (e.g. for additional tracheal gas insufflation) and adjusts the volume monitoring tolerances in order to avoid inadvertent alarms

**Evita Remote (Remote Pad)**

optionally available

— Remote control pad for parallel remote operation of function keys on Evita 2 dura 4.n

**NIV**

optionally available

— Application mode to support non-invasive ventilation therapies

**Nurse call**

optionally available

— Socket for connecting alarm signals to a central alarm station in the hospital

**Simplified settings**

under »other modes«

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# For Your Safety and that of Your Patients

**Strictly follow the Instructions for Use**

Any use of the apparatus requires full understanding and strict observation of these instructions. The apparatus is only to be used for purposes specified here.

**Maintenance**

The apparatus must be inspected and serviced regularly by trained service personnel at six monthly intervals.
Repair and general overhaul of the apparatus may only be carried out by trained service personnel.
We recommend that a service contract be obtained with DrägerService and that all repairs also be carried out by them.
Only authentic Dräger spare parts may be used for maintenance.
Observe chapter "Maintenance Intervals".

**Accessories**

Do not use accessory parts other than those in the order list.

Note: Even reusable accessories (e.g. parts which can be cleaned and/or sterilized) have a limited useful life. Wear and tear may be increased and the service life reduced considerably as a result of various factors when handling and conditioning such parts (e.g. disinfectant residues left behind after autoclaving may corrode the material). Such parts must be replaced immediately if external signs of wear become evident, such as cracks, deformation, discoloration, peeling, etc.

**Not for use in areas of explosion hazard**

This apparatus is neither approved nor certified for use in areas where combustible or explosive gas mixtures are likely to occur.

**Safe connection with other electrical equipment**

Electrical connections to equipment which is not listed in these Instructions for Use should only be made following consultations with the respective manufacturers or an expert.

**Liability for proper function or damage**

The liability for the proper function of the apparatus is irrevocably transferred to the owner or operator to the extent that the apparatus is serviced or repaired by personnel not employed or authorised by DrägerService or if the apparatus is used in a manner not conforming to its intended use.

Dräger cannot be held responsible for damage caused by non-compliance with the recommendations given above. The warranty and liability provisions of the terms of sale and delivery of Dräger are likewise not modified by the recommendations given above.

Dräger Medical GmbH

## Safe use of the equipment

**This equipment must only be used under the supervision of qualified medical staff, so that help is available immediately if any faults or malfunctions occur.**

**Medications containing alcohol and other flammable substances, must NOT be used in the patient circuit. This is a fire hazard!**

**Medicaments and other substances based on inflammable solvents, such as alcohol, must not be used in the patient system. Danger of fire!**

Adequate ventilation must be ensured when using inflammable substances for disinfection.

**Do not use mobile telephones within 10 metres of ventilators!**

Mobile telephones may impair the functioning of electromedical equipment and endanger the patient*

**When the unit is mounted onto the trolley it must NOT be tilted at more than 5°, this could cause the entire assembly to tip over.**

**Appropriate ventilation monitoring**

The (built-in) monitoring facilities of the Evita 2 dura ventilator ensure appropriate monitoring of ventilation therapy and (therefore) will detect any undesirable changes in the following ventilation parameters:

- Airway pressure, Paw
- Expiratory minute volume, MV
- Inspiratory $O_2$ concentration, $FiO_2$
- Inspiratory breathing gas temperature, T
- Expiratory $CO_2$ concentration, $etCO_2$ (optional)
- Inspiratory breathing volume, $V_{Ti}$
- Apnoea time
- Tachypnoea monitoring

Changes in these parameters may be caused by:

- Acute changes in the patient's condition
- Incorrect settings and faulty handling
- Equipment malfunctions
- Failure of power and gas supplies

If a fault occurs in this equipment, separate measuring instruments should be used.

**Back-up ventilation with an independent manual ventilation device**

If a fault is detected in Evita 2 dura so that its life-support functions are no longer assured, ventilation using an independent ventilation device must be started without delay – if necessary with PEEP and/or increased inspiratory $O_2$ concentration (e.g. with the Dräger Resutator 2000).

* Dräger medical equipment meets the requirements for immunity to interference in accordance with the specific product standards and EN 60601-1-2 (IEC 60601-1-2). Depending on the type of mobile telephone used and on the application situation, however, field strengths exceeding the values specified in the applicable standards may develop in the immediate vicinity of the mobile telephone and therefore lead to faults and malfunctions.

# Intended Medical Application

**Evita 2 dura**

Long-term ventilator for intensive care.
For adults, children and neonates.

**With the following ventilation modes**

**IPPV** (**I**ntermittent **P**ositive **P**ressure **V**entilation)
controlled and assisted constant-volume ventilation.
With the options:

- **CPPV** (**C**ontinuous **P**ositive **P**ressure **V**entilation)
- **PLV** (**P**ressure **L**imited **V**entilation)
- **AutoFlow**® (optional)
  for automatic regulation of inspiration flow
- **IRV** (**I**nversed **R**atio **V**entilation)

**SIMV** (**S**ynchronized **I**ntermittent **M**andatory **V**entilation)
Procedure for weaning patients off the ventilator after they have started spontaneous breathing.
With the options:

- **PLV** (**P**ressure **L**imited **V**entilation)
- **AutoFlow**® (optional)
  for automatic regulation of inspiration flow

**MMV** (**M**andatory **M**inute Volume **V**entilation)
Spontaneous breathing with automatic adjustment of mandatory ventilation to the patient's minute volume requirement.
With the options:

- **PLV** (**P**ressure **L**imited **V**entilation)
- **AutoFlow**® (optional)
  for automatic regulation of inspiration flow

**SB** (**S**pontaneous **B**reathing)
Spontaneous breathing at ambient pressure

**CPAP** (**C**ontinuous **P**ositive **A**irway **P**ressure)
Spontaneous breathing with positive airway pressure

**ASB** (**A**ssisted **S**pontaneous **B**reathing)
Pressure-assisted spontaneous breathing

**BIPAP*** (**B**iphasic **P**ositive **A**irway **P**ressure)
Pressure-controlled ventilation combined with free spontaneous breathing during the complete breathing cycle, and adjustable pressure increase to CPAP level.

**BIPAPAssist** (**B**iphasic **P**ositive **A**irway **P**ressure **A**ssisted)
Pressure-controlled assisted ventilation

**APRV** (**A**irway **P**ressure **R**elease **V**entilation) (optional)
Spontaneous breathing on two pressure levels with long time ranges – independently adjustable.

Special modes:

**Apnoea Ventilation**
For switching over automatically to volume-controlled mandatory ventilation, if breathing stops.
If apnoea occurs, Evita 2 dura emits an alarm after the preset alarm period ($T_{Apnoea}$) and starts volume-controlled ventilation.

**ILV** (optional)
**I**ndependent **L**ung **V**entilation,
Separate, differentiated, synchronised ventilation with two units, one for each lung, either two Evita 2 dura units or an Evita 2 dura with another Evita unit.

**Diagnostics**

**Intrinsic PEEP-measurement** (optional)
for determining intrinsic PEEP and measuring trapped volume.

**Occlusion pressure measurement** (optional)
for evaluating breathing drive during spontaneous breathing.

**With monitoring for**

Airway pressure, Paw
Expiratory minute volume, MV
Inspiratory $O_2$ concentration, $FiO_2$
Inspiratory breathing gas temperature, T
Expiratory $CO_2$ concentration, $etCO_2$ (optional)
Functional $O_2$ saturation and heart rate (optional)
Inspiratory breathing volume, $V_{Ti}$
Apnoea time
Tachypnoea monitoring to detect rapid, shallow spontaneous breathing

**Automatic gas switch-over**

In the event of a gas failure, the change-over to another gas is automatic.

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* Registered trade mark

# Operating Concept

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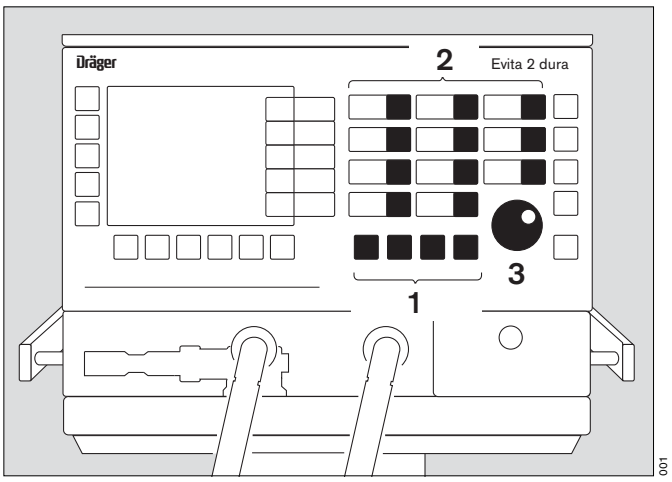
# Operating Concept

## Ventilation Controls




1 Keys for selecting the ventilation modes:
   – **IPPV**
   – **SIMV**
   – **BIPAP**
   and
   – **other modes**
2 Keys for selecting/setting ventilation parameters:
   – Tidal volume **$V_T$**
   – Inspiration time **$T_{insp}$**
   – Frequency **f**
   – Inspiratory flow **Flow**
   – Inspiratory pressure **$P_{insp}$**
   – Pressure-assisted spontaneous breathing **$\Delta P_{ASB}$**
   – Positive end-expiratory pressure **PEEP**
   – Pressure rise time **Ramp**
   – $O_2$ concentration **$O_2$**
   – Sensitivity **Trigger**
3 Central "turn-and-push" rotary knob for setting the parameters:
   To set = turn the rotary knob
   To confirm setting = press the rotary knob.

#### Setting ventilation parameters

2 To set a ventilation parameter = press the corresponding parameter key. The yellow LED in the key lights up.

3 To set the value of the ventilation parameter = turn the rotary knob. The value is displayed next to the parameter key.

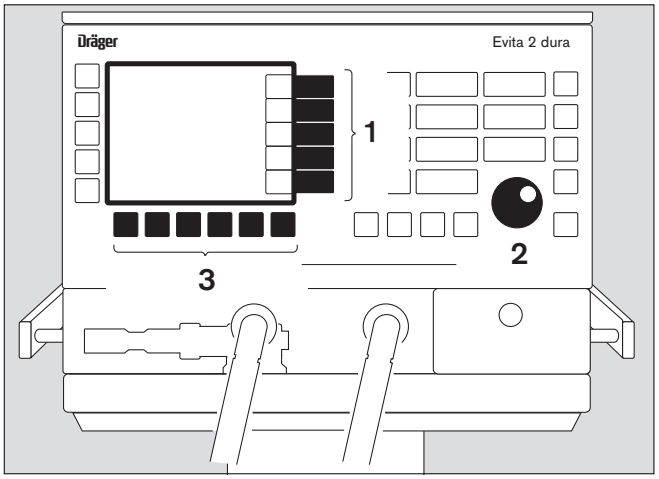
3 To confirm the value = press the rotary knob. The yellow LED goes out.

#### Selecting the ventilation mode

1 Hold down the appropriate key for about 3 seconds
   or
   press the appropriate key briefly and confirm = press the rotary knob.
   The selected ventilation mode will now be activated.

For detailed instructions on setting the ventilation modes, see page 41.

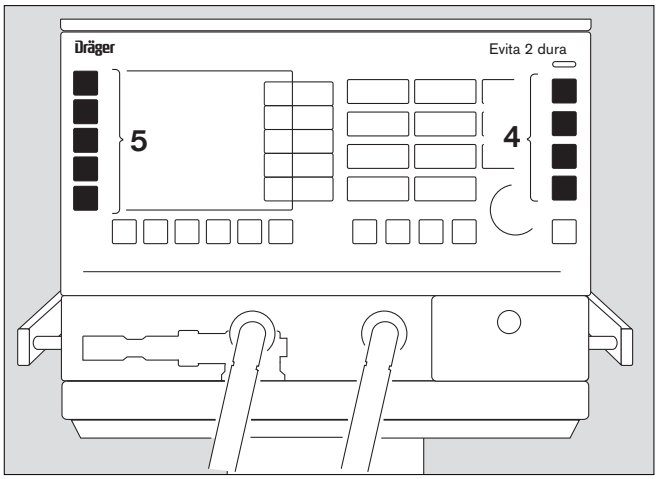
## Screen Operating Controls




**1** Menu keys for selecting the menu on the screen.

**2** Central "turn-and-push" rotary knob for selecting and setting the options displayed on the screen.
To select/set = turn the rotary knob
To confirm = press the rotary knob.

**3** Screen operating keys:
- »**Print** « key for manual printer logging,
- » ☼/● « key for setting the screen brightness to bright or dark,
- »**Freeze** « key for freezing the curves,
- »**Curves** « key for displaying a different pair of curves,
- »**Values** 1 2 « key for displaying a different combination of measured values,
- one reserve key for future functions.



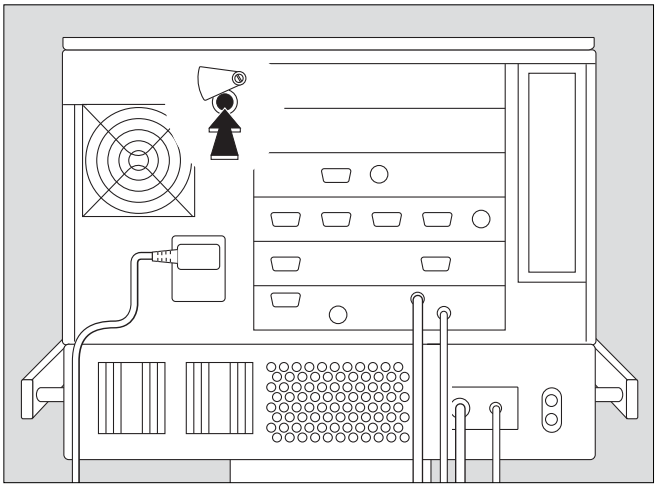

**Keys for routine and additional functions**

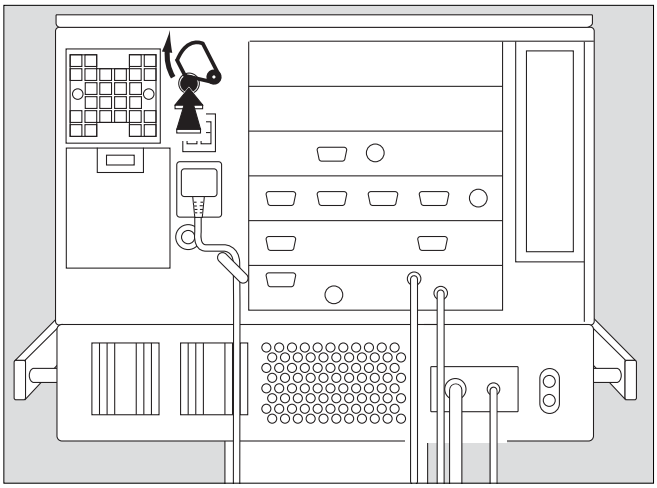
**4** Frequently used keys for routine functions are positioned on the right-hand side of the front panel:
- » 🔔 « key for suppressing the audible alarm tone,
- »**Alarm Reset**« key for resetting or acknowledging alarm messages,
- » ⓘ « key for calling up information and help on the desired setting,
- » 🔒 « key for protecting against inadvertent or unauthorised modification of the settings of the ventilation parameters or ventilation modes.

**5** Keys for additional functions are positioned on the left-hand side of the front panel:
- » « key for switching the medicament nebuliser on/off,
- »**$O_2$ ↑ Suction**« key for oxygen enrichment during bronchial suction,
- »**Insp. hold**« for manually activated inspiration,
- »**Exp. hold**« for extending the expiration time,
- one reserve key for future functions.

## Power switch

To switch the apparatus on/off.
Located on the back panel, with a covering flap to protect the switch from being switched off inadvertently.




## Standby key »⏻«

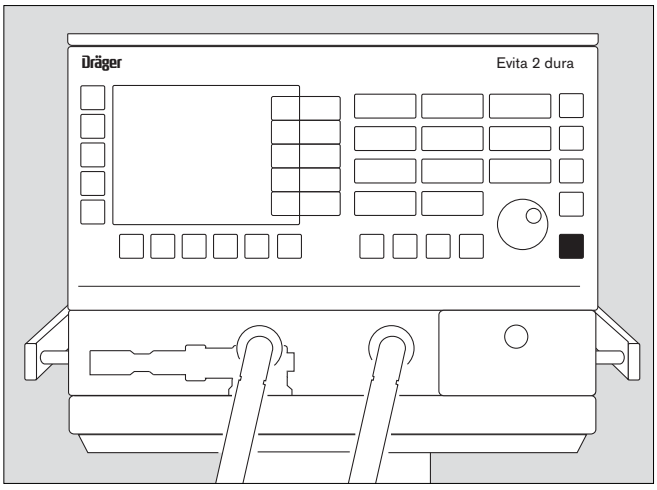
Placed on its own, away from other keys.
For keeping the apparatus on standby
or
for switching on ventilation.

To switch to standby:

- Press and hold down the »⏻« key for at least 3 seconds.

To switch on ventilation:

- Briefly press and release the »⏻« key.



## Screen Pages

The screen pages consist of two basic structures:

— the main page, displaying all important ventilation characteristics at a glance
and

— application-specific pages for functions and settings.

Important functions are displayed in the same position in both structures:

— active ventilation mode and patient mode

— alarm, warning and advisory messages

— field for the menu selection keys

— information and help

### Structure of the main page

① Line for the active ventilation mode, patient mode and trigger indicator

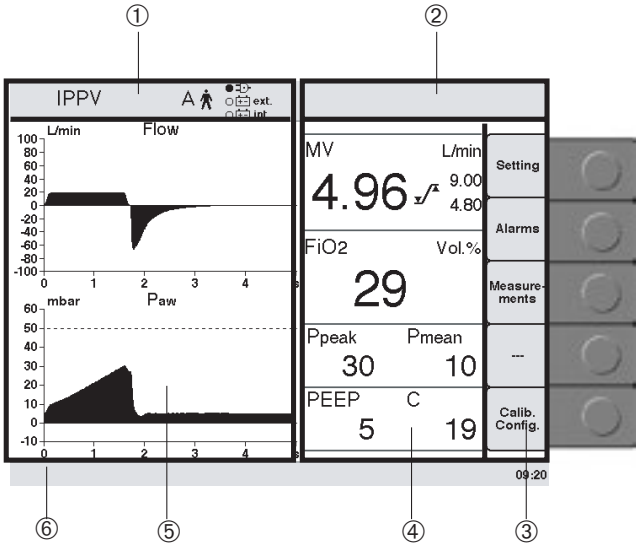
② Bar for alarm, warning and advisory messages

③ Field for menu selection keys

④ Field for measured values

⑤ Field for curves

⑥ Bar for information and help




### Structure of the application-specific pages

① Bar for the currently active ventilation mode and patient mode (example: BIPAP)

② Field for displaying the selected menu

③ Field for the menu bar

④ Bar for the alarm, warning and advisory messages

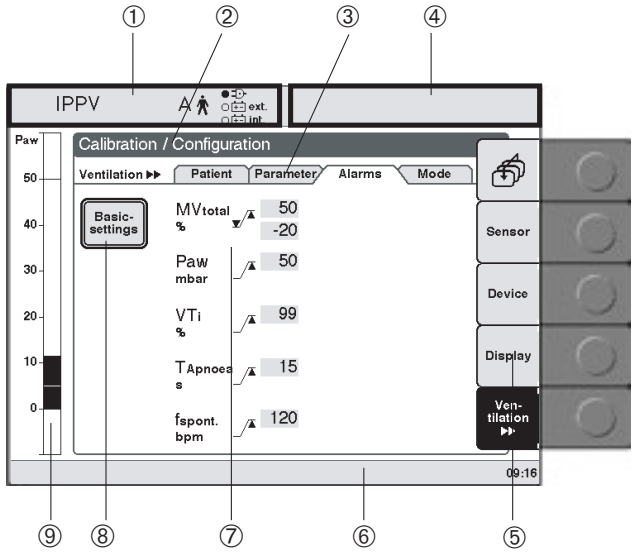
⑤ Field for menu selection keys

⑥ Bar for information and help

⑦ Screen field, selectable with the rotary knob

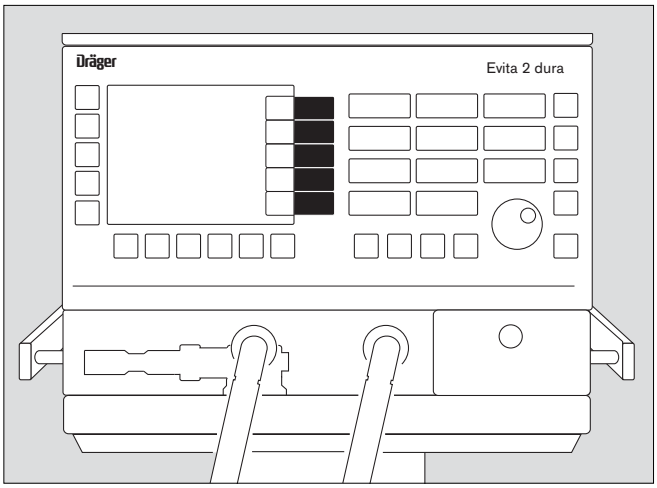
⑧ Screen key, selectable with the rotary knob

⑨ Field for continuous pressure display and monitoring



The menu keys on the right-hand edge of the screen select the screen pages for the following specific application situations:

– Settings
– Alarms
– Measurements
– Measurement manoeuvre (optional)
– Calib./Config.




**Screen page »Settings«**

– For setting apnoea ventilation
– For setting intermittent PEEP (sigh)

For detailed operating instructions, see "Setting ventilation modes" on page 41 onwards.

**Screen page »Alarms«**

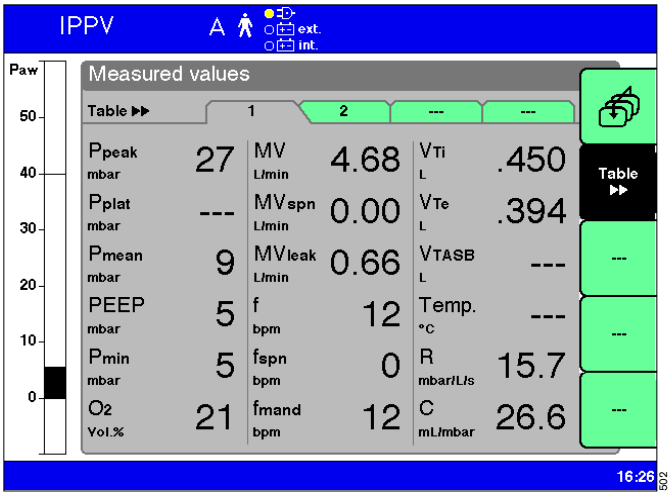
– For displaying the measured values with their alarm limits
– For setting the alarm limits

For detailed operating instructions, see "Setting alarm limits" on page 53.

**Screen page »Measured values«**

– For displaying all the measured values in the current ventilation mode.

Press the »**Table ▶▶**« screen key to display more option measured values in »**Table 2**«.



**Screen page »Calibration/Configuration«**

**Sensors**

– Calibrating the sensors for $O_2$ and flow
– Switching the monitoring system on and off

**Device**

– Setting the volume of the acoustic alarm
– Setting the screen contrast
– Setting the date and time
– Selecting language and measurement units
– Setting the external interfaces

**Display**

– Selecting 2 x 6 measured values from the main page
– Selecting 2 x 2 curves from the main page

**Ventilation**

– Patient mode
– Ventilation mode
– Ventilation parameters
– Alarm limits

## Colour screen

For differentiating various items of information on the screen.

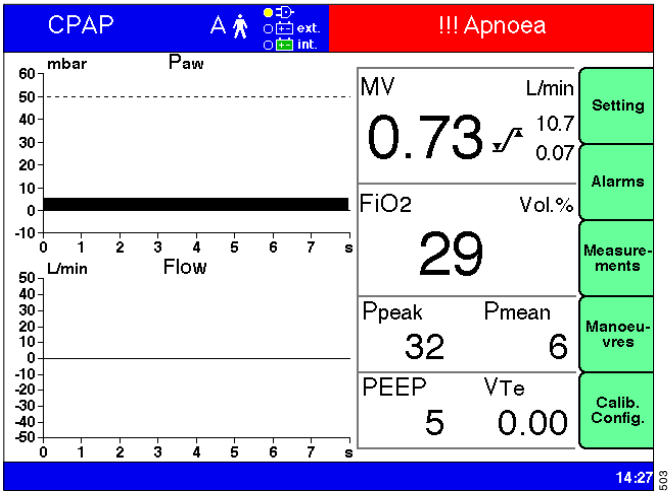
**For messages**

Red = Alarm

Yellow = Caution or advisory message

Blue = Alarm is no longer active

Example: »**!!! Apnoea**« alarm

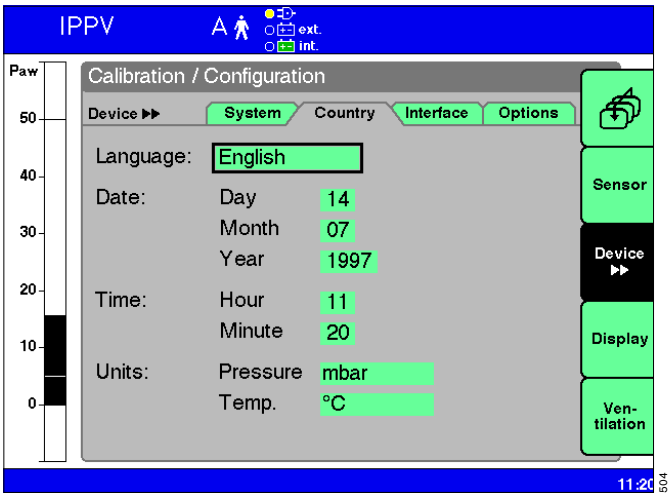



**For menu buttons:**

Green = Can be selected

Black = Has been selected

Example: Menu button »**Device ▶▶**«

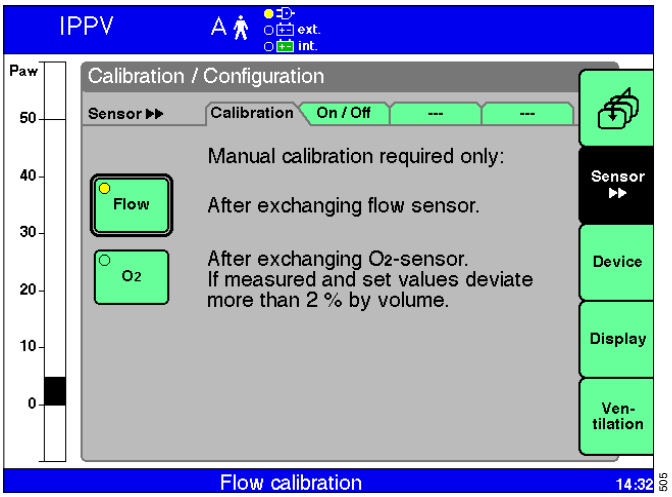



**For screen keys**

Green "LED" in the screen key = function not active

Yellow "LED" in the screen key = function active

Example: Screen key »**Flow**« = function active



# Preparing

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# Preparing for use

The following instructions cover:

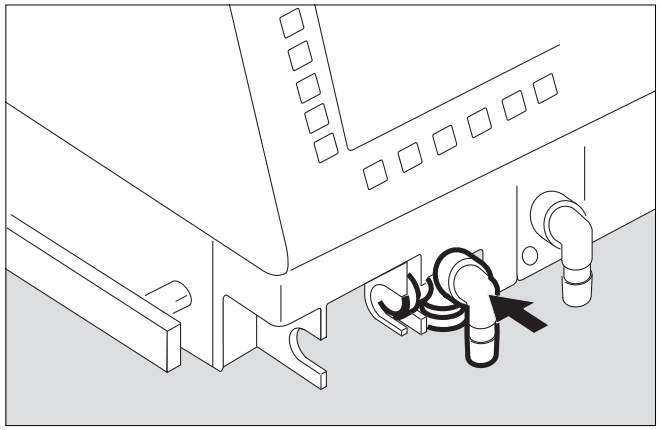
– Assembly of the various equipment items.
– Electrical connection and gas connection.
– Setting the language for display texts.
– Automatic device check with calibration of the sensors.

## Fitting components

- Always use properly prepared parts, see "Care", page 90.

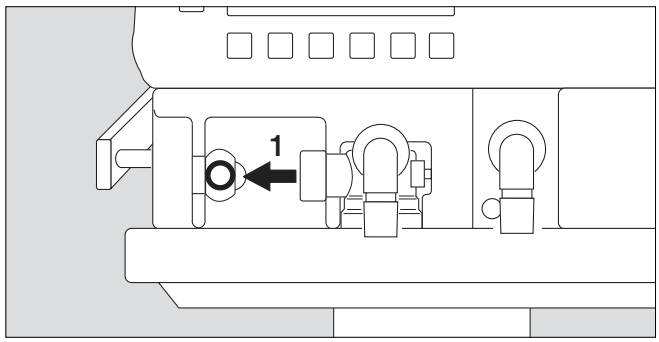
### Fitting the expiration valve

- Push the expiration valve block firmly into the mounting. Check that it is properly secured by gently pulling the port.




### Fitting the flow sensor

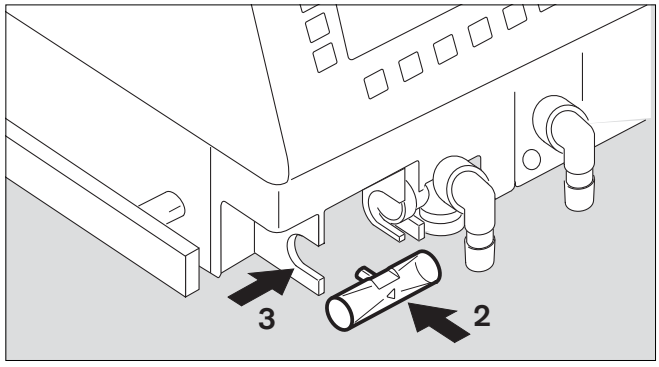
**1** Push the socket to the left as far as it will go.




**2** Insert the flow sensor – with the probe facing towards the ventilator – into the mounting and push it into the socket as far as it will go.

Then:

**3** Push flow sensor to the right as far as it will go into the rubber lip of the expiration valve.



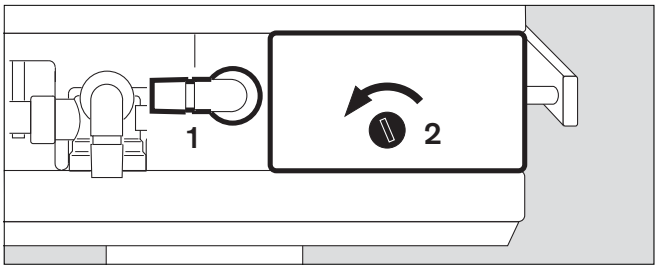
**Fitting the $O_2$ sensor**

— when using the system for the first time
— when the display reads:
»**$O_2$ measurement inop.**«
— when calibration can no longer be performed.

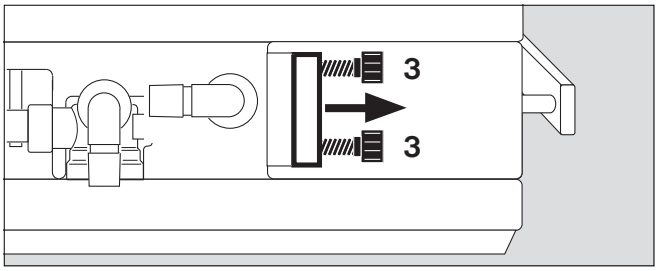
● Tilt the control unit upwards.

**1** Turn port downwards or to the left.

**2** Unscrew (e.g. with coin), and remove protective cover.



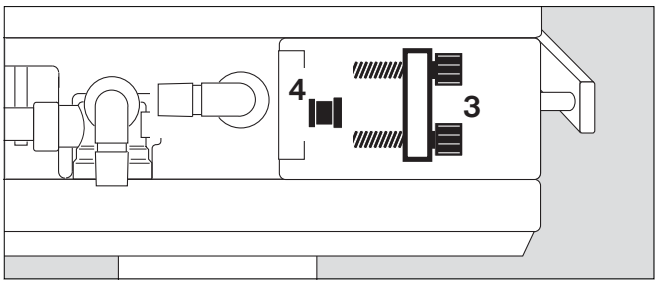

**3** Unscrew the two knurled screws and open the sensor housing.




**4** Insert new sensor. The sensor end with the visible circular tracks on the contacts goes into the housing.

**3** Close the sensor housing securely with the two knurled screws.

● Screw the protective cover back in place.




After inserting:

● Wait 15 minutes for the $O_2$ sensor to warm up. The $O_2$ sensor cannot be calibrated until it has warmed up.
● Calibrate $O_2$ sensor, page 66.
● Dispose of used sensor, page 99.

## Note on the use of heat and moisture exchangers

The use of heat and moisture exchangers (HME's) in the patient connection can considerably increase breathing resistance. An increase in breathing resistance will in turn lead to greater effort in spontaneous breathing and/or greater trigger effort during assisted ventilation. Under unfavourable conditions, an increase in breathing resistance can lead to an unwanted intrinsic PEEP.
This breathing resistance in the patient connection cannot be directly monitored by the ventilator.

- The condition of the patient and the ventilator's measured values for air volume and resistance must be checked more frequently.
- Follow the Instructions for Use of the heat and moisture exchanger (HME).
- Do not use the heat and moisture exchanger (HME) at the same time as a medicament nebuliser or humidifier!

## Note on the use of bacterial filters

The use of expiratory bacterial filters and/or HME filters on the ventilator is not recommended.

However, if bacterial filters are nevertheless used on the expiration side, an undesirable increase in breathing resistance is possible. Especially during medicament nebulisation and humidifying, the resistance of the expiratory bacterial filter may increase gradually. For the patient, the effect may be increased breathing effort and intrinsic PEEP.

An intrinsic PEEP can be recognised by the fact that the expiratory flow does not return to "0" before the end of expiration.

If PEEP is unacceptably high, the unit signals the »**!!! PEEP high**« alarm.

- Check the bacterial filter and replace it if it is the cause of the PEEP.

The inspiratory and expiratory breathing resistance of the patient system can be determined before ventilation by the device check in standby mode – see page 30 onwards.

## For ventilating adults and children

From 100 mL tidal volume VT and above:

Patient mode »Adults«

**If using a breathing gas humidifier, do not use an additional heat and moisture exchanger (HME)! Risk of increased breathing resistance due to condensation.**

### Connecting Aquapor humidifier

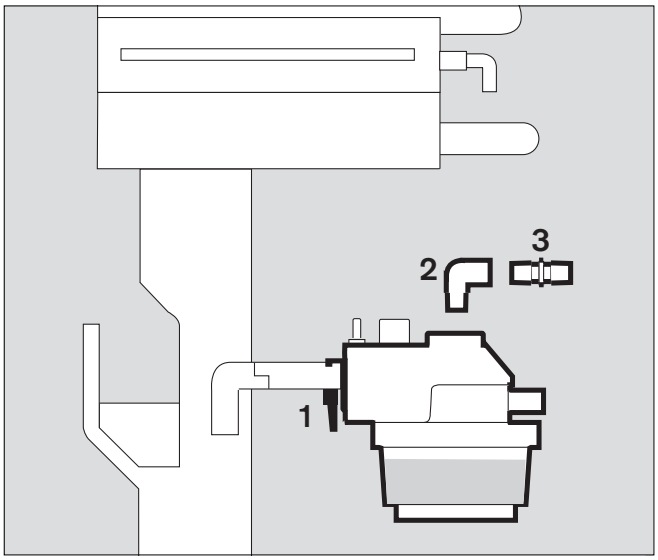
Prepare Aquapor according to its separate Instructions for Use.

**1** Hang Aquapor from rail by bracket and tighten screws.

**2** Insert elbow connector into Aquapor.

**3** Insert the double connector into the elbow connector.

- Fill Aquapor bowl to the upper mark with distilled water.




### Connection of ventilation hoses

Do not use antistatic or conductive hoses*.

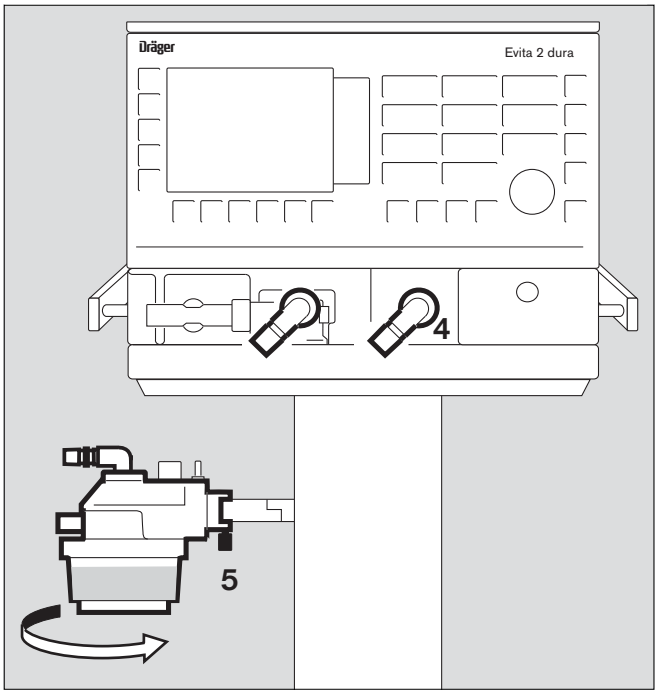
Depending on the desired position of the ventilator in relation to the bed, the hinged arm can be fitted to either side of the machine.

Attachment on left-hand side:

**4** Turn both ports to the left.

**5** Turn Aquapor to the left.

The following description applies when the ventilation hoses have been attached on the **left-hand** side.




* DIN VDE 0750 Part 215:
The use of anti-static or electrically conductive material in the breathing system of the lung ventilator is not considered to contribute any improvement in safety. On the contrary, the use of these materials increases the danger of electric shock to the patient and of fire due to the presence of oxygen.

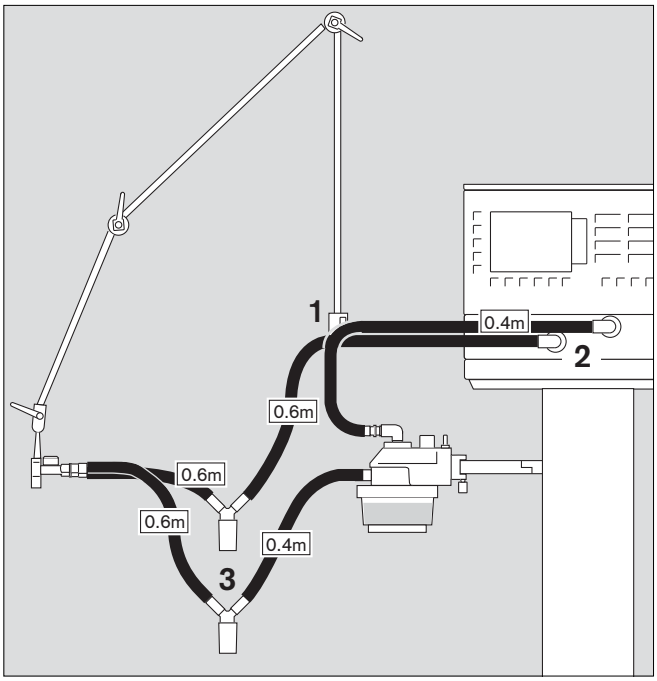
**1** Hang the hinged arm from the rail on the left-hand side and tighten screws.

- Connect ventilation hoses, and note length of hose (metres).

**2** Turn ports in direction of hoses.

**3** Install water traps in vertical position at the lowest point of their hose lines.

- Connect the Y-piece, with the rubber sleeve of the Y-piece on the inspiratory side.

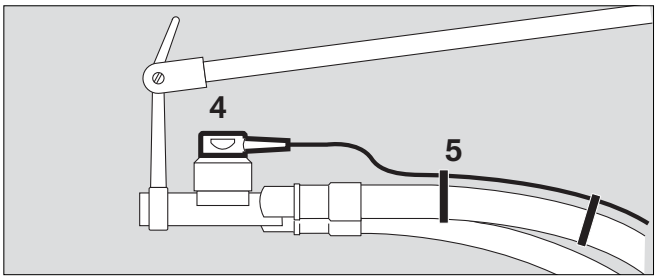



**Do not place any containers with liquid on or above the ventilator! Any leaking or spilled liquid can cause malfunctions!**

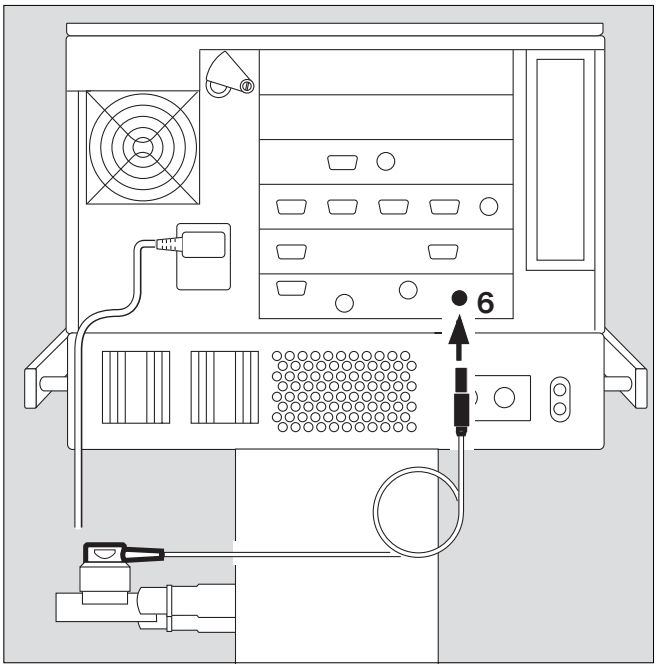
**Fitting the temperature sensor (option)**

**4** Push the sensor as far as it will go into the rubber sleeve on the inspiratory side of the Y-piece. Align the Y-piece so that the sensor is on top.

**5** Attach the sensor cable with hose clips.




**6** Insert the probe of the temperature sensor into the socket »**Temp.** « at the rear of the unit.



## For ventilating infants

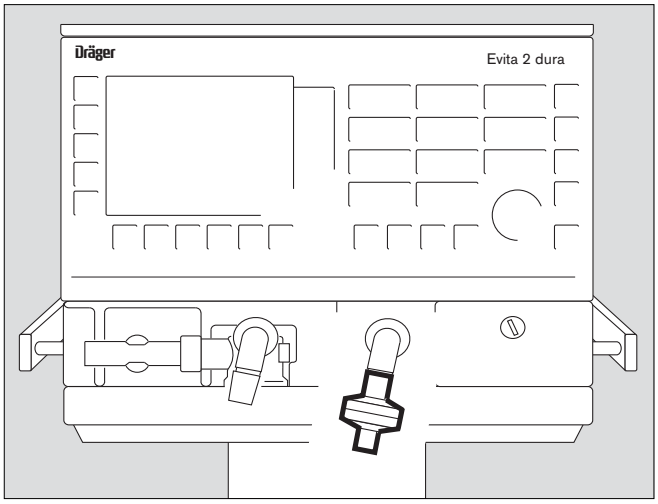
Up to 300 mL tidal volume VT and below:

Patient mode »Paediatric«

**Do not use a heat and moisture exchanger (HME) at the same time as a humidifier! Risk of increased breathing resistance because of condensation.**

### Fitting bacterial filter

- Fit the bacterial filter to the inspiratory port.




### Fitting humidifier and ventilation hoses

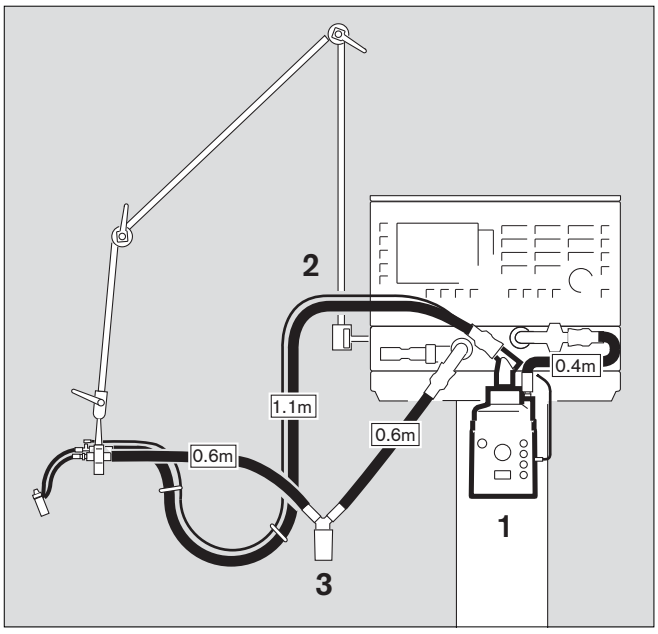
- Prepare the "Fisher & Paykel MR 730" humidifier in accordance with the separate Instructions for Use, using hose set K (paediatric), as supplied.

**1** Hang the humidifier with a bracket to the mounting below the machine and tighten the screws.

**2** Hang the hinged arm with a bracket to the rail on the left-hand side, and tighten the screws.

- Connect the ventilation hoses, and note their length (in metres).

**3** Place the water trap in the vertical position.




**Do not place any containers with liquid on or above the ventilator! Any leaking or spilled liquid can cause malfunctions!**

## In-house/intra hospital transport

Ensure that the equipment does not topple over by moving the accessories as close to the ventilator and trolley as possible:

- Hinged arm set to minimum deflection.
- Drawers pushed in fully.
- Hoses and cables hooked as close as possible to the trolley.
- Humidifier secured to the trolley, not to the ceiling pendant/ bed/wall.

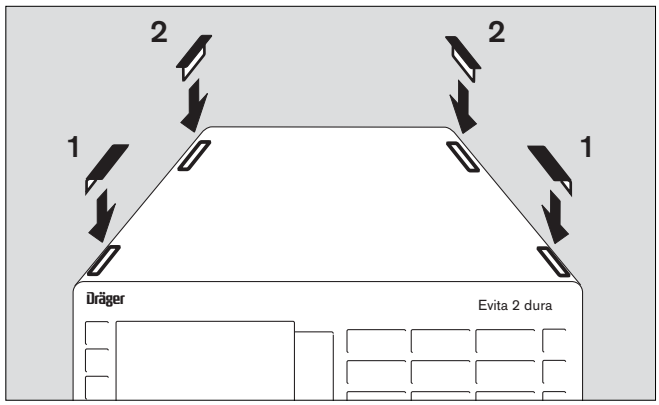
**The unit must not be tilted more than 5° when mounted on a trolley.**
It may tip over at steeper angles.

## If no instrument tray (option) is fitted to the device

Seal off the slits in the top panel with the rubber plugs:

1 Press the round plugs in the front slits – rounded part facing outwards.

2 Press the flat plugs into the rear slits.




**Do not place any liquid container (e.g. infusion container) above or on top of the Evita 2 dura!**

Any leak, spill or seepage could prevent it working properly.

## Supply and Connections

### Electrical power supply

The ventilator is designed for a mains voltage of

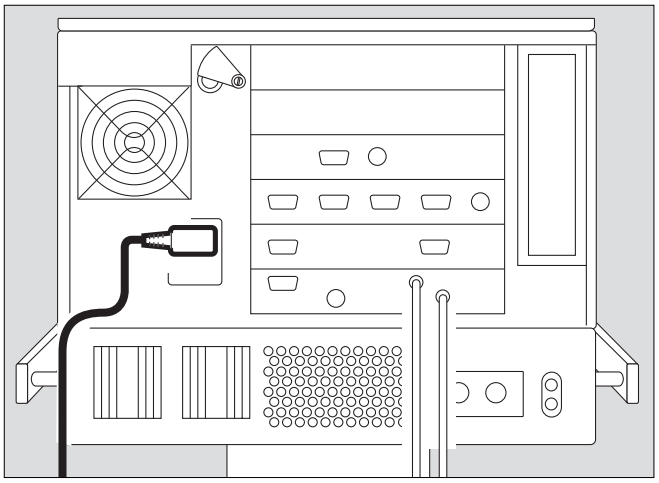
either: 220 V to 240 V

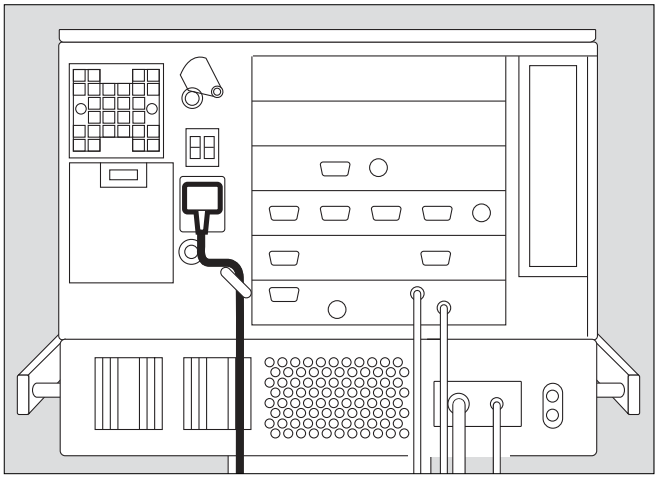
or: 100 V to 127 V

- Insert the plug in the mains socket.

Operation with Evita DC power supply and external battery (optional):

- Connect external battery via battery lead. Note Instructions for Use of the Evita DC power supply.




### Note on the use of a socket strip

Connecting other devices to the same extension socket strip may, in the event of earth failure, cause the current leakage to the patient to increase beyond the permissible values. In this case, the risk of electric shock cannot be eliminated.

### Temporary interruption of power supply

e.g. when switching on the reserve power supply.

Without optional Evita DC power supply:

During the power failure, Evita 2 dura will output a continuous tone for max. 2 minutes.
This continuous tone may be output for a shorter period if Evita 2 dura was switched on for less than 15 minutes.

Evita 2 dura tolerates power interruptions shorter than 10 milliseconds – without any effect on ventilation.

In the case of a power interruption lasting longer then 10 milliseconds, the machine restarts with a short self-test lasting about 4 seconds – ventilation is continued with the same values that were set before the power interruption. If a lower alarm limit has been set for the minute volume, the »**!!! MV low**« alarm is activated until the measured value has risen above the lower alarm limit.

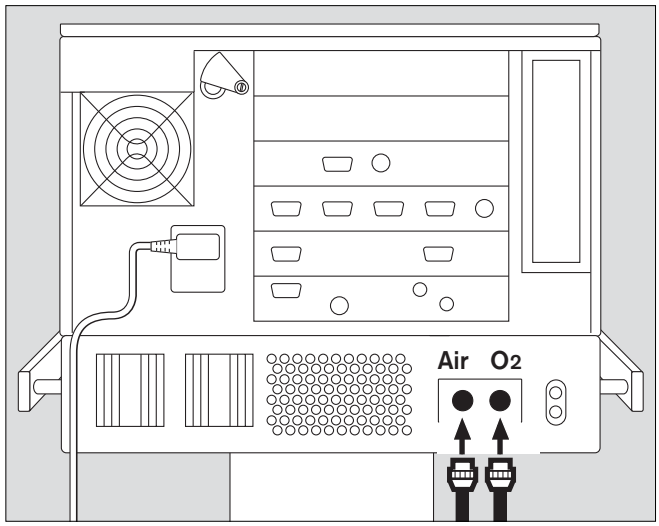
With optional Evita DC power supply:
Follow Instructions for Use of the Evita DC power supply.

**Other equipment, e.g. printers, may only be connected to the COM ports if Evita 2 dura is connected to the mains power supply via a mains power cable or if it has been earthed via the earth connection on the back of the unit.** Electric power may pose a hazard in all other cases.

**Gas supply**

- Screw the connecting hoses for medical air and oxygen to the back panel of Evita 2 dura and insert their probes into the terminal units.

  The compressed gases must be dry and free from dust and oil. Gas pressure must be 3 to 6 bar.



## Evita Remote

Optional remote control unit (Remote Pad)

The kit may only be installed and programmed by specialists.

For parallel, remote operation of the following LED and key functions:

**1** Red LED – to indicate warning messages

**2** Yellow LED – to indicate caution and advisory messages

**3** »🔔« key – to suppress the alarm tone for approx. 2 minutes

**4** »**Alarm Reset**« key – to acknowledge alarm messages

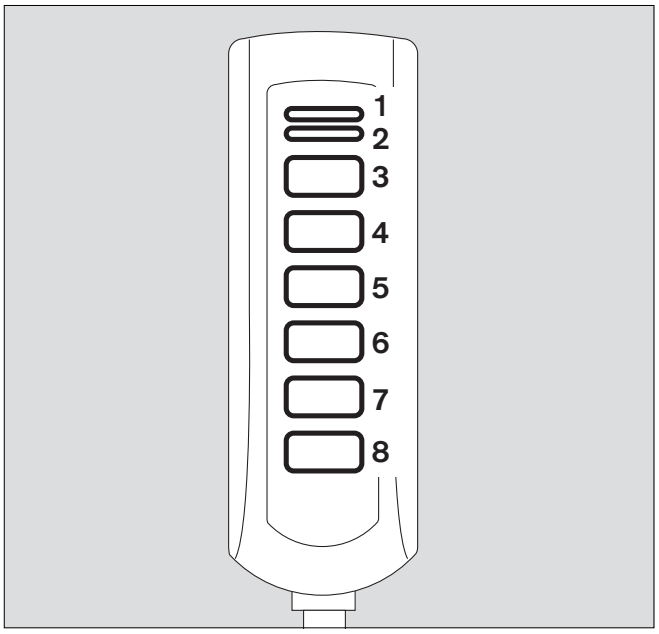
**5** »**Neb.**« key – to start and end medicament nebulisation

**6** »**O2 Suction**« key – for bronchial suctioning

**7** »**Insp. hold**« key – for sustained, manually induced inspiration

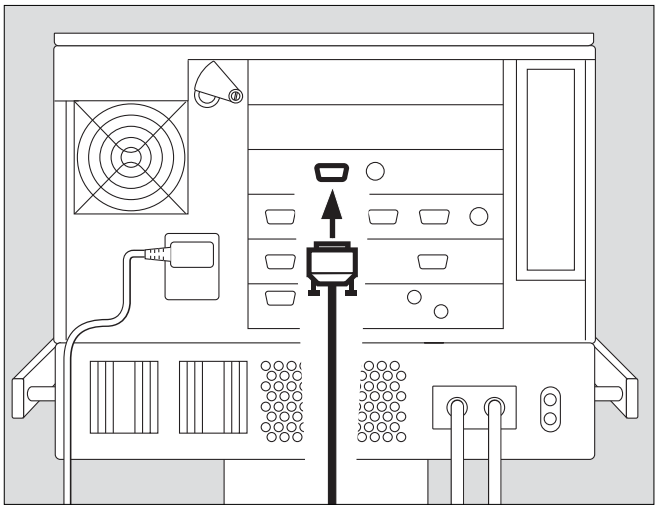
**8** »**Exp. hold**« key – for extended and sustained expiration

The function of the respective LEDs and keys is the same as that of the corresponding elements on the front panel of Evita 2 dura and is described in the application chapters of the Instructions for Use.

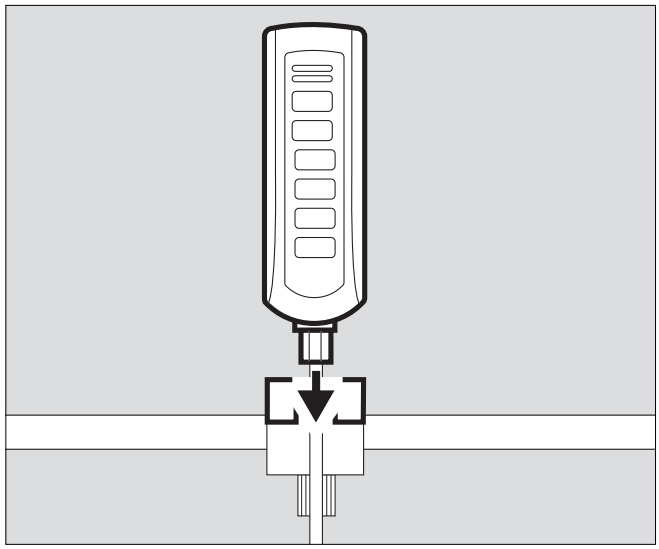



### Connection

- Plug the lead of the Remote Pad into the socket »⎍« on the rear of Evita 2 dura. The plug can be connected or disconnected at any time without impairing operation of Evita 2 dura.



- Hook holder onto a standard rail and clamp into place.
- Hang Remote Pad into holder from above.




**Note automatic self-test**

– when connecting the Remote Pad to Evita 2 dura while the latter is switched on

or

– when switching on Evita 2 dura after connecting the Remote Pad.

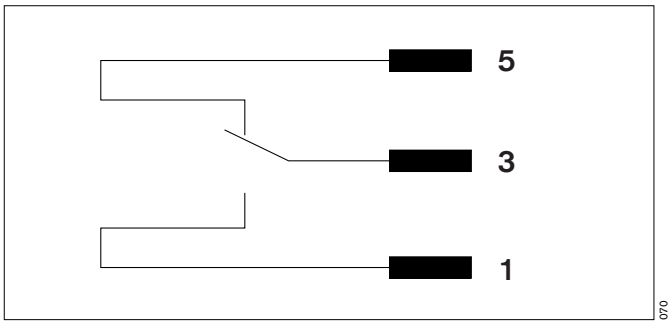
- Do not press any keys on the Remote Pad.
- All LEDs on the Remote Pad light up for 5 seconds:
  – Red LED
  – Yellow LED
  – Yellow LEDs in the keys
- The Remote Pad is tested by Evita 2 dura. An advisory message is output if a fault is detected, see page 84 "Fault – Cause – Remedy".

## **Nurse call** (optional)

Connection on the rear panel of Evita 2 dura for transmitting top-priority alarm signals to a central hospital alarm system.

- The kit may only be installed by specialists.
- The 6-pin round DIN plug (female connector) must be connected to the lead for the central alarm station in the hospital by a specialist.

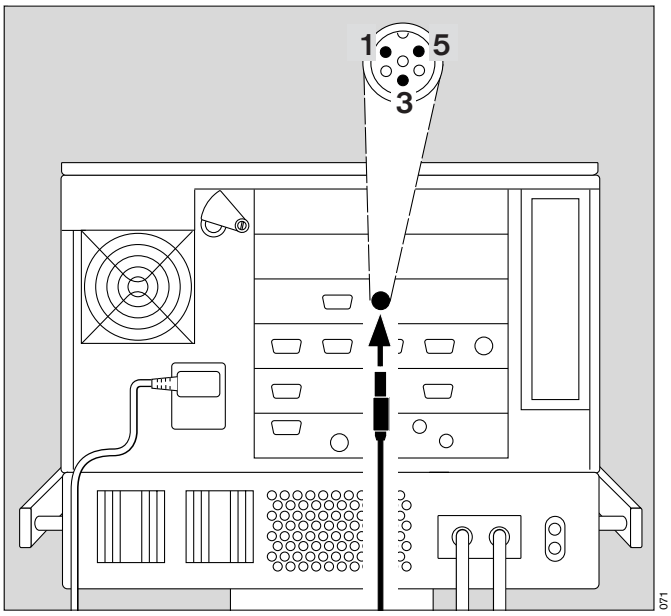
Connection 3-5 makes and the nurse call is activated as soon as Evita 2 dura signals an alarm.




**The central hospital alarm system may only be connected to the nurse call if Evita 2 dura is connected to the mains power supply via a mains power cable or if it has been earthed via the earth connection on the back of the unit.**

Electric power may pose a hazard in all other cases.

- Plug the connector into the »⏚« socket on the rear and screw into place.
- Check correct operation of connected nurse call system.




**Only alarm messages of the highest priority (see page 54) are transmitted via nurse call.**

Alarm messages are indicated in red with three exclamation marks in the top field of the screen, see page 54.
Caution and Advisory level messages are not transmitted. The nurse call is activated also when the internal loudspeaker in the ventilator is faulty.

**Connection of a nurse call does not relieve staff of their duty to check the monitoring on the Evita 2 dura screen at regular intervals.**

- **Screen displays must be checked regularly.**

**A fault in any of the components in the link between nurse call and central hospital alarm system (e.g. in the electronics for nurse call in Evita 2 dura, in the Evita 2 dura power supply or in the alarm generator of the central hospital alarm system) may result in failure of the nurse call.**

Background: The hospital connections to the central alarm typically use only one channel. The electronics for nurse call consequently also uses only one channel.

**Technical Data**

| | |
|---|---|
| Floating DC contact | |
| Input voltage | Max. 40 V = |
| Input current | Max. 500 mA |
| Switching capacity | Max. 15 W |

## Device Check

Must be carried out immediately before use on the patient in order to confirm that the ventilator is operating correctly.

The device check comprises of the »Device« test and »Leakage« test.

The following functions are performed during this device check:

— Checking that the machine assembly is complete
— Testing the alarm tone
— Testing the expiratory valve
— Testing of the air-$O_2$ changeover valve
— Testing the safety valve
— Testing the displays
— Calibrating the flow sensor
— Calibrating the $O_2$ sensor
— Calibrating the $CO_2$ sensor
— Testing the leakproofing of the hose system
— Checking the compliance of the hose system

The test results obtained from this device check and the calibration and zero-checking values of the sensors remain stored until the next calibration – even if the device is switched off.

If the hose system, type of humidification or patient mode is changed after performing the device check, the leakproofing test must be repeated before starting operation.

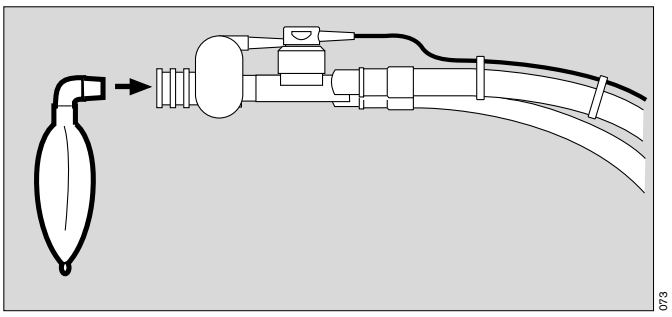
**Preparing the adult test lung 84 03 201**

for the adult hose system

The test lung consists of an elbow connector for connection to the Y-piece, a 7 mm diameter catheter connection for simulating the resistance of the airways and a 2 litre breathing bag to simulate compliance.

**Overextended breathing bags must not be used as they may cause artefacts during the device check!**

- The elbow connector must not be plugged into the patient connection of the Y-piece until directed by Evita 2 dura.

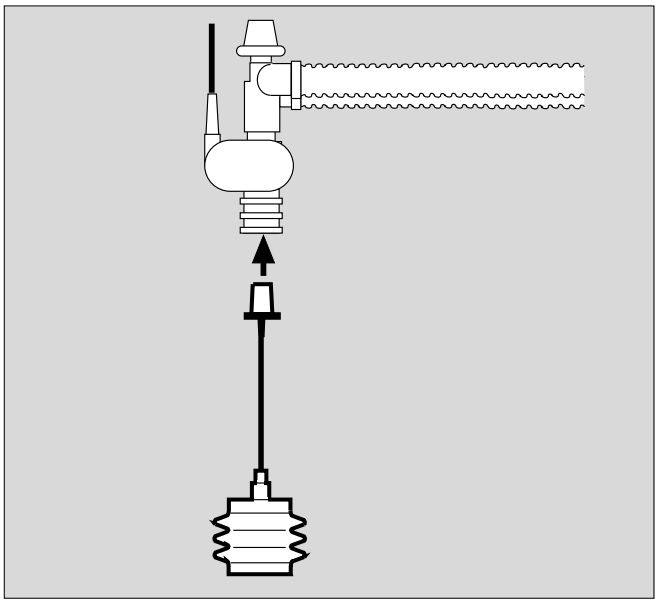


**Preparing the child test lung 84 09 742**

for the paediatric hose set

The test lung consists of a tracheal tube CH 12 to simulate the resistance of the airways and a small bellows to simulate compliance.

- Only insert the elbow connector into the Y-piece when Evita 2 dura advises you to do so on the screen.

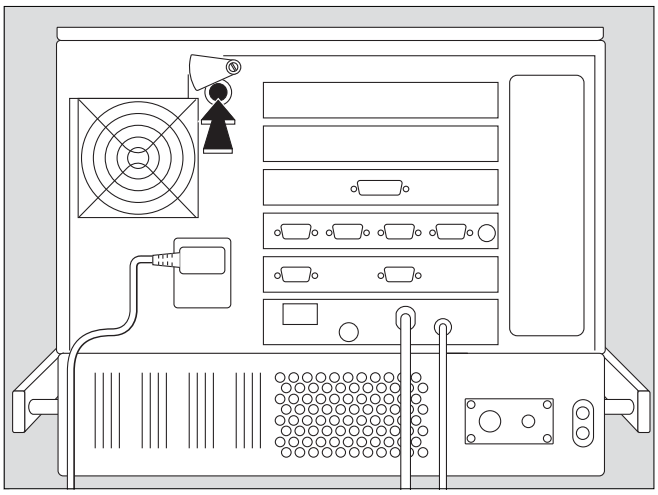



**Performing the device check**

- Switch on the machine = raise flap* and press power switch on the back panel until it clicks into position.

Evita 2 dura runs through its self-test procedure.

- Wait until the 10-second test phase has been completed.



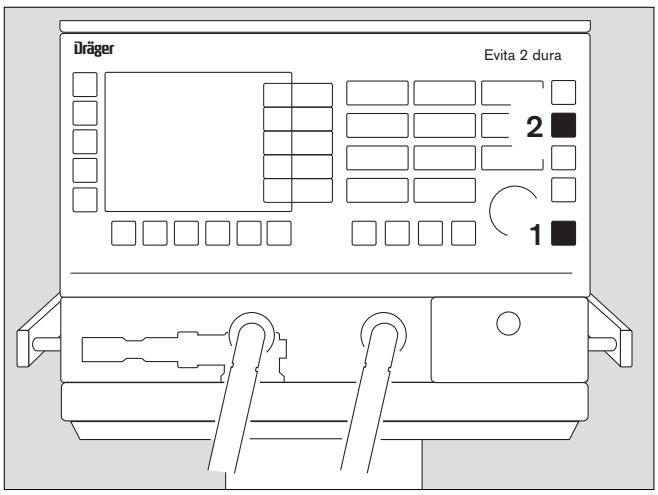

After the self-test:

1 Switch Evita 2 dura to standby = Hold down key »⏻« for about 3 seconds.

2 Switch off the standby alarm tone with the »**Alarm Reset**« key.

- Touch the »**Device check**« menu key.

The standby alarm tone cannot be switched off with the »🔔« key.




* Mains power switch flaps may differ, depending on the power supply used, see "Switching on", page 38.

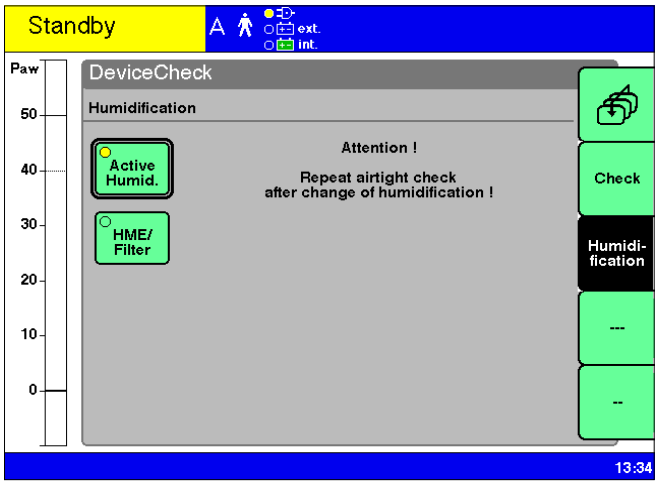
### Select type of humidifier

The selected type of humidifier (either active or HME) must be entered before starting the device check and leak test:

– Active humidifier, e.g. Dräger Aquapor
  or
– HME/Filter (artificial nose)

If the type of humidifier is known, Evita 2 dura can take the temperature and moisture situation into account when measuring the volume parameters.

- Touch the »**Humidification**« screen key.
- Touch the »**Active Humid.**« screen key
  or
- Touch the »**HME/Filter**« screen key = turn rotary knob.
- Confirm selection = press rotary knob.




The selected humidifier is indicated by a yellow LED.

The selected type of humidifier is indicated by a black dot in the corresponding screen key.

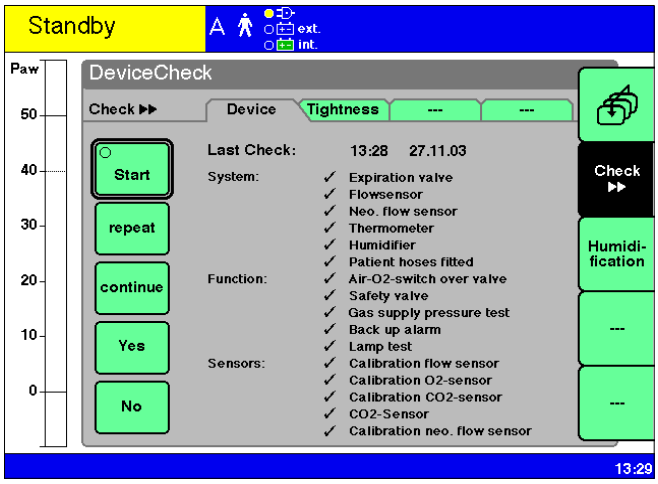
If the type of humidifier is changed and has to be reselected on the screen, the following test steps are shown to be invalid (– – –) after the device check:

– Humidification
– Air tight check

The operator is prompted to repeat the device check for these two steps.

### Start »Device« check

- Press the »**Check ▶▶**« menu key and select the menu »**Device**«.
- Activate the »**Start**« screen key = press rotary knob.




A device check cannot be started during automatic calibration of the flow sensor or $O_2$ sensor:

- Wait until calibration is complete and then start the device check again.

The following tests are performed during the device check:

System

- Secure postioning and clear passage of the expiratory valve
- Secure postioning of the flow sensor
- Secure postioning of the neonatal flow sensor (if "NeoFlow" option is installed)
- Secure postioning of the temperature sensor
- Humidifier
- Hose system

Function

- Function of the air-$O_2$ changeover valve
- Function of the safety valve
- Gas supply
- Displays

Sensors

- Calibration of the flow sensor
- Calibration of the $O_2$ sensor
- Zero calibration of the $CO_2$ sensor (if "CapnoPlus" option is installed)
- $CO_2$ sensor (if "CapnoPlus" option is installed)
- Calibration of the neonate flow sensor (if "NeoFlow" option is installed)

The user is guided through each check in a dialogue with the device. Questions are displayed in the information line and must be answered by entering »**Yes**« or »**No**«. Instructions for carrying out the check may also be displayed instead.

On completion of the »**Device**« check, a checklist is displayed on the screen to show the results of the check.

| | |
|---|---|
| Correct result: | ✓ |
| Incorrect result: | F |
| Check not performed: | – – – |

In the event of incorrect results:

- Eliminate the cause of the fault.
- Select the »**repeat**« screen key =
  turn the rotary knob.
  Activate = press the rotary knob.

Only the tests with incorrect results are repeated.

After the »**Device**« check:

- Perform the leak test, page 34.

**Perform »Tightness« test**

- after the »**Device**« check
- after changing the hose system or humidifier
- after changing the patient mode
- after changing the type of humidifier
- after cancelling the leak test

The actual leakage flow is displayed continuously throughout the test. A leakage flow of 300 mL/min at a pressure of 60 mbar is permissible.

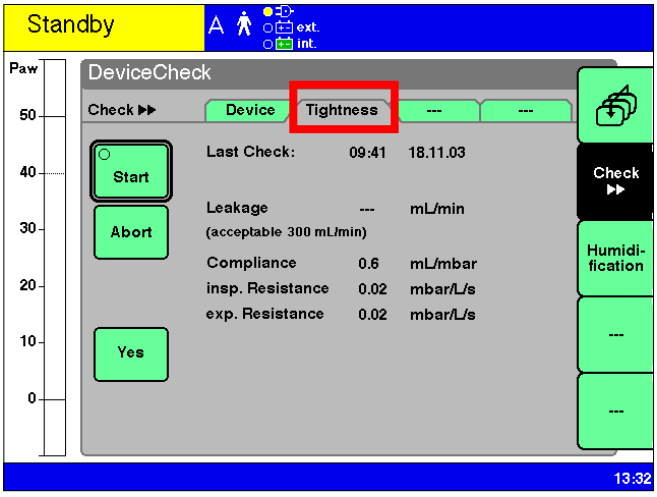
Evita 2 dura determines the compliance and resistance of the patient circuit during the »**Tightness**« test.

The established compliance of the hose system is used by the ventilator for automatic correction of the volume-controlled ventilation strokes, as well as of the measured values for flow monitoring, see page 123.

The established resistance of the patient circuit is used by the ventilator for correction of the pressure measured in the presence of a basic flow (NeoFlow option).

When changing the patient mode or type of humidifier, and when cancelling the leak test, the ventilator automatically resets the values for patient circuit compliance and patient circuit resistance to the default values. The »**Tightness**« test is shown to be invalid (– – –) and the operator is prompted to repeat the test.

- Select the menu »**Tightness**« via the menu button »**Check ▶▶**«.
- Activate screen key »**Start**« = press rotary knob.




The »**Tightness**« test can also be started separately.

In standby mode:

- Press menu key »**DeviceCheck**«
- Use menu key »**Check ▶▶**« to select the menu »**Tightness**«.

Leakage:
The ventilator establishes the leakage in L/min referred to a pressure of 60 mbar. Corrective measures can be taken with the aid of the continuous leakage display.

Compliance:
The ventilator establishes the system compliance in mL/mbar. The established system compliance is used for automatic correction of the volume-controlled ventilation strokes, as well as of the measured values for flow monitoring.

Resistance:
The ventilator establishes the sum of the inspiratory and expiratory resistance in mbar/L/s.

For immediate operation (e.g. in an emergency) the device check can be interrupted:

- Press the »⏻« key. The device immediately starts ventilation.

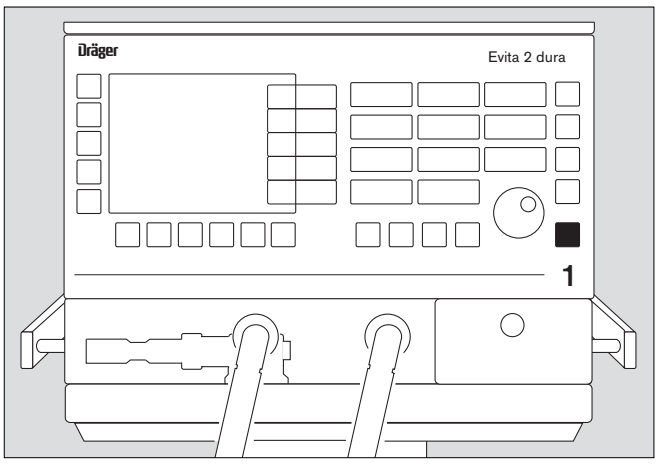
**Evita 2 dura is ready for use when the device check and leak test have been successfully completed.**

Either:

- Leave Evita in Standby mode and if necessary preselect the ventilation mode and ventilation parameters,

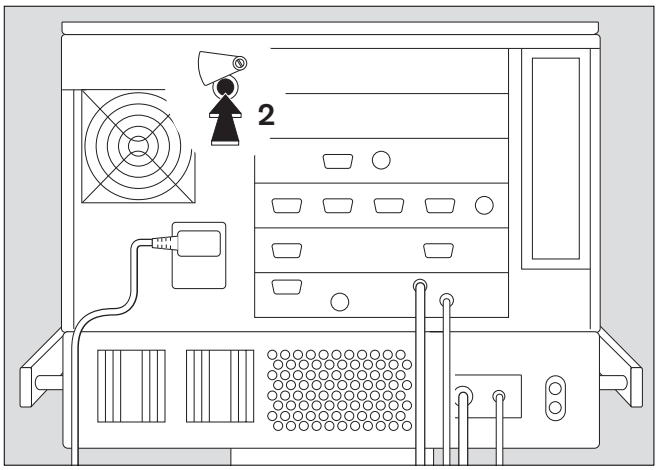
or:

**1** Immediately start up Evita 2 dura, press »⏻«,




or:

**2** Switch off Evita 2 dura for later use. Switch on back panel = pivot the cover-flap to the side, press button in as far as it will go and release.



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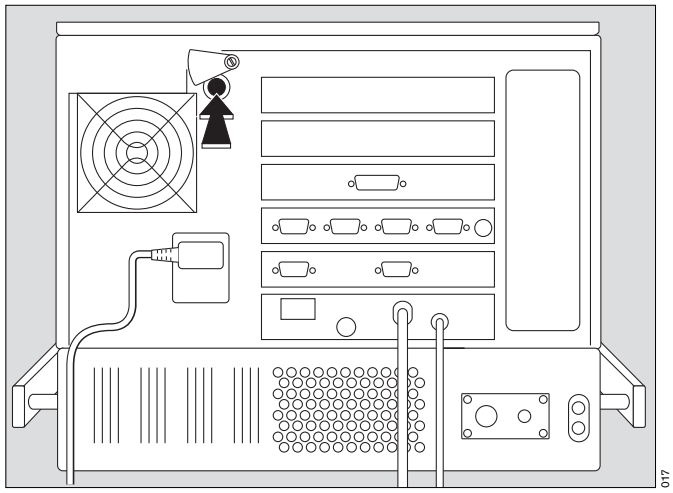
# Operation

## Starting up

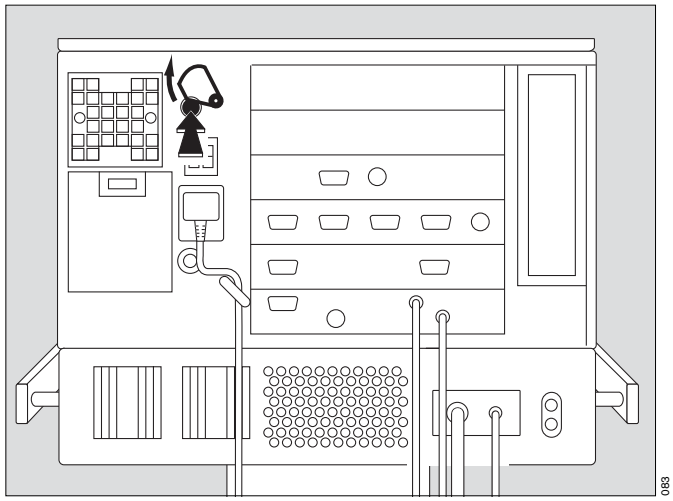
### Switching on

- Push in power switch on back panel until it clicks into place = ON.
  The flap comes down over the switch to prevent it being inadvertently switched off.




Units with DC power supply MB:

- Switch on unit = pivot flap upwards and press power switch on rear of unit until it clicks into position. The flap falls over the button to protect against inadvertent switching off.
  To switch the ventilator off, first pivot the mains power switch flap upwards and then depress the button fully, then release the button and allow the flap to settle back into position.




Evita 2 dura runs a self-test.

- Wait until the 10-second test phase is complete.

Evita 2 dura always begins ventilation with the start-up values marked by an arrow on the on-screen knobs.

To select these start-up values, please refer to pages 77 onwards.

After power cuts and after standby mode, the settings valid immediately before the interruption of operation remain in use.

**Patient mode**

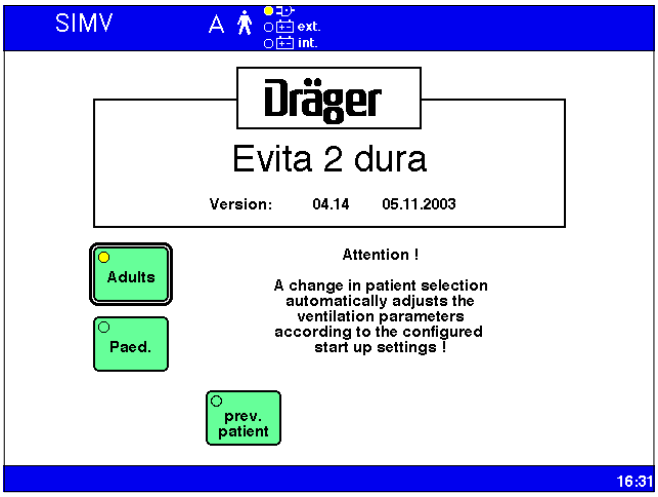
The patient mode can be selected after switching on Evita 2 dura:

— »**Adults**« = adult patients
— »**Paed.**« = children
— »**Neo.**« = neonates (when using the "NeoFlow" option)
— »**prev. patient**« = previous patient

Example:

**Adult ventilation**

With this information, Evita 2 dura defines the adjustment ranges and the start-up values of the ventilation parameters.

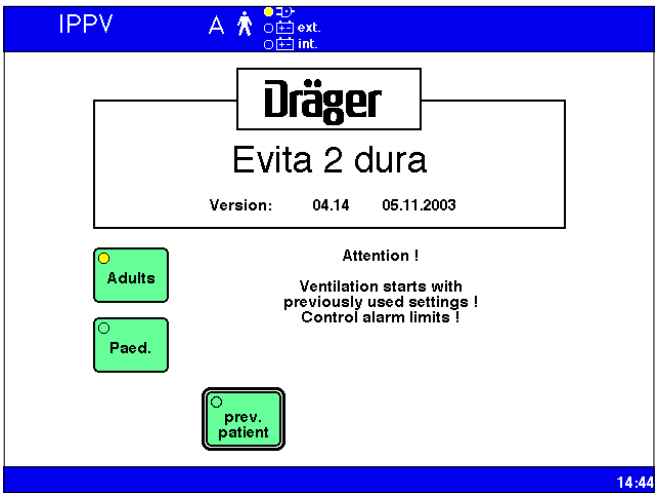



The screen key »**prev. patient**« can be used to restore the specific patient settings, including alarm limits and monitoring status, effective before switching off the device.

The previous modes are displayed in the status line:

— Previous ventilation mode (example: IPPV)
— Previous patient mode (A = Adult)
— Previous application mode – tube or mask for optional NIV (example: NIV)

The key »**prev. patient**« is not displayed by Evita 2 dura following a loss of data or removal of a previously used option (e.g. NeoFlow), thus preventing restoration of the previous setting.




**Selecting the patient mode**

Either:

- Select the »**Adults**« key or the »**Paed.**« key or the »**Neo.**« key (NeoFlow option) = turn rotary knob.
- Confirm = press rotary knob.

or:

- Select the key »**prev. patient**« = turn rotary knob.
- Confirm = press rotary knob.

## Starting ventilation

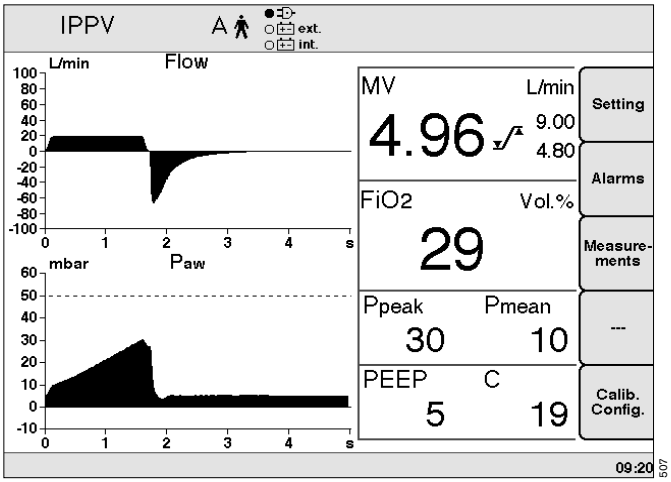
Evita 2 dura starts ventilation with the ventilation mode configured by the user and with the specific start settings for the patient or with the settings valid before the machine was last switched off.

To select other start-up settings, see page 77.

If no selection is made or if the rotary knob is not pressed to confirm the new settings, the apparatus automatically starts ventilation after 30 seconds with the last selected patient mode and ventilation mode and the associated ventilation parameters.

The main page is displayed on the Evita 2 dura screen.

The user can check and correct the settings in the display fields next to the parameter keys.



## Setting Ventilation Modes

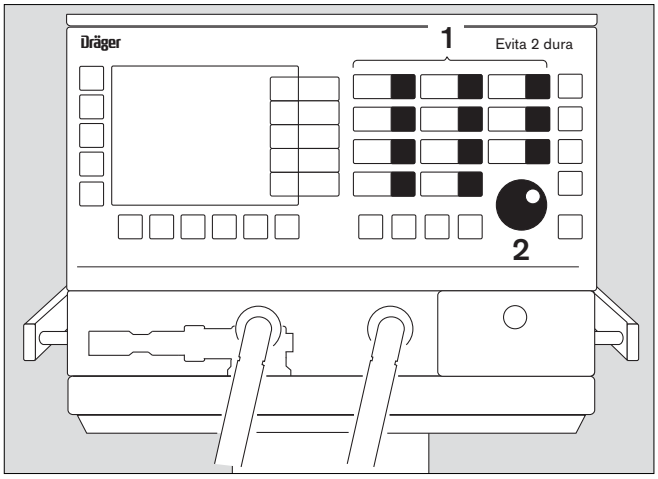
To set the ventilation parameters:

1 Press the appropriate ventilation mode key. The yellow LED in the key will light up.

2 Set the desired value = turn the rotary knob.
Confirm value = press the rotary knob. The yellow LED will go out.
If the setting is at the upper or lower limit of the adjustment range for a parameter, the LED in the relevant key will start flashing.

2 Acknowledge = press the rotary knob.

If you fail to confirm/acknowledge the new settings within 30 seconds, the previous settings will remain operative.




**Setting parameters for another ventilation mode**

1 Press the relevant ventilation mode key briefly.
Its LED will flash.
The yellow indicators for the relevant parameters for the new ventilation mode flash in the parameter keys.

Set the new ventilation parameters:

1 Press the relevant key: its LED will stop flashing and remain constantly lit.

2 Set the desired value = turn the rotary knob.
Confirm value = press the rotary knob. The yellow LED will go out.

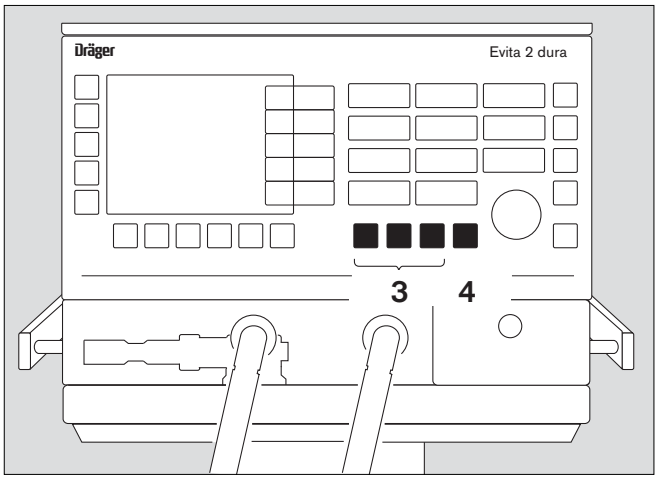
To activate the ventilation mode:

3 Ventilation mode keys:
– **IPPV**
– **SIMV**
– **BIPAP**
or

4 »**Other modes**« key for other ventilation modes that are set on the screen.
Factory-set default: CPAP/ASB.

- Hold down the relevant key for 3 seconds,
or
- briefly press and release the relevant key and press the rotary knob.

The selected ventilation mode will now be active.

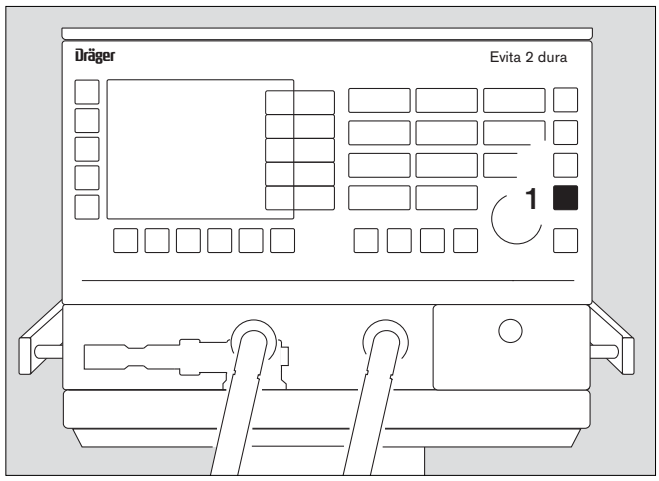


To prevent settings being changed inadvertently:

1 Press the »🔒« key. Its yellow LED will light up. The parameter keys and ventilation mode keys will be protected against inadvertent setting.

Before setting a new value:

1 Press the »🔒« key. The yellow LED will go out.




**IPPV**

**I**ntermittent **P**ositive **P**ressure **V**entilation

Volume-controlled ventilation with a fixed mandatory minute volume MV, set with the tidal volume $V_T$ and frequency f.

For patients unable to breathe spontaneously.

Set ventilation pattern for IPPV via the keys for the ventilation parameters:

Tidal volume »**$V_T$**«

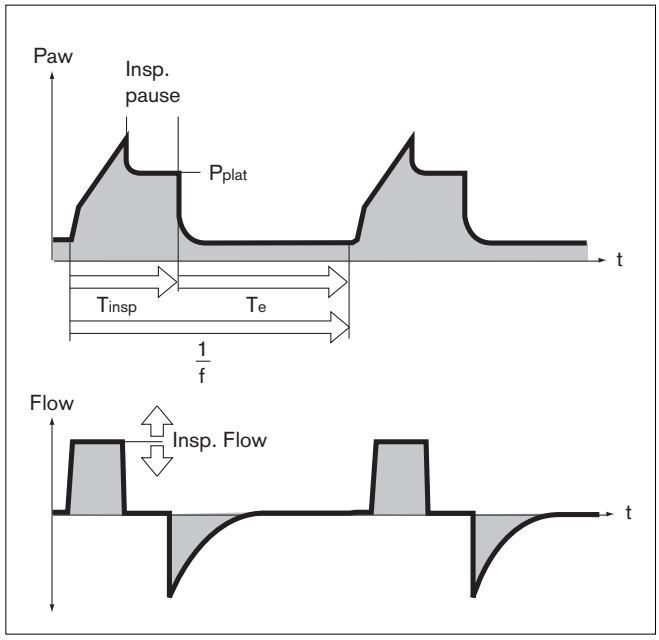
Insp. Flow »**Flow**«

Frequency »**f**«

Inspiration time »**$T_{insp}$**«

$O_2$ concentration »**$O_2$**«

Positive end-expiratory pressure »**PEEP**«




IPPV can be supplemented by the following ventilation parameters:

**Trigger** (IPPV$_{Assist}$) – for synchronising mandatory ventilation with attempted spontaneous breathing by the patient. By activating the trigger and setting the trigger sensitivity, the mandatory ventilator strokes are synchronised with the patient's spontaneous breathing attempts.
The trigger can be switched off if synchronisation with the patient's spontaneous breathing attempts is not required.

To activate/set:

- Press ventilation parameter key »**Trigger**«.
- Set value = turn the rotary knob,
  Confirm value = press the rotary knob.

To deactivate:

- Set a value less than 0.3 or above 15 L/min.
  The display will show: **– – –**

**Sigh** – to prevent atelectasis.
Atelectasis can be prevented by activating the Sigh function and setting the sigh in the form of an intermittent PEEP. When the Sigh function is activated, the end-expiratory pressure is increased by the set intermittent PEEP for 2 ventilation strokes every 3 minutes.

**Pmax**

IPPV can be supplemented by the ventilation parameter Pmax.

- Activate »Pressure limit Pmax«, see page 79.
- Set value Pmax via the key for the ventilation parameter »**Pinsp**«.

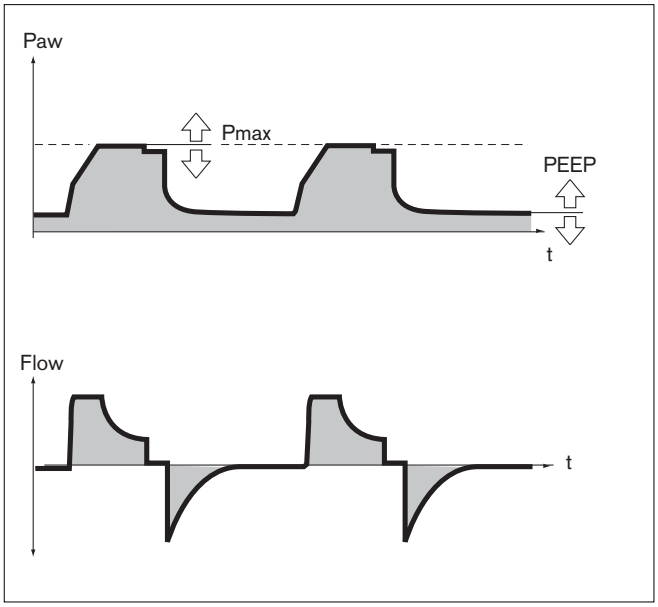
**Pressure limited ventilation PLV*** – for manually limiting pressure peaks to the pressure limit Pmax.

The tidal volume remains constant as long as the pressure curve continues to show a short pressure plateau and the flow curve shows a brief pause in the flow between inspiration and expiration.

Volume monitoring is constantly active. If the set tidal volume $V_T$ can no longer be applied, the alarm »**!! Volume not constant**« is automatically generated.

When changing from IPPV to a pressure-controlled ventilation mode, the value of Pmax is adopted but is limited to 50 mbar (the display for the »**Pinsp**« ventilation parameter flashes).

- Confirm value = press the rotary knob
  or
  set a higher value.




* For a detailed description of PLV, see page 116.

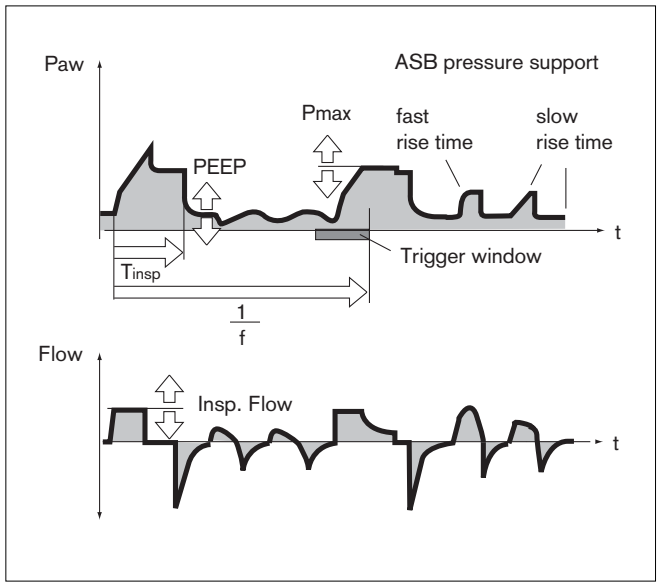
**SIMV, SIMV/ASB**

**S**ynchronized **I**ntermittent **M**andatory **V**entilation*
**A**ssisted **S**pontaneous **B**reathing**

Fixed mandatory minute volume MV, set with the tidal volume $V_T$ and frequency f. The patient can breathe spontaneously between the mandatory ventilation strokes, thereby contributing to the overall minute volume. Spontaneous breathing can be assisted by ASB.

For patients with insufficient spontaneous breathing or patients being weaned from artificial ventilation by progressive reduction of the mandatory proportion of the total minute volume.

The frequency can be reduced to 0 during the weaning process. The machine automatically changes to ventilation mode CPAP or CPAP/ASB. This ventilation mode is also displayed.




Set the ventilation pattern for SIMV via the keys for the ventilation parameters:

Tidal volume »**$V_T$**«

Insp. Flow »**Flow**«

Frequency »**f**«
At f = 0/min, the ventilator switches to CPAP mode.

Inspiration time »**$T_{insp}$**«

Sensitivity »**Trigger**«

$O_2$ concentration »**$O_2$**«

Positive end-expiratory pressure »**PEEP**«

Additionally for SIMV/ASB:

Pressure support »**$P_{ASB}$**«
Pressure rise time »**Ramp**«

SIMV, SIMV/ASB can be supplemented with the following ventilation parameters:

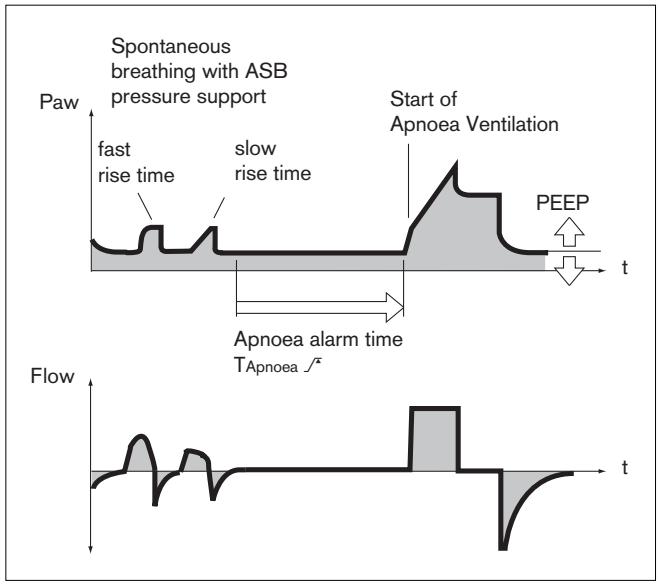
**Apnoea ventilation** – for automatic switchover to volume-controlled mandatory ventilation if the patient stops breathing.

If breathing stops, Evita 2 dura activates an alarm after the set alarm time ($T_{Apnoea}$ ) and starts volume-controlled ventilation with the set ventilation parameters:

Frequency »**$f_{Apnoea}$**«
Tidal volume »**$VT_{Apnoea}$**«

The patient can breathe spontaneously during apnoea ventilation. The apnoea ventilation frequency remains constant.

Set apnoea ventilation, see page 52.




* For a detailed description of SIMV, see page 118.
** For a detailed description of ASB, see page 119.

**Pmax**

SIMV, SIMV/ASB can be supplemented with the ventilation parameter Pmax:

- Activate »Pmax pressure limit«, see page 79.
- Set the value of Pmax with the »**$P_{insp}$**«

**Pressure limited ventilation PLV*** – for manually limiting pressure peaks using the Pmax pressure limit.
The tidal volume remains constant as long as the pressure curve continues to show a short plateau, and the flow curve shows a brief pause in the flow between inspiration and expiration.
Volume monitoring is constantly active. If the set tidal volume $V_T$ can no longer be applied, the alarm »**!! Volume not constant**« is automatically generated.

* For a detailed description of PLV, see page 116.

**BIPAP, BIPAP/ASB**

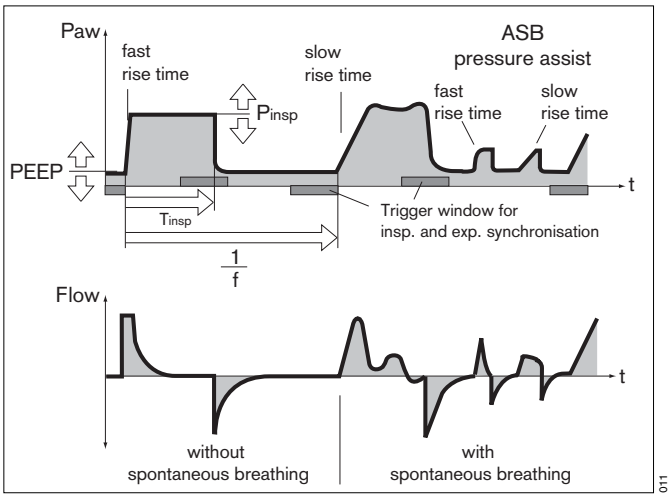
**B**iphasic **P**ositive **A**irway **P**ressure
**A**ssisted **S**pontaneous **B**reathing

Pressure-controlled ventilation combined with free spontaneous breathing during the complete breathing cycle, supported by adjustable additional pressure at CPAP level.

The mandatory proportion of the total minute volume MV is set by means of the inspiration pressure $P_{insp}$, PEEP and frequency f.

Adaptable to a wide range of patients, from those unable to breathe spontaneously at all to those breathing spontaneously before extubation. Suitable for weaning patients from artificial ventilation by progressively reducing the mandatory fraction of the minute volume MV and by reducing the additional artificial pressure support $P_{ASB}$.

The frequency can be reduced to 0 during the weaning process. The machine automatically changes to ventilation mode CPAP or CPAP/ASB. This ventilation mode is also displayed.




Set the ventilation pattern for BIPAP via the keys for the ventilation parameters:

Inspiration pressure »**$P_{insp}$**«
If $P_{insp}$ is set to the same value as PEEP, the machine changes over to CPAP mode.

Frequency »**f**«
If f = 0/min, the apparatus switches over to CPAP mode.

Inspiration time »**$T_{insp}$**«

Sensitivity »**Trigger**«

$O_2$ concentration »**$O_2$**«

Positive end-expiratory pressure »**PEEP**«

Additionally for BIPAP/ASB:

Pressure support »**$P_{ASB}$**«
Pressure rise time »**Ramp**«

BIPAP, BIPAP/ASB can be supplemented with the following ventilation parameters:

**Apnoea ventilation** – for automatic switchover to volume-controlled mandatory ventilation if the patient stops breathing.

If the patient stops breathing, Evita 2 dura activates an alarm after the set alarm time ($T_{Apnoea}$ ) and starts volume-controlled ventilation with the set ventilation parameters:

Frequency »**$f_{Apnoea}$**«
Tidal volume »**$VT_{Apnoea}$**«

The patient can breathe spontaneously during apnoea ventilation. The apnoea ventilation frequency remains constant.

Set apnoea ventilation, see page 52.

**BIPAP**Assist

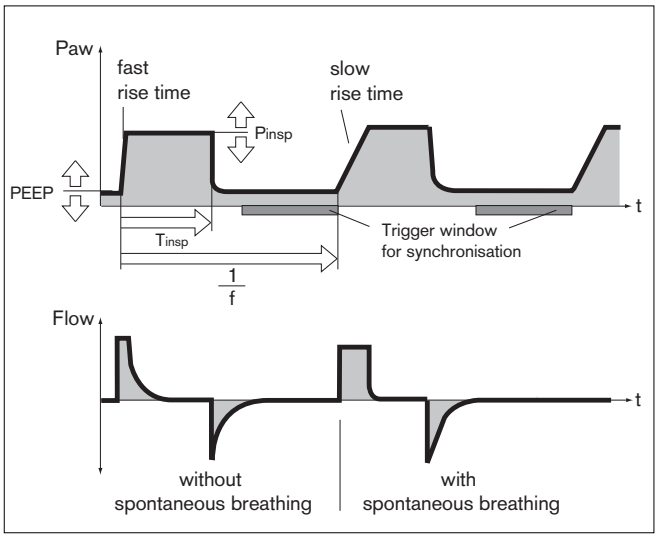
**B**iphasic **P**ositive **A**irway **P**ressure **A**ssisted
Druckkontrollierte, assistierende Beatmung

The inspiratory strokes are the same as for BIPAP, but the changeover from $P_{insp}$ to PEEP is not synchronised with expiration by the patient. The patient can breathe spontaneously at PEEP level through the entire ventilation process.

Every spontaneous breathing activity by the patient triggers a synchronised inspiratory stroke.

A non-synchronised inspiratory stroke is started by the device at the latest upon expiry of the time »f«.

For all patients, from those unable to breathe spontaneously to those breathing spontaneously before being weaned off the ventilator.




The set values for the relevant ventilation parameters are displayed alongside the keys for the ventilation parameters.

Set the ventilation pattern for BIPAPAssist via the keys for the ventilation parameters:

Inspiratory pressure »**Pinsp**«

Frequency »**f**«

Inspiration time »**Tinsp**«

Sensitivity »**Trigger**«

$O_2$ concentration »**$O_2$**«

Positive end-expiratory pressure »**PEEP**«

Pressure rise time »**Ramp**«

Absolute inspiratory pressure »**Pinsp**«

---

To activate:

- Press menu button »**other modes**«.

When BIPAPAssist has been selected in the menu with the cursor:

- Hold the menu button »**other modes**« for approx. 3 seconds,

or:

- Press the rotary knob.

Otherwise:

- Select BIPAPAssist = turn rotary knob, activate = press rotary knob.

The "LED" in the screen key »**BIPAPAssist**« changes from green to yellow. Ventilation mode BIPAPAssist is now active and displayed in the status line.

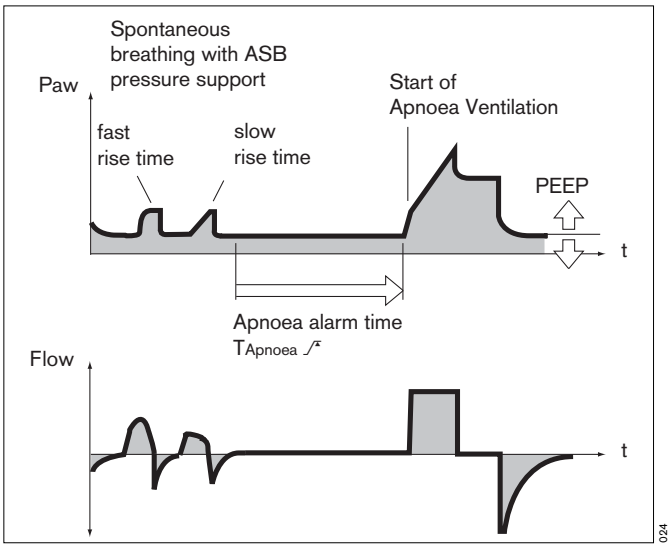
---

**CPAP, CPAP/ASB**

**C**ontinuous **P**ositive **A**irway **P**ressure
**A**ssisted **S**pontaneous **B**reathing

Spontaneous breathing at a raised pressure level, to increase the functional residual capacity FRC. Spontaneous breathing can be assisted with additional pressure by ASB.

For patients breathing spontaneously.




Set the ventilation pattern for CPAP via the keys for the ventilation parameters:

$O_2$ concentration »**$O_2$**«

Positive end-expiratory pressure »**PEEP**«

Additionally, for CPAP/ASB:

Pressure support »**PASB**«

Pressure rise time »**Ramp**«

Sensitivity »**Trigger**«

---

To activate:

- Press menu button »**other modes**«.

When CPAP/ASB has been selected in the menu with the cursor:

- Hold the menu button »**other modes**« for approx. 3 seconds,

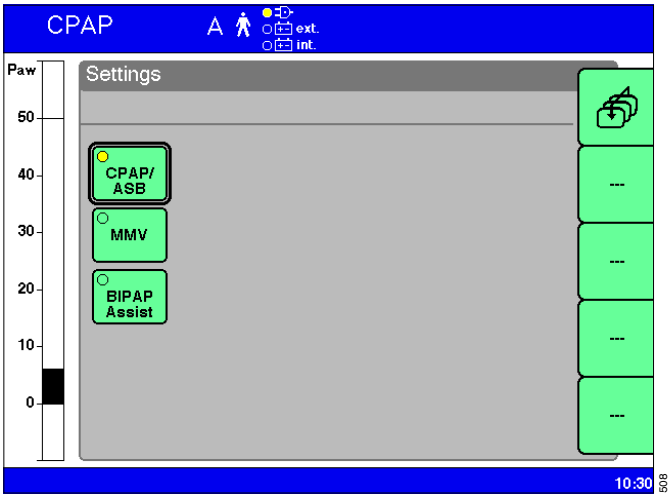
or:

- Press the rotary knob.

Otherwise:

- Select CPAP/ASB = turn rotary knob, activate = press rotary knob.

The "LED" in the screen key »**CPAP/ASB**« changes from green to yellow. Ventilation mode CPAP/ASB is now active and displayed in the status line.




---

CPAP/ASB can also be activated when frequency f = 0 in SIMV or BIPAP.

CPAP, CPAP/ASB can be expanded with the following ventilation parameters:

**Trigger** – for synchronising ventilation with attempted spontaneous breathing by the patient.
By activating the trigger and setting the trigger sensitivity, the assisting ventilator strokes are synchronised with the patient's own spontaneous breathing attempts.

**Apnoea ventilation** – for automatic switchover to volume-controlled mandatory ventilation if the patient stops breathing.

If the patient stops breathing, Evita 2 dura activates an alarm after the set alarm time (TApnoea ) and starts volume-controlled ventilation with the set ventilation parameters:

Frequency »**fApnoea**«
Tidal volume »**VTApnoea**«

The patient can breathe spontaneously during apnoea ventilation. The apnoea ventilation frequency remains constant.

To set apnoea ventilation, see page 52.

**MMV, MMV/ASB**

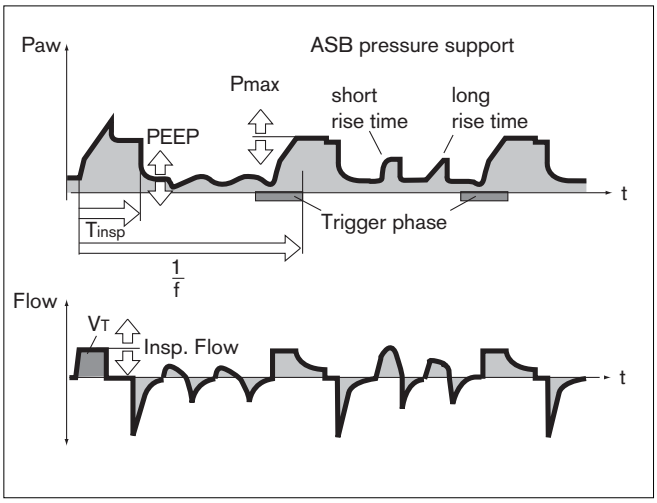
**M**andatory **M**inute **V**olume **V**entilation*
**A**ssisted **S**pontaneous **B**reathing

The overall minute volume is preset to a mandatory level, which can be adjusted by means of the tidal volume VT and frequency f.

The patient can breathe spontaneously, thereby contributing a proportion of the total minute volume.

The difference between the spontaneously breathed minute volume and the set minute volume is covered by the mandatory ventilation strokes. Spontaneous breathing can be assisted by the ASB pressure support.

This mode is intended for patients being weaned off the ventilator by progressively reducing the mandatory proportion of the total minute volume.




Set the pattern of ventilation for MMV, MMV/ASB with the ventilation parameters:

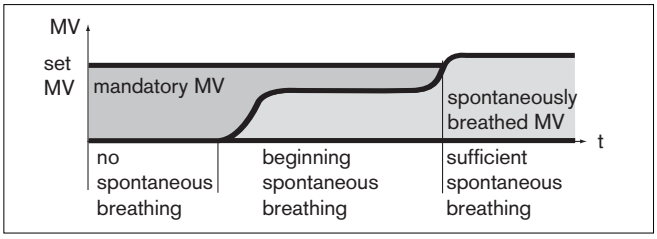
Tidal volume »**VT**«
Insp. Flow »**Flow**«

Frequency »**f**«
Inspiration time »**Tinsp**«

Sensitivity »**Trigger**«

O2 concentration »**O2**«

Positive end-expiratory pressure »**PEEP**«




Additionally, for MMV/ASB:

Pressure assist »**PASB**«
Pressure rise time »**Ramp**«

---

To activate:

- Press menu button »**other modes**«.

When MMV has been selected in the menu with the cursor:

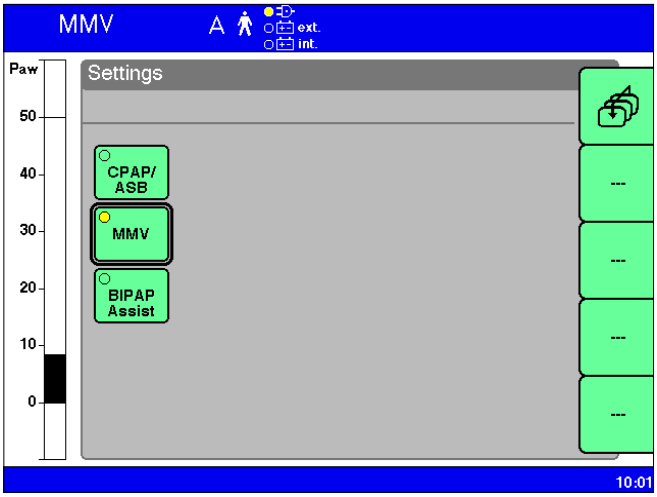
- Hold the menu button »**other modes**« for approx. 3 seconds,
  or:
- Press the rotary knob.

Otherwise:

- Select MMV = turn rotary knob,
  activate = press rotary knob.

The "LED" in the screen key »**MMV**« changes from green to yellow. Ventilation mode MMV is now active and displayed in the status line.

---




* For a detailed description of MMV, see page 122.

**Pmax**

MMV, MMV/ASB can be supplemented with the ventilation parameter Pmax.

- To activate »Pmax pressure limit«, see page 79.

**Pressure limited ventilation PLV*** – for manually limiting pressure peaks using the Pmax pressure limit.
The tidal volume remains constant as long as the pressure curve continues to show a short plateau, and the flow curve shows a brief pause in the flow between inspiration and expiration.
Volume monitoring is constantly active. If the set tidal volume VT can no longer be applied, the alarm »**!! Volume not constant**« is automatically generated.

---

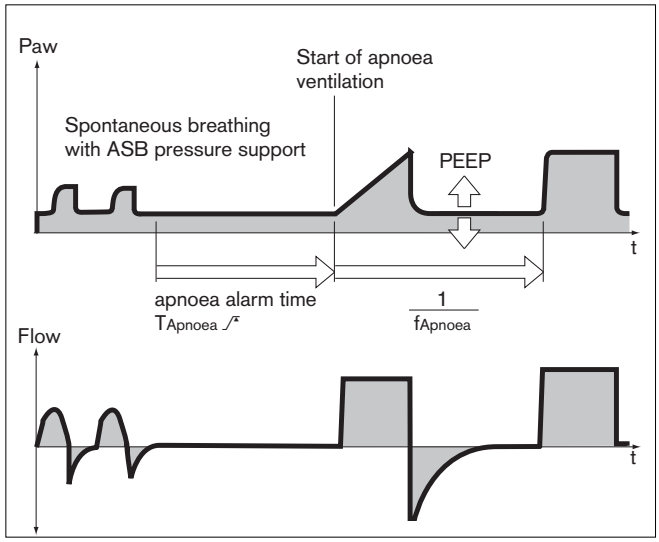
* For a detailed description of PLV, see page 116.

## Apnoea ventilation

For automatic switch-over to volume-controlled mandatory ventilation if the patient stops breathing.
It can be switched on in the ventilation modes SIMV, BIPAP, CPAP, APRV.
Evita 2 dura emits an apnoea alarm if during the set alarm period »**TApnoea**« no expiration flow is measured or insufficient inspiratory gas is delivered.
If breathing stops, Evita 2 dura emits an alarm after the set alarm time ($T_{Apnoea}$) and starts volume-controlled ventilation with the set ventilation parameters:

Frequency »**fApnoea**«

Tidal volume »**VTApnoea**«




The ventilation parameters »**O2**« and »**PEEP**« correspond to the settings effective at the time.
The inspiration time for apnoea ventilation is determined from the set apnoea frequency »**fApnoea**« and a fixed I:E ratio of 1:2.
As in SIMV, the patient can breathe spontaneously during apnoea ventilation and the mandatory ventilation strokes will be synchronised with the patient's spontaneous breathing.
The apnoea ventilation frequency remains constant.

---

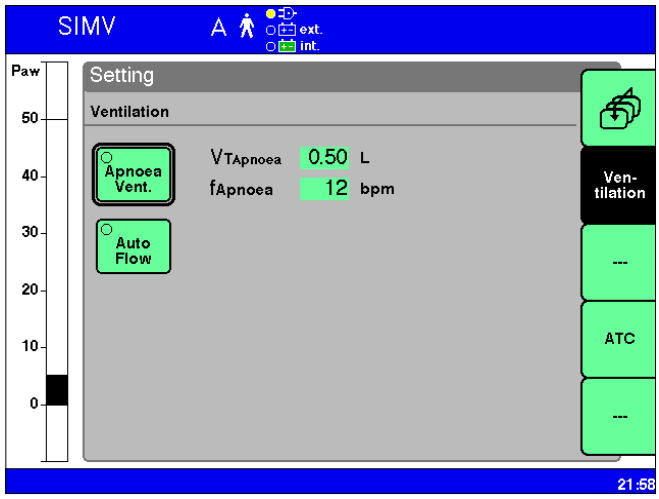
To set apnoea ventilation:

- Press menu button »Settings«.

Display:

- Select screen key »**Apnoea Vent.**« = turn rotary knob.
  Switch on apnoea ventilation = press rotary knob. The "LED" in the screen key changes from green to yellow = apnoea ventilation is on.
- Select field »**VTApnoea**« = turn rotary knob,
  activate = press rotary knob.
- Set values = turn rotary knob,
  confirm = press rotary knob.
- Select, set and confirm »**fApnoea**« accordingly.

---




To terminate apnoea ventilation:

- Press »**Alarm Reset**« key. The machine will continue operating in its previous ventilation mode.
  or
  select another ventilation mode.

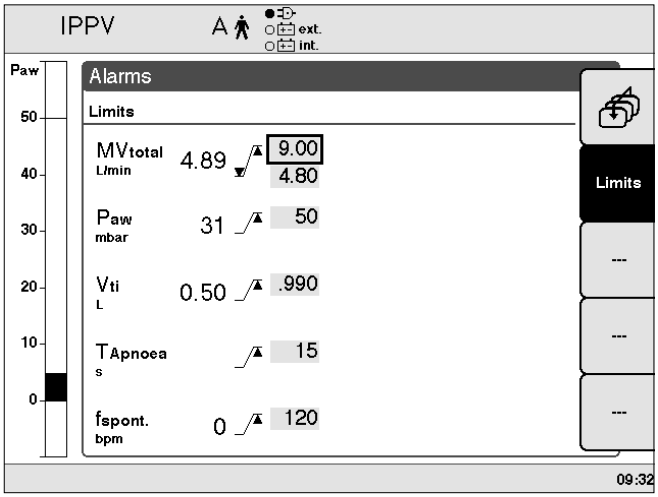
See page 80 for configuration of the apnoea ventilation status when starting the machine.

## Setting Alarm Limits

- Press the »**Alarms**« menu key.

Example display »**Limits**«
This page displays all the alarm limits that can be set/adjusted.

= lower alarm limit
= upper alarm limit




Example: Setting the upper alarm limit for $f_{spont}$.

- Select the »**fspont.**« screen field with the cursor = turn the rotary knob.
  Confirm = press the rotary knob.
- Set the desired value = turn the rotary knob.
  Confirm = press the rotary knob.

The lower alarm limit does not have to be set for the airway pressure Paw, because it is automatically coupled with the PEEP setting.

The alarm limits do not have to be set for the $O_2$ concentration. These limits are automatically coupled to the $O_2$ concentration setting.

Lower alarm limit:
or settings up to 60 Vol.% $O_2$: setting –4 Vol.% $O_2$
for settings from 60 to 100 Vol.% $O_2$: setting –6 Vol.% $O_2$

Upper alarm limit:
for settings up to 60 Vol.% $O_2$: setting +4 Vol.% $O_2$
for settings from 60 to 100 Vol.% $O_2$: setting +6 Vol.% $O_2$

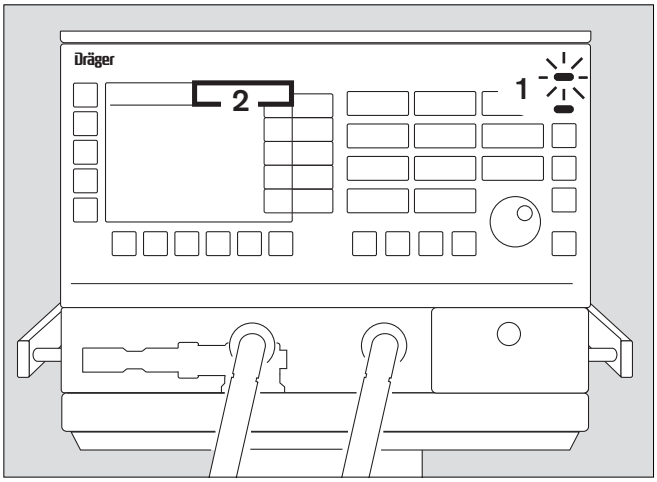
Setting ranges for alarm limits, see "Technical Data", page 112.

## In the Event of an Alarm

**1** the red or yellow LED flashes.

**2** The alarm message is displayed in the right-hand corner of the top line of the screen.

Evita 2 dura assesses the alarm message according to its priority, marks the text with exclamation marks and generates the various alarm tone sequences.




**Warning = top priority message**

**1** The red LED flashes.

Warning messages are marked with three exclamation marks.

Example: »**!!! Apnoea**«

Evita 2 dura generates a five-tone sequence that is sounded twice and repeated every 7 seconds.

**Caution = medium priority message**

**3** The yellow LED flashes.

Caution messages are marked with two exclamation marks.

Example: »**!! Check settings**«

Evita 2 dura generates a 3-tone sequence that is repeated every 20 seconds.

**Advisory = low priority message**

**3** The yellow LED lights up and remains constantly lit.

Caution messages are marked with one exclamation mark.

Example: »**! Malfunction fan**«

Evita 2 dura generates a 2-tone sequence that sounds only once.

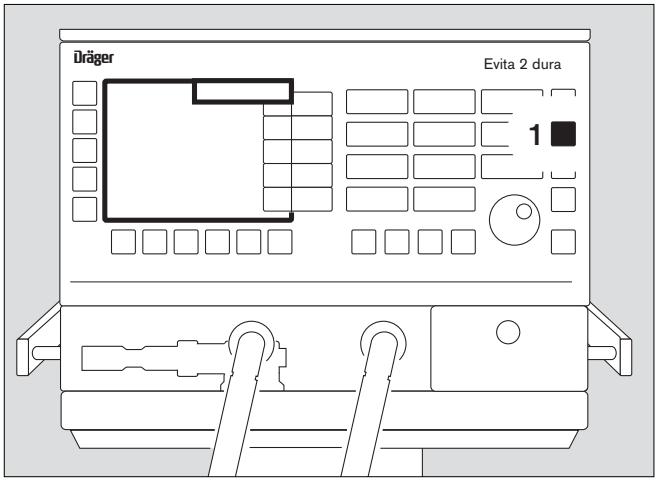
If the loudspeaker for audible alarms fails on account of a defect, an auxiliary signal will sound continuously.
This continuous tone also serves as power failure alarm, see page 25, if power is interrupted while the ventilator is in use.

To remedy the faults, please refer to the "Troubleshooting" section (starting) on page 84.

Once the fault has been remedied, the alarm tone is switched off. Caution and advisory messages disappear automatically.

Alarm messages (!!!) are then displayed in the colour of the status line and must be acknowledged:

1 Press the »**Alarm Reset**« key.
The message is erased from the screen.




**Suppressing the audible alarm**

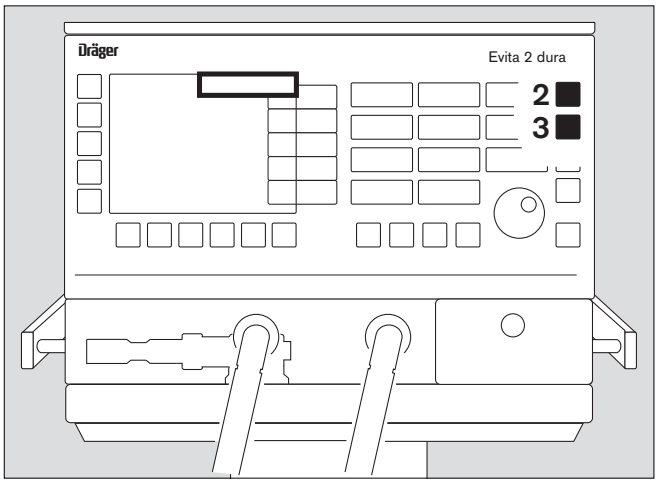
for max. 2 minutes:

2 Press the »🔔« key, its yellow LED lights up and the acoustic alarm is cancelled for 2 minutes.
If the fault that triggered the alarm is still not remedied, the audible alarm starts up again after this period.

If you wish to reactivate the audible alarm before the end of the 2-minute muting period:

2 Press the »🔔« key again, its LED goes out.
The message remains on the screen.

3 Alarms which can be acknowledged via Alarm Reset must be acknowledged via the »**Alarm Reset**« key, see "Fault – Cause – Remedy", page 84.



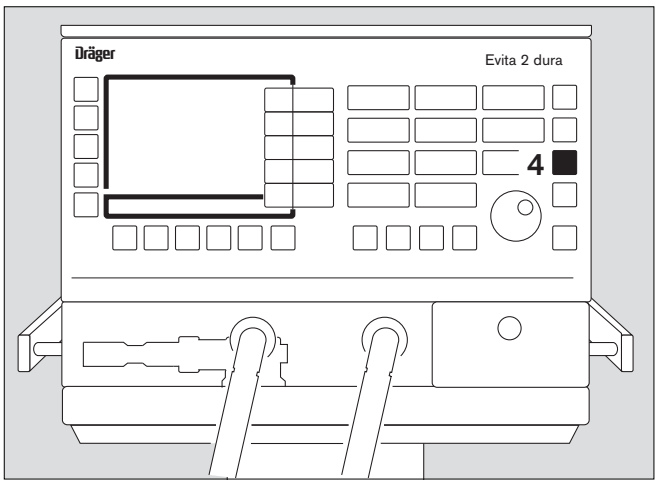

**Information ℹ**

– For help with system operation
– For help with troubleshooting

4 Press the »ℹ« key: the required information is displayed in the bottom line of the screen.

To erase the message:

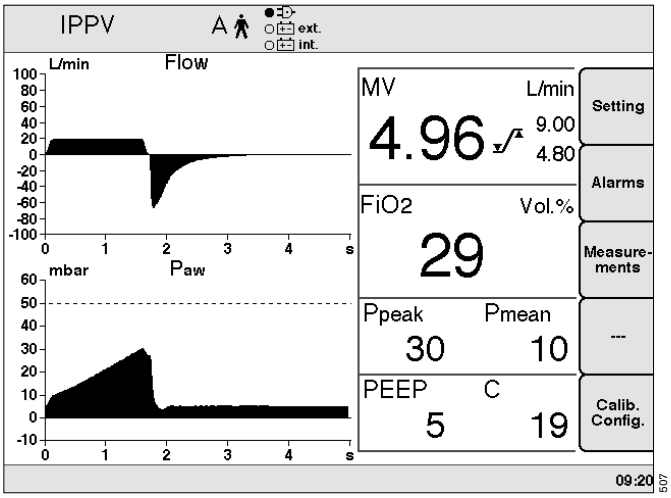
4 Press the »ℹ« key again.



## Displaying Curves and Measured Values

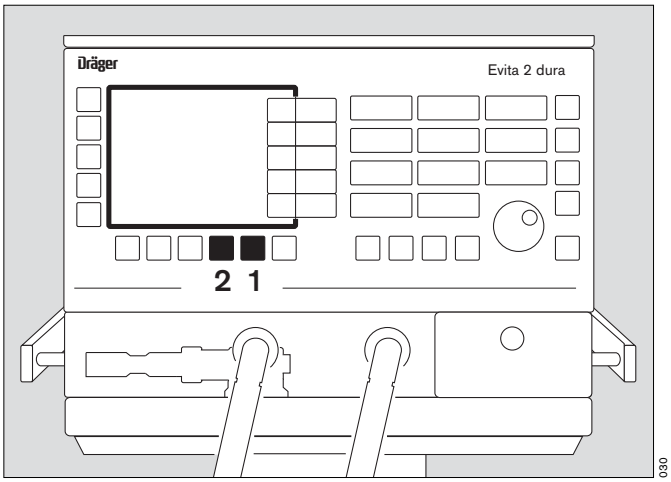
### In the main page

A set of six selectable measured values is displayed in the right-hand field, and two selectable curves in the left-hand field.




To select a second group of 6 measured values:

**1** Press the »**Values** 1▭ 2▭« key.



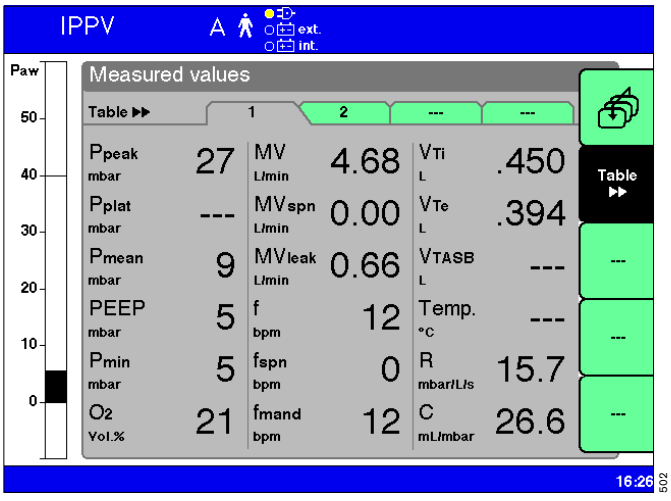

To select another pair of curves:

**2** Press the »**Curves** ◢◣« key.

Measured values and curves can be selected, see "Combine displayed measured values", page 75 and "Combine displayed curves", page 76.

In the other screen pages, these curves and measured values are not displayed. The airway pressure is therefore continuously indicated by means of an analogue vertical bar display on the left-hand side of the screen.

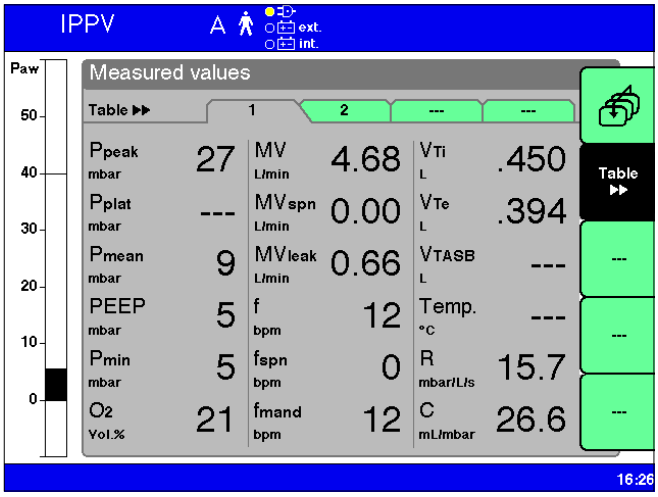
Example: screen page »**Measures values 1**«



## Display measured values

- Press menu button »**Measurements**«.

Display example: »**Table 1**«



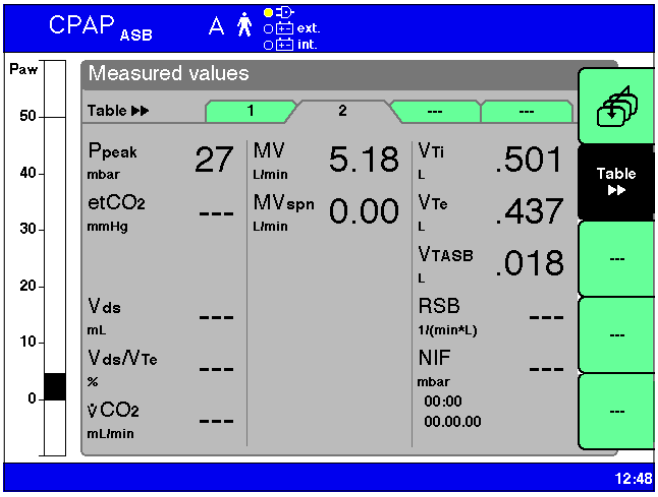

Evita 2 dura displays the measured values and their units of measure in the form of a table. The menu »**Table 1**« is displayed with all standard available measured values.

The measured value $MV_{leak}$ represents the leakage in L/min and is determined by Evita 2 dura by comparing the applied inspiratory minute volume with the measured expiratory minute volume.

The measured value $MV_{leak}$ is used by Evita 2 dura for automatic correction of the applied tidal volume $V_{Ti}$ and the flow and volume curves. This presupposes that leakage compensation has been activated, see page 80. For safety reasons, the measured values for the minute volume are not corrected.

To display the measured values of add-on features (e.g. "Evita 2 dura CapnoPlus"):

- Select the »**Table 2**« menu with the »**Table ▶▶**« menu key.
- Functional extensions of measured values, e.g. CapnoPlus $CO_2$ monitoring, are displayed in further measured value tables.




**The following are optionally displayed (upgrade SW4.n plus)**

| | |
|---|---|
| $V_{TASB}$ | Inspiratory tidal volume during an ASB stroke |
| RSB | Rapid Shallow Breathing* |
| NIF | Negative Inspiratory Force** |

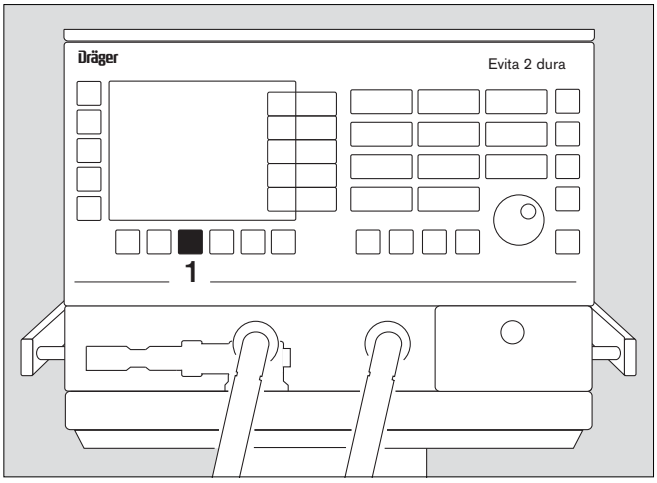
* For a detailed description of RSB, see page 126.

** For a detailed description of NIF, see page 126.
Use of NIF, see "Manual expiration", page 59.

## Curve freezing

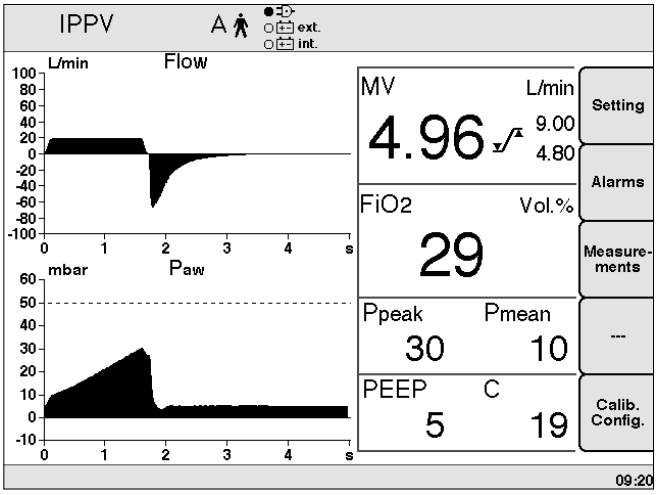
To study the curve(s) in detail:

1 Press the »**Freeze** « key.




To return to displaying new curve(s):

1 Press the »**Freeze** « key again.



## Special Functions

### Manual inspiration

This function may be used in all modes except CPAP spontaneous breathing without ASB pressure support.
An automatic ventilation stroke can be triggered independently of the starting time and extended up to a maximum of 15 seconds.
Or:
Between two automatic ventilation strokes, a ventilation stroke can be manually started and held for a maximum 15 seconds.

The pattern of the manually started ventilation stroke depends on the ventilation mode used.

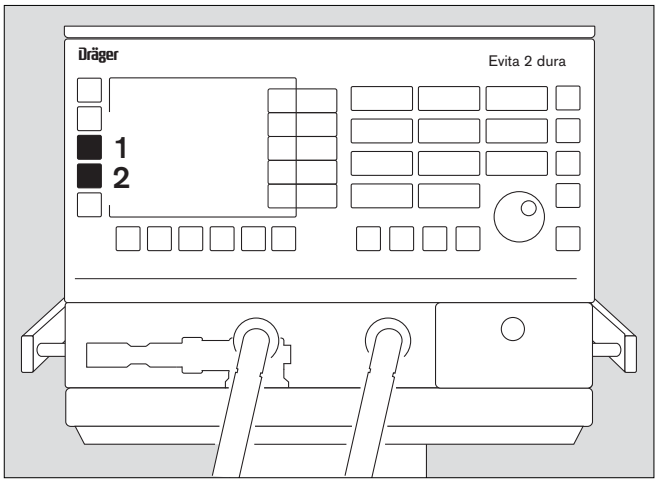
For IPPV, SIMV and MMV:
volume-controlled ventilation stroke, defined by the $V_T$ and $T_{insp}$ settings.

For BIPAP:
pressure-controlled ventilation stroke, defined by the $P_{insp}$ and $T_{insp}$ settings.

For CPAP/ASB:
pressure-controlled ventilation stroke, defined by the $P_{ASB}$ setting.

1 Press and hold down the »**Insp. hold**« key for as long as inspiration is required.

Either an automatic ventilation stroke that has just begun will be prolonged for as long as the key is held down, or a new ventilation stroke will be started and prolonged for as long as the key is held down – in each case for a maximum of 15 seconds.




### Manual expiration hold

Active in all ventilation modes.
For determining the weaning value NIF*

2 Hold down the »**Exp. hold**« key.

The expiration phase remains effective and Evita 2 dura determines the measured NIF value as long as the key is pressed.
After 15 seconds, the system automatically interrupts the expiration phase.

---

* For a detailed description of NIF, refer to the Annex, page 126.

### Medicament nebulisation

**Inflammable substances must not be nebulised! Fire hazard due to the glowing flow sensor. Nebulants containing flammable substances such as alcohol must NOT be used, any contact of a flammable substance with the hot wire flow sensor could cause a fire.**

#### During adult ventilation

Applicable in every ventilation mode.

Evita 2 dura applies the medicament aerosol in synchronisation with the inspiratory flow phase and maintains the minute volume constant.

Depending on the set $O_2$ concentration, the ventilator supplies the medicament nebuliser with medical air, pure oxygen or a mixture of medical air and oxygen. Deviations in $O_2$ concentration are therefore kept to a minimum.

In extreme cases (with a minimum inspiration flow of 15 L/min), the deviations can be up to ±4 % by volume*. To avoid greater deviations, medicament nebulisation is automatically switched off with inspiration flows of less than 15 L/min.

#### During paediatric ventilation

Medicament nebulisation is possible in the pressure-controlled paediatric ventilation modes.

In volume-controlled ventilation modes, medicament nebulisation is only possible with AutoFlow® (optional extra).

Contrary to the case during adult ventilation, the medicament is nebulised continuously in paediatric mode. However, the aerosol generated during expiration does not enter the lungs. Nebulising while in paediatric mode is continuous, please note that nebulised medication will not enter the lungs during the expiratory phase of the breath. Nebulising in the adult mode is synchronized with the inspiratory phase only, and is not active during the expiratory phase.

Depending on the set $O_2$ concentration, the medicament nebuliser is supplied by the ventilator with medical air, oxygen or a mixture of medical air and oxygen. Deviations in $O_2$ concentration are therefore kept to a minimum.

**We recommend that you do not use the medicament nebuliser at breathing rates of less than 12 bpm!**

For breathing rates above 12 bpm, please refer to the graph on page 127 of these Instructions for Use.

The maximum possible deviations in $O_2$ concentration are ±4 % by volume.

**For breathing rates of less than 12 bpm, the deviations in $O_2$ concentration may be much greater.** These deviations cannot be detected by the device's internal $O_2$ concentration monitor.

---

* For a detailed description of the inspiratory $O_2$ concentration during (medicament) nebulisation, see page 127.

The minute and tidal volumes displayed may be considerably higher or lower than those actually set to be delivered to the patient due to varying tolerances in flow during nebulising. The measured values prior to nebulisation must be taken into account if necessary.

In the event of a discrepancy between $V_T$ and MV values, the ventilation pressure can be used for an accurate assessment of ventilation. $V_T$ and MV values can be compared by comparing the difference between PEEP and plateau pressure before and during nebulisation.

The medicament nebuliser is automatically switched off after 30 minutes. After administration of the aerosol, the flow sensor is automatically cleaned and calibrated in order to prevent malfunctions in flow measurement.

**Use only medicament nebuliser 84 12 935 (white middle section).**

Prepare the medicament nebuliser as specified in the specific Instructions for Use.

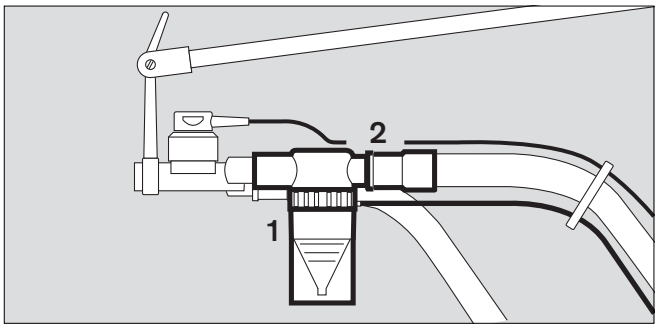
**If other pneumatic medicament nebulisers are used, major deviations in tidal volume and inspiratory $O_2$ concentration may be caused!**

**For use during adult ventilation**

**1** Connect the nebuliser to the inspiratory side (temperature sensor side) of the Y-piece.

**2** Connect the inspiration hose to the medicament nebuliser.

- Place the medicament nebuliser in the vertical position.
- Using hose clips, route the nebuliser hose back to the ventilator along the expiratory hose.

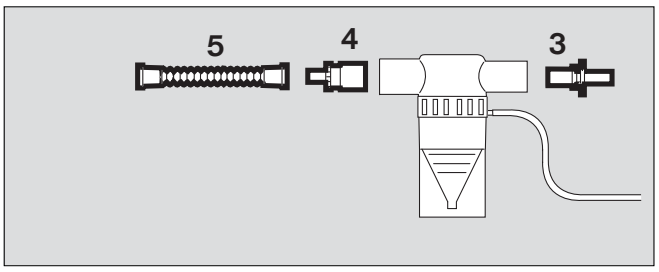



**For use during paediatric ventilation**

**3** Insert the catheter connector (ISO cone Ø 15 / Ø 11) into the inlet of the medicament nebuliser.

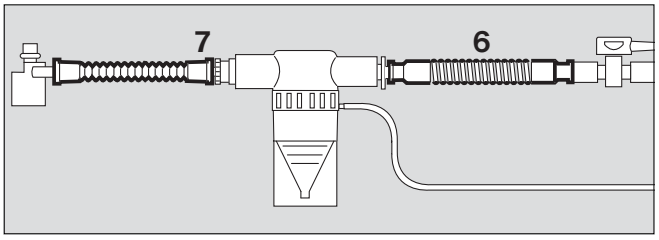
**4** Insert the adapter (ISO cone Ø 22 / Ø 11) into the outlet.

**5** Fit the corrugated hose (0.13 m long) on to the outlet adapter.



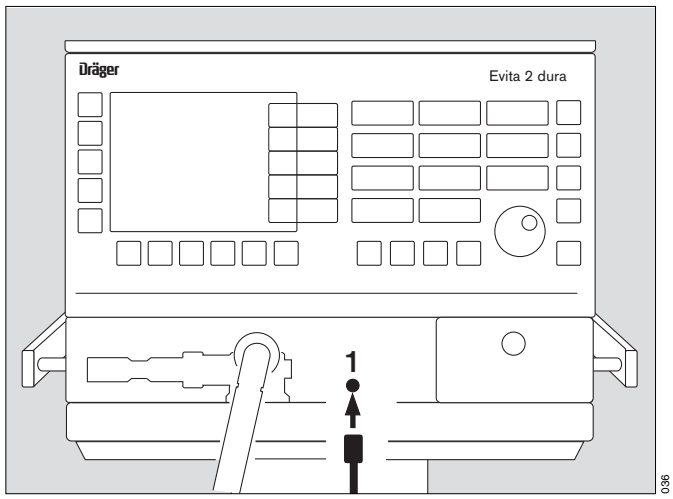

**6** Remove the corrugated hose of the hose set from the inspiratory adapter of the Y-piece and connect it to the inlet adapter of the medicament nebuliser.

**7** Connect the free end of the corrugated hose on the nebuliser outlet to the inspiratory adapter of the Y-piece.



1 Connect the nebuliser hose to the port on the front panel of the Evita 2 dura.

- Fill the medicament nebuliser in accordance with its specific Instructions for Use.




**Warning: the effect of aerosols on sensors, filters and heat and moisture exchangers (HME) must be taken into account!**

The measuring function of the flow sensor may be impaired.

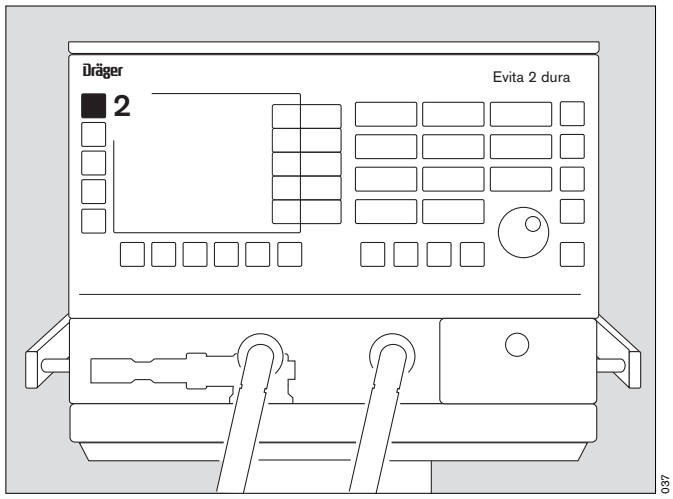
The flow resistance of filters is liable to increase and may impair ventilation.

**Do not place a microbial filter on the nebuliser outlet during nebulisation!**

**During medicament nebulisation, do not use a heat and moisture exchanger (HME) at the Y-piece. Risk of increased breathing resistance!**

2 Hold down key » ☜ « until the yellow LED lights up.

- Advisory message on the screen:
  »**Nebuliser on!**«
  The nebuliser remains in operation for 30 minutes.




If you wish to interrupt medicament nebulisation before it is complete:

2 Press » ☜ « again. The yellow LED goes out, the nebuliser will be switched off.

The flow sensor is subsequently cleaned and calibrated automatically.

- Remove residual medicament. Strictly follow the Instructions for Use of the medicament nebuliser.

### Oxygen enrichment for bronchial suction

To avoid any risk of hypoxia during bronchial suction, Evita 2 dura offers a programme for oxygen enrichment during the removal of secretions.

After the programme is started, Evita 2 dura ventilates the patient in the selected ventilation mode for an initial oxygen enrichment phase of 180 seconds. In adult mode, the ventilator supplies 100 % oxygen by volume, and in paediatric mode it delivers the set $O_2$ concentration* plus 25 % (for example: setting = 60 % by vol.; administered = 75 % by vol.)

When the ventilator is disconnected for suction, Evita 2 dura interrupts the ventilation. During the suction time, the audible alarms are suppressed, so that the suction routine is not disturbed.

After suction and automatically recognised reconnection, Evita 2 dura delivers an increased $O_2$ concentration* for the final oxygen enrichment phase of 120 seconds. In adult mode, the $O_2$ concentration is 100 % by volume. In paediatric mode, the enriched concentration is 25 % higher than the set concentration*.

During suction and for 2 minutes afterwards, the lower alarm limit for the minute volume is switched off.

### Before suction

1 Hold down the »**$O_2$ ┼ Suction**« key until the yellow LED comes on.

Evita 2 dura ventilates the patient in the set ventilation mode with increased $O_2$ concentration: 100 % $O_2$ by volume in adult mode, and a 25 % higher $O_2$ concentration than the set value in paediatric mode.

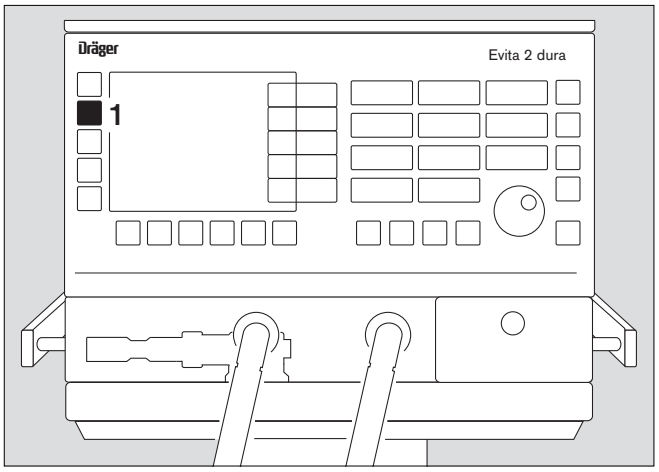
If no PEEP greater than 4 mbar is set, a PEEP of 4 mbar will be automatically activated. This PEEP enables the Evita 2 dura to detect subsequent disconnection.

The other ventilation parameters remain unchanged.

- Display in the help line at the bottom edge of the screen: »**$O_2$ enrichment 180 s**«

The remaining time is counted down continuously. This initial oxygen enrichment lasts for a maximum of 180 seconds. During this time, Evita 2 dura waits for a disconnection for suction.

If there is no disconnection after expiry of the 180 seconds, the oxygen enrichment programme is automatically terminated.




* For a detailed description of the inspiratory $O_2$ concentration during medicament nebulisation, please refer to the Appendix page 127.

**After disconnection for suction**

Evita 2 dura delivers a minimal flow for the duration of disconnection in order to detect the end of the disconnection phase automatically.

In the help line at the bottom of the screen, the amount of time available for suction is continuously counted down (example): »**Execute suction and reconnect 120 s**«

If suction is ended and ventilation reconnected within the displayed time, Evita 2 dura starts the final $O_2$ enrichment phase.

**Automatic interruption of oxygen enrichment**

If there is still no reconnection after 120 seconds, the oxygen enrichment programme is reeminated. All alarms are immediately reactivated. Evita 2 dura immediately continues ventilating in the set ventilation mode.

**After reconnection**

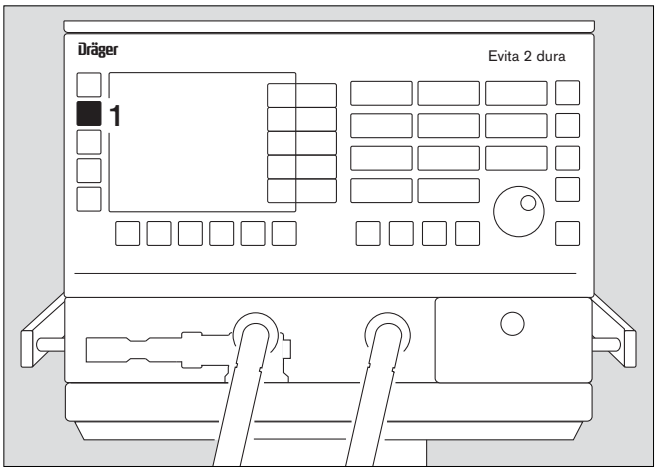
Evita 2 dura continues ventilating in the set ventilation mode, except that for final oxygen enrichment the increased oxygen concentration of 100 % by volume for adults and 25 % above the set concentration for paediatric ventilation will continue to be delivered for 120 seconds.

- Message in the help line at the bottom of the screen: »**Final $O_2$ enrichment 120 s**«

The time remaining is counted down continuously.

To interrupt oxygen enrichment

1 Press the »**$O_2$ ↑ Suction**« key again.



## Selecting Standby Mode

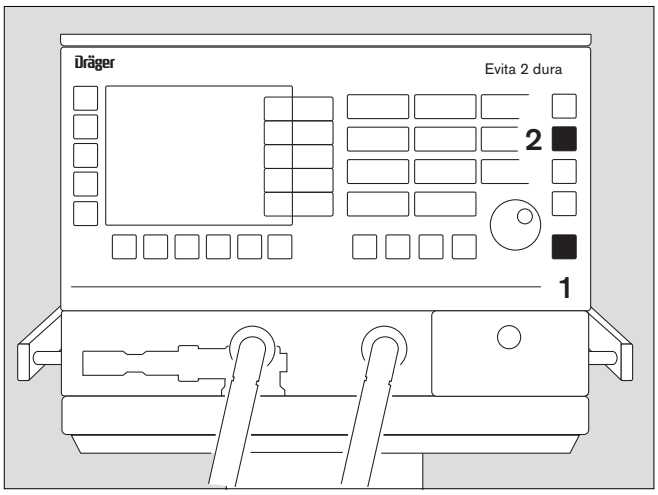
**No ventilation takes place in standby mode!**

– to select the patient mode
– to perform the device check
– to maintain Evita 2 dura ready for operation
– to preset ventilation parameters and alarm limits.

### Switching to Standby

1 Hold down the »⏻« key for about 3 seconds. The Standby alarm tone is sounded.
2 The »**Alarm Reset**« key can be used to switch off the Standby alarm tone.

The standby alarm tone can no longer be muted with the »🔔« key.



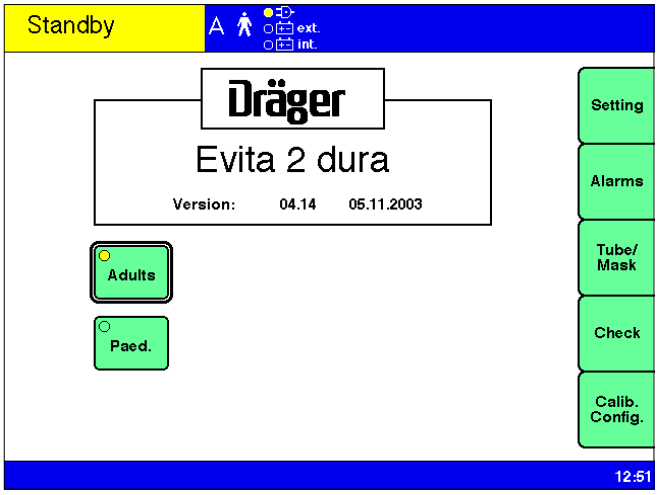
039

### Terminating standby mode

– to continue ventilation.
1 Press »⏻« key. The LED goes out, and ventilation commences.

If the patient mode is changed while on standby, Evita 2 dura will determine new starting values for ventilation, see page 78.

Display (example):



512

## Calibration

The saved calibration/zeroing values remain stored even when the machine is switched off.

The pressure sensors for measuring the airway pressure are calibrated automatically.

The flow sensor and $O_2$ sensor are automatically calibrated once per day.

Calibration of the flow sensor can be performed at any time, even during ventilation.

Calibration of the $O_2$ sensor can be performed at any time, even during ventilation. The applied $O_2$ concentration is not affected by calibration.

The calibration of the $CO_2$ sensor (optional) can be checked during ventilation.

**Calibrating the $O_2$ sensor manually**

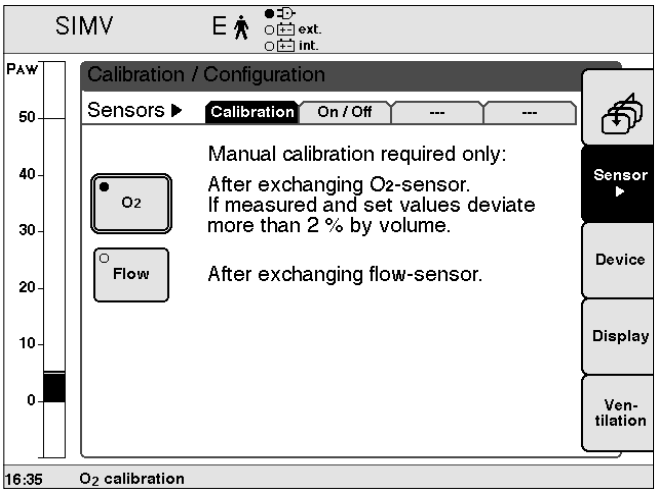
– Before operation, during the device check.
– After replacing the $O_2$ sensor (wait for the 15-minute warm-up time of the $O_2$ sensor).
– If the measured value and set value deviate from each other by more than 2 Vol.%.

The $O_2$ sensor can be calibrated during ventilation.

Start calibration:

- Press the »**Calib./Config.**« menu key.
- Select the »**$O_2$**« menu key = turn the rotary knob.
- Start »**$O_2$**« calibration = press the rotary knob.

Display (example):




Message in the help line at the bottom of the screen:

»**$O_2$ calibration**«

After calibration is complete, the following message appears in the help line:

»**Calibration ok**«

**Calibrating the flow sensor manually**

– Before operation, during the device check.

– After replacing the flow sensor.

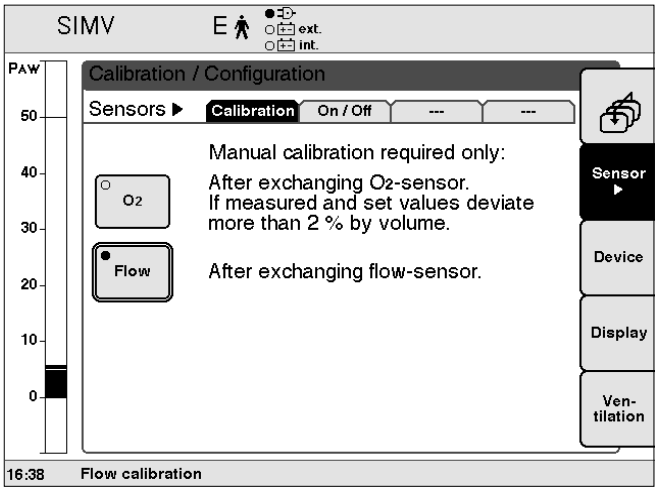
The flow sensor is automatically cleaned before each calibration.

After using the medicament nebuliser, the flow sensor is automatically cleaned and calibrated.

To start calibration:

- Avoid flammable gases (e.g. alcohol vapours after disinfection).
- Flow sensors which have been disinfected in ethanol must be left to dry in air for at least 30 minutes.
- Press the »**Calib./Config.**« key.
- Select the »**Flow**« screen key = turn the rotary knob.
- Start calibration = press the rotary knob.

Display (example):




Evita 2 dura uses the next inspiration phase for the calibration. Short inspiration times are prolonged to about 1 second.

Message in the help line at the bottom of the screen:
»**Flow calibration**«

After calibration is complete, the following message appears in the help line:

»**Calibration ok**«

## External flow source

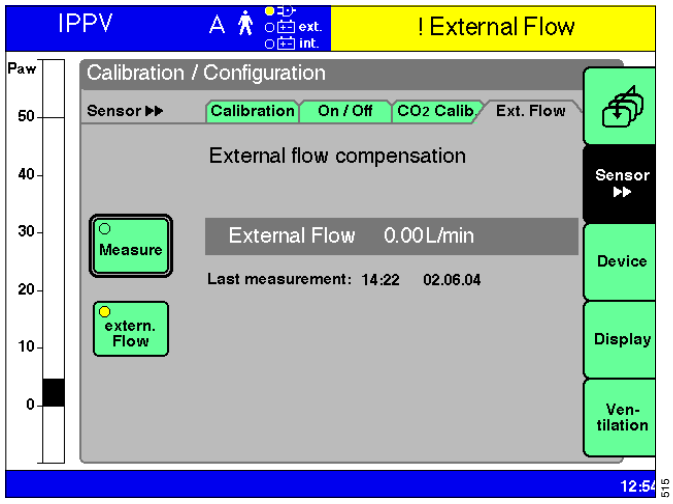
When a constant external flow of up to 12 L/min is applied (e.g. during medicament nebulisation with separate gas supply and not from Evita 2 dura or during separate tracheal gas insufflation TGI), this flow can be determined by Evita 2 dura and the tolerance for the flow sensor monitoring parameters increased in order to prevent generation of the alarms "Flow measurement fault" and "Neo. flow measurement fault" (NeoFlow option) during these applications.
The original measurement of the expiratory volume is continued: During an expiratory flow, Evita 2 dura measures a correspondingly higher value for $V_{Te}$ and MV.
The displayed $V_{Ti}$ value is too low. During volume-controlled ventilation, the actual tidal volume applied to the patient is higher than that set. It is therefore advisable to use pressure-controlled ventilation in combination with an external flow.

To avoid false alarms and ensure adequate monitoring:

- Adjust both alarm limits for MV in line with the actual value.
- Use additional monitoring, e.g. $SpO_2$, if necessary.

To determine the external flow:

- Press menu button »**Calib./Config.**«.
- Select the menu »**External Flow**« via the menu button »**Sensor ▶▶**«.
- Select screen key »**Measure**« = turn rotary knob, confirm = press rotary knob.
- Yellow LED lights up in the »**Measure**« key.




The external flow is calculated by Evita 2 dura.
Display during calculation:
»**Determining external flow**«

Once the external flow has been determined, it is displayed by Evita 2 dura together with the time and date.
The following message is simultaneously displayed by Evita 2 dura:
»**Confirm value via** ⊙«

- Confirm = press rotary knob.

Determination of the external flow is aborted by Evita 2 dura if it exceeds 12 L/min or if flow measurement by Evita 2 dura is faulty.

When the external flow has been determined successfully, it is taken into account in the monitoring of the flow sensor: the yellow LED in the key »**extern. Flow**« lights up.
The advisory message
»**! External flow**«
is displayed as long as the external flow is taken into account by Evita 2 dura.

When an external flow is not applied:

- Switch off:
  select key »**extern. Flow**« = turn rotary knob,
  confirm = press rotary knob.

Once the external flow has been measured by Evita 2 dura, its inclusion can be reactivated at any time:

- Select screen key »**extern. Flow**« = turn rotary knob,
  confirm = press rotary knob.

If the external flow changes:

- Press key »**Measure**« so that the external flow can be redetermined by Evita 2 dura.

## Switching off the monitor functions

E.g. if a spent sensor cannot be immediately replaced.

**An adequate external monitoring function must immediately be ensured!**

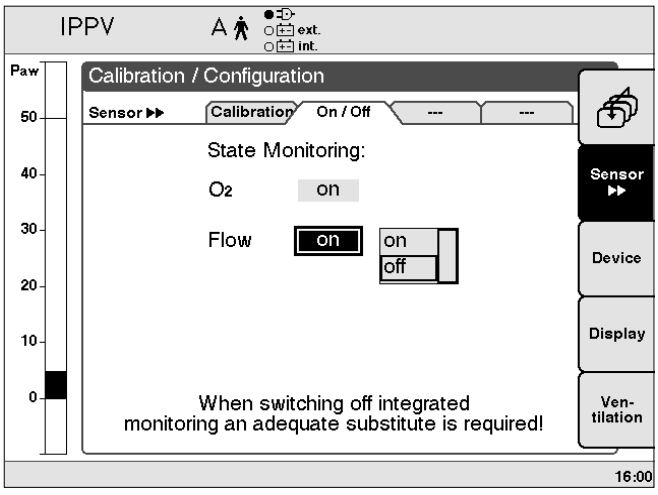
Example: Switching off Flow Monitoring

- Press the »**Calib./Config.**« menu key.
- Select »**Sensor On/Off**« with the »**Sensor ▶▶**« menu key.

Example display:

- Select the »**Flow on**« screen line = turn the rotary knob.
  Confirm = press the rotary knob.
- In the selection menu, select »**off**« = turn the rotary knob.
  Confirm = press the rotary knob.

The corresponding measured values disappear.
The alarm function is deactivated.




To switch the monitor function back on after replacing the sensor:

- Select »**Flow off**« screen line = turn the rotary knob.
  Confirm = press the rotary knob.
- In the selection menu, select »**on**« = turn the rotary knob.
  Confirm = press the rotary knob.

# Configuration

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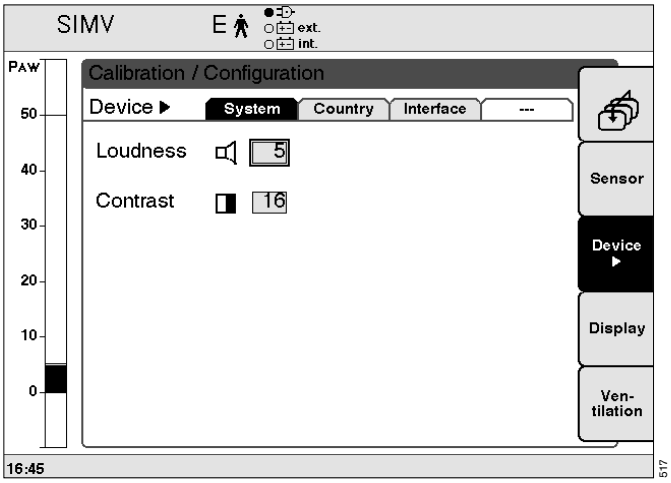
# Configuration

## System Settings

**Adjusting the volume of the audible alarm**

- Press the »**Calib./Config.**« menu key.
- Press the »**Device ▶▶**« menu key. The »**System**« menu appears.

Display (example):




- Select the »**Loudness**« screen field = turn the rotary knob.
  Activate = press the rotary knob.
- Set the desired volume = turn the rotary knob.
  Confirm = press the rotary knob.

After the setting has been confirmed, the alarm tone is sounded once to enable you to judge the volume.

**Set the volume of the acoustic alarm to a sufficiently high level so that the alarm can be heard!**

**Setting the contrast**

Not possible with all types of monitor

- Press the »**Calib./Config.**« menu key.
- Press the »**Device ▶▶**« menu key. The »**System**« menu is displayed.
- Select the »**Contrast**« field on the screen = turn the rotary knob.
  Activate = press the rotary knob.
- Setting the contrast = turn the rotary knob,
  confirm = press the rotary knob.

The set contrast will now be activated.

## Country-specific settings

### Selecting the language

Evita 2 dura is supplied in the language of the customer's country.

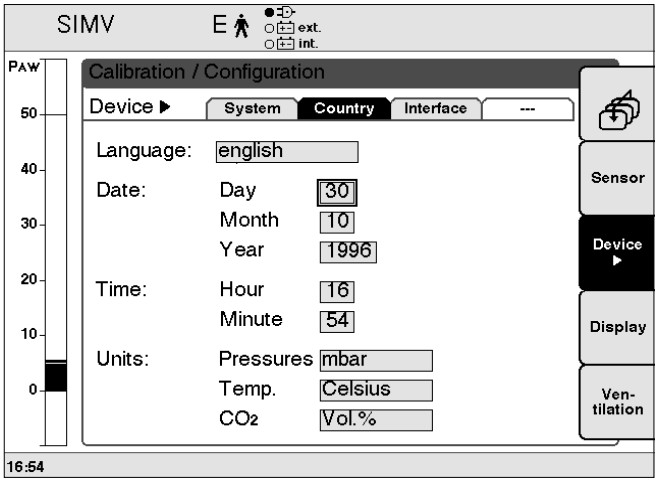
The following languages can be selected:

– English
– French
– Italian
– Spanish
– Dutch
– Swedish
– American English
– Japanese
– Greek
– Russian
– Portuguese
– Arabic
– Chinese
– Turkish

- Press the »**Calib./Config.**« menu key.
- Press the »**Device ▶**« menu key.
- With the »**Device ▶**« menu key, select the »**Country**« menu.

Display (example):

- Select the »**Language**« screen field = turn the rotary knob.
  Confirm = press the rotary knob.
- Select language = turn the rotary knob.
  Confirm = press the rotary knob.




### Setting the date and time

- Press the »**Calib./Config.**« menu key.
- Press the »**Device ▶**« menu key.
- With the »**Device ▶**« menu key, select the »**Country**« menu.
- Select the »**Day**« screen field = turn the rotary knob.
  Confirm = press the rotary knob.
- Set the date = turn the rotary knob.
  Confirm = press the rotary knob.

Set the month, year, hour and minute in the same way.

### Selecting measuring units

- Press the »**Calib./Config.**« menu key.
- Press the »**Device ▶**« menu key.
- With the »**Device ▶**« menu key, select the »**Country**« menu.

Under units:

- Select the »**Pressures**« screen field = turn the rotary knob.
  Confirm = press the rotary knob.
- Set »**Temp.**« and »**CO2**« (option) in the same way.

## Interface

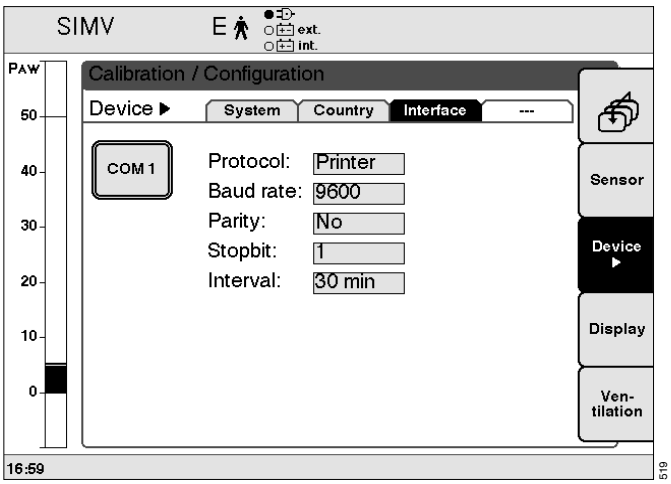
### Selecting the interface

Evita 2 dura offers the following interface protocols:

– Printer (HP Deskjet 500 Series 500 and compatible printers with serial interface)
– MEDIBUS (Dräger communications protocol for medical appliances)
– LUST (List-controlled universal interface driver program, compatible with the Evita RS 232 interface as from software version 7.n)

**Other equipment, e.g. printers, may only be connected to the COM ports if Evita 2 dura is connected to the mains power supply via a mains power cable or if it has been earthed to the earth connection on the back of the unit.**
Electric power may pose a hazard in all other cases.

- Press the »**Calib./Config.**« menu key.
- Press the »**Device ▶**« menu key.
- With the »**Device ▶**« menu key, select the »**Interface**« menu.
- Select the screen key corresponding to the required interface, »**COM1**«, »**COM2**«, »**COM3**« and »**Analog**« = turn the rotary knob.
  Confirm = press the rotary knob. (COM2, COM3 and Analog are optional).
- Select the desired interface protocol in the "Protocol" screen field = turn the rotary knob.
  Confirm = press the rotary knob.




- Select the screen field corresponding to the desired interface parameter = turn the rotary knob.
  Confirm = press the rotary knob.
- Set the desired value = turn the rotary knob.
  Confirm = press the rotary knob.

Adapting the interface protocols:

- See the Instructions for Use of the device you want to connect.

  For the printer protocol:
  Baud rate
  Set printer interval as required

  For the MEDIBUS protocol:
  Baud rate
  Parity check bits
  Number of stop bits

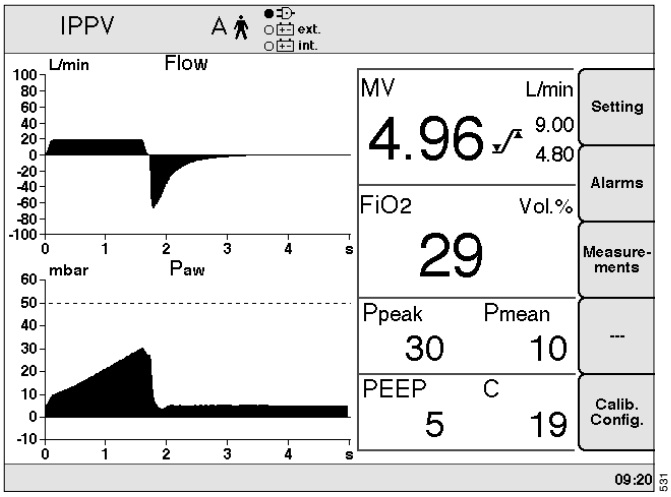
  For the LUST protocol:
  Baud rate

## Screen

### Selecting the displayed combination of measured values

Evita 2 dura displays a group of 6 selectable measured values in the right-hand field of the main page.

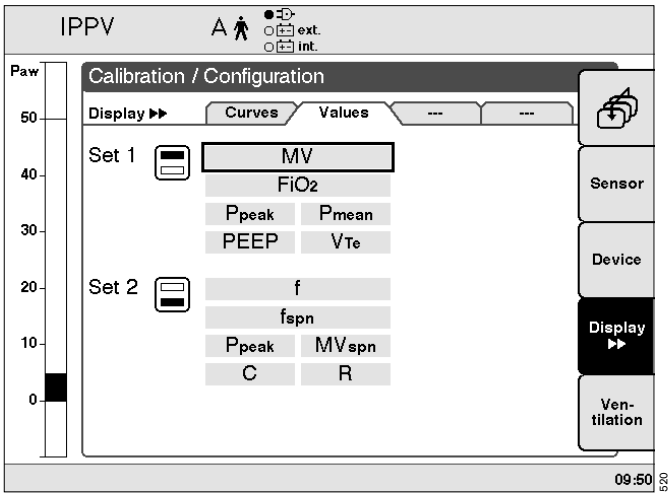
An alternative second group can be displayed by pressing the »**Values 1▭ 2▭**«.




These two groups can be composed in the configuration page:

- Press the »**Calib./Config.**« menu key.
- Press the »**Display ▶▶**« menu key.
- With the »**Display ▶▶**« menu key, select the »**Values**« menu.

Display (example):



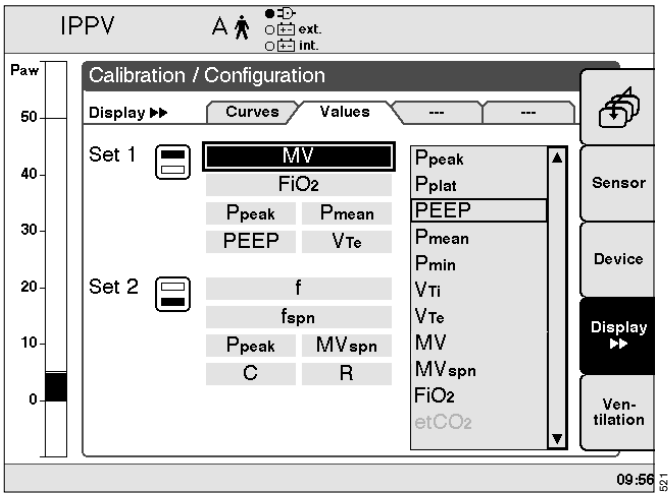

To replace one displayed measured value by another:

- Select the relevant screen field = turn the rotary knob.
  Activate = press the rotary knob.

The selection list with all available measured values is then displayed on the right of the screen.

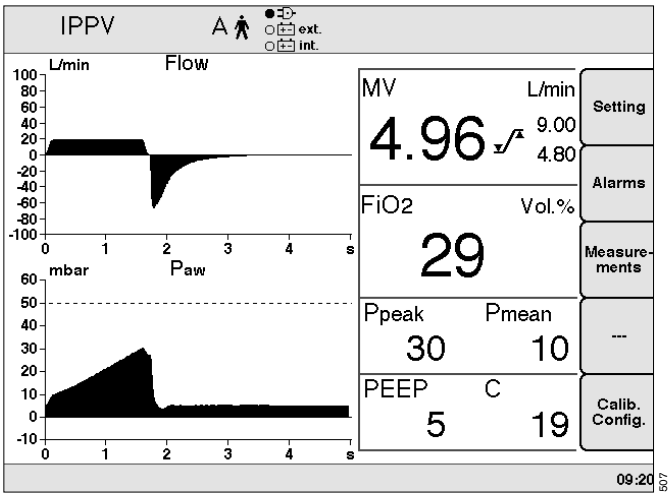
Display (example): Replacing MV

- Select the other measured value, e.g. »**PEEP**« = turn the rotary knob.
  Confirm = press the rotary knob.



### Selecting the displayed curves

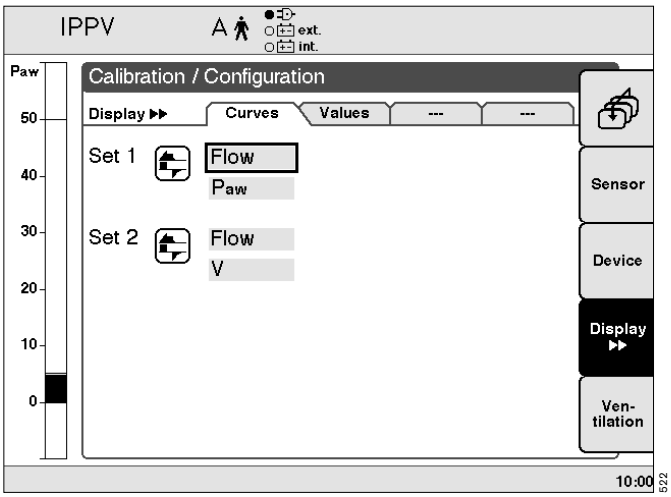
Evita 2 dura shows two curves in the left-hand field of the main page.
A different pair of curves can be selected by pressing the »**Curves** « key.




The curve pairs can be combined as required.

- Press the »**Calib./Config.**« menu key.
- Press the »**Display ▶▶**« menu key. The »**Curves**« menu appears.

Display (example):



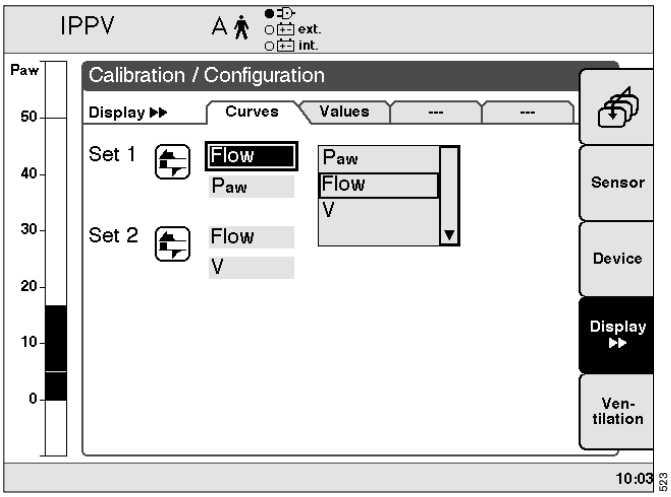

One displayed curve can be replaced by another:

- Select the relevant field = turn the rotary knob.
  Activate = press the rotary knob.

The list of all available curves to choose from is displayed on the right-hand side of the screen.

Display example: Replacing Paw

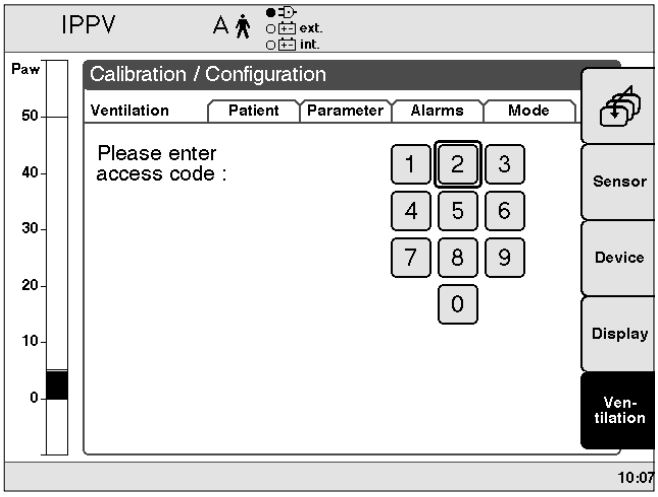
- Select the other curve (»**Flow**«) = turn the rotary knob.
  Confirm = press the rotary knob.



## Ventilation Defaults

– For defining the patient-specific start-up parameters »**f**« and »**VT**«
– Ventilation parameters active on starting up the device
– Alarm limits active on starting up the device
– Ventilation mode

The »**Ventilation**« menu for the default settings active on starting ventilation can only be accessed after entering the code number 3032.
This code-protection is designed to prevent accidental changes to the configuration.




### Patient-specific defaults

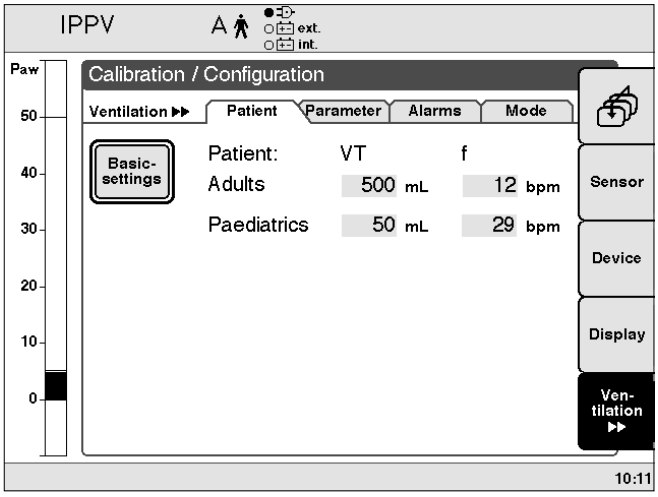
for Adult or Paediatric mode

– To set the values of the »**f**« and »**VT**« parameters active on starting up the device.

- Press the »**Calib./Config.**« menu key.
- Press the »**Ventilation ▶▶**« menu key.
- Enter code number »**3032**«.
- The »**Patient**« menu is displayed.

Display (example):

- Select the »**VT**« screen field = turn the rotary knob.
  Confirm = press the rotary knob.
- Set the desired value = turn the rotary knob.
  Confirm = press the rotary knob.




### Patient-specific defaults VT, f

| Patient mode | Factory setting | | Hospital-specific setting | |
|---|---|---|---|---|
| | Tidal volume VT mL | Ventilation frequency f 1/min | Tidal volume VT mL | Ventilation frequency f 1/min |
| Paediatric | 50 | 29 | | |
| Adult | 500 | 12 | | |

The hospital-specific defaults for your hospital can be entered in the table.

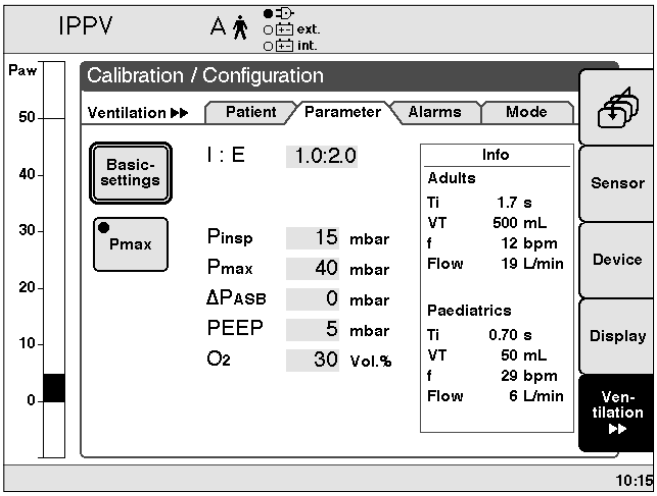
**Default ventilation parameter values**

– These defaults specify the ventilation parameters and alarm limits that are not patient-specific and are activated on starting up the device.

- Press the »**Calib./Config.**« menu key.
- Press the »**Ventilation ▶▶**« menu key.
- Enter code number »**3032**«.
- Select the »**Parameter**« menu with the »**Ventilation ▶▶**« menu key.

Display (example):

- Select the Pmax desired screen field = turn the rotary knob.
  Confirm = press the rotary knob.
- Set value = turn the rotary knob.
  Confirm = press the rotary knob.




**Default ventilation parameters**

| | I:E | $P_{insp}$ mbar | $P_{ASB}$ mbar | PEEP mbar | Ramp s | Trigger L/min | $O_2$ Vol.% |
|---|---|---|---|---|---|---|---|
| Factory setting | 1:2 | 15 | 0 | 5 | 0.2 | 5 | 30 |
| Hospital-specific setting | | | | | | | |

The hospital-specific defaults for your hospital can be entered in the table.

To restore the factory-set defaults:

- Select the »**Basic settings**« screen field = turn the rotary knob.
  Confirm = press the rotary knob.

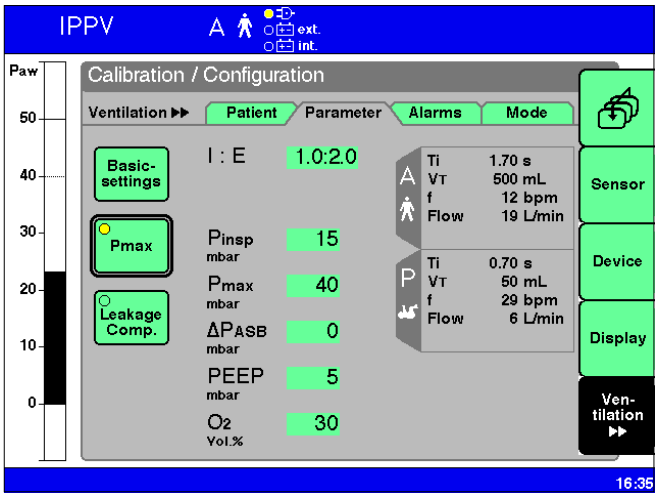
**Activating/deactivating pressure limit Pmax**

– This parameter defines the pressure limit for pressure-limited ventilation in the IPPV, SIMV and MMV ventilation modes.

- Press the »**Calib./Config.**« menu key.
- Press the »**Ventilation ▶▶**« menu key.
- Enter code number »**3032**«.
- With the »**Ventilation ▶▶**« menu key, select the »**Parameter**« menu.

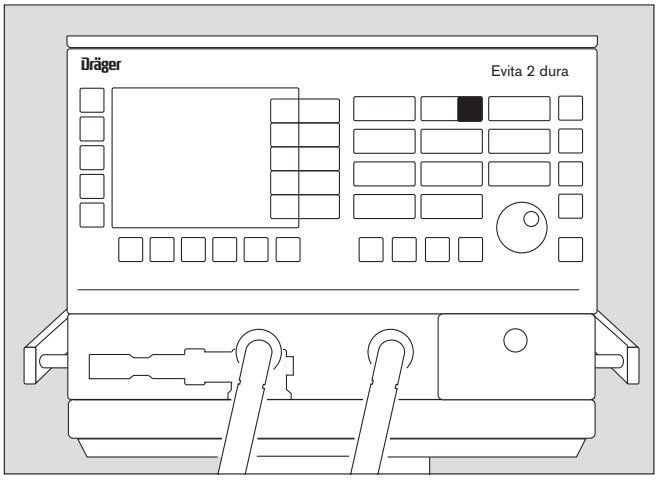
Display (example):

- Select the »**Pmax**« screen key = turn the rotary knob. The "LED" in the screen key »**Pmax**« lights up yellow. Pmax is activated.
- Deactivate Pmax = press rotary knob, the "LED" in the screen key »**Pmax**« lights up green.




Set the value for Pmax:

- Press the »**Pinsp**« parameter key.
- Set the desired value = turn the rotary knob. Confirm = press the rotary knob.



### Apnoea ventilation on/off

To determine whether apnoea ventilation is automatically ready for use when starting.

- Press menu button »**Calib./Config.**«.
- Press menu button »**Ventilation ▶▶**«.
- Enter code number »**3032**«.
- Select the menu »**Mode**« via the menu button »**Ventilation ▶▶**«.
- Select screen key »**Apnoea vent.**« = turn rotary knob.
- Switch on apnoea ventilation = press rotary knob, the "LED" in the screen key »**Apnoea vent.**« lights up yellow.
- Switch off apnoea ventilation = press rotary knob, the "LED" in the screen key »**Apnoea vent.**« lights up green.

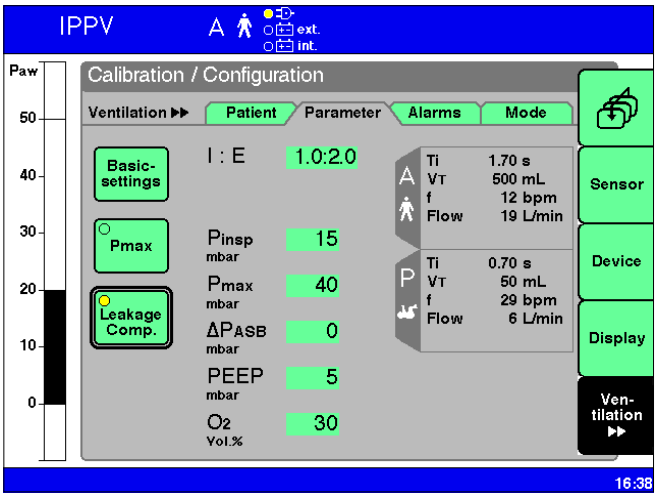
### Leakage compensation* on/off

Automatic leakage compensation allows the unit to compensate leakages up to 100 % of the set tidal volume in all volume-controlled ventilation modes.

The setting for »**Leakage compensation on/off**« is saved and remains effective when the unit is restarted.

- Press menu button »**Calib./Config.**«,
- Press menu button »**Ventilation ▶▶**«.
- Enter the numerical code »**3032**«.
- Select the menu »**Parameter**« via the menu button »**Ventilation ▶▶**«.

Display:




- Select screen key »**Leakage comp.**«,
- Switch on »**Leakage comp.**« = press rotary knob, the "LED" in the screen key »**Leakage comp.**« lights up yellow.
- Switch off »**Leakage comp.**« = press rotary knob, the "LED" in the screen key »**Leakage comp.**« lights up green.

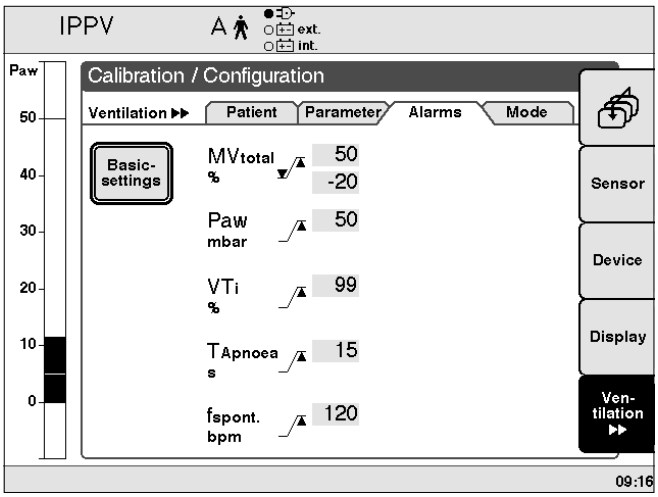
---

* For a detailed description of leakage compensation, refer to page 124 in the Annex.

**Set initial values for alarm limits**

- Press the »**Calib./Config.**« menu key.
- Press the »**Ventilation ▶▶**« menu key.
- Enter code number »**3032**«.
- With the »**Ventilation ▶▶**« menu key, select the »**Alarms**« menu.

Display (example):




- Select the screen field of the desired alarm limit = turn the rotary knob.
  Confirm = press the rotary knob.
- Change the value = turn the rotary knob.
  Confirm = press the rotary knob.

Default alarm limits

| Alarm limit | Factory-set defaults | Hospital-set defaults |
|---|---|---|
| $MV_{total}$ low [L/min] | ($V_T$ x f) –20 % | |
| $MV_{total}$ high [L/min] | ($V_T$ x f) +50 % | |
| Paw high [mbar] | 50 | |
| $V_{Ti}$ high [L] | $V_{Ti}$ +100 % | |
| $T_{Apnoea}$ high [s] | 15 | |
| $f_{spont.}$ high [1/min] | 50 | |

The selected hospital-specific defaults can be entered in the table.

The lower alarm limit does not have to be set for the airway pressure Paw, because it is automatically coupled with the PEEP setting.

The alarm limits do not have to be set for the $O_2$ concentration because they are automatically coupled with the $O_2$ concentration setting.

Lower alarm limits:
for settings up to 60 Vol.% $O_2$: set value –4 Vol.% $O_2$
for settings from 60 to 100 Vol.% $O_2$: set value –6 Vol.% $O_2$

Upper alarm limits:
for settings up to 60 Vol.% $O_2$: set value +4 Vol.% $O_2$
for settings from 60 to 100 Vol.% $O_2$: set value +6 Vol.% $O_2$

To restore the factory-set defaults:

- Select the »**Basic settings**« screen field = turn the rotary knob.
  Confirm = press the rotary knob.

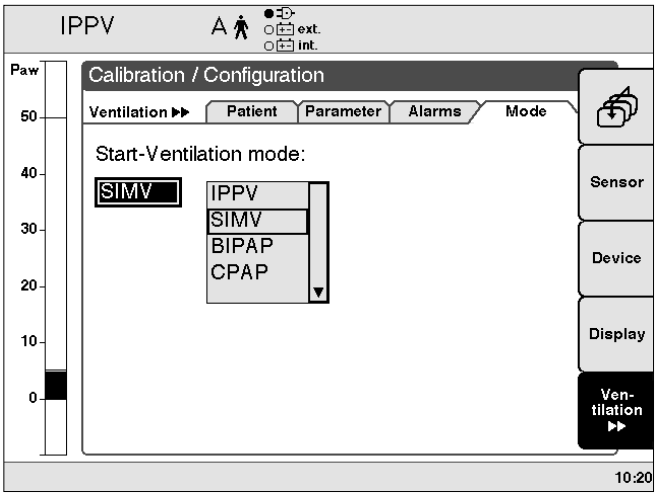
**Default ventilation mode**

After switching on, Evita 2 dura starts up in the ventilation mode displayed when this screen key is selected.
The factory-set default is IPPV.

If you require a different start-up ventilation mode:

- Press the »**Calib./Config.**« menu key.
- Press the »**Ventilation ▶▶**« menu key.
- Enter code number »**3032**«.
- With the »**Ventilation ▶▶**« menu key, select the »**Mode**« menu.

Display example: SIMV




- Select the screen field for the ventilation mode = turn the rotary knob.
  Confirm = press the rotary knob.
  The list of all available ventilation modes to choose from is then displayed on the righthand side of the screen.
- Select other ventilation mode = turn rotary knob, confirm = press rotary knob.

# Fault – Cause – Remedy

**Fault – Cause – Remedy** . . . . . 84

# Fault – Cause – Remedy

Alarm messages in the alarm display field are displayed in hierarchical order.

If, for example, two faults are detected at the same time, the more critical of the two is displayed.

The priority for alarm messages is marked by exclamation marks:

Warning = Message with top priority !!!

Caution = Message with medium priority !!

Advisory = Message with low priority !

In the table below, the messages are listed in alphabetical order. The table should help you identify the cause of any alarm, and to ensure rapid remedy of the problem.

| Message | | Cause | Remedy |
|---|---|---|---|
| !!! | **Air supply down** | Air supply pressure too low. | Make sure pressure is greater than 3 bar. |
| ! | **Air supply down** | Air supply pressure too low.<br>Air supply pressure not required when $FiO_2$ = 100 Vol.%. | Make sure pressure is greater than 3 bar. |
| !! | **Air supply pressure high** | Air supply pressure too high. | Ensure pressure is less than 6 bar. |
| ! | **Air supply pressure high** | Air supply pressure too high.<br>Air supply is not needed for $FiO_2$ = 100 Vol.%. | Ensure pressure is less than 6 bar. |
| !!! | **Airway pressure high** | The upper alarm limit for the airway pressure has been exceeded.<br>The patient is "fighting" the ventilator, cough. | Check patient condition, check ventilation pattern, correct alarm limit if necessary. |
| | | Ventilation hose buckled. | Check hose system and tube. |
| !!! | **Airway pressure low** | Leaking cuff. | Inflate cuff and perform leak test. |
| | | Leak or disconnection. | Check hose system for tight connections. Check that the expiration valve is properly engaged. |
| !!! | **Apnoea** | Patient's spontaneous breathing has stopped. | Apply controlled ventilation. |
| | | Stenosis | Check condition of patient. Check tube. |
| | | Flow sensor not calibrated or faulty. | Calibrate flow sensor. Replace if necessary. |
| ! | **Apnoea alarm off** | Flow monitoring deactivated. | Reactivate flow monitoring, page 69, or ensure adequate external monitoring immediately. |
| | | In NIV mode:<br>Apnoea monitoring has been deactivated. | Re-set the upper alarm limit for apnoea monitoring to the required value.<br>Note Instructions for Use of NIV mode. |

| Message | | Cause | Remedy |
|---|---|---|---|
| !! | **Apnoea ventilation** | Due to detected apnoea, the system has switched over automatically to mandatory ventilation. | Check ventilation procedure.<br>Return to the original ventilation procedure with »**Alarm Reset**«.<br>Check condition of patient. Check tube. |
| ! | **ASB > 1.5 s** | Only appears in paediatric mode.<br>The ASB cycle has been switched off 3 times due to time limitation. | Test ventilation system for leaks. |
| !!! | **ASB > 4 s** | Only appears in adult mode.<br>The ASB cycle has been switched off 3 times due to time limitation. | Test ventilation system for leaks. |
| !! | **Check settings** | Power interruption while setting a ventilation pattern or the alarm limits. | Check pattern of ventilation and alarm limits. Confirm message with key »**Alarm Reset**«. |
| !!! | **Device failure** | Device faulty. | Call DrägerService. |
| ! | **Evita Remote ?** | The Remote Pad has not been identified correctly. | Remove Remote Pad.<br>Confirm message with key »**Alarm Reset**«.<br>Call DrägerService at the next opportunity. |
| ! | **Evita Remote inop.** | Key pressed on Remote Pad during self-test. | Confirm message with key »**Alarm Reset**«.<br>Remove Remote Pad and reconnect.<br>Ensure that no key is pressed on the Remote Pad. |
| | | Remote Pad faulty. | Confirm message with key »**Alarm Reset**«.<br>Remove Remote Pad. Call DrägerService at the next opportunity. |
| !! | **Execute device check** | Device check not performed. | Perform device check, page 31.<br>Confirm message with »**Alarm Reset**« key. |
| ! | **Exp. hold interrupted** | The »**Exp. hold**« key has been pressed for more than 15 seconds. | Release the »**Exp. hold**« key. |
| !!! | **Exp. valve inop.** | Expiration valve not properly connected to socket. | Push expiration valve firmly into socket until it clicks into place. |
| | | Flow sensor not calibrated or defective. | Calibrate flow sensor, page 67, replace if necessary. |
| | | Expiration valve faulty. | Replace expiration valve. |
| ! | **External Flow** | Evita 2 dura calculates the externally supplied flow when monitoring correct functioning of the flow measurement. | Deactivate calculation of the external flow, see page 68. |
| !!! | **Fan failure** | Fan failure. | Call DrägerService. |
| !!! | **FiO2 high** | O2 sensor not calibrated. | Calibrate O2 sensor, page 66. |
| | | Faulty mixer function. | Call DrägerService. |
| !!! | **FiO2 low** | O2 sensor not calibrated. | Calibrate O2 sensor, page 66. |
| | | Faulty mixer function. | Call DrägerService. |
| !!! | **Flow measurement inop.** | Water in flow sensor. | Dry flow sensor. |
| | | Flow sensor faulty. | Calibrate flow sensor, page 67, replace if necessary. |
| | | Flow measurement malfunction. | Call DrägerService. |

| Message | | Cause | Remedy |
|---|---|---|---|
| ! | **Flow monitoring off** | Flow monitoring is switched off. | Switch on flow monitoring again, as described on page 69, or immediately ensure an adequate external monitor function. |
| !!! | **Flow sensor ?** | Flow sensor not fully inserted in rubber lip of expiration valve. | Insert flow sensor correctly. |
| !! | **Hard key xx failed** | Key xx (e.g. »🔔« ) can no longer be pressed. | Call DrägerService. |
| !!! | **High frequency** | Patient is breathing at a high spontaneous frequency | Check condition of patient, check pattern of ventilation, correct alarm limit if necessary. |
| ! | **Insp. hold interrupted** | The »**Insp. hold**« key was held down longer than 15 seconds. | Release »**Insp. hold**« key. |
| !!! | **Insp/Exp cycle failure** | The device does not deliver any gas. | Check the $P_{max}$/PEEP setting.<br>Set an IPPV frequency of at least 4/min.<br>Increase $T_{Apnoea}$ alarm time. |
| | | Device faulty. | Call DrägerService. |
| !! | **Key xx overused ?** | Key has been pressed several times in a short period (e.g. »🔔«). | Confirm message with key »**Alarm Reset**« Contact DrägerService if this message reoccurs frequently. |
| !! | **Key overused ?** | Due to very frequent key use, the screen contents of the display are repeatedly redrawn. | Confirm message with key »**Alarm Reset**«. |
| | | Brief communication failure between the display processor and main processor. | Confirm message with key »**Alarm Reset**«. Contact DrägerService if this message reoccurs frequently. |
| ! | **Leakage** | The measured leakage minute volume $MV_{leak}$ is 20 % higher than the minute volume measured on the expiration side. | Check that the hose connection is leakproof. Check that the tube is correctly fitted. |
| !!! | **Loss of data** | Lithium battery discharged. | Call DrägerService. |
| ! | **Malfunction fan** | Temperature in machine too high. | Check fan function, clean cooling-air filter or call DrägerService. |
| ! | **MEDIBUS COM. inop.** | The connector of the MEDIBUS cable was unplugged during operation. | Plug the connector in again and secure it against disconnection with the two screws. |
| | | MEDIBUS cable defective. | Use a new MEDIBUS cable. |
| | | Interface defective. | Call DrägerService. |
| !!! | **Mixer inop.** | Mixer malfunction. $FiO_2$ can deviate considerably. | **Immediately ventilate with separate manual ventilation device!**<br>Call DrägerService. |
| ! | **Multi functional board inop.** | The multi-functional board for operating the nurse call or Remote Pad is faulty. | Confirm message with key »**Alarm Reset**«. Call DrägerService at the next opportunity.<br>The original ventilation functions of Evita 2 dura are not affected. Correct functioning of the nurse call or Remote Pad is not guaranteed, however: remove the nurse call and/or Remote Pad. |

| Message | | Cause | Remedy |
|---|---|---|---|
| !! | **Multi functional board inop.** | The multi-functional board for operating the nurse call or Remote Pad is faulty. | Confirm message with key »**Alarm Reset**«. Call DrägerService at the next opportunity.<br>The original ventilation functions of Evita 2 dura are not affected. Correct functioning of the nurse call or Remote Pad is not guaranteed, however: remove the nurse call and/or Remote Pad. |
| !!! | **MV high** | The minute volume has exceeded the upper alarm limit. | Check condition of patient,check pattern of ventilation, correct alarm limit if necessary. |
| | | Flow sensor not calibrated or faulty. | Calibrate flow sensor, page 67, replace if necessary. |
| | | Water in flow sensor. | Drain water trap in hose system.<br>Dry flow sensor. |
| | | Machine malfunction. | Call DrägerService. |
| !!! | **MV low** | The minute volume has fallen below the lower alarm limit. | Check condition of patient, check pattern of ventilation, correct alarm limit if necessary. |
| | | Stenosis. | Check condition of patient. Check tube. |
| | | Leak in breathing system. | Establish leakproof breathing system. |
| | | Flow sensor not calibrated or faulty. | Calibrate flow sensor, page 67, replace if necessary. |
| | | Machine malfunction. | Call DrägerService. |
| !! | **Nebulisation interrupted** | Only in paediatric mode.<br>Nebulisation is only possible in pressure-controlled ventilation or with AutoFlow®. | Select the patient mode.<br>Restart nebulisation.<br>Acknowledge the alarm with »**Alarm Reset**». |
| | | Only in paediatric mode, only for ventilation with AutoFlow. Flow sensor not ready for measurement. | Switch on flow monitoring or calibrate flow sensor, page 51, or replace flow sensor or change mode. Restart nebulisation.<br>Acknowledge the alarm with »**Alarm Reset**». |
| ! | **Nebulizer on** | The medicament nebuliser is switched on, page 60. | Switch off the medicament nebuliser if necessary, page 60. |
| !!! | **$O_2$ measurement inop.** | $O_2$ sensor provides invalid measured values. | Calibrate $O_2$ sensor, page 66, replace if necessary. |
| | | $O_2$ measurement malfunction. | Call DrägerService. |
| ! | **$O_2$ monitoring off** | $O_2$ monitoring switched off. | Switch on $O_2$ monitoring again, as described on page 66, or immediately ensure an adequate monitor function. |
| !!! | **$O_2$ supply down** | $O_2$ supply pressure too low. | Make sure pressure is greater than 3 bar. |
| ! | **$O_2$ supply down** | $O_2$ supply pressure too low.<br>$O_2$ supply pressure is not required when $FiO_2$ = 21 Vol.%. | Make sure pressure is greater than 3 bar. |
| !! | **$O_2$ supply pressure high** | $O_2$ supply pressure too high. | Make sure pressure is less than 6 bar. |

| Message | | Cause | Remedy |
|---|---|---|---|
| ! | **$O_2$ supply pressure high** | $O_2$ supply pressure too high.<br>$O_2$ supply pressure is not required when $FiO_2$ = 21 Vol.%. | Make sure pressure is less than 6 bar. |
| !!! | **PEEP high** | Expiratory system obstructed. | Check hose system and expiration valve. |
| | | Expiratory resistance is increasing. | Check bacterial filter. Replace if necessary. |
| | | Machine faulty. | Call DrägerService. |
| !!! | **PEEP valve inop.** | Internal PEEP valve faulty. | Call DrägerService. |
| ! | **Pressure limited** | $P_{max}$ pressure limit is active. | Check condition of patient, check pattern of ventilation, correct setting if necessary. |
| !!! | **Pressure meas. inop.** | Fluid in expiration valve. | Replace expiration valve, page 92, then clean and dry. |
| | | Pressure measurement malfunction. | Call DrägerService. |
| !!! | **Standby activated** | Evita 2 dura has been switched to standby. | Confirm standby with »**Alarm Reset**« key. |
| !!! | **Temperature high** | Breathing gas temperature higher than 40 °C. | Switch off humidifier. |
| !!! | **Temperature meas. inop.** | Temperature sensor faulty. | Fit new temperature sensor, see page 22. |
| !!! | **Temperature sensor ?** | Temperature sensor probe has been disconnected during operation. | Reconnect probe. |
| | | Sensor cable broken. | Fit new temperature sensor. |
| !!! | **Tidal volume high** | The upper alarm limit of the applied inspiratory tidal volume $V_T$ has been exceeded during three consecutive ventilation strokes. | Check condition of patient,check pattern of ventilation, correct alarm limit if necessary. |
| | | Leak or disconnection. | Check that hose system connections are leakproof. |
| ! | **Tidal volume high** | The inspiratory tidal volume $V_T$ has exceeded the upper alarm limit. | Check condition of patient,check pattern of ventilation, correct alarm limit if necessary. |
| | | Leak or disconnection. | Check that hose system connections are leakproof. |
| !!! | **Tube blokked** | Evita 2 dura only applies a very small volume with each mechanical stroke, e.g. because the tube is blocked. | Check condition of patient, check tube. |
| | | Patient "fights" against the mechanical strokes in pressure-controlled ventilation, so that the set inspiratory pressure volume is achieved with only a very small volume. | Check condition of patient, check machine settings. |
| !! | **Volume not constant** | Due to pressure limit or time limit, the set tidal volume $V_T$ has not been applied. | Prolong inspiratory time »$T_{insp}$«<br>Increase inspiratory flow »Flow«<br>Increase pressure limit »$P_{max}$«.<br>Press the »**Alarm Reset**« key to suppress the visual and acoustic alarm until the cause of the alarm is remedied. |
| !!! | **$CO_2$ measurement inop** | $CO_2$ sensor faulty. | Replace defective $CO_2$ sensor. |
| | | $CO_2$ electronics in unit faulty. | Call Dräger Service. |

# Care

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# Care

- Note the hospital hygiene regulations!

The ventilator must be cleaned and prepared after every patient.

**To avoid all risk of infection by hospital staff and other patients, the ventilator must be disinfected and cleaned before it is used on the next patient (Use protective clothing, eye protection, etc.).**

## Removing parts

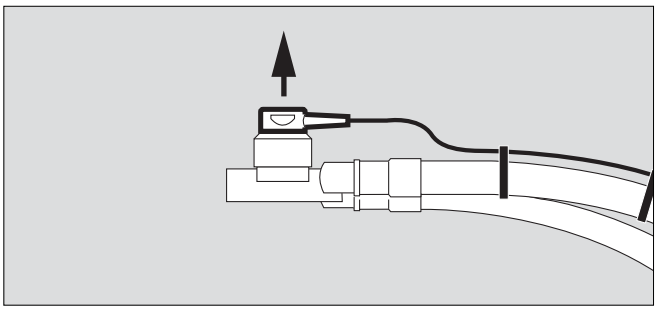
- Switch off the ventilator and humidifier, and remove their power plugs.
- Drain the water traps and ventilation hoses.
- Drain the water container of the humidifier.

### Humidifier

- Dismantle in accordance with the specific Instructions for Use and prepare for disinfecting/sterilising.

### Temperature sensor (option)

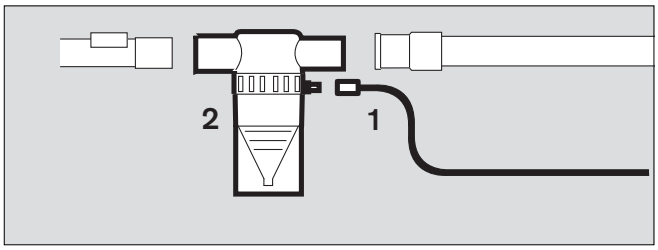
- Remove the temperature sensor from the Y-piece – do not tug on cable. Remove the sensor probe from the back panel of Evita 2 dura.
- The temperature sensor is designed for wipe-disinfection. **The temperature sensor must not be placed in a cleaning and disinfection machine or disinfectant bath.**



**Medicament nebuliser (option)**

**1** Disconnect nebuliser hose from medicament nebulizer and from the port on the unit.

**2** Disconnect the medicament nebuliser from the adult hose system
or

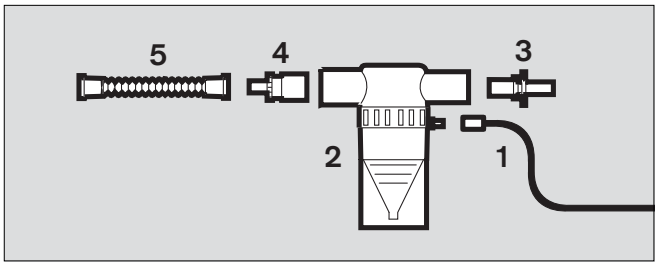



**2** from the paediatric hose system.

**3** Remove catheter connector (ISO cone Ø 15 / Ø 11) from the inlet.

**4** Remove the adapter (ISO cone Ø 22 / Ø 11) from the outlet.

**5** Remove the corrugated hose from the adapter.




- Dismantle the medicament nebuliser in accordance with its Instructions for Use.
- Prepare the individual parts of the medicament nebuliser and the adapter parts for cleaning and disinfection in a cleaning and disinfection machine.

**Ventilation hoses**

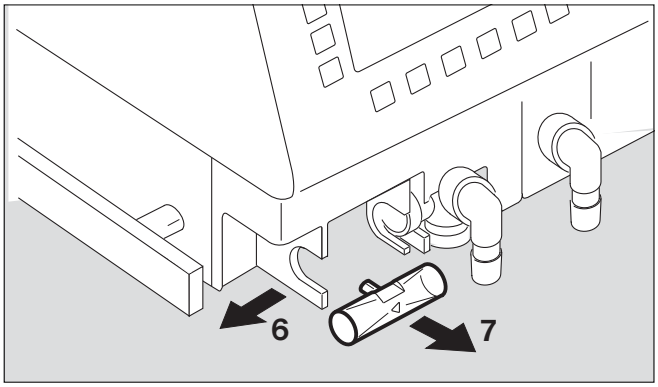
- Remove ventilation hoses from the device ports.
- Remove the water traps from the ventilation hoses. Remove the water containers from the water traps.
- Prepare the ventilation hoses, water traps and their collecting jars and the Y-piece for cleaning and disinfection in a cleaning and disinfection machine.

**Flow-Sensor**

**6** Push the flow sensor to the left as far as it will go and

**7** pull out.

**The flow sensor cannot be disinfected/cleaned in a machine, nor can it be sterilised by the hot steam method.**
See page 95 for cleaning instructions of the flow sensor.



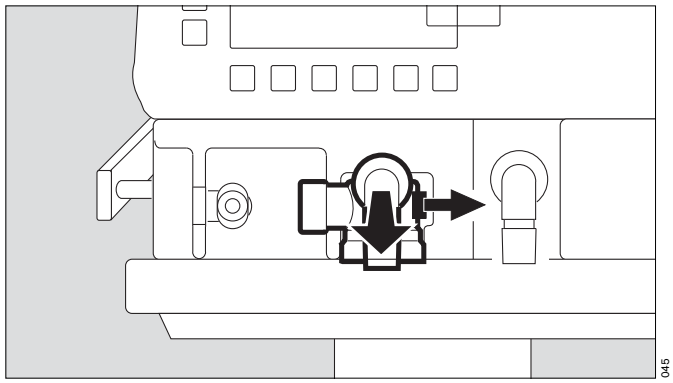

- Disinfect flow sensor for about 1 hour in 70 % ethanol solution.

**Expose the sensor to air for at least 30 minutes to allow the alcohol to evaporate.**
**Otherwise the sensor could be damaged beyond control by ignition of any residual alcohol during calibration.**

- The flow sensor may be re-used as long as calibration can be carried out successfully.

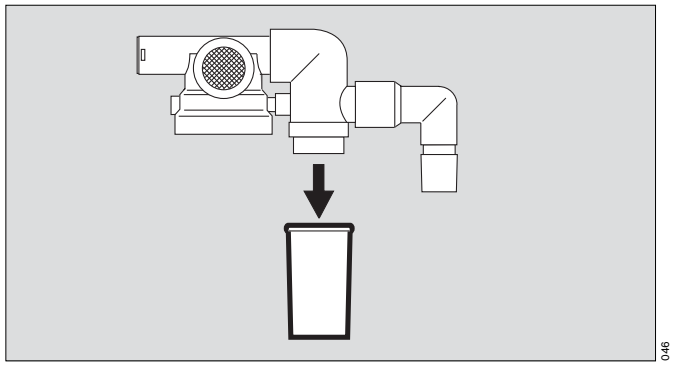
**Expiration valve**

- Push the catch to the right, pulling off the expiration valve at the same time.



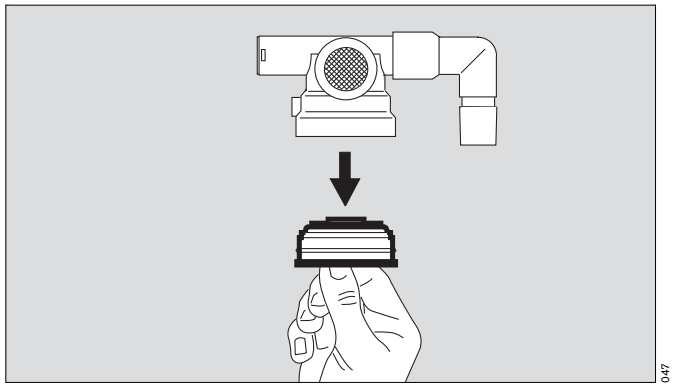

If the expiration valve has an optional water trap:

- Remove the collecting jar.




Only strip down the expiration valve if badly soiled:

- Unscrew stopper by hand and remove together with the diaphragm.
- Do not disassemble the expiration valve any further.
- Prepare the expiration valve for cleaning and disinfection in a cleaning and disinfection machine,
  then
- for sterilisation by the hot steam method.



## Disinfecting/Cleaning

Use surface disinfectants. For surface compatibility, use disinfectants based on:

— aldehydes,
— quaternary ammonium compounds.

To avoid the possibility of damage to material, do not use any disinfectants based on:

— alkylamine-based compounds
— phenol-based compounds,
— halogen-releasing compounds,
— strong organic acids,
— oxygen-releasing compounds.

For users in the Federal Republic of Germany, we recommend that only disinfectants on the current DGHM list are used (DGHM: German Society for Hygiene and Microbiology). The DGHM list (published by mhp-Verlag, Wiesbaden) also classifies each disinfectant by its active agents.
For countries where the DGHM list is not available, we recommend the types of disinfectant given above.

Disinfectants often contain – besides their main active agents – additives that can also damage materials.

If in doubt, ask the supplier/manufacturer of the disinfectant/ cleaning agent.

**Parts must not be sterilised in ethylene oxide – health hazard!**

**To avoid all risk of infection by hospital staff and other patients, the ventilator must be disinfected and cleaned before it is used on the next patient (Use protective clothing, eye protection, etc.).**

**Ventilator without ventilation hoses, gas supply hoses, temperature sensor**

Wipe disinfect

- e.g. with Buraton 10 F or Terralin (Schülke & Mayr, Norderstedt, Germany). Comply with the manufacturer's instructions.

**Cooling air filter, room air filter**

- Filters must be cleaned or replaced when soiled or at the latest after 4 weeks, see page 98.

**Ventilation hoses, water traps and their collectors, Y-piece, expiratory valve (or in the event of severe soiling, its individual components)**

- Disinfect in a moisture saturated environment at 93 °C (200 °F) for 10 minutes using a cleaning and disinfecting machine. **Use detergent only**.
- After disinfecting with moist heat, we recommend that the expiratory valve or its disassembled components be autoclaved **at 134 °C** (273 °F) to remove any remaining liquid in the pressure measuring canal in the block.

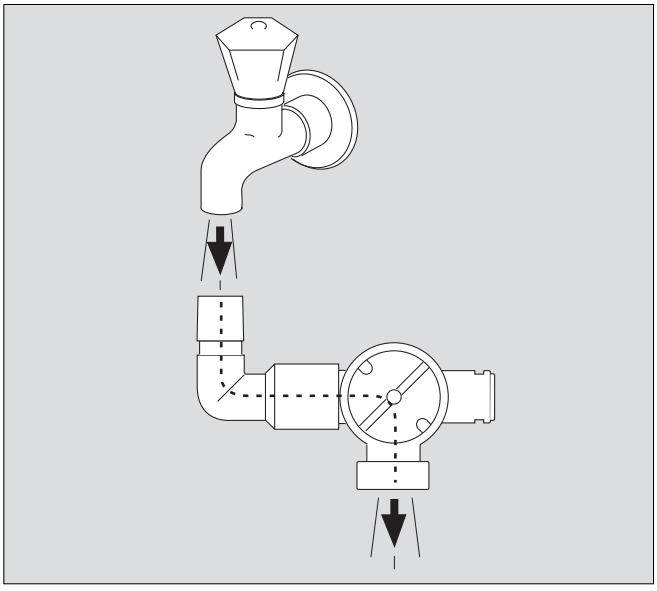
Alternatively:

If a cleaning and disinfection machine is not available:

- Bath disinfect, e.g. with Sekusept from Henkel. Comply with the manufacturer's instructions.
- Then rinse with clean water, preferably from a soft water supply. Shake water out thoroughly, and leave the products to dry.

**Expiration valve and its individual parts after disinfection**

- Rinse thoroughly with clear water, preferably from a soft water supply. Shake water out thoroughly.
- After rinsing thoroughly, dry expiration valve.
- After drying, sterilise in hot steam at 134 °C, otherwise liquid may remain in the pressure measuring line and impair correct functioning.




**Ventilation hoses, water traps and their collectors, Y-piece, expiratory valve, temperature sensor**

- Can be autoclaved at 134 °C (273 °F).

**Humidifier**

- Prepare in accordance with separate Instructions for Use.

## Care list for Evita 2 dura Intensive Care Ventilator

Applicable for use with non-infectious patients.

**For infectious patients, all parts that conduct breathing gas must be additionally sterilised after disinfecting and cleaning.**

The parts in contact with breathing gas and listed below can be sterilised in hot steam at 134 °C. Refer to the column "Sterilising".

**The below/above table contains the manufacturers recommended guidelines. Please note that these are merely guidelines and are not intended to take precedence over the hospitals hygene/infection control protocols!!**

| **Part** | **How often** | **How** | | | |
|---|---|---|---|---|---|
| | | **Disinfecting and cleaning** | | | **Sterilising** |
| Reusable components | Recommended cleaning intervals | Cleaning and disinfection machine, 93 °C 10 minutes | Wiping | Bath immersion | Steam 134 °C 10 minutes |
| Evita 2 dura basic device | per patient | no | outside | no | no |
| Trolley<br>Hinged arm<br>Medical gas hoses | per patient | no | outside | no | no |
| Ventilation hoses,<br>Y-piece,<br>Water traps,<br>Collecting jars | per patient/ weekly | yes | no | possible | yes |
| Expiration valve | per patient/ weekly* | yes** | no | possible** | yes |
| Temperature sensor | per patient/ weekly* | no | yes | no | yes |
| Flow sensor | daily | no*** | outside | possible*** | no |

* Nebulisation may lead to formation of more extensive deposits necessitating more frequent replacement.

** After disinfecting/cleaning: sterilise at 134 °C. Otherwise risk of malfunction due to residual liquid in pressure measuring line.

*** Special treatment, see page 91.

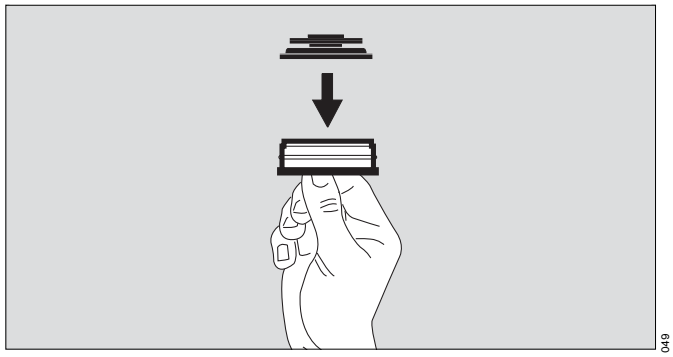
## Assembling

**Mounting the expiration valve**

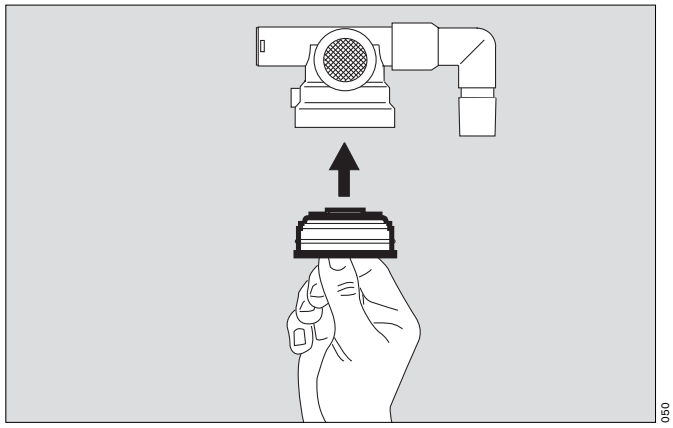
The parts must be entirely dry to prevent malfunctioning.

Be careful to fit the diaphragm in the correct position.

- Hold stopper by the flange and place diaphragm on the collar of the stopper.

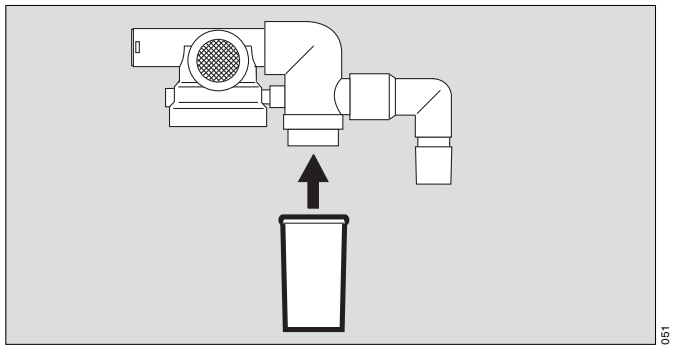



- Insert stopper with diaphragm on top into the housing from below and screw in tightly.




If the expiration valve has an additional water trap:

- Fit collecting jar.




**Medication nebuliser**

- Assemble in accordance with separate Instructions for Use.
- Installation, see page 61.

**Breathing gas humidifier**

- Assemble in accordance with separate Instructions for Use.

## Before re-using on patient

- Assemble machine as described under "Preparing for use" on page 18 onwards.
- Carry out checks to ensure readiness for operation, see "Device Check" on page 30 onwards.

## Maintenance Intervals

**Clean and disinfect equipment and/or components before any maintenance procedures and/or before returning for repair!**

Note the maintenance intervals specified in the respective Instructions for Use of the options installed!

| | |
|---|---|
| $O_2$ sensor capsule | Replace when the following message is displayed:<br>»**$O_2$ measurement inop**«<br>and when calibration is no longer possible.<br>Spent $O_2$ sensors can be returned to Dräger for disposal. |
| Ambient-air filter | Clean or replace after 4 weeks, see page 98. |
| Cooling-air filter | Replace after 1 year.<br>Dispose of with normal domestic waste. |
| Filters in the compressed gas inlets | To be replaced by trained service personnel every 2 years. |
| Lithium battery for data protection | To be replaced by trained service personnel every 2 years.<br>Disposal: see page 99. |
| Real-time clock | To be replaced by trained service personnel every 6 years.<br>Disposal: page 99. |
| Pressure reducer | To be replaced every 6 years by DrägerService. |
| Equipment inspection and service | Every 6 months by trained service personnel. |

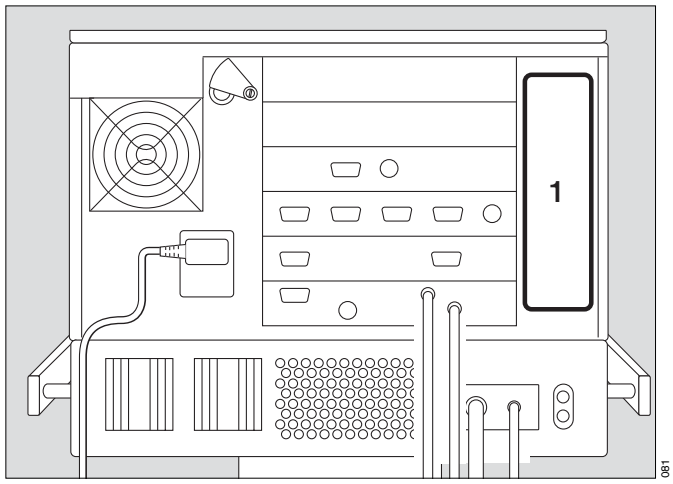
**Clean or replace cooling air filter**

– Filter must be cleaned or replaced when soiled or at the latest after 4 weeks.
  Replace after 1 year at the latest.

**1** Remove cooling-air filter from its slot on the back of machine.

- Replace or clean in warm water with added detergent; dry well.
- Insert cooling-air filter in slot, taking care not to crease it.
- Dispose of used cooling-air filter with domestic waste.

Note the Instructions for Use of the option when using the (optional) DC power supply MB.

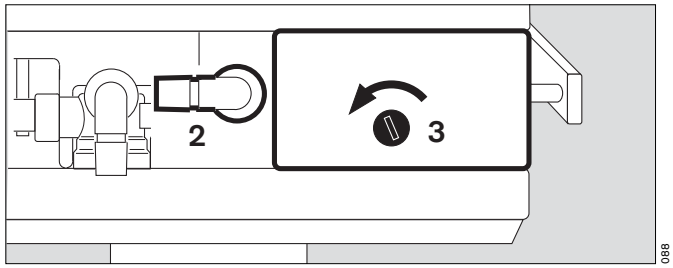



**Removing and reinserting ambient-air filter**

– Filter must be cleaned or replaced when soiled or at the latest after 4 weeks.
  Replace filter every year.

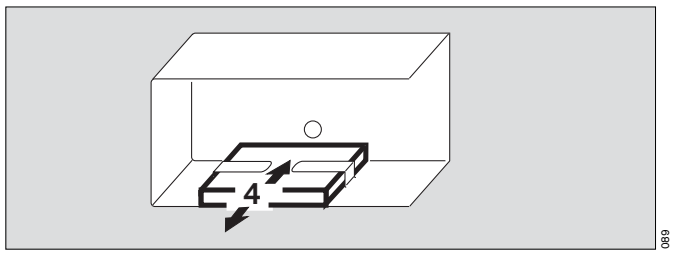
**2** Swivel port to the left.

**3** Unscrew the screw (e.g. with a coin), and remove the protective cover.




**4** Remove the ambient-air filter from the protective cover.

- Push the new/cleaned ambient-air filter under the lugs.
- Replace protective cover, and tighten screw with a coin.
- Dispose of used ambient-air filter with domestic waste.



**Correct disposal of batteries and $O_2$ sensors**

Batteries and $O_2$ sensors:

- Do not incinerate or throw in fire; risk of explosion!
- Do not open using force; risk of corrosion!
- Do not re-charge batteries.

Batteries must be disposed of as special waste:

- Information may be obtained from the local environmental and public health authorities or from approved waste disposal companies.

$O_2$ sensors can be returned to Dräger.

**Correct disposal of apparatus**

– at the end of its useful life

- After contacting the competent waste disposal company, hand over Evita 2 dura for appropriate disposal. The applicable legal regulations must be observed.

# What's what

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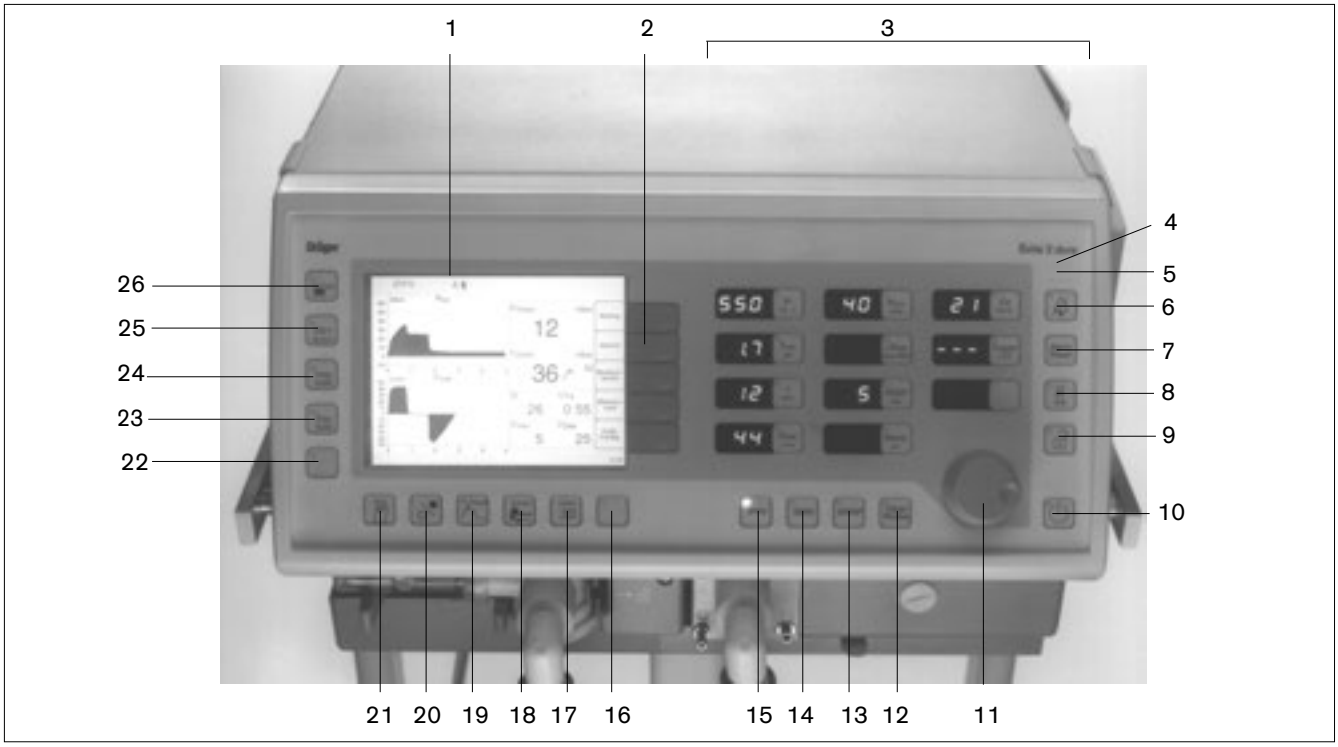
# What's what

## Control unit




**1** Screen for displaying application-specific screen pages.

**2** Menu keys for displaying the application-specific screen pages.

**3** Parameter keys with displays indicating their settings – for setting the ventilation parameters.

**4** Red LED to indicate warnings

**5** Yellow LED to indicate cautions and advisory messages

**6** »🔔« key for suppressing the audible alarm tone for 2 minutes.

**7** »**Alarm Reset**« key for acknowledging alarm messages

**8** » ℹ « key for calling up information and help on settings

**9** » 🔓 « key ("lock") for protecting the ventilation parameters and ventilation mode against unauthorised modification.

**10** »⏻« key ("standby") for changing between ventilation and standby

**11** Central "turn and press" rotary knob for selecting and confirming settings

**12** »**Other Modes**« key for using other ventilation modes programmed on-screen

**13** Key for the **BIPAP** ventilation mode

**14** Key for the **SIMV** ventilation mode

**15** Key for the **IPPV** ventilation mode

**16** Key for future functions

**17** »**Values** 1▭ 2▭« key for changing the displayed value set

**18** »**Curves** ◢◣« key for changing the displayed curve pair

**19** »**Freeze** ⌒« key for freezing curves

**20** » ☼/● « key for switching the screen brightness between bright/dark

**21** »**Print** 🖨 « key for manual printer logging

**22** Key for future functions

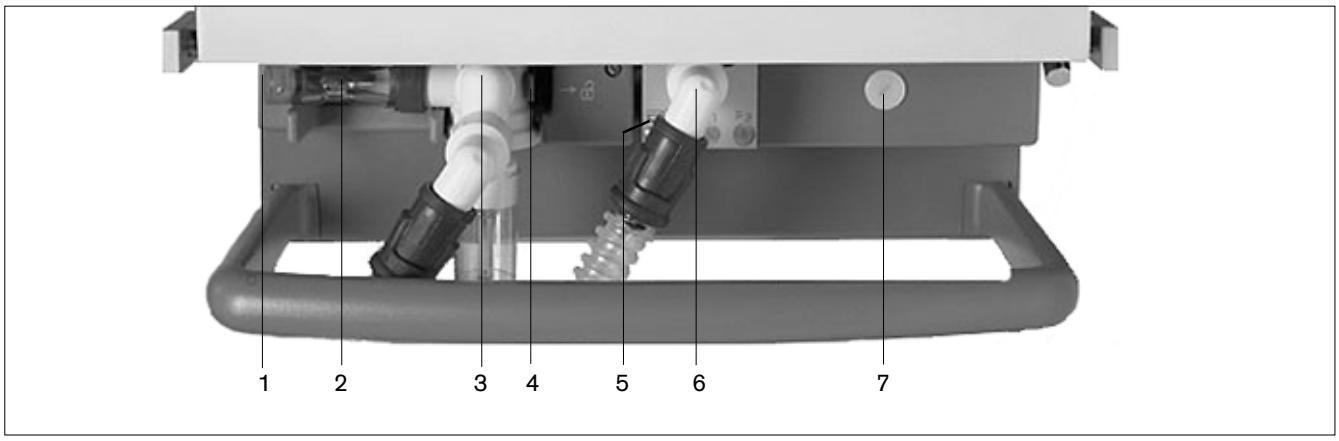
**23** »**Exp. hold**« key for manually extending the expiration phase

**24** »**Insp. hold**« key for manual inspiration

**25** »**O2 ↑ Suction**« key for bronchial suction

**26** »🌫« key for switching the pneumatic medicament nebuliser on/off

## Front connections




**1** Gas outlet (EXHAUST – NOT FOR SPIROMETERS)

**2** Flow sensor

**3** Expiration valve with expiration port (GAS RETURN)

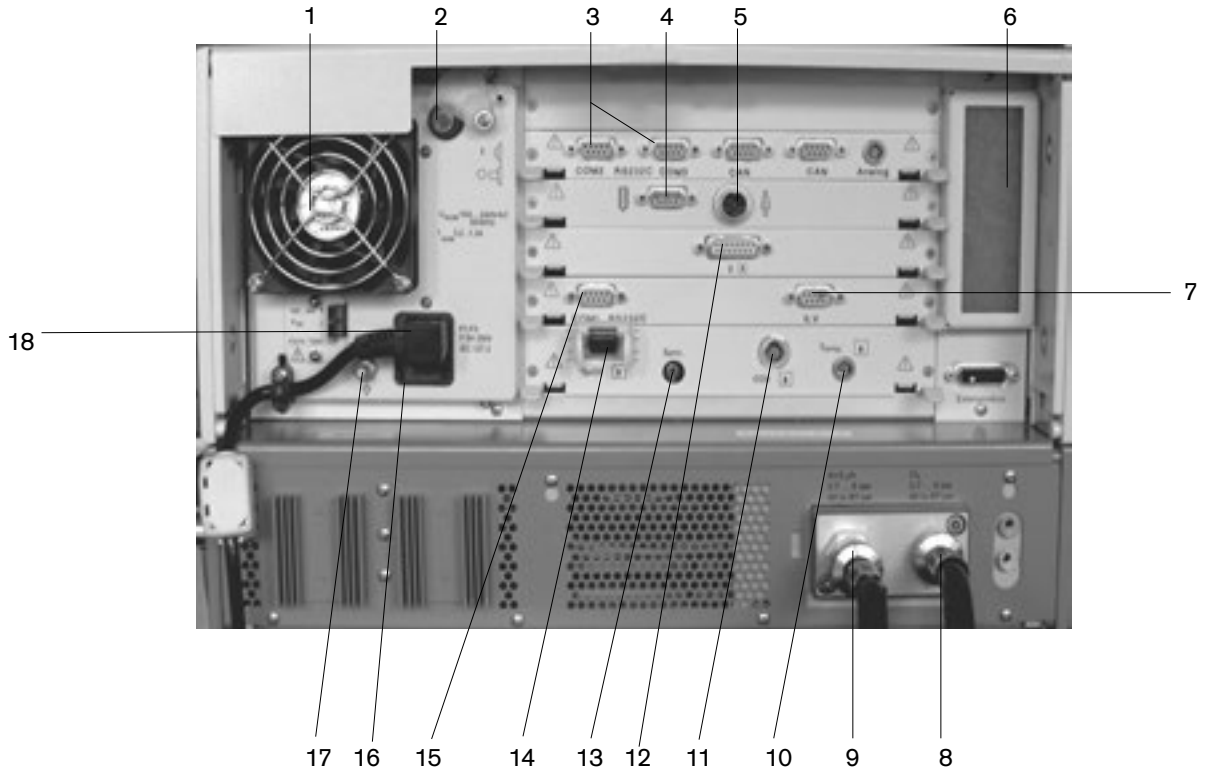
**4** Latch for expiration valve

**5** Nebuliser port

**6** Inspiratory port (GAS OUTPUT)

**7** Locking screw for protective cover
(behind it: $O_2$ sensor and ambient-air filter)

## Back panel




**1** Fan

**2** Power switch with protective flap

**3** »**COM2**«, »**COM3**« sockets for RS 232 and analogue interfaces (optional)

**4** Connection »« for Remote Pad, optional

**5** Connection »« for nurse call, optional

**6** Cooling-air filter

**7** ILV socket, optional

**8** Connection for oxygen

**9** Connection for medical air

**10** »**Temp.**« socket for temperature sensor

**11** »**$CO_2$**« socket for $CO_2$ sensor, optional

**12** Connection for neonate flow sensor (optional)

**13** »**Sync.**« socket for C-Lock-ECG synchronisation for optional $SpO_2$ measurement, optional

**14** »**$SpO_2$**« socket for functional $SpO_2$ measurement, optional

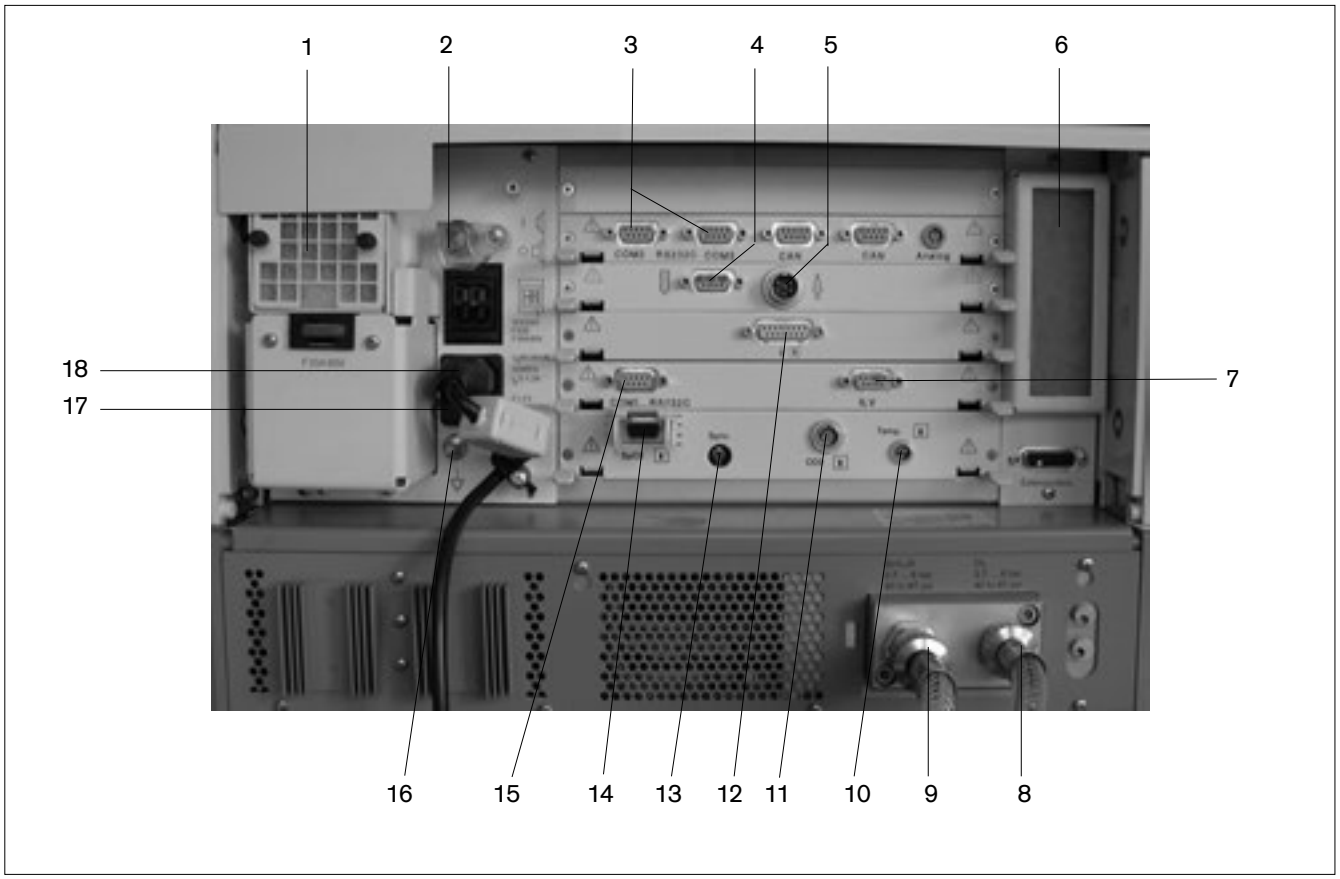
**15** »**COM1 RS232C**« socket for RS 232 interface, e.g. for printer

**16** Mains fuses

**17** Earth connection

**18** Connector for power cord

## Back panel, with DC power supply MB

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# Technical Data

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# Technical Data

## Environmental conditions

| | |
|---|---|
| In operation | |
| Temperature | 10 to 40 °C |
| Atmospheric pressure | 700 to 1060 hPa |
| Rel. humidity | 0 to 90 %, without condensation |
| | |
| In storage | |
| Temperature | –20 to 60 °C |
| Atmospheric pressure | 500 to 1060 hPa |
| Rel. humidity | 0 to 100 %, without condensation |

## Settings

| | |
|---|---|
| Ventilation modes | IPPV/IPPV$_{Assist}$,<br>SIMV, SIMV/ASB<br>MMV, MMV/ASB<br>BIPAP/ASB<br>BIPAP$_{Assist}$<br>CPAP/ASB |
| Ventilation frequency f | 0 to 100/min |
| Inspiration time $T_{insp}$ | 0.1 to 10 s |
| Inspiration time $V_T$ | |
| Paediatrics | 0.02 to 0.3 L, BTPS* |
| Accuracy | ±10 % of set value, or ±10 mL, whichever is greater. |
| Adults | 0.1 to 2.0 L, BTPS* |
| Accuracy | ±10 % of set value, or ±25 mL, whichever is greater. |
| Inspiratory Flow | |
| Paediatrics | 6 to 30 L/min |
| Adults | 6 to 120 L/min |
| Inspiratory pressure $P_{insp}$ | 0 to 80 mbar |
| Inspiratory pressure limit Pmax | 0 to 100 mbar |
| $O_2$ concentration | 21 to 100 Vol.% |
| Accuracy | ±5 % of set value, or ±2 Vol.%, whichever is greater. |
| Positive end-expiratory pressure PEEP or interm. PEEP | 0 to 35 mbar |
| Trigger sensitivity | 0.3 to 15 L/min |
| Pressure assist $P_{ASB}$ | 0 to 80 mbar |
| Rise time for pressure support (Ramp) | 0 to 2 s |
| I:E | 1:9.5 to 4:1 (can only be configured in default settings) |

* BTPS = Body Temperature, Pressure, Saturated.
Measured values with reference to the conditions of the patient lung: Body temperature 37 °C, steam-saturated gas, ambient pressure.

## Performance data

| | |
|---|---|
| Control principle | Time-cycled, volume-constant, pressure-controlled |
| Intermittent PEEP frequency | 2 cycles every 3 minutes |
| Medicament nebulisation | for 30 min |
| Bronchial suction | |
| Disconnection detection | automatic |
| Reconnection detection | automatic |
| Oxygen enrichment | max. 3 minutes |
| Active suction phase | max. 2 minutes |
| Final oxygen enrichment | 2 minutes |
| Valve response time $T_{0...90}$ | ≤5 ms |
| Supply system for spontaneous breathing and ASB | adaptive CPAP system with high initial flow |
| Max. flow rate | 2 L/s in 8 ms |
| Max. inspiratory flow | 180 L/min |
| Equipment compliance (with Aquapor humidifier and patient tubing system for adults) | ≤2 mL/mbar |
| Inspiration resistance | ≤2.3 mbar/L/s |
| Expiration resistance | ≤3.8 mbar/L/s |
| Equipment compliance (with Fisher & Paykel MR 730 humidifier and tubing system K for paediatric use) | ≤1 mL/mbar |
| Inspiration resistance | ≤4.1 mbar/L/s |
| Expiration resistance | ≤4.1 mbar/L/s |
| Additional functions | |
| Inspiratory relief valve | Opens if medical air supply fails (pressure <1.2 bar), enables spontaneous breathing with filtered ambient air |
| Safety valve | Opens the breathing system at 100 mbar. |

## Measured value displays

| | |
|---|---|
| Airway pressure measurement | |
| Max. airway pressure | $P_{peak}$ |
| Plateau pressure | $P_{plat}$ |
| Pos. end-exp. pressure | PEEP |
| Mean airway pressure | $P_{mean}$ |
| Min. airway pressure | $P_{min}$ |
| Range | 0 to 99 mbar |
| Resolution | 1 mbar |
| Accuracy | ±2 mbar |

$O_2$ measurement in main flow (inspiratory side)

Inspiratory $O_2$ concentration $FiO_2$

| | |
|---|---|
| Range | 15 to 100 Vol.% |
| Resolution | 1 Vol.% |
| Accuracy | ±3 Vol.% |

Flow-Messung

Minute Volume MV

Spontaneously breathed minute volume $MV_{spn}$

| | |
|---|---|
| Range | 0 to 99 L/min, BTPS* |
| Resolution | 0.1 L/min |
| Accuracy | ±8 % of measured value |
| $T_{0...90}$ | approx. 35 s |

Tidal volume $V_{Te}$

Spontaneously breathed tidal volume $VT_{spn}$

| | |
|---|---|
| Range | 0 to 3999 mL, BTPS* |
| Resolution | 1 mL |
| Accuracy | ±8 % of measured value |

Tidal volume $V_{TASB}$

Inspiratory tidal volume during an ASB stroke

| | |
|---|---|
| Range | 0 to 3999 mL, BTPS* |
| Resolution | 1 mL |
| Accuracy | ±8 % of measured value |

Frequency Measurement

Breathing frequency $f_{tot}$

Spontaneous breathing frequency $f_{spn}$

| | |
|---|---|
| Range | 0 to 150 /min |
| Resolution | 1 /min |
| Accuracy | ±1 /min |
| $T_{0...90}$ | approx. 35 s |

Breathing gas temperature measurement

| | |
|---|---|
| Range | 18 to 51 °C |
| Resolution | 1 °C |
| Accuracy | ±1 °C |

* Body Temperatur, Pressure, Saturated.
Measured values relating to the conditions of the patient lung: Body temperature 37 °C, steam-saturated gas, ambient pressure.

| | |
|---|---|
| Computed value displays | |
| Compliance C | |
| Range | 0.7 to 200 mL/mbar |
| Resolution | |
| Range 0.7 to 99.9 mL/mbar | 0.1 mL/mbar |
| Range 100 to 200 mL/mbar | 1 mL/mbar |
| Accuracy | ±20 % of measured value* |
| Resistance R | |
| Range | 3 to 200 mbar/L/s |
| Resolution | |
| Range 3 to 99.9 mbar/L/s | 0.1 mbar/L/s |
| Range 100 to 200 mbar/L/s | 1 mbar/L/s |
| Accuracy | ±20 % of measured value** |
| Leakage minute volume $MV_{leak}$ | |
| Range | 0 to 99 L/min, BTPS |
| Resolution | 0.1 L/min or for values less than 0.1 L/min: 0.01 L/min |
| Accuracy | ±18 % of measured value |
| $T_{0...90}$ | approx. 35 s |
| Curve displays | |
| Airway pressure Paw (t) | –10 to 100 mbar |
| Flow (t) | –150 to 180 L/min |
| Volume V (t) | 0 to 2000 mL |
| Rapid-Shallow-Breathing RSB | |
| Range | 0 to 9999 1/(min x L) |
| Resolution | 1/(min x L) |
| Accuracy | see measurement of $V_T$ and f |
| Negative Inspiratory Force NIF | |
| Range | –45 to 0 mbar |
| Resolution | 1 mbar |
| Accuracy | ±2 mbar |

* C-values may be considerably falsified as spontaneous breathing increases; compliance with the measuring accuracy therefore cannot be guaranteed for spontaneous breathing.

** R-values may be considerably falsified as spontaneous breathing increases; compliance with the measuring accuracy therefore cannot be guaranteed for spontaneous breathing.

## Monitoring

| | |
|---|---|
| Expiratory minute volume **MV** | |
| Upper alarm limit alarm | when MV exceeds the upper alarm limit. |
| Setting range | 0.1 to 1 L/min in 0.01 L/min increments<br>1 to 41 L/min in 0.1 L/min increments |
| Lower alarm limit alarm | when MV falls below the lower alarm limit. |
| Setting range | 0.01 to 1 L/min in 0.01 L/min increments<br>1 to 40 L/min in 0.1 L/min increments |
| Airway pressure **Paw** | |
| Upper alarm limit alarm | when the "Paw high" value is exceeded. |
| Setting range | 10 to 100 mbar |
| Lower alarm limit alarm | when the value "PEEP +5 mbar" (coupled with the PEEP set value) is not exceeded for at least 96 ms in 2 successive ventilation strokes. |
| Insp. $O_2$ concentration **$FiO_2$** | |
| Upper alarm limit alarm | if $FiO_2$ exceeds the upper alarm limit for at least 20 seconds. |
| Lower alarm limit alarm | if $FiO_2$ falls below the lower alarm limit for at least 20 seconds. |
| Range | both alarm limits are automatically allocated to the set value:<br>less than 60 Vol.%: ±4 Vol.%<br>60 Vol.% and over: ±6 Vol.% |
| Insp. breathing gas temperature | |
| Upper alarm limit alarm | when temperature reaches 40 °C.<br>(Evita 2 dura can also be used without temperature sensor if the sensor is not connected on switching on). |
| Tachypnoea monitoring **$f_{spn}$** | |
| Alarm | when the spontaneous breathing frequency is exceeded during spontaneous breathing. |
| Adjustment range | 5 to 120/min |
| Volume monitoring **$V_{Ti}$** | |
| Lower alarm limit alarm | if the set tidal volume $V_T$ (coupled with the set value $V_T$) has not been supplied. |
| Upper alarm limit alarm | if the applied tidal volume exceeds the value of the alarm limit, inspiration is interrupted and the expiration valve is opened. |
| Adjustment range | 21 to 4000 mL |
| Apnoea alarm time **$T_{Apnoea}$** | |
| Alarm | if no breathing activity is detected. |
| Adjustment range | 5 to 60 s, adjustable in 1 second steps. |

## Operating data

| | |
|---|---|
| Mains power connection | 100 V to 240 V  50/60 Hz |
| Current input | |
| at 230 V | max. 1.3 A |
| at 100 V | max. 3.2 A |

| | |
|---|---|
| Power consumption | typically approx. 125 W |
| Machine fuses | |
| Range 100 V to 240 V | F 5 H 250 V IEC 127-2 (2x) |
| Protection class | |
| Machine | Class I |
| $CO_2$ sensor (sensor connected) | Type BF |
| Temperature sensor AWT 01 (sensor connected) | Type BF |
| Gas supply | |
| $O_2$ gauge pressure | 3 bar –10 % to 5.5 bar +10 % at 60 L/min (peak flow 200 L/min) |
| $O_2$ connection thread | M 12 x 1, female |
| Air gauge pressure | 3 bar –10 % to 5.5 bar +10 % at 60 L/min (peak flow 200 L/min) |
| Air connection thread | M 20 x 1.5, male |
| Dew point | 5 °C below ambient temperature |
| Oil concentration | <0.1 mg/m$^3$ |
| Particle size | Dust-free air (filtered with filter size <1 µm) |
| Gas consumption of control system | Medical air or $O_2$ approx. 3.5 L/min |
| Output for pneumatic medicament nebuliser | Medical air or $O_2$, max. 2.25 bar, max. 11 L/min |
| Automatic gas switch-over | if one gas fails (inlet pressure <1.5 bar) the device switches to the other gas. |
| Sound pressure (for free-field measurement over a reflecting surface) | max. 47 dB (A) |
| Dimensions (W x H x D) | |
| Basic machine | 530 x 290 x 450 mm |
| Machine with trolley | 580 x 1335 x 660 mm |
| Weight | |
| Basic machine | approx. 27 kg |
| Basic machine with trolley incl. cabinet 8H | approx. 69 kg |

## Machine outputs

| | |
|---|---|
| Digital output | Output and reception via an RS 232 C interface |
| COM 1 | LUST protocol<br>Baudrate: 1200, 2400, 4800, 9600, 19200 baud<br>Data bits: 7<br>Parity: even<br>Stop bits: 1<br>MEDIBUS protocol<br>Baudrate: 1200, 2400, 4800, 9600, 19200 baud<br>Data bits: 8<br>Parity: even, odd, no<br>Stop bits: 1 or 2<br>(19200 baud are required for transmission of high-speed data, e.g. for flow curve)<br>Printer protocol HP Deskjet, series 500<br>Baudrate: 1200, 2400, 9600, 19200 baud<br>Data bits: 8<br>Parity: no<br>Stop bits: 1 |

| | |
|---|---|
| Cable length | Up to 15 m |
| Load impedance | 3000 to 7000 Ω |
| Signal level (at load impedance 3000 to 7000 Ω) | |
| Low | Between 3 and 15 V |
| High | Between –3 and –15 V |
| Electrical isolation | Port COM 1 is electrically isolated from the machine electronics.<br>The test voltage for the electrical isolation equals 1500 V. |
| Pin assignment | Pin 2 RxD<br>Pin 3 TxD<br>Pin 5 GND<br>Connector housing Machine housing |
| Digital output | Output for independent lung ventilation (ILV) |
| Digital output (optional) | for output and reception via two RS 232 C interfaces |
| Digital output (optional) | for output and reception via a CAN interface |
| Analogue output (optional) | for output of analog data |
| Electromagnetic compatibility (EMC)<br>(conforming to European Directive 89/336/EEC) | Tested in accordance with EN 60601-1-2 |
| Classification<br>as per EC Directive 93/42/EEC Annex IX | II b |
| UMDNS-Code<br>Universal Medical Device Nomenclature System – Nomenclature for medical products | 17-429 |

## Materials used

| Part | Appearance | Material |
|---|---|---|
| Ventilation hose | milky, transparent | silicone rubber |
| Water traps | yellow, transparent | polysulphone |
| Y-piece<br>with<br>connector for temperature measurement | milky, transparent<br><br>yellow, transparent | polysulphone<br><br>silicone rubber |
| Expiration valve<br>housing, closure | white | polyamide |
| Diaphragm | whitish and grey | silicone rubber and aluminium |
| $CO_2$ cuvette | yellow, transparent | polysulphone with glass windows |
| Temperature sensor/cable | milky/green or blue | silicone rubber |
| $CO_2$ sensor/cable | grey/grey | polyurethane |

# Description

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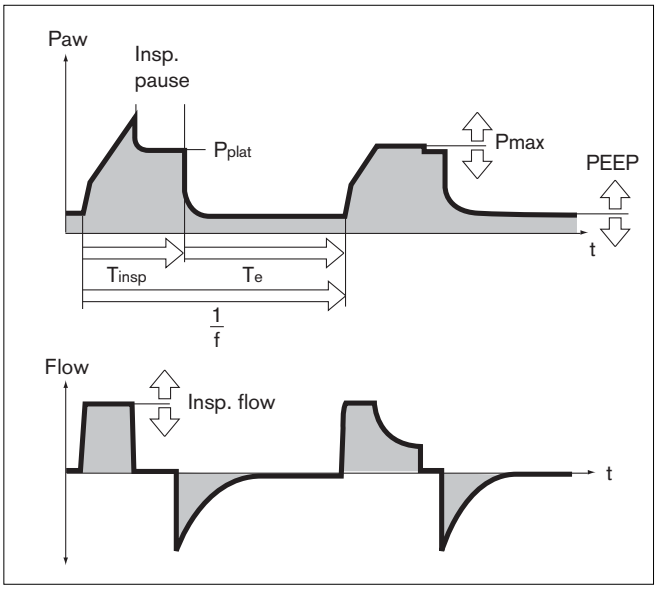
# Description

## Ventilation Modes

**Volume-controlled ventilation with PLV**

**Classic volume-constant mandatory ventilation stroke**

In mandatory ventilation strokes, the »Flow« parameter restricts the inspiration flow. If the inspiration flow is so high that the set tidal volume $V_T$ is attained before the inspiration time $T_{insp}$ has fully elapsed, the inspiration valve closes, and the supply of breathing gas stops. The expiration valve remains closed until the end of the inspiration time $T_{insp}$. This phase, the inspiratory pause, can be identified as the plateau $P_{plat}$ in the curve Paw (t).




**Manual pressure limiting with Pmax**

Evita 2 dura can prevent peaks of pressure, while maintaining the set tidal volume $V_T$, by means of the pressure limit Pmax. The tidal volume $V_T$ remains constant as long as a pressure plateau $P_{plat}$ is still detectable and the flow curve shows a brief pause of zero flow between inspiration and expiration.

Evita 2 dura performs this function by reducing the inspiratory flow on reaching the set Pmax value. If the tidal volume $V_T$ can no longer be attained with the selected pressure Pmax, due to reduced compliance, the alarm "Volume not constant" is automatically generated. Manual pressure limiting can be performed with all Evita models.

**Sigh (intermittent PEEP)**

"Sigh", in the form of intermittent PEEP, is operative in IPPV, IPPVAssist and ILV modes.

The purpose of the expiratory sigh during ventilation is to open collapsed areas of the lung, or to keep open "slow" areas of the lung.

Since atelectatic alveoli have a longer time constant – also caused by obstructed bronchioles – increased airway pressure maintained over a longer period is required to open them.

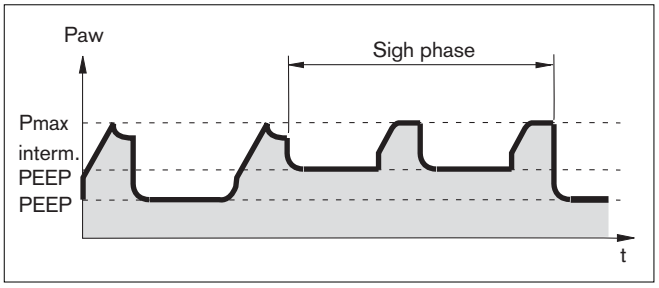
In many cases, the sigh function is achieved by increasing the ventilation stroke; however, due to the short time available, this form of sigh only marginally improves the filling of the "slow" alveoli.

In Evita 2 dura, the sigh operates during expiration with an intermittent PEEP for two ventilation strokes every 3 minutes.

The average airway pressure is higher, and a longer filling time is normally available.

To avoid overinflation of the lung, the peaks of pressure during the sigh phase can be limited by the pressure limit Pmax without impairing the sigh function.

During the sigh phase, the "Volume not constant" alarm is disabled.

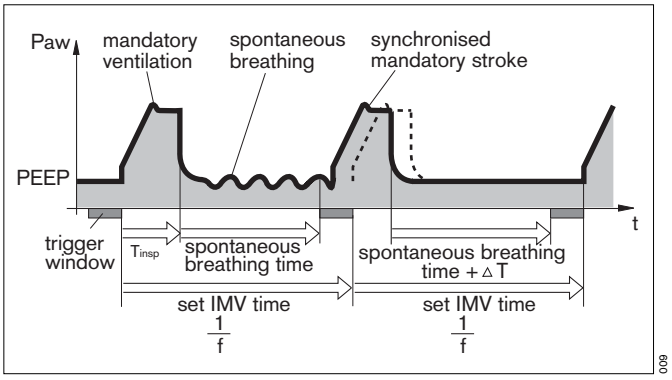


**SIMV**

**S**ynchronised **I**ntermittent **M**andatory **V**entilation

Combination of machine ventilation and spontaneous breathing.

SIMV enables the patient to breathe spontaneously in regular prescribed intervals between mandatory mechanical ventilation strokes that ensure a minimum ventilation. This minimum ventilation is defined by two set values, tidal volume ($V_T$) and ventilation frequency (f). The minimum ventilation is the product of $V_T$ x f.




The ventilation pattern is programmed by the following set values: tidal volume $V_T$, Insp. Flow, frequency f and inspiration time $T_{insp}$. To prevent the mandatory ventilation stroke being applied during spontaneous expiration, the Flowtrigger of the machine ensures that the ventilation stroke is triggered within a "trigger window" and synchronised with the patient's spontaneous inspiration.

The "trigger window" is 5 seconds long in adult mode and 1.5 seconds long in paediatric mode. If the expiration times are less than 5 seconds or 1.5 seconds respectively, the trigger window covers the entire expiration time.

Since the synchronisation of the mandatory ventilation stroke reduces the effective SIMV time and therefore would normally result in an undesirable increase in the effective SIMV frequency, Evita 2 dura adds back the reduced SIMV time by prolonging the subsequent spontaneous breathing phase by the SIMV time difference $\Delta$ T – thus preventing an increase in SIMV frequency. The frequency parameter f remains constant. This parameter, in combination with the tidal volume $V_T$, sets the minimum ventilation. If the patient has breathed in a considerable inspiratory volume at the beginning of the trigger window, the machine reduces the subsequent mandatory ventilation stroke by shortening the time for the inspiratory flow phase and the inspiration time. In this way, the tidal volume $V_T$ remains constant, and overinflation of the lungs is avoided.

During the spontaneous breathing phases, the patient can be assisted with pressure by ASB pressure support.

During the weaning process, the frequency f/breath rate on the ventilator is gradually reduced, the clinician thereby reduces the mandatory minute volume. The increase in expiratory time allows for a longer spontaneous breathing window, eventually the required minute volume level should be met by the patients' spontaneous breath rate.

**ASB**

**A**ssisted **S**pontaneous **B**reathing

Pressure support for insufficient spontaneous breathing.

The function of the machine in assisting insufficient spontaneous breathing is similar to that of the anaesthetist who manually assists and monitors the patient's spontaneous breathing by feeling the breathing bag.

The machine takes over part of the inhalation function, with the patient maintaining control of spontaneous breathing.

The CPAP system supplies the spontaneously breathing patient with breathing gas, even if the inspiration effort is weak.

The pressure support of the ASB system is started:

— when the spontaneous inspiration flow reaches the set value of the Flowtrigger,
or at the latest

— when the spontaneous inspired volume exceeds 25 mL (12 mL in paediatric mode).

The machine then produces an increase in pressure up to the preselected ASB pressure PASB, which is adjustable to the breathing requirement of the patient.

The time for this pressure increase (»Ramp«) is adjustable from 0.05 seconds to 2 seconds.

With a rapid increase in pressure
Evita 2 dura supports the insufficient spontaneous breathing of the patient with a high peak flow.

With a slow increase in pressure
Evita 2 dura begins gently with regular inspiratory flow. The patient has to take over more breathing effort, and so the tone of the breathing muscles gradually improves.

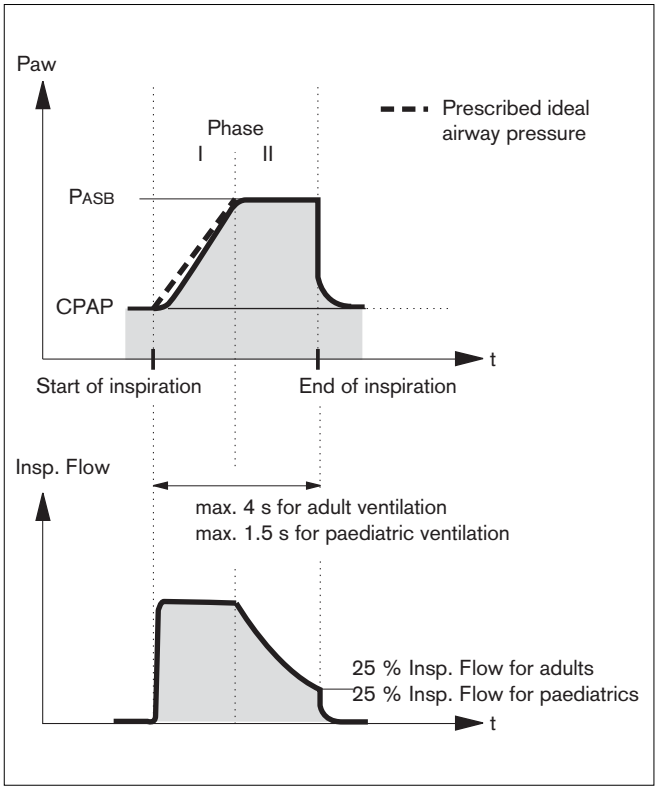
With patient-adjusted pressure increase and the preset ASB level, PASB, the patient's own breathing activity defines the required inspiration flow, which can rise to 2 L/s in 8 ms.

ASB is terminated:

— when the inspiration flow returns to zero during phase I, i.e. when the patient exhales or fights the ventilator,
or

— when the inspiration flow in phase II falls below a certain ratio of the maximum value previously supplied:
25 % Insp. Flow for adults
25 % Insp. Flow for paediatrics
or

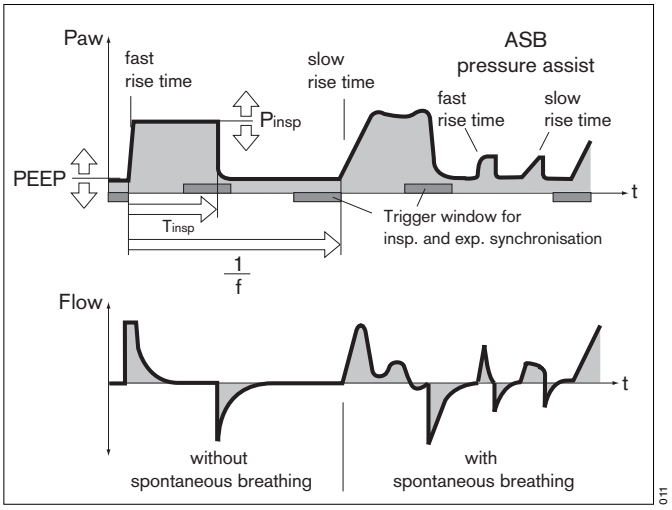
— at the latest after 4 seconds (1.5 seconds in paediatric ventilation) if the other two criteria have not come into operation.
If this 4-second criterion occurs three times in succession, Evita 2 dura sounds an alarm and warns of a possible leak in the ventilation system.



**BIPAP**

**B**iphasic **P**ositive **A**irway **P**ressure

The BIPAP ventilation mode is a pressure/time-cycled ventilation mode in which the patient can always breathe spontaneously. BIPAP is therefore often described as a timed alternation between two CPAP levels.*




The time-cycled change of pressure produces controlled ventilation corresponding to the pressure-controlled ventilation PCV. However, the constant option of spontaneous breathing allows the transition from controlled breathing to independent spontaneous breathing to take place smoothly over the course of the weaning phase, without requiring any change in the ventilation mode. To adapt easily to the patient's spontaneous breathing pattern, the change-over from expiratory pressure level to inspiratory pressure level, and also the change-over from inspiratory pressure level to expiratory pressure level, are synchronised with the patient's spontaneous breathing.

The frequency of the change-over is kept constant, even with patient synchronisation, by defining a trigger time window with a fixed time constant.

The "trigger window" is 5 seconds long in adult mode and 1.5 seconds long in paediatric mode. For expiration times shorter than 5 seconds or 1.5 seconds respectively, the trigger window covers the entire expiration time. At $P_{insp}$ level, the "trigger window is" 1/4 x $T_{insp}$ seconds long.

This smooth adaptation to the patient's spontaneous breathing requires less sedation, so that the patient returns to spontaneous breathing more rapidly.

As in all pressure-controlled ventilation modes, the patient is not prescribed a fixed tidal volume ($V_T$). The tidal volume results principally from the pressure difference between the settings for PEEP and $P_{insp}$.

The display of the tidal volume measured on expiration, $V_{Te}$, is used to set the required difference between the two pressure levels. Any increase in this difference will cause an increased BIPAP ventilation stroke.

Changes in lung compliance and airways, as well as active 'fighting' by the patient can lead to changes in tidal volume. This is a desired effect in this ventilation mode.

With the knowledge that the tidal volume, and therefore the minute volume, are not constant, the alarm limits for minute volume must be adjusted with care.

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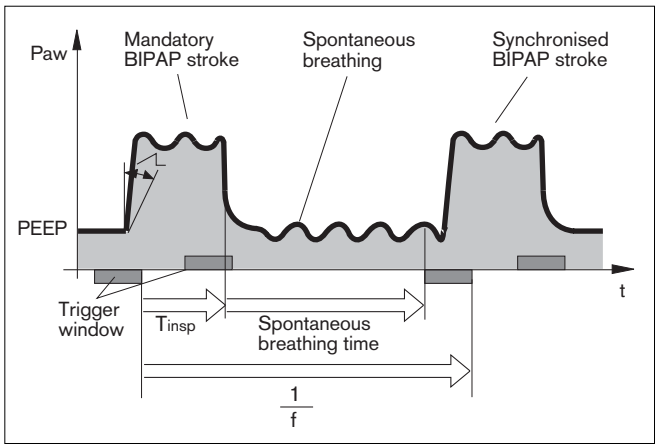
* Bibliography (1), (2), (3), (4), (5), (6), (7), (8), (9), (10) page 131

### Using BIPAP

As with IPPV, the time pattern is set using the basic setting parameters of frequency f and inspiration time $T_{insp}$. The lower pressure level is set with the PEEP parameter, while the upper level is set with $P_{insp}$. When switching over from IPPV to BIPAP mode – while retaining the time pattern – only the $P_{insp}$ setting needs to be changed.

The steepness of the increase from the lower pressure level to the upper pressure level is controlled by the »Ramp« setting. The effective time for the increase in pressure cannot be greater than the set inspiratory time $T_{insp}$.
This precaution ensures that the upper pressure level $P_{insp}$ is reached safely during inspiration. The transition from controlled ventilation via the weaning phase to fully spontaneous breathing is achieved by a gradual reduction of the inspiratory pressure $P_{insp}$ and/or frequency f.




### BIPAP**Assist**

**B**iphasic **P**ositive Airway **P**ressure **A**ssisted

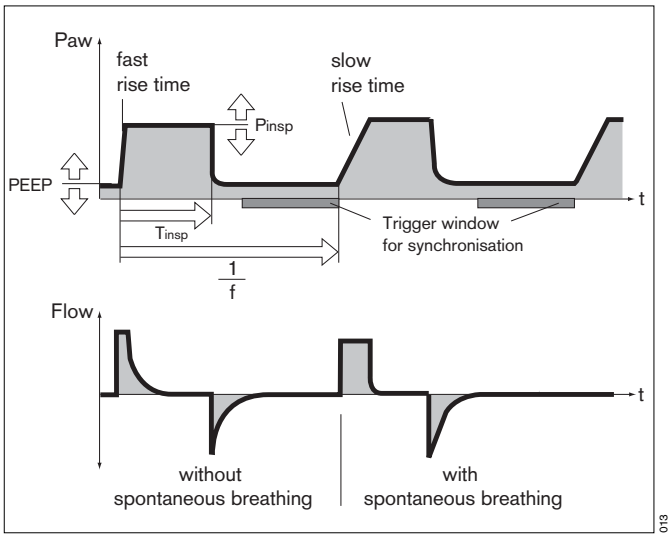
Pressure-controlled, assisted ventilation

The inspiratory strokes are the same as for BIPAP, except that the change from $P_{insp}$ to PEEP is not synchronised with expiration by the patient. The duration of $P_{insp}$ depends on $T_{insp}$. The patient can breathe spontaneously throughout the ventilation process.

Every detected spontaneous breathing activity by the patient triggers a synchronised inspiration stroke.

A non-synchronised inspiratory stroke is triggered by the machine at the latest upon expiry of the inspiration time defined by »f« and »$T_{insp}$«.

For all patients, from those unable to breathe spontaneously to those breathing spontaneously before being weaned off the ventilator.



**MMV**

**M**andatory **M**inute Volume **V**entilation

In contrast to SIMV, the MMV ventilation mode gives mandatory breathing only if spontaneous breathing is not yet sufficient and has fallen below a pre-selected minimum ventilation. This minimum ventilation is controlled by the two set values tidal volume $V_T$ and frequency f, and results from the product $V_T$ x f.

Unlike SIMV, the mandatory strokes are not given regularly but only in cases of insufficient ventilation.

The frequency of mandatory strokes is determined by the level of spontaneous breathing: if spontaneous breathing is sufficient, mandatory strokes are not applied at all:
If spontaneous breathing is not sufficient, intermittent mandatory strokes of the set tidal volume $V_T$ are applied.
If there is no spontaneous breathing at all, the mandatory strokes are applied at the set frequency f.

Evita 2 dura continuously monitors the difference between spontaneous breathing and the set minimum ventilation. As soon as the balance becomes negative, because spontaneous breathing is no longer sufficient, Evita 2 dura applies a mandatory ventilation stroke with the set tidal volume $V_T$, so that the balance is again positive.

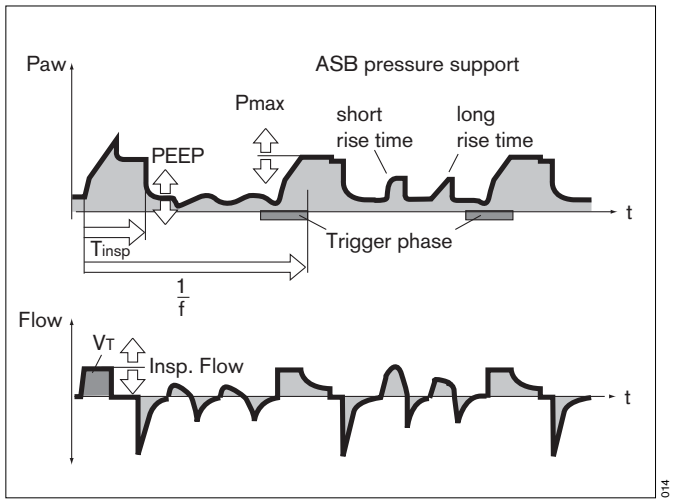
Experience shows that patients breathe very irregularly. Phases of weak breathing alternate with phases of heavy breathing. In order to allow for these individual fluctuations, the balancing process also takes account of the extent by which the set minimum ventilation has been exceeded. This positive allowance is progressively reduced to zero by Evita 2 dura within a maximum of 7.5 seconds after apnoea.

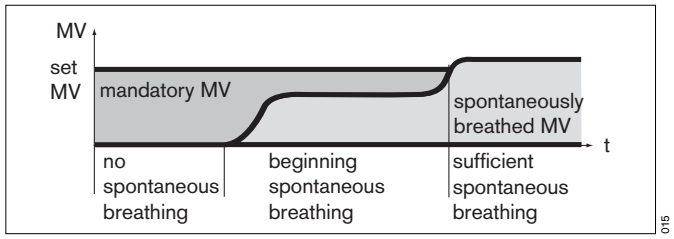
In other words, the response time of Evita 2 dura before activating mandatory ventilation is automatically adapted to the preceding cycle of spontaneous breathing:

If this spontaneous breathing was close to the minimum ventilation, the machine responds rapidly within the cycle time (1/f). By contrast, if the patient's spontaneous breathing was much higher than the set minimum ventilation, Evita 2 dura tolerates a longer breathing pause. In extreme cases of sudden apnoea after a phase of heavy breathing, the response time will be 7.5 seconds plus the trigger time, with a minimum of 1 cycle time (1/f).

Response times longer than 15 seconds may only occur if the minimum ventilation with a very low IMV frequency f is set to correspondingly low values.

In this case, Evita 2 dura triggers an apnoea alarm that is cancelled again as soon as the mandatory ventilation strokes have been applied. If the cycle time (1/f) is set to a longer period than the $T_{Apnoea}$ alarm limit, and if there is no spontaneous breathing between the mandatory ventilation strokes, the apnoea alarm will be regularly triggered.



Example:

f = 3/min = cycle time (1/f) = 20 seconds

$T_{Apnoea}$ = 15 seconds

This system is designed to prevent mandatory ventilation being prematurely triggered in the event of irregular spontaneous breathing, whilst at the same time giving an alarm for any long period of low ventilation.

## Measurements

### Flow measurement

Regardless of whether ventilation is volume-controlled or pressure-controlled, positive pressures are generated in both the breathing system and patient lung during the inspiration phase. Depending on the ratio of lung compliance to hose system compliance, the volume delivered by the ventilator is distributed to the patient's lung and to the hose system installed between the ventilator and patient. Deviations in the measured expiration flow and derived values, such as the minute volume and breath volume, are low for adult patients, due to their relatively high lung compliance in relation to the much lower compliance of the ventilation hoses.

However, since only the volume attained and surrendered by the lung is relevant to the efficiency of ventilation, and since higher differences are possible during paediatric ventilation, Evita 2 dura provides basic compensation for hose compliance during ventilation.

### Compensation of the effect of hose system compliance

During the device check before ventilation, Evita 2 dura determines the compliance of the ventilation hoses, and then, during ventilation, compensates for the effect of compliance on volumetric flow measurement.

Depending on the airway pressure, Evita 2 dura increases the tidal volume by the amount that remains in the ventilation hoses.

In addition to hose system compliance, flow/volume measurement is influenced by the environmental factors of temperature and humidity and by leaks in the hose system. Evita 2 dura takes these factors into account and corrects the settings and measured values accordingly.

**Conversion according to ambient conditions**

The volume occupied by a gas depends on the ambient conditions of temperature, pressure and humidity.
In lung physiology, the minute volume and tidal volume are related to the ambient conditions in the lung:
37 °C body temperature, pressure in the lung,
100 % relative humidity.

The flow and volume values measured under these conditions are marked with BTPS*. On the other hand, medical gases from cylinders or from the central supply are dry (approx. 0 % r.h.) and are delivered by the ventilator at 20 °C. The flow and volume values measured under these conditions are marked NTPD**. The difference between measured values under NTPD and BTPS conditions is typically approx. 12 %.

Example: a tidal volume of 500 mL NTPD is increased to 564 mL BTPS by heating to 37 °C and humidifying to 100 % r.h. Evita 2 dura delivers the tidal volume after conversion, so that the set tidal volume is effective in the lung under BTPS conditions.

**Automatic leakage compensation**

Evita 2 dura determines the difference between the delivered flow on the inspiration side and the measured flow on the expiration side. This difference provides a measure of the amount of leakage and is displayed by Evita 2 dura as the leakage minute volume $MV_{leak}$. Evita 2 dura can compensate for this leakage in volumecontrolled ventilation.
Example:
Tidal volume setting $V_T$ = 500 mL,
10 % leakage in tube.

**Leakage compensation Off**

Evita 2 dura delivers 500 mL. This is indicated as the inspiratory tidal volume $V_{Ti}$. 50 mL escape as leakage during inspiration, and 450 mL reach the lung. 450 mL are expired, and 45 mL again escape as leakage. A tidal volume of 405 mL is measured on the expiration side and indicated as $V_{Te}$. With a ventilation rate of 10 strokes per minute, a minute volume of 5.0 L/min is delivered on the inspiration side and a minute volume of 4.05 L/min is measured on the expiration side. The lung is ventilated with an MV of 4.5 L/min.

**Without leakage compensation, the set $V_T$ determines the volume delivered by Evita 2 dura.**

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* BTPS = Body Temperature, Pressure, Saturated.
** NTPD = Normal Temperature Pressure Dry.

**Leakage compensation On**

With automatic leakage compensation, Evita 2 dura delivers 550 mL on the basis of the measured leakage minute volume, instead of the 500 mL set. 500 mL enter the lung and the displayed inspiratory tidal volume $V_T$ is 500 mL. The volume of 450 mL measured on the expiration side is displayed without compensation, even when leakage compensation is activated. The minute volume measured on the expiration side is 4.5 L/min and is also uncompensated. If this were not so, the alarm for a low minute volume could be inhibited by the expiratory leakage compensation. Evita 2 dura must always emit an alarm if the minute volume is too low.

**With leakage compensation, the set $V_T$ determines the volume to be delivered to the patient.**

This example has been simplified:
In fact, the calculated leakage correction takes into account the pressures in the hose system. A higher percentage volume is lost on the inspiration side than on the expiration side because the pressure during inspiration is higher. The displayed leakage minute volume $MV_{leak}$ is based on the mean pressure $P_{mean}$.

The leakage minute volume $MV_{leak}$ also takes the inspiratory leaks into account. The sum of the minute volume MV + the leakage minute volume $MV_{leak}$ is consequently greater than the inspiratory minute volume delivered to the patient.

Unlimited volume compensation is inappropriate.
Evita 2 dura compensates for losses of up to 100 % of the set tidal volume $V_T$. Due to technical tolerances, a small leakage minute volume may be displayed even if the hose system is leakproof.

### Rapid-Shallow-Breathing RSB

The Rapid Shallow Breathing index (RSB)* is the quotient of the spontaneous breathing frequency (spontaneously breathed breaths per minute) and the tidal volume

$$\text{RSB}\,[1/(\text{min} \times \text{L})] = \frac{f_{spn}\,[1/\text{min}]}{V_T[\text{L}]}$$

The lower the RSB index for a patient with spontaneous breathing, the more probably he or she can be weaned successfully. The significance of the RSB index is due to the fact that patients who can be weaned successfully tend to have a lower spontaneous breathing frequency and a higher tidal volume than those who are not yet ready to be weaned. In their 1991 study*, Yang and Tobin showed that the RSB index is an effective instrument for predicting the success of an attempt to wean the patient. Patients with an RSB index <100 1/(min x L) were weaned with a probability of 80 %, while 95 % of those with an RSB index > 100 were not yet ready to be weaned. Evita 2 dura indicates the RSB index in CPAP/ASB and PPS modes.

### Negative Inspiratory Force NIF

The Negative Inspiratory Force index (NIF)** measures the patient's maximum inhalation effort after exhaling. The patient system is closed during measurement of the NIF. This value is also known as the Maximum Inspiratory Pressure (MIP). As a result of the inhalation effort during manually extended expiration, the patient generates a negative pressure in relation to PEEP. The probability that the patient can be weaned successfully increases with the magnitude of this negative pressure. Patients with a NIF < –30 mbar can in all probability be weaned successfully, while those with a NIF of up to –20 mbar will most probably prove unsuccessful.

Evita 2 dura determines the NIF value during manually extended expiration. The patient system closes following expiration by the patient while the »**Exp. hold**« key is held down and Evita 2 dura measures the maximum inhalation effort made by the patient. The NIF is measured as a pressure against PEEP. The measuring procedure is ended when the »**Exp. hold**« key is released or after not more than 15 seconds. The last measured NIF value and the time of measurement are shown in Table 2 on the screen.

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* Bibliography (8), page 131
** Bibliography (9), (10), page 131

**Insp. $O_2$ concentration during medicament nebulisation**

**Use only medicament nebuliser 84 12 935 (white central body).**

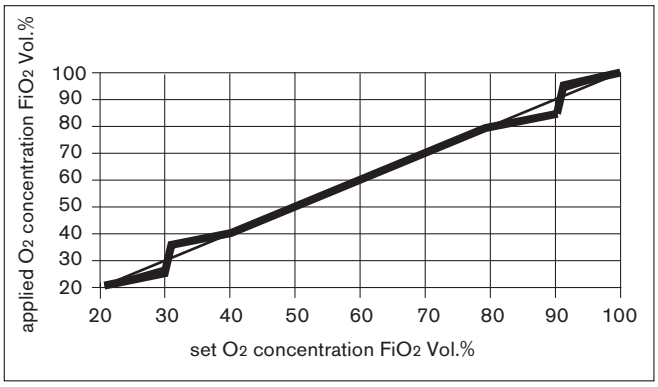
**If other medicament nebulisers are used, considerable deviations may occur in the tidal volume and inspiratory $O_2$ concentration!**

To minimise the deviation from the set $O_2$ concentration, Evita 2 dura generates a mixed gas to drive the medicament nebuliser.

In adult ventilation, this mixed gas is generated by switching over the compressed gases (medical air and oxygen) in synchronisation with inspiration.

In paediatric ventilation, the nebuliser is operated continuously, with medical air or oxygen in alternation. The drive gas of the medicament nebuliser therefore roughly corresponds to the set $FiO_2$.

The graph shows the possible deviations of the applied $O_2$ concentration as a function of the set $FiO_2$ at a minimal inspiratory flow (15 L/min) in adult ventilation, or at ventilation frequencies above 12 bpm in paediatric ventilation.



## Abbreviations

| Abbreviation | Definition |
|---|---|
| APRV | **A**irway **P**ressure **R**elease **V**entilation<br>Spontaneous breathing at continuous positive airway pressure with short-term pressure release |
| ASB | **A**ssisted **S**pontaneous **B**reathing<br>Pressure supported spontaneous breathing |
| BIPAP | **B**iphasic **P**ositive **A**irway **P**ressure<br>Ventilation mode for spontaneous breathing at continuous positive airway pressure with two different pressure levels |
| $BIPAP_{Assist}$ | **B**iphasic **P**ositive **A**irway **P**ressure Assisted<br>Ventilation mode for assisted ventilation with continuous positive airway pressure with two different pressure levels |
| Body Wt | Body weight (kg) |
| bpm | breath per minute |
| BTPS | **B**ody **T**emperatur, **P**ressure. **S**aturated<br>Measured values based on the condition of the patient's lungs, with body temperature 37 $^{o}$C, steam-saturated gas, atmospheric pressure |
| C | Compliance |
| CPAP | **C**ontinuous **P**ositive **A**irway **P**ressure<br>Breathing with continuous positive pressure in the airways |
| $etCO_2$ | End-expiratory $CO_2$ concentration |
| f | Frequency |
| Fail to cycle | Breathing cycle failure. Machine detects no inspiration |
| $f_{Apnoea}$ | Frequency setting for apnoea ventilation |
| $FeCO_2$ | Expiratory $CO_2$ concentration |
| $FiO_2$ | Inspiratory $O_2$ concentration |
| Flow | Set value of the maximum inspiratory flow |
| $f_{mand}$ | Mandatory mechanical portion of overall breathing frequency |
| $f_{spn}$, $f_{spont.}$ | Spontaneous breathing portion of overall breathing frequency |
| HME | **H**eat **M**oisture **E**xchanger<br>Heat and moisture exchanger |
| I : E | Ratio of Inspiration to Expiration |
| Int. PEEP | Intermittent Positive End-Expiratory Pressure = Sigh |
| IPPV | **I**ntermittent **P**ositive **P**ressure **V**entilation |
| $IPPV_{Assist}$ | Trigger Assist Intermittent Positive Pressure Ventilation |
| IRV | **I**nversed **R**atio **V**entilation<br>Ventilation with inversed inspiration/ expiration ratio |

| Abbreviation | Definition |
|---|---|
| ISO 5369 | International standard for mechanical ventilators – "Lung Ventilation" |
| MMV | **M**andatory **M**inute Volume **V**entilation |
| MV | **M**inute **V**olume |
| $MV_{leak}$ | Leakage minute volume |
| $MV_{spn}$ | Spontaneous breathed minute volume |
| NIF | **N**egative **I**nspiratory **F**orce<br>Maximum inhalation effort |
| $O_2$ | Set value for inspiratory oxygen concentration [Vol.%] |
| $P_{ASB}$ | Set value of ASB pressure support |
| Paw | Airway pressure |
| PEEP | **P**ositive **E**nd-**E**xpiratory **P**ressure |
| PEEPi | ntrinsic Positive End-Expiratory Pressure |
| $P_{high}$ | Set value of the upper pressure level APRV |
| $P_{insp}$ | Set value of the upper pressure level in BIPAP |
| $P_{low}$ | Value set for lower pressure level in APRV |
| PLV | **P**ressure **L**imited **V**entilation |
| Pmax | Set value for pressure limited ventilation |
| $P_{mean}$ | Mean airway pressure |
| $P_{peak}$ | Peak pressure |
| $P_{plat}$ | End-inspiratory airway pressure |
| R | Resistance |
| Ramp | Setting for the temporary pressure increase in ASB |
| RSB | **R**apid **S**hallow **B**reathing<br>Quotient of spontaneous breathing frequency and tidal volume |
| SIMV | **S**ynchronized **I**ntermittent **M**andatory **V**entilation |
| T | Inspiratory breathing gas temperature |
| $T_{Apnoea}$ | Apnoea alarm time |
| Te | Expiration time |
| TGI | Tracheale Gas Insuflation |
| $T_{high}$ | Time for the upper pressure level in APRV |
| $T_{insp}$ | Set value of the inspiratory time |
| $T_{low}$ | Time for the lower pressure level in APRV |
| $\dot{V}CO_2$ | $CO_2$ production [L/min] |
| Vds | Serial dead space |
| $V_T$ | Setting for tidal volume |
| $VT_{Apnoea}$ | Setting for tidal volume of apnoea ventilation |
| $V_{TASB}$ | Inspiratory breathing volume during an ASB stroke |

| Abbreviation | Definition |
|---|---|
| $V_{Te}$ | Expiratory tidal volume |
| $V_{Ti}$ | Inspiratory tidal volume |
| $V_{trap}$ | Volume trapped in the lung by intrinsic PEEP, and exhaled during subsequent expiration. |

## Symbols

| Symbol | Definition |
|---|---|
|  | Switch medicament nebuliser on/off |
|  Suction | Activate/deactivate oxygen enrichment for bronchial suction |
| Insp. hold | Start manual inspiration |
| Exp. hold | Manually extend the expiration phase |
|  | Bright/dark screen brightness setting |
|  | Manual printer logging |
|  | Switch help function on/off |
| Freeze  | "Freeze" curves in screen |
|  | Suppress audible alarm for 2 minutes |
| Alarm Reset | Acknowledge alarms |
|  | Protect ventilation parameters and ventilation mode |
|  | Standby/Operation |
|  | Select other combination of measured values |
|  | Select other curve(s) |
|  | Lower/upper alarm limit |
|  | Observe Instructions for Use! |
|  | Protection class Type B |
|  | Protection class Type BF |
|  | Insert flow sensor |
|  | Unlocking expiration valve |
|  | Evita Remote Pad |
|  | Nurse call |
| Exp. | Expiration port (GAS RETURN) |
| Insp. | Inspiratory port (GAS OUTPUT)* |
|  | Gas outlet (EXHAUST – NOT FOR SPIROMETER)* |
|  | Earth |

* Additional, depending on equipment configuration

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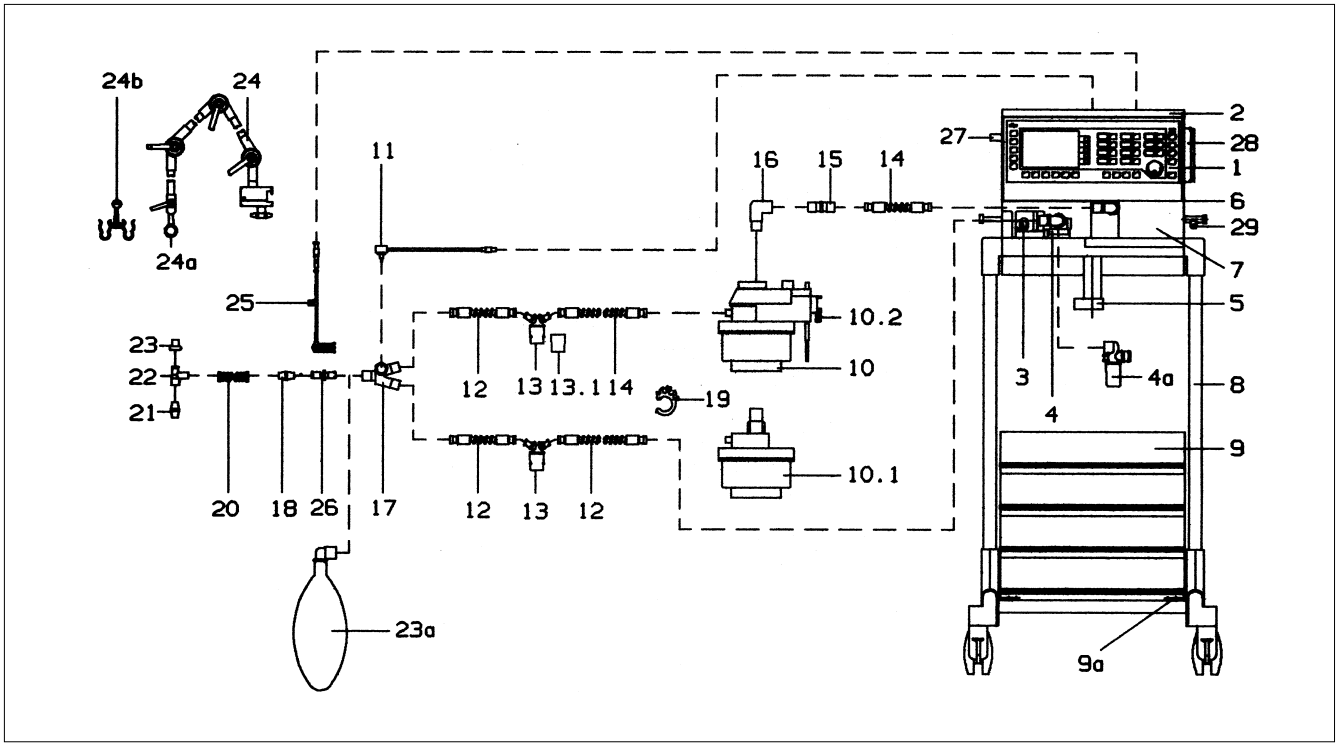
# Parts List

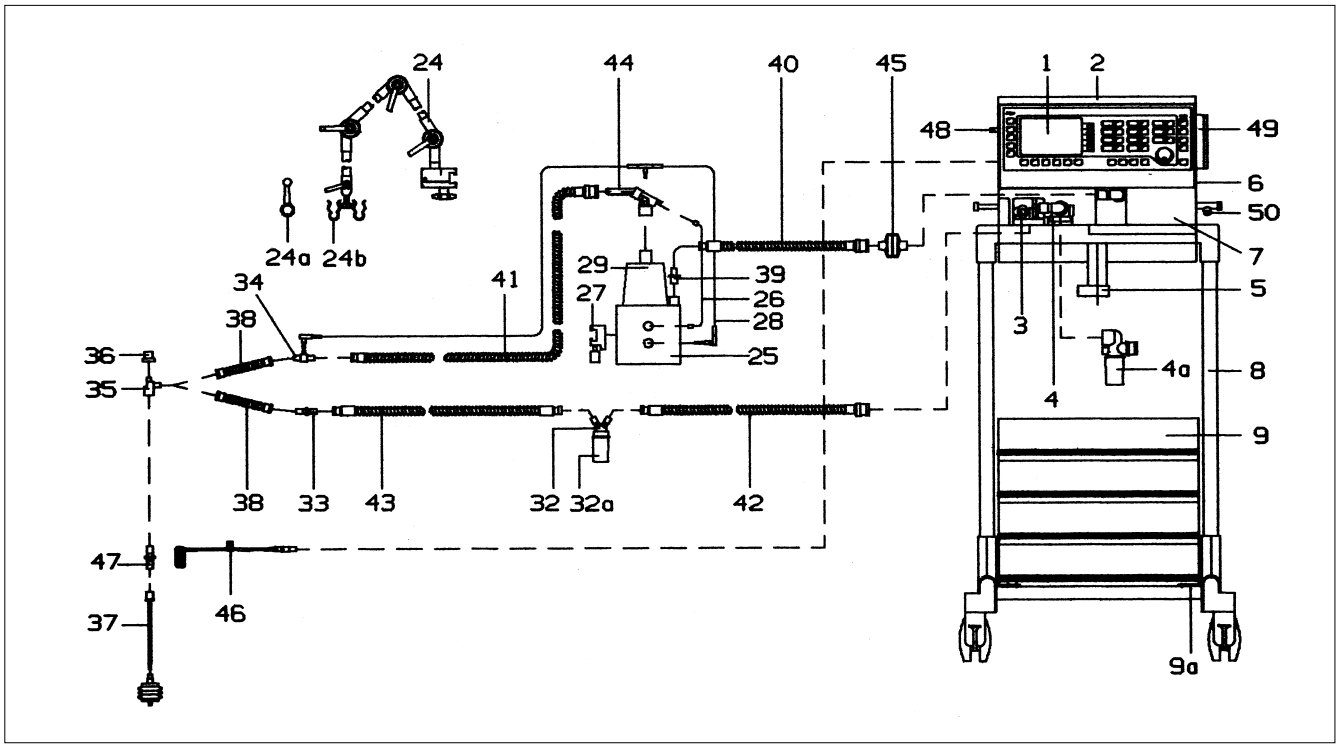
## For adult ventilation




| Item No. | Name/Description | Order No. |
|---|---|---|
| 1 | Evita 2 dura | 84 11 800 |
| 2 | Instrument tray | 84 11 621 |
| 3 | Flow sensor (set of 5) | 84 03 735 |
| 4 | Expiration valve | 84 10 580 |
| 5 | Bracket (for Aquapor) | 84 11 956 |
| 6 | $O_2$ sensor housing | 68 50 645 |
| 7 | Ambient-air filter | 84 12 384 |
| 7a | Cooling-air filter (back of Evita 2 dura, not illust.) | 84 12 384 |
| 8 | "EvitaMobil" trolley (high) | 84 11 950 |
| 8a | "EvitaMobil" trolley (low) | 84 11 965 |
| 8b | Cabinet 8H, 360 mm high (4 drawers) | M 31 796 |
| 8c | Cabinet 4H (2 drawers) (not illust.) | M 31 795 |
| 8d | "EvitaMobil" cylinder holder set (not illust.) | 84 11 970 |
| 8e | Breathing air compressor (not illust.) | 84 13 890 |
| 10 | Aquapor (220 to 240 V) | 84 05 020 |
| | Aquapor (110 V) | 84 05 199 |
| 10.1 | Patient part, Aquapor | 84 05 029 |
| 10.2 | Set of spare brackets | 84 03 345 |
| 11 | Temperature sensor | 84 05 371 |
| 12-23 | Hose set, adult (blue socket) | 84 12 092 |
| 12 | Spiral hose, adult, silicone 0.6 m | 21 65 627 |
| 13-13.1 | Water trap | 84 04 985 |

| Item No. | Name/Description | Order No. |
|---|---|---|
| 13.1 | Water container | 84 03 976 |
| 14 | Spiral hose, adult, silicone 0.35 m | 21 65 619 |
| 15 | Connector | M 25 647 |
| 16 | ISO elbow connector | M 25 649 |
| 17 | Y-piece, straight | 84 05 435 |
| 18 | Catheter connector, straight, size 12.5 (set of 10) | M 23 841 |
| 19 | Hose clamp | 84 03 566 |
| 20 | Corrugated hose 0.32 m | 84 02 041 |
| 21 | Catheter connector, adult | |
| | Set of catheter connectors, adult Sizes 6 to 12 (set of 12) | 84 03 685 |
| 22 | Adaptor, adult | 84 03 076 |
| 23 | Cap (set of 5) | 84 02 918 |
| 23a | Adult test lung (bag) | 84 03 201 |
| 24-24b | Hinged arm or | 84 09 609 |
| | Quick-fix hinged arm 2 | 2M 85 706 |
| 24a | Bracket | 84 09 746 |
| 24b | Hose clamp | 84 09 841 |
| 25 | $CO_2$ main flow sensor | 68 70 300 |
| 26 | Cuvette, adult | 68 70 279 |
| 27 | Holder for parking $CO_2$ sensor | 84 12 840 |
| 28 | Short GA holder set | 84 11 615 |
| 29 | Y-piece parking rest | 84 11 784 |

## For paediatric ventilation




| Item No. | Name/Description | Order No. |
|---|---|---|
| 1 | Evita 2 dura | 84 11 800 |
| 2 | Instrument tray | 84 11 621 |
| 3 | Flow sensor (set of 5) | 84 03 735 |
| 4 | Expiration valve (expiration valve) | 84 10 580 |
| 5 | Bracket (for Aquapor) | 84 11 956 |
| 6 | $O_2$ sensor housing | 68 50 645 |
| 7 | Ambient-air filter | 84 12 384 |
| 7a | Cooling-air filter (back of Evita 2 dura, not illust.) | 84 12 384 |
| 8 | "EvitaMobil" trolley (high) | 84 11 950 |
| 8a | "EvitaMobil" trolley (low) | 84 11 965 |
| 8b | Cabinet 8H, 360 mm high (4 drawers) | M 31 796 |
| 8c | Cabinet 4H (2 drawers) (not illust.) | M 31 795 |
| 8d | "EvitaMobil" cylinder holder set (not illust.) | 84 11 970 |
| 8e | Breathing air compressor (not illust.) | 84 13 890 |
| 24-24b | Hinged arm or | 84 09 609 |
| | Quick-fix hinged arm 2 | 2M 85 706 |
| 24a | Bracket | 84 09 746 |
| 24b | Hose clamp | 84 09 841 |
| 26-28 | Humidifier, basic unit MR 730 (Fisher & Paykel) | 84 11 046 |
| 26 | Hose heater adapter | 84 11 097 |
| 27 | Mounting set (clamps for rail) | 84 11 074 |
| 28 | Double temperature sensor | 84 11 048 |
| 29-30 | Humidifier chamber MR 340 | 84 11 047 |
| 30 | Filter paper (set of 100, not illustr.) | 84 11 073 |

| Item No. | Name/Description | Order No. |
|---|---|---|
| 31 | Single-strand wire 1.5 m (not illustr.) | 84 11 050 |
| 32-43 | Hose set, paediatrics (Fisher & Paykel) | 84 12 081 |
| 32-32a | Condensation trap, expiration | 84 09 627 |
| 32 | Water container | 84 03 976 |
| 33 | Double conical connector | 84 09 897 |
| 34 | Temperature sensor mounting | 84 11 044 |
| 35 | Adapter K90 | 84 03 075 |
| 36 | Cap 5x | 84 01 645 |
| 37 | Bellows, paediatric, complete | 84 09 742 |
| 38 | Corrugated hose, flex., 0.13 m | 84 09 634 |
| 39 | Catheter connector, size 11 | M 19 351 |
| 40 | Spiral hose, paediatric, silicone 22/10, 0.40 m | 21 65 856 |
| 41 | Spiral hose, paediatric, silicone 22/10, 1.10 m | 21 65 651 |
| 42 | Spiral hose, paediatric, silicone 22/10, 0.60 m | 21 65 821 |
| 43 | Spiral hose, paediatric, silicone 10/10, 0.60 m | 21 65 848 |
| 44 | Hose heater 1.10 m | 84 11 045 |
| 45 | Bacterial filter | MX 02 650 |
| 46 | $CO_2$ main flow sensor | 68 70 300 |
| 47 | Cuvette, paediatrics | 68 70 280 |
| 48 | Holder for parking $CO_2$ sensor | 84 12 840 |
| 49 | Short GA holder set | 84 11 615 |
| 50 | Y-piece parking rest | 84 11 784 |

# Order List

| Name/Description | Order No. |
|---|---|
| **Basic unit** | |
| Evita 2 dura | 84 11 800 |
| | |
| **Accessories required for operation** | |
| Hinged arm | 84 09 609 |
| or | |
| Quick-fix hinged arm 2 | 2M 85 706 |
| | |
| $O_2$ connecting hose 3 m, blue/white | M 29 231 |
| or | |
| $O_2$ connecting hose 5 m, blue/white | M 29 251 |
| $O_2$ connecting hose 3 m, neutral colour | M 34 402 |
| or | |
| $O_2$ connecting hose 5 m, neutral colour/white | M 34 403 |
| | |
| Medical air connecting hose 3 m, yellow/black | M 29 239 |
| or | |
| Medical air connecting hose 5 m, yellow/black | M 29 259 |
| Medical air connecting hose 3 m, neutral colour | M 34 408 |
| or | |
| Medical air connecting hose 5 m, neutral colour | M 34 409 |
| EvitaMobil trolley | 84 11 950 |
| | |
| **For adult ventilation** | |
| Temperature sensor | 84 05 371 |
| Aquapor EL humidifier | 84 14 698 |
| Set of spare brackets | 84 03 345 |
| Hose set, adult<br>consisting of: patient hoses, water traps, Y-piece, catheter connectors | 84 12 092 |
| | |
| **For paediatric ventilation** | |
| Humidifier, basic unit MR 730 (Fisher & Paykel) | 84 11 046 |
| Mounting set (rail brackets) | 84 11 074 |
| Humidifier chamber MR 340 | 84 11 047 |
| Double temperature sensor | 84 11 048 |
| Single-strand wire, 1.5 m | 84 11 050 |
| Hose set, paediatric (Fisher & Paykel)<br>consisting of:<br>hose heater, patient hoses, water traps, Y-piece, catheter connectors | 84 12 081<br><br><br><br>23 47 020 |
| Bacterial filter | MX 02 650 |

| Name/Description | Order No. |
|---|---|
| **Special accessories** | |
| Instrument tray | 84 11 621 |
| Holder for quick reference manual | 84 11 615 |
| Wall bracket, module 2000 Type 13<br>alternative to trolley | 84 08 613 |
| Pneumatic medicament nebuliser | 84 12 935 |
| Flow sensor cover | 84 14 714 |
| | |
| For manual ventilation: | |
| Resutator 2000 | 21 20 046 |
| Paediatric Resutator 2000 | 21 20 984 |
| Baby-Resutator | 21 20 941 |
| Hook for Resutator | M 26 349 |
| | |
| Adult test lung<br>consisting of: | 84 03 201 |
| Mask manifold | M 25 649 |
| Catheter connector ISO size 7 | M 25 591 |
| Breathing bag, 2 L | 21 65 694 |
| For trolley: | |
| Cabinet unit 8H, 360 mm high | M 31 796 |
| | |
| For supplying Evita 2 dura with medical air: | |
| Breathing air compressor | 84 13 890 |
| Standby option | 84 13 939 |
| Special voltage transformer | 84 13 936 |
| MEDIBUS cable | 83 06 488 |
| Printer cable | 83 06 489 |
| | |
| **Options** | |
| Installation set, Ventilation Plus | 84 13 540 |
| Installation set, Monitoring Plus | 84 13 545 |
| Installation set, Service Plus | 84 13 550 |
| Installation set, Evita Link | 84 11 735 |
| Installation set, Evita Sat | 84 13 035 |
| Modification set – DC module | 84 13 034 |
| Modification set – Evita DC power supply MB | 84 15 581 |
| Installation set, Capno Plus | 84 13 780 |
| Accessories for CapnoPlus: | |
| Adult cuvette | 68 70 279 |
| Paediatric cuvette | 68 70 280 |
| $CO_2$ main flow sensor | 68 70 300 |
| Bracket for parking $CO_2$ sensor | 84 12 840 |
| Modification set – Mask ventilation (NIV) | 84 14 474 |

| Name/Description | Order No. |
|---|---|
| Modification set – Nurse call | 84 14 476 |
| Plug for connecting the nurse call | 18 46 248 |
| Modification set – EvitaRemote | 84 14 472 |
| Upgrade modification set Software 4.14 Evita 2 dura | 84 15 794 |
| Upgrade modification set Software 4.0 plus Evita 2 dura | 84 14 470 |
| Modification set – Nurse call/ 2nd pressure sensor | 84 15 570 |
| **For $CO_2$ measurement (option)** | |
| Test filter | 68 70 281 |
| Calibration set | 84 12 710 |
| Test gas cylinder 5 Vol.% $CO_2$, 95 Vol.% $N_2$ | 68 50 435 |
| **Spare set for sterilisation** | |
| Expiration valve (expiration valve) | 84 10 580 |
| For adult ventilation: | |
| Hose set, adult | 84 12 092 |
| Patient part for Aquapor | 84 05 029 |
| Temperature sensor | 84 05 371 |
| Pneumatic medicament nebuliser | 84 12 935 |
| Cuvette, adult | 68 70 279 |
| For paediatric ventilation: | |
| Hose set, paediatric (Fisher & Paykel) | 84 12 081 |
| Humidifier chamber MR 340 incl. filter paper for humidifier chamber (set of 100) | 84 11 047 |
| Cuvette, paediatric | 68 70 280 |
| **Replacement parts** | |
| For Evita 2 dura: | |
| $O_2$ sensor capsule | 68 50 645 |
| Flow sensor (set of 5) | 84 03 735 |
| Cooling air filter, blue | 84 12 384 |
| Cooling air filters DC power supply MB | 84 15 572 |
| Lithium battery for data protection | 18 35 343 |
| For hinged arm: | |
| Holder | 84 09 746 |
| Hose clamp | 84 09 841 |
| For adult ventilation: | |
| Temperature sensor | 84 05 371 |
| Replacement set of lids for Aquapor | 84 06 135 |

| Name/Description | Order No. |
|---|---|
| Aquapor bowl | 84 04 739 |
| Aquapor float | 84 04 738 |
| Spiral hose, adult, silicone 0.6 m | 21 65 627 |
| Spiral hose, adult, silicone 0.35 m | 21 65 619 |
| Water trap | 84 04 985 |
| Water container | 84 03 976 |
| Hose clamp | 84 03 566 |
| Connector | M 25 647 |
| Y-piece | 84 05 435 |
| Catheter connector, straight, size 12.5 (set of 10) | M 23 841 |
| Corrugated hose | 84 02 041 |
| Adaptor, adult | 84 03 076 |
| Set of catheter connectors, adult | 84 03 685 |
| Set of caps (set of 5) | 84 02 918 |
| ISO elbow connector | M 25 649 |
| For paediatric ventilation: | |
| Spiral hose, paediatric, silicone, 22/10, 1.10 m | 21 65 651 |
| Spiral hose, paediatric, silicone, 22/10, 0.60 m | 21 65 821 |
| Spiral hose, paediatric, silicone,10/10, 0.60 m | 21 65 848 |
| Spiral hose, paediatric, silicone, 22/10, 0.40 m | 21 65 856 |
| Corrugated hose flex., 0.13 m | 84 09 634 |
| Catheter connectors, size 11 (set of 10) | M 19 351 |
| Cap | 84 01 645 |
| Adaptor, paediatric, 90° | 84 03 075 |
| Double conical connector | 84 09 897 |
| Temperature sensor mounting | 84 11 044 |
| Condensation trap, expiration | 84 09 727 |
| Water container | 84 03 976 |
| Hose heater 1.10 m | 84 11 045 |
| Double temperature sensor | 84 11 048 |
| Adaptor for hose heater | 84 11 097 |
| Single-strand wire, 1.5 m | 84 11 050 |
| Humidifier chamber, MR 340, incl. filter paper (set of 100) | 84 11 047 |
| Filter paper for humidifier chamber (set of 100) | 84 11 073 |
| Bacterial filter | MX 02 650 |
| Technical documentation available on request | |

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These Instructions for Use apply only to
**Evita 2 dura**
with Serial No.:

If no Serial No. has been filled in by Dräger these Instructions for Use are provided for general information only and are not intended for use with any specific machine or device.

CE 0123

Directive 93/42/EEC
concerning Medical Devices


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