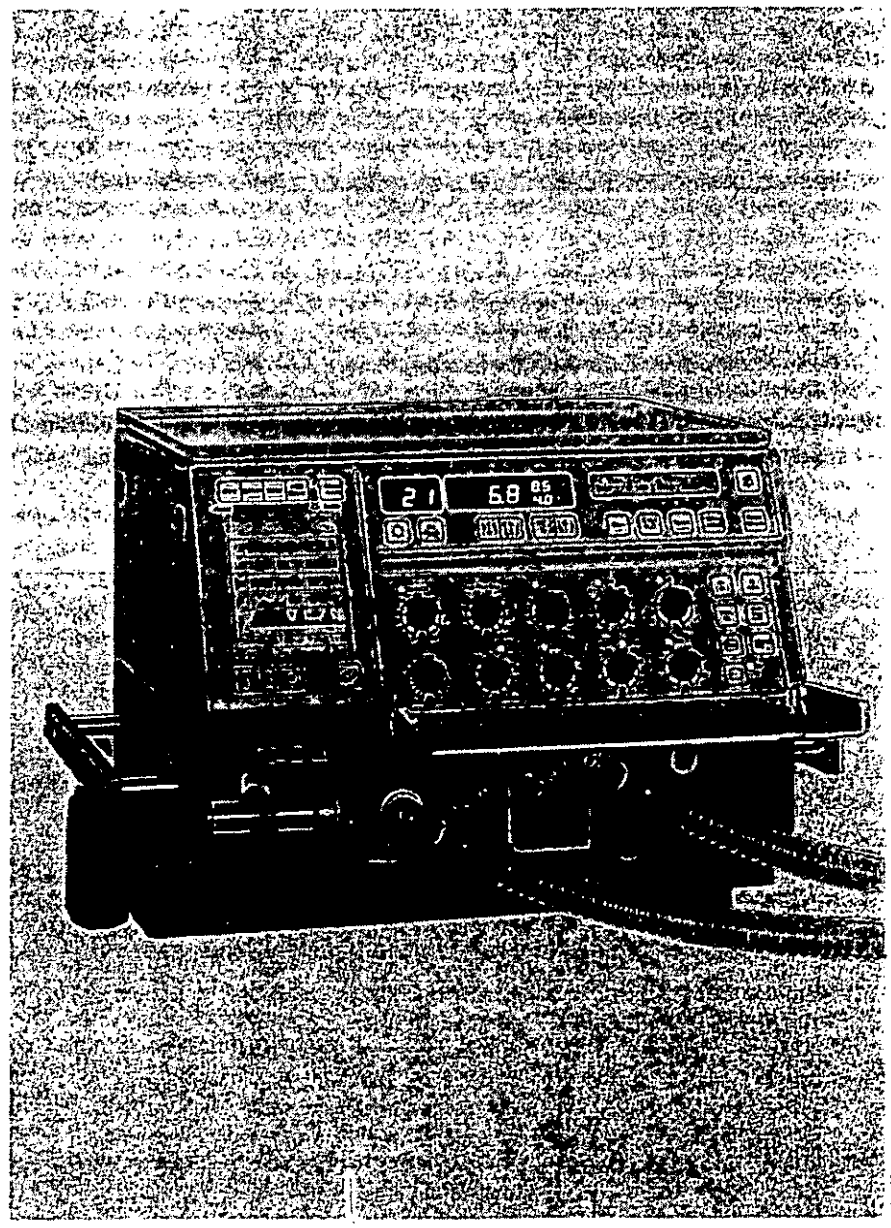
Dräger

# Evita 2

## Intensive Care Ventilator

Instructions for Use
Software 1.n



A2

# Contents





A3

# For Your Safety and that of Your Patients

For correct and effective use of the apparatus and to avoid hazards it is essential to read the following recommendations and to act accordingly[1]:

### 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[2] and serviced[2] regularly by trained service personnel at six monthly intervals (and a record kept).
Repair[2] 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[2].
Observe chapter "Maintenance Intervals".

### Power connection

The apparatus is to be used only in rooms with mains power supply installations complying with national safety standards (such as in F. R. of Germany: VDE 0107).

The requirements laid down in IEC 601-1 "Safety of Medical Electrical Equipment" are applicable for electrically powered equipment.

### 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 authorized by DrägerService or if the apparatus is used in a manner not conforming to its intended use.

Drägerwerk Aktiengesellschaft 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 Drägerwerk Aktiengesellschaft are likewise not modified by the recommendations given above.

Drägerwerk Aktiengesellschaft 12.92

---

1)
Insofar as reference is made to laws, regulations or standards, these are based on the legal system of the Federal Republic of Germany.

2)
Definitions according to DIN 31 051:

| | |
|---|---|
| Inspection | = examination of actual condition |
| Service | = measures to maintain specified condition |
| Repair | = measures to restore specified condition |
| Maintenance | = inspection, service, repair |



A4

# Intended Use

Time-cycled, volume-constant long-term ventilator for intensive care. For adults and children with a body weight of at least 3 kg.

With the following ventilation modes:

**IPPV** Intermittent Positive Pressure Ventilation controlled and assisted volume-constant ventilation.
With the options:
- CPPV (Continuous Positive Pressure Ventilation)
- PLV (Pressure Limited Ventilation)
- PCV (Pressure Controlled Ventilation)
- IRV (Inverse Ratio Ventilation).

**SIMV** Synchronised Intermittent Mandatory Ventilation,
procedure for weaning spontaneously-breathing patients off the ventilator.

**MMV** Mandatory Minute Volume Ventilation, spontaneous breathing with automatic adjustment of mandatory ventilation to the patient's minute volume requirement.

**SB** Spontaneous Breathing,
spontaneous breathing at ambient pressure.

**CPAP** Spontaneous breathing with positive airway pressure.

**ASB** Assisted Spontaneous Breathing,
pressure-assisted spontaneous breathing.

**BIPAP** Biphasic Positive Airway Pressure,
spontaneous breathing on two different CPAP levels and adjustable pressure increase with switching between CPAP levels automatically synchronised.

**BIPAP-SIMV** Spontaneous breathing on two pressure levels (same as BIPAP), but with SIMV time model and pressure assistance ASB.

**BIPAP-APRV** Airway Pressure Release Ventilation, spontaneous breathing on two pressure levels (same as BIPAP) with long time ranges, independently adjustable.

Special types:

**Apnoea-ventilation** Spontaneous breathing with guaranteed ventilation after end of adjustable Apnoea time.

**ILV** (optional) Independent Lung Ventilation independent, differentiated, synchronised ventilation with two Evita 2 ventilators.

Diagnosis:

**Tachypnoea** for detecting dead space intensive spontaneous breathing.

***Intrinsic* PEEP measurement** for determining intrinsic PEEP during air trapping.

**Occlision pressure** for evaluating breathing drive during spontaneous breathing.



A5

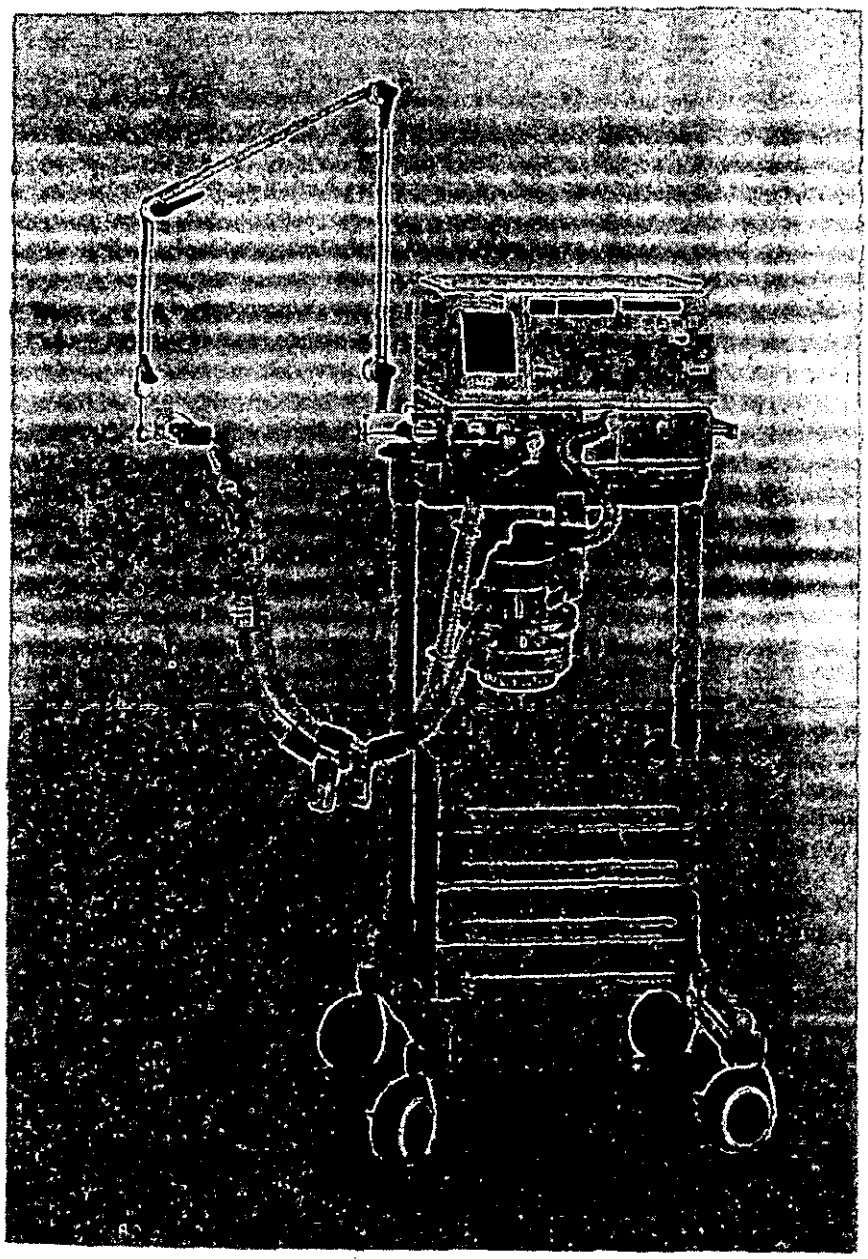
# Intended Use

With monitoring for:

- airway pressure, Paw
- minute volume, $\dot{V}_E$
- inspiratory $O_2$ concentration, $FiO_2$
- inspiratory breathing gas temperature

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

**This equipment must not be used with flammable gases or anaesthetic agents. Danger of fire.**





AG

**Appropriate monitoring of ventilation**
(recommendations by DGAI)*

The following ventilation parameters are monitored to ensure appropriate supervision of ventilation and the detection of undesirable changes:

- airway pressure
- inspiratory oxygen concentration
- expiratory minute volume
- inspiratory breathing gas temperature, where applicable.

Changes in these parameters may be caused by:

- acute changes in the patient's condition
- incorrect settings and faulty handling
- malfunctioning equipment
- failure of power and gas supplies

Evita 2 has built-in monitoring facilities for airway pressure, inspiratory oxygen concentration, expiratory minute volume, as well as inspiratory breathing gas temperature.

If a fault occurs in the equipment, separate measuring instruments (e.g. PM 8030, Oxydig, AWT 01) may be used.

**Ventilation with an independent manual ventilation device**

When due to a recognised fault in the ventilator its life-support functions can no longer be ensured, ventilation must be started without delay by means of an independent ventilation device – if required with PEEP and/or increased inspiratory $O_2$ concentration (e.g. Resutator 2000).

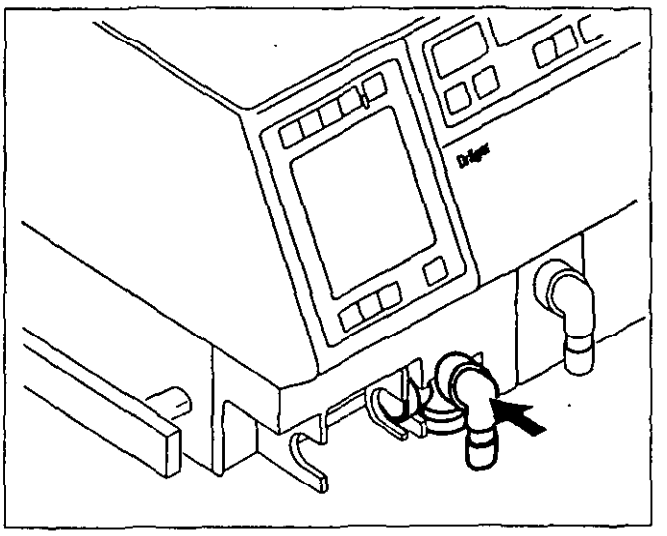
* German Association for Anaesthesia and Intensive Care Medicine



A 7

# Preparation

The following description refers to the assembly of the equipment, the connection of the hoses, as well as the calibration of the integrated monitors. These actions must be followed by a test of readiness for operation, page 92.

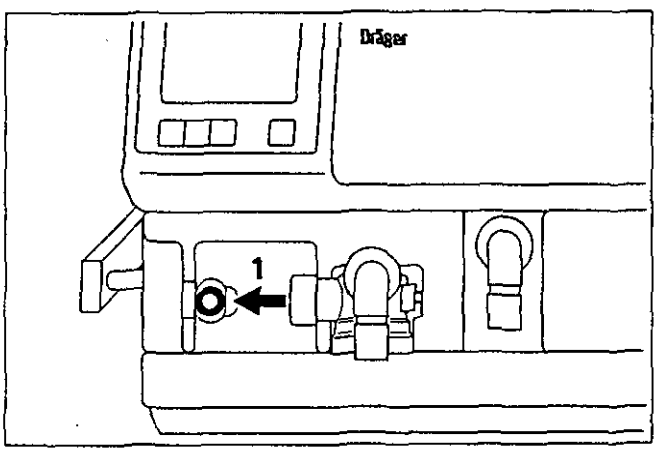


## Fitting patient system

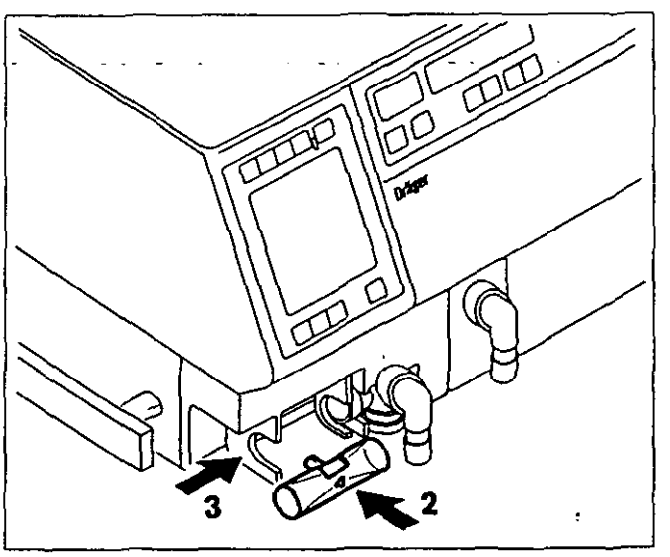
- Push patient system into mounting as far as it will go.

  Make sure that it is engaged by gently pulling the port.

## Fitting flow sensor




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




2 Place flow sensor – with plug towards the equipment – into the mounting and push into the socket as far as it will go.

Then:

3 push to the right into the rubber lip on the patient system as far as it will go.



A8

## Fitting O2 sensor

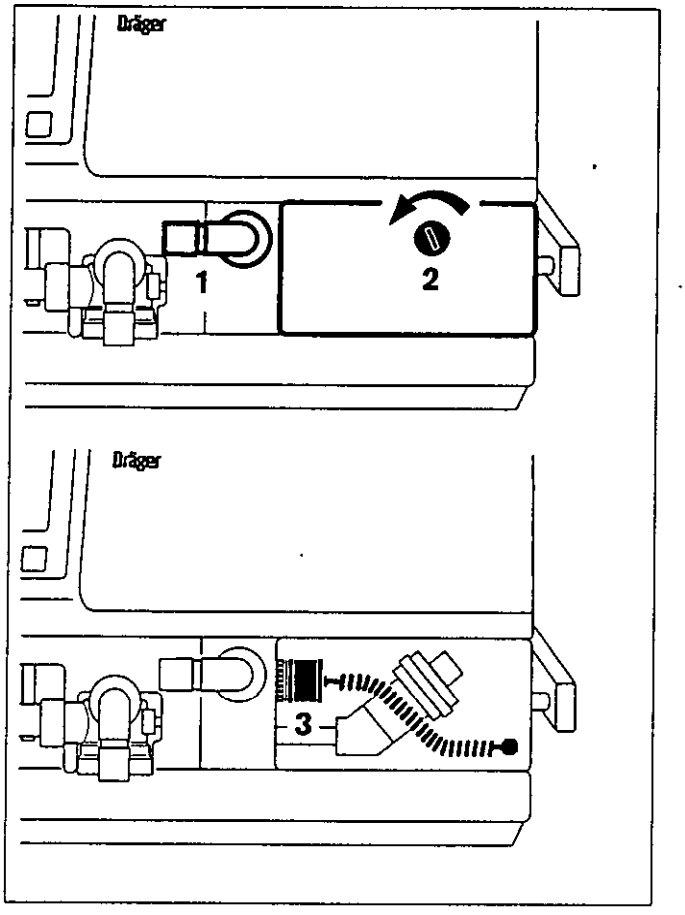
- when operating for the first time
- when display reads:

  **O2 meas. inop**

  when calibration can no longer be carried out.

1 Turn port downwards or to the left.

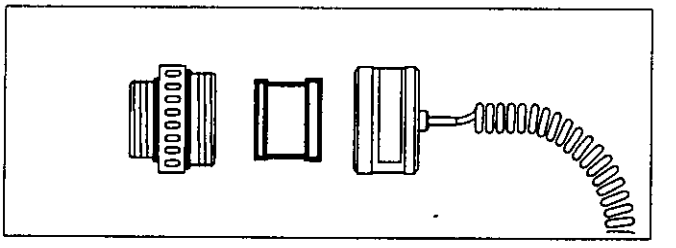
2 Use coin to loosen screw, remove protective cover.




3 Remove O2 sensor from the mounting and unscrew housing.

Insert new sensor capsule:

- The side with circular contacts goes into the housing.



- Re-assemble sensor housing, push firmly into the mounting. Re-assemble protective cover.
- Dispose of used sensor, page 102.

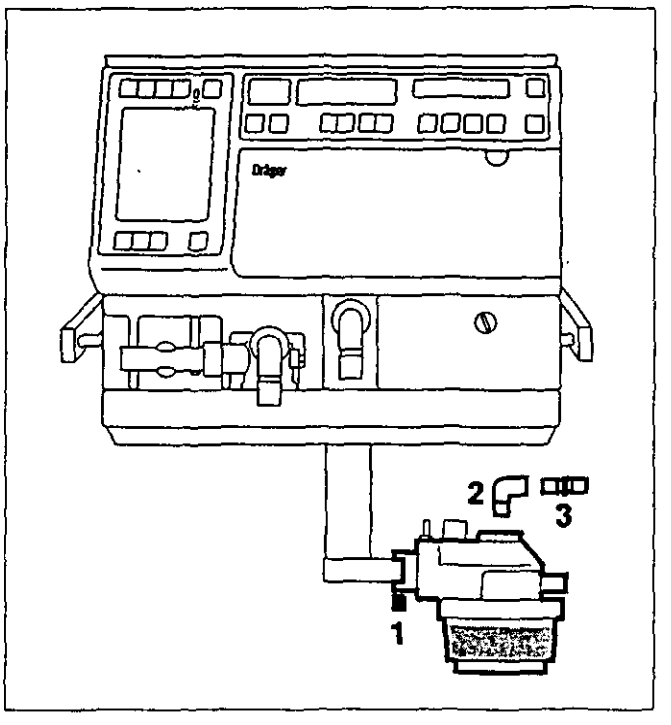


A9

## For Ventilating Adults and Children

from 100 mL tidal volume $V_T$

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




### Connecting Aquapor humidifier

Prepare Aquapor following relevant Instructions for Use.

1 Hang Aquapor from rail by bracket and tighten screws.

2 Insert elbow connector into Aquapor.

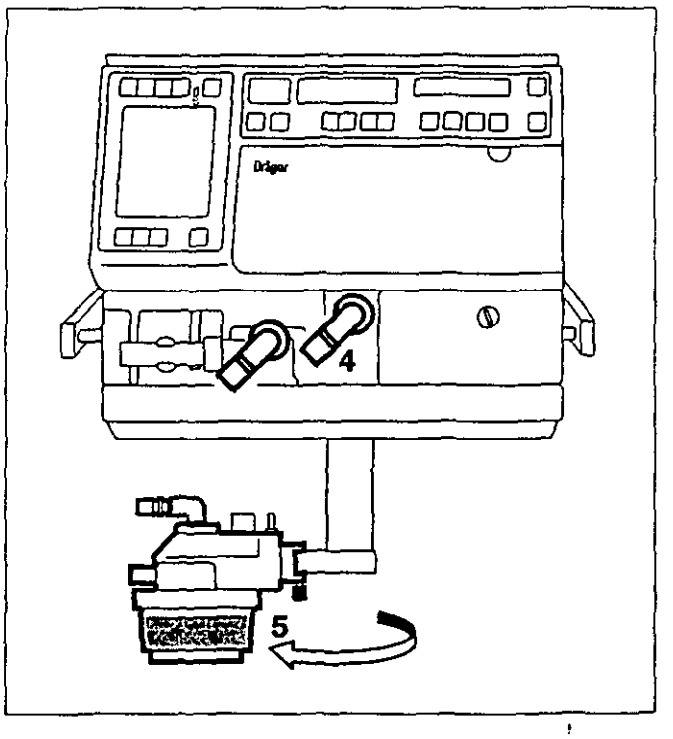
3 *Insert connector into elbow connector.*

- Fill Aquapor bowl with distilled water to upper mark.

### Connecting ventilation hoses

*Do not use antistatic or conductive hoses*.*

The ventilation hoses can be attached on either side of the machine.




Attachment on **left-hand side:**

4 Rotate both ports to the left by 180°.

5 Swivel Aquapor to the left.

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

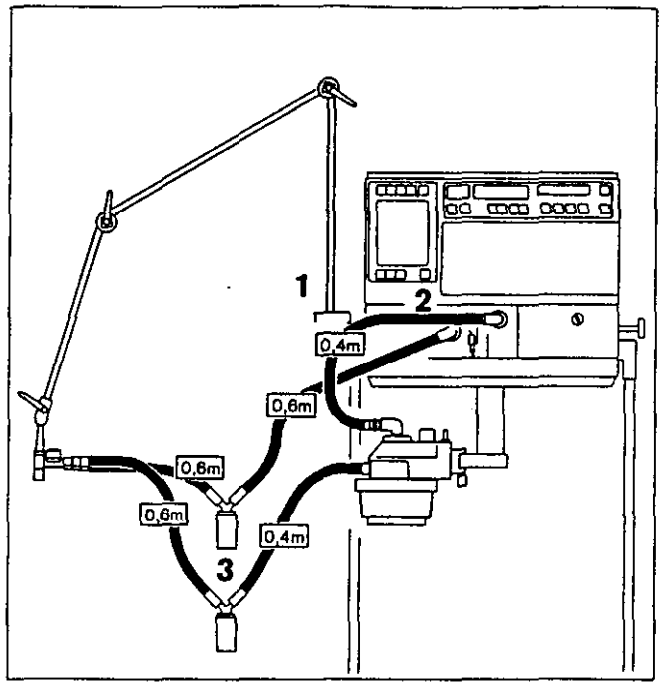
* DIN VDE 0750 part 215 "Lung ventilators":
To avoid any increase in electrical risk to the patient in the event of earth failure on patient monitoring equipment, *antistatic or electrically-conductive hoses* should not be used.

1 Suspend hinged arm from rail on left-hand side and tighten screws.

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

2 Rotate ports in the direction of the hoses.

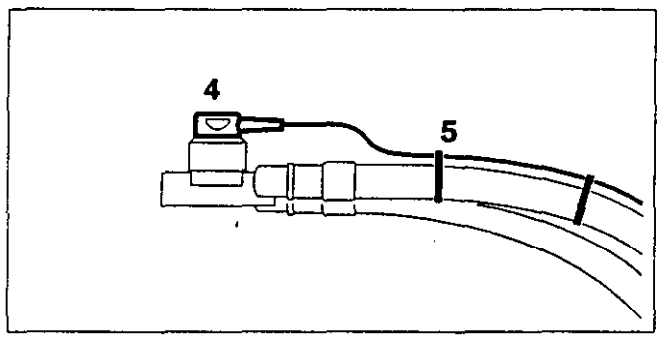
3 Keep water traps in a vertical position.



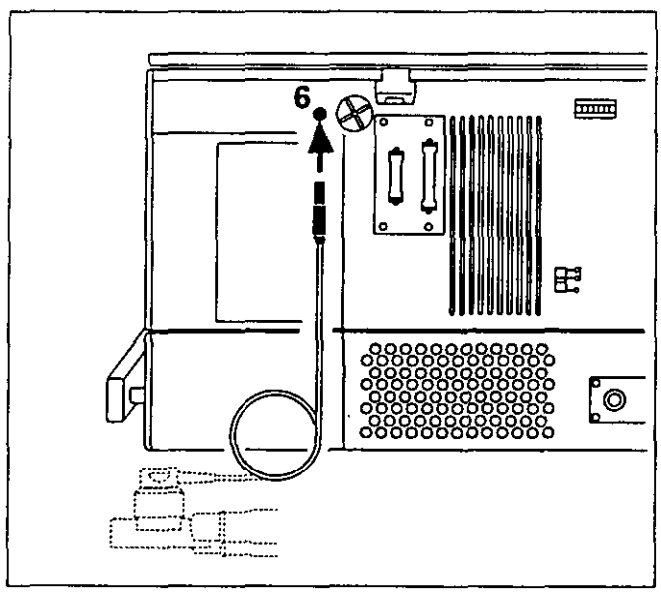

**Fitting temperature sensor**

4 Put sensor into rubber sleeve on inspiratory side of Y-piece. Align Y-piece so that sensor is located at the top.

5 Attach sensor cable with hose clips.




6 Insert cable plug into socket at rear.




Evita 2 can also be operated without a temperature sensor, if the temperature sensor was not connected when switching on.

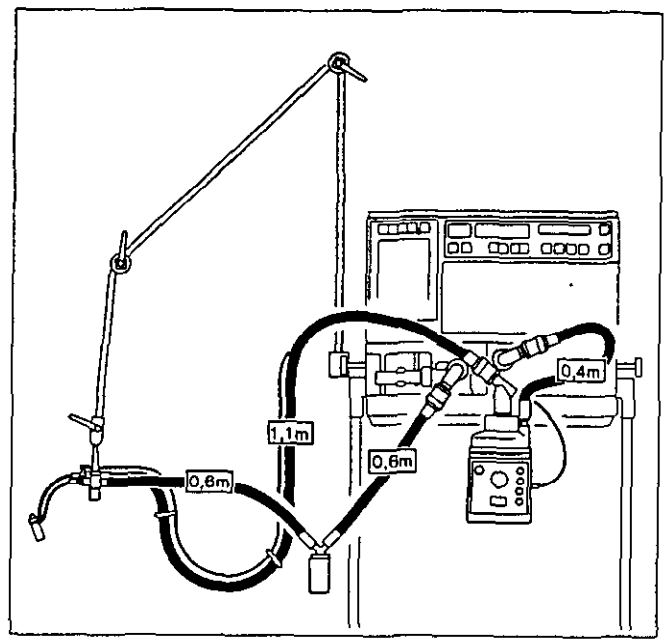


A11

## For Ventilating Infants

Up to 300 mL tidal volume $V_T$

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




- Prepare "Fisher & Paykel MR 730" humidifier following Instructions for Use, using K, F & P hose set.
- Attach humidifier and bracket to mounting below the equipment and tighten screws.
- Hang hinged arm from rail by bracket on left-hand *side and tighten screws.*
- Connect ventilation hoses, note length of hoses (metres).
- Keep water trap in a vertical position.



A12

## Electrical power supply

Mains voltage must correspond to voltage range given on plate on back.

either: 220 V to 240 V
or : 100 V to 127 V

- Insert mains connector.

### Socket strip for ancillary equipment

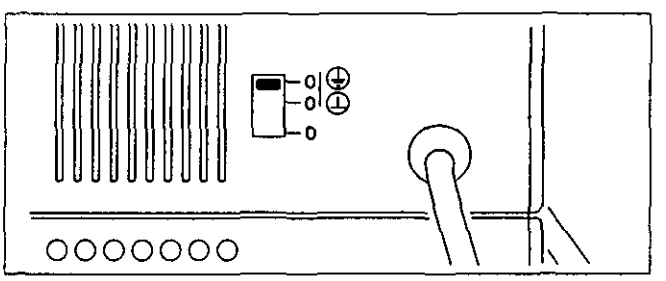
Connecting equipment to extension sockets may lead to an increase in current leakage to the patient beyond the permissible values in the event of earth failure. There may then be an increased electrical risk.

## Connection to other equipment

– via optional RS 232 interface.

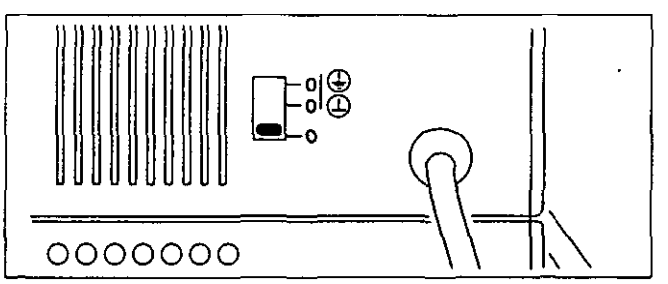
Connecting electronics to earth:

- Slide switch (back of machine) upwards
- Do not earth the electronics of the other equipment connected to Evita 2.



### When no equipment connected to Evita 2

- Slide switch downwards.





A 13

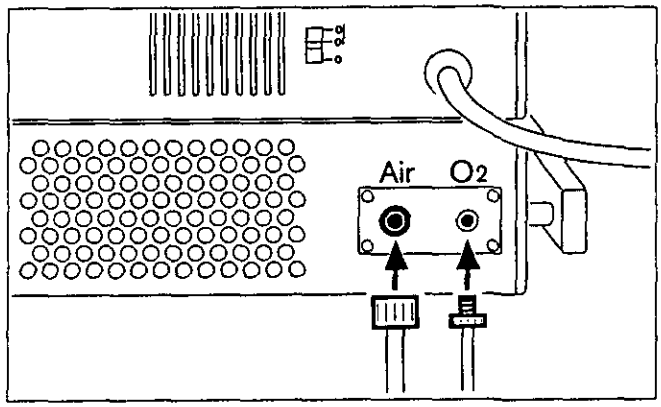
## Temporary interruption of power supply
**for instance when switching on reserve power supply**

Evita 2 reacts to power interruptions lasting longer than 10 milliseconds in the same way as it does during switching on: The machine carried out a 10-second self-test and then continues operating with the set values set previously.
When lower alarm limit for minute volume has been set the »MV low« alarm is activated until the measured value has risen above the lower alarm limit.

## Gas supply

- Screw compressed air and oxygen connecting hoses to the back of Evita 2 and insert the probes into terminal units.

  Compressed gases must be dry and free from dust and oil.




**Do not place containers of liquid in the immediate vicinity of, or on top of, Evita 2. A leak or spill could prevent it from working properly.**

**Equipment must always be used with instrument tray attached.**

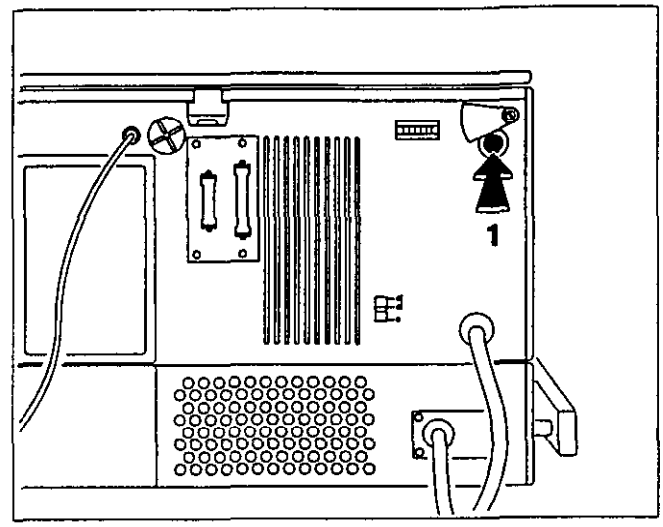


A14

## Operating for the first time

### Charging storage battery for mains failure alarm

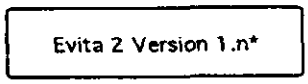
The built-in battery for power failures is automatically re-charged during operation. Before operating for the first time the equipment should be run for 2 hours to make sure that the battery is adequately charged.

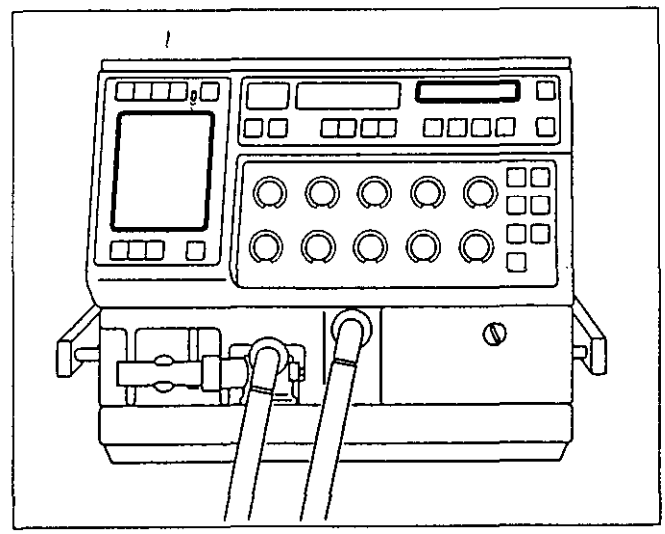



1 Push in mains switch on left hand side at the back until stop = ON.

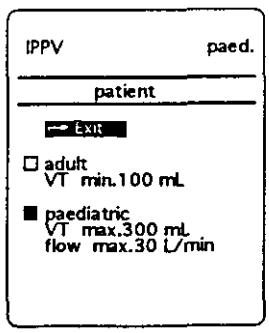
Display on screen:


A self-test which checks the internal programme memory runs for about 10 seconds. All LEDs are lit. The measured value display shows which software version is being used:



- Display on screen (example):




After switching on, Evita 2 always starts ventilation in the ventilation procedure and patient mode selected previously.

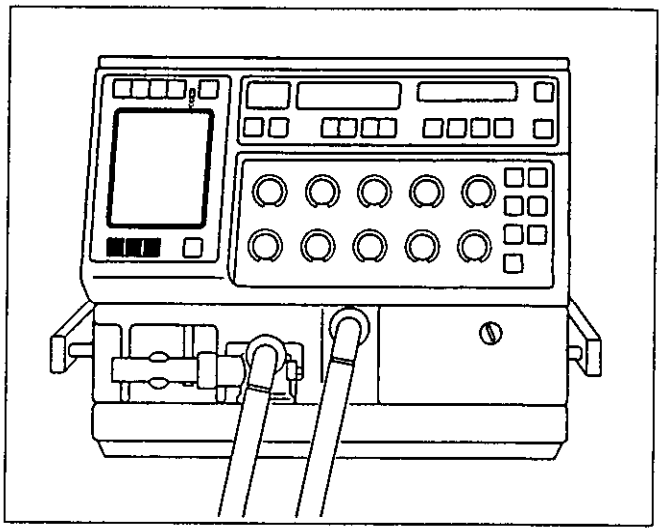
* n = 00 to 99

When another patient mode is selected:

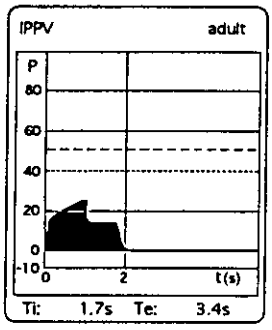
- In »patients« menu, select between adults and children:
  with [↓] button or [↑] button.

The selection is shown light on a dark background.

- Confirm selection:
  with [•] button.



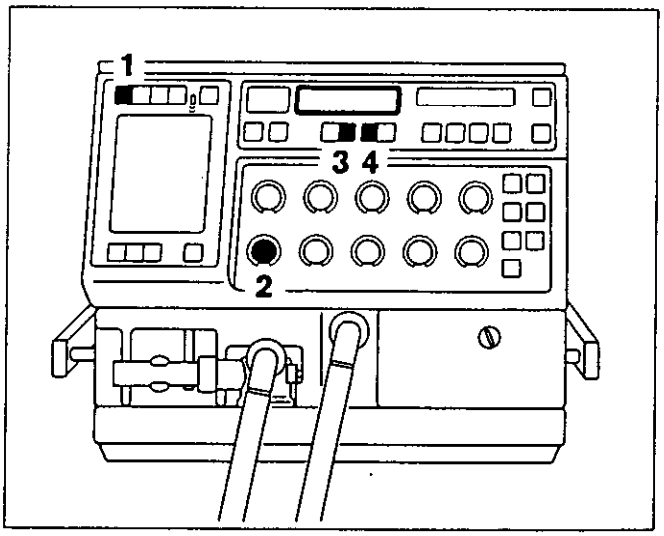
Display on screen (example):




1 Keep [IPPV] button pressed for about 3 seconds, until green LED is continuously lit.

2 Rotary knob »$V_T$« to 0.5 L.

- Other rotary knobs to »green dot«.




To switch off alarm limits for minute volume $\dot{V}_E$:

3 Press [↑] button until upper alarm limit = OFF.

4 Press [↓] button until lower alarm limit = OFF.

- Attach 2.0 L breathing bag on Y-piece, and operate Evita 2 for about 2 hours at this setting to re-charge storage battery for mains failure alarm completely.

* Ausführliche Beschreibung der Menü-Funktionen, Seite 64.



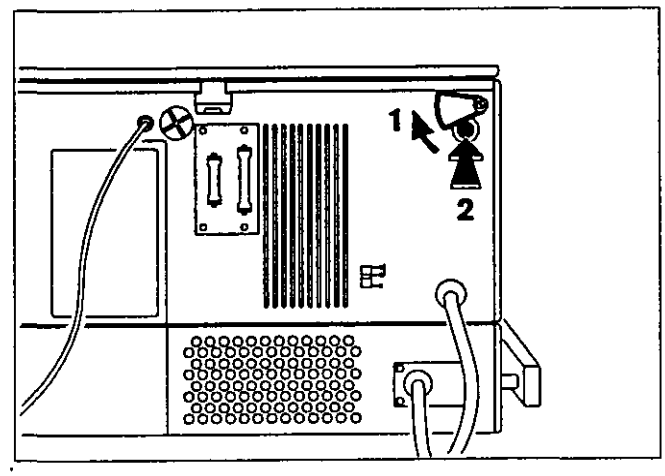
B2

**To switch off equipment**

At rear:

**5** Move protective cap on mains power plug aside,

**6** Push button in as far as it will go and release = OFF.






B3

## Calibration

The values obtained during the last calibration will be stored until the next calibration, even when the machine is switched off. Flow sensor can be calibrated at any time, including during ventilation. The pressure sensors are calibrated automatically for measuring airway pressure.

## Calibrating O2 sensor

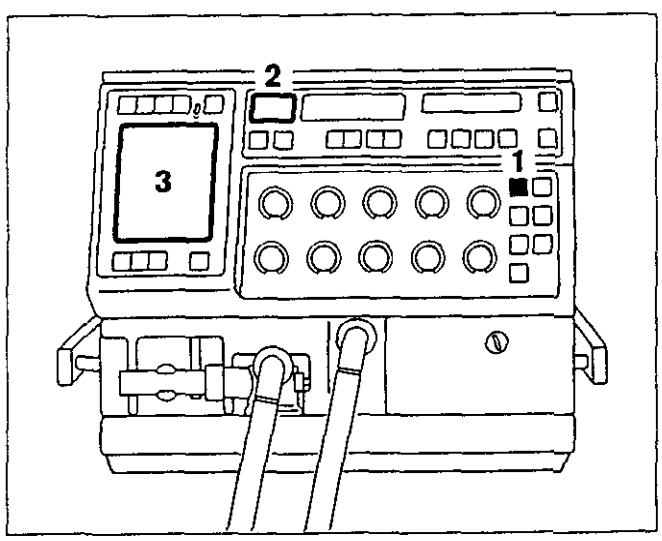
- When $O_2$ alarm has been given.
- Following sensor replacement
- When the difference between measured value and set value has been more than 2 vol.%

We recommend calibration every time the machine is prepared for optimum accuracy of measurement. The $O_2$ sensor can be calibrated with 100 vol.% $O_2$ at any time, provided that the ventilation hose system is disconnected during calibration.

1 Keep [O2 ▼] button pressed for at least 3 seconds, until the yellow LED remains continuously lit.

2 Display for $O_2$ concentration in window:

| | |
|---|---|
| $O_2$ | 0 |
| Vol.% | 0 |




3 Display on screen:

**disconnect Y-piece**

Evita 2 now ventilates with 100 vol.% $O_2$. If no PEEP greater than 4 mbar has been set, a PEEP of 4 mbar comes into operation. With this PEEP, Evita 2 can detect any disconnection of the Y-piece which may follow.

- Disconnect the Y-piece within the next minute.

The machine detects the disconnection.

3 Display on screen:

**$O_2$ calibration***

* If the message »time limited« is given during calibration, there will be no »$O_2$ calibration« display.
However, calibration will continue normally.



B4

During calibration the acoustic alarms are suppressed. When calibration has finished, the machine re-starts ventilation.

- Re-connect Y-piece.

The acoustic alarms remain muted for another 15 minutes, the lower alarm limit for minute volume is switched off for 2 minutes.

1 Screen display:

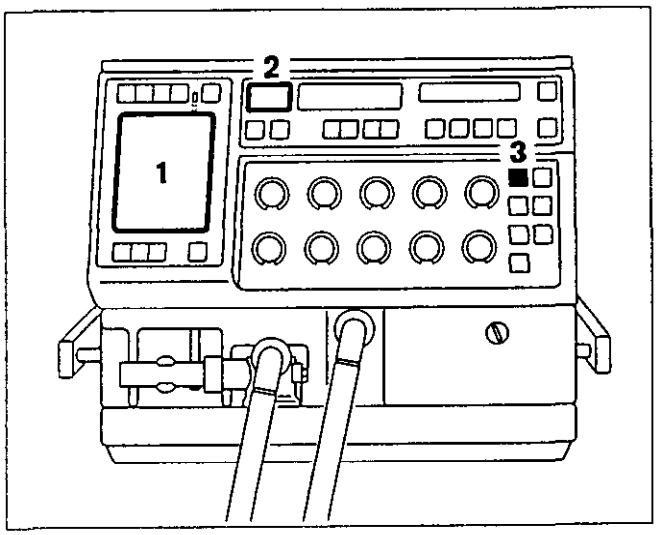
**$O_2$ cal. interrupted**

or

2 Display in window for $O_2$ concentration:

– –

See "Fault, Cause, Remedy", page 104.




**If calibration is to be discontinued for instance,** when Evita needs to be used immediately:

3 Press $O_2$ ▼ button again, the machine operates with the previous calibration values and

1 Display on screen:

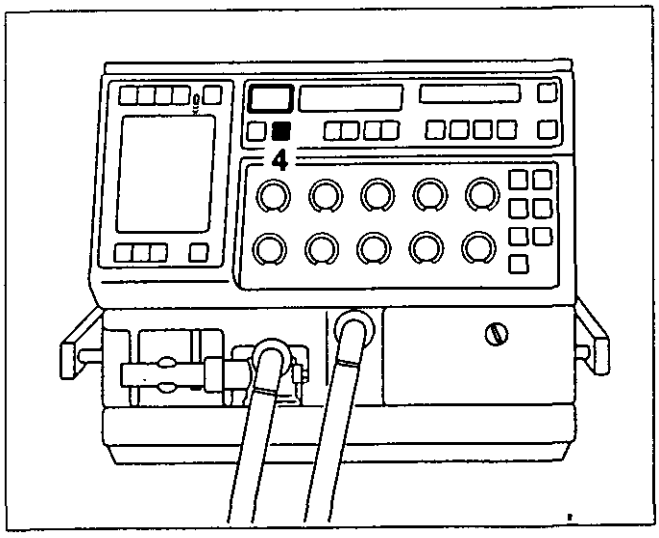
**$O_2$ cal. interrupted**

**When monitoring is to be switched off in exceptional circumstances**

for instance, if a malfunction in $O_2$ measurement cannot be put right immediately:

4 Press $O_2$ Alarm button, yellow LED flashes:

**$O_2$ monitoring is switched off permanently**




Switching on again:

4 Press $O_2$ Alarm button again, yellow LED goes out.



B5

## Calibrating flow sensor

- Every 24 hours
- Following sensor replacement.

Before each calibration the flow sensor is cleaned automatically. After a medicament nebulizer has been used the flow sensor is cleaned automatically and calibrated.

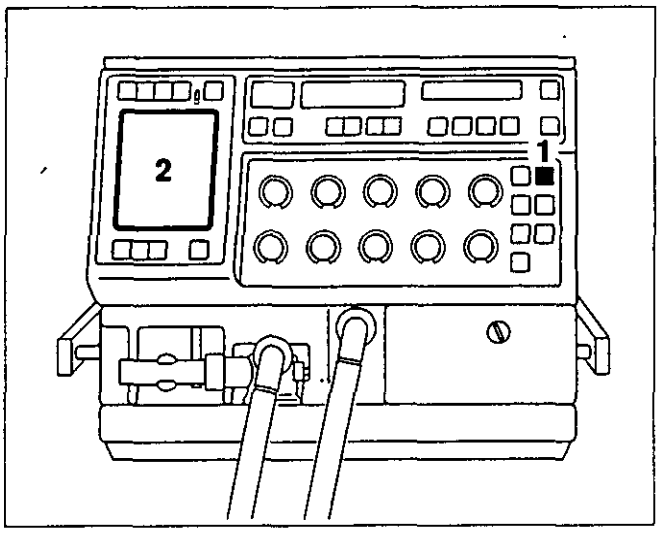
Calibration is carried out automatically during the inspiration phase.

1 Press VE button:

At the start of inspiration the expiratory valve is closed for about 1 second: flow = 0. Shorter inspiration times are increased to about 1 second. Yellow LED lights during calibration.

2 Display on screen:

**flow cal.***




After calibration the yellow LED in VE button goes out.

* If the message »time limited« is given during calibration, there will be no »flow cal.« display. However, calibration will continue normally.



B6

## Equipment Check

– immediately before use.

A copy of the following checklist is in the drawer below the machine.

- Each step of the checklist must be ticked off with a pencil, dated and signed by the checker.

| System | What | Requirement |
|---|---|---|
| Breathing system | Patient system<br>Flow sensor<br>Temperature sensor<br>Hoses, water traps, humidifier | engaged or screwed on.<br>connected.<br>inserted.<br>complete and fixed. |
| Electrical supply | Mains switch ON,<br>Connect mains plug:<br><br>Press [IPPV] button: | Intermittent sound commences.<br>Continuous sound, and then intermittent sound.<br><br>Display: **air supply down**<br>Fan noise and suction at the fan in the back of the machine. |
| Gas supply | Insert »$O_2$« and »air« probes<br><br>Keep [Reset Check] button pressed: | New display:<br>**airway pressure low**<br><br>Continuous sound commences, all number displays are shown and all LEDs are lit. |
| Hunidifier Aquapor*<br>Electrical supply<br>function | Distilled water level:<br>Mains switch ON,<br>Heating switched on | to »max«<br>white »Mains« light on<br>yellow »Heating« light on. |
| Calibration<br>Flow<br><br>$O_2$ | <br>Press button [$\dot{V}E$ -O-]<br><br>Only if measured value deviates from set value by more than 2 vol.%:<br><br>Press button [$O_2$ ▼] and leave Y-piece open. | <br>Display: **flow cal.**<br><br><br><br>Display: **$O_2$ cal.** |
| Gas-tightness of breathing system | Rotary knob $V_T$ to 0.1 L or for paed. ventilation to 0.04 L,<br>»insp. flow $\dot{V}_{max}$« to 6 L/min<br>»$p_{max}$« to 80 mbar and press button [Reset Check],<br><br>»$T_I$:$T_E$« to 4:1 and press [Reset Check] button,<br>all other rotary knobs to »green dot«.<br><br>Keep Y-piece sealed and observe peak pressure (pmax) and plateau pressure (pplat) over several ventilation strokes. | When peak pressure of 80 mbar is reached, plateau pressure **must not be below peak pressure by more than 15 mbar.**<br>If peak pressure remains below 80 mbar, plateau pressure **must not be below peak pressure by more than 10 mbar.**<br><br>A slight pressure increase (caused by internal flush flow) indicates sufficient tightness). |
| IPPV function | »$V_T$« to 0.1 L, or for paed. ventilation to 0.04 L,<br>»$p_{max}$« to 60 mbar, all other rotary knobs to »green dot«.<br>Connect test lung 84 03 201.<br>Or:<br>Connect child test lung 84 09 742. | After about 30 s in the right-hand display:<br><br>Tidal volume $V_{Te}$ 90 to 100 mL<br>frequency f 12 ± 1/min<br>or for paed. ventilation 36 to 44 mL. |
| ASB/spont. function | Press button [ASB Spont],<br>CPAP to 5 mbar,<br>»ASB« to 20 mbar<br>» ⩘ « to 0.5,<br>Squeeze test lung or child test lung on Y- piece gently and release. | Airway pressure rises to about 20 mbar and then falls back to 5 mbar. |

* Fisher & Paykel MR 730 humidifier – test following relevant Instructions for Use.

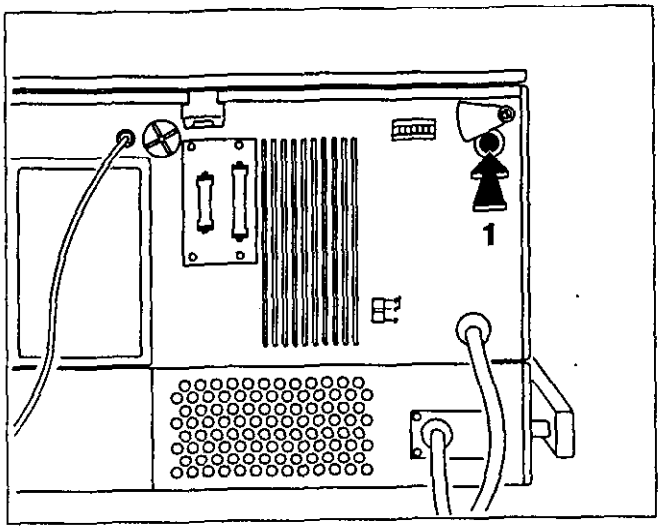


B7

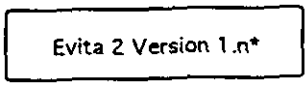
## Switching on

1 Press mains switch on left hand side at rear until it engages = ON.

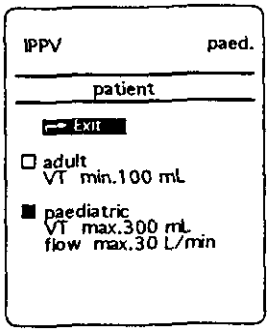
Screen display:


A self-test which checks the internal programme memory runs for about 10 seconds, all LEDs are lit. The software version used for the measured values is shown in the display:




Menu display is shown on screen (example, paediatric ventilation):




After switching on, Evita 2 always starts ventilation in the ventilation procedure and patient mode selected previously.

**After switching on, set machine to desired patient mode, page 22.**

* n = 00 to 99



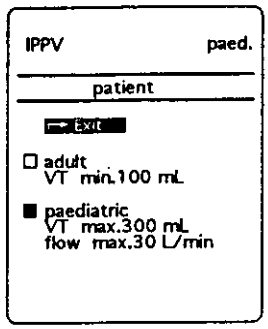
B8

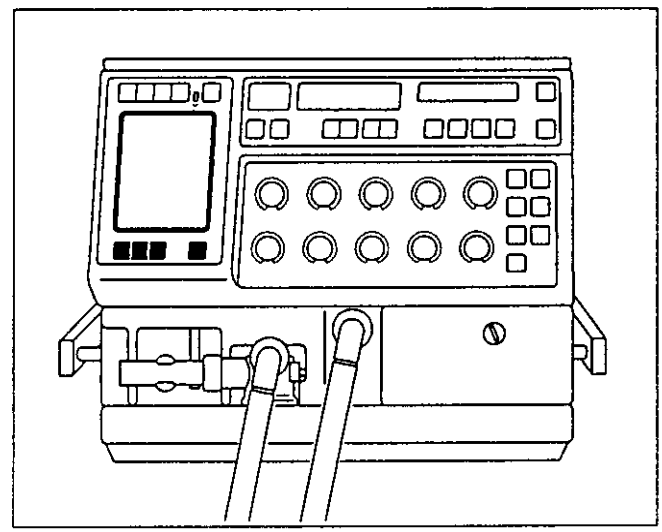
## Selecting adult or paediatric ventilation

### After switching on

Paediatric ventilation with tidal volume $V_T$ 0.04 L to 0.3 L.
Adult ventilation from tidal volume $V_T$ of 0.1 L.

Display (example, paediatric ventilation):



If a different patient mode is desired:

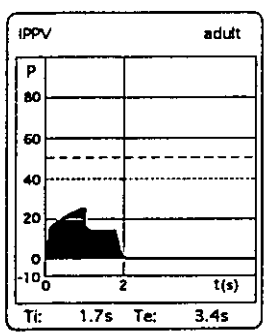
- In menu select with ↓ button or ↑ button.
  Selection is shown light on a dark background.
- Confirm selection with • button.

If no change of patient mode is desired:

- Press • button or ⧉ button

  or

- after about 30 seconds the pressure curve will be displayed automatically.
- Screen display (example):




* Detailed description of the menu-functions, page 64.



B9

## Basic setting of mandatory pattern of ventilation

For the ventilation modes

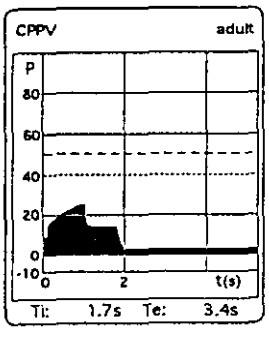
IPPV, SIMV, MMV, ASB/spont., Apnoea ventilation, ILV (optional):

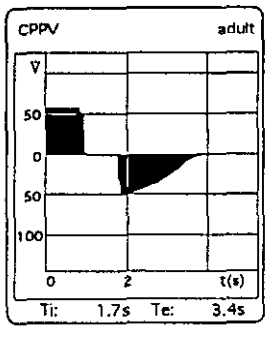
- with rotary knobs:

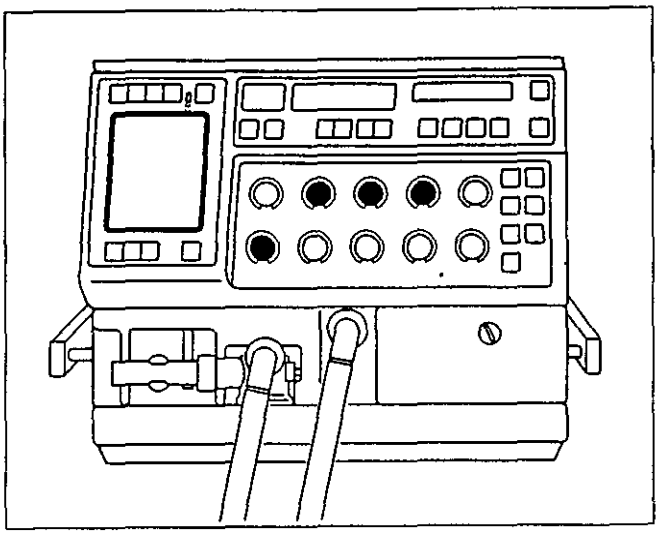
| | |
|---|---|
| tidal volume | $V_T$ |
| frequency | f |
| ratio | $T_I$:$T_E$ |
| insp. flow | $\dot{V}_{max}$ |

and
with rotary knobs which apply for all ventilation modes:

| | |
|---|---|
| $O_2$ concentration | $O_2$ vol.% |
| endexp. pressure | PEEP/CPAP |



Select screen diagram Paw (t) or $\dot{V}$ (t), pages 61, 62.
Select measured values for the display, page 53.

The inspiration time $T_I$ and expiration time $T_E$ which apply are displayed at the bottom of the screen.

The basic setting can be optimised:

by setting insp. flow, $\dot{V}_{max}$, appropriately

or

by adjusting the working pressure to suit the specific patient situation, e.g. with pressure limited ventilation, PLV

or

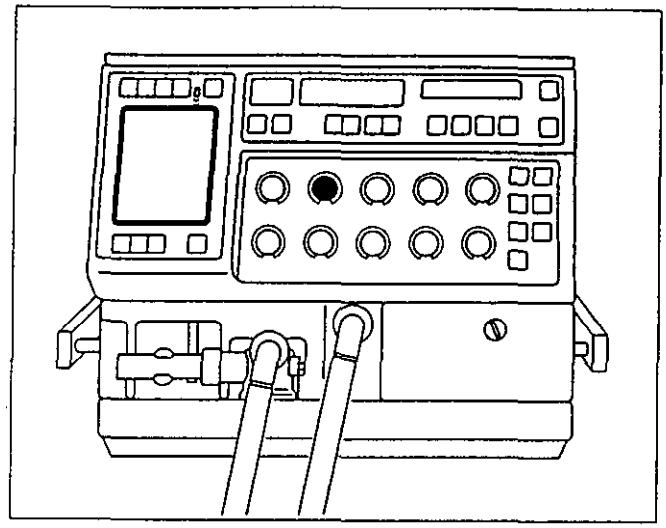
with pressure controlled ventilation, PCV.



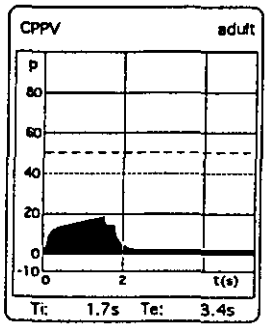
B10

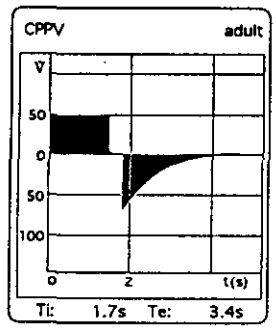
## Optimising basic setting

- use the »insp. flow $\dot{V}_{max}$« rotary knob

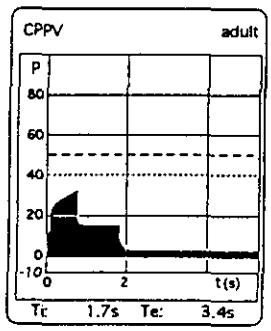


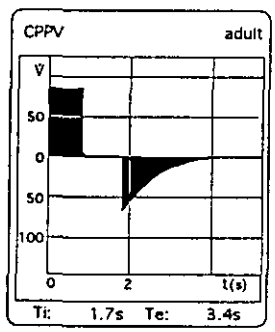
**Low flow**
prevents high peak pressures during increased airway resistance; fills the lung slowly.
Example:




**High flow**
for rapid filling of the lung with increased plateau time.
Example:






B11

## Pressure limited ventilation PLV

To reduce peak pressure and thereby prevent risk of barotrauma and tracheal lesion.
For effective ventilation when distribution is faulty.

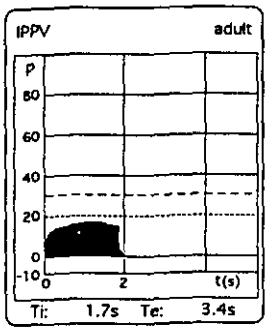
- Carry out basic setting, page 23.

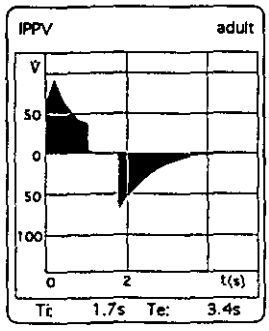
1 Set measured values of airway pressure with [Paw] button.

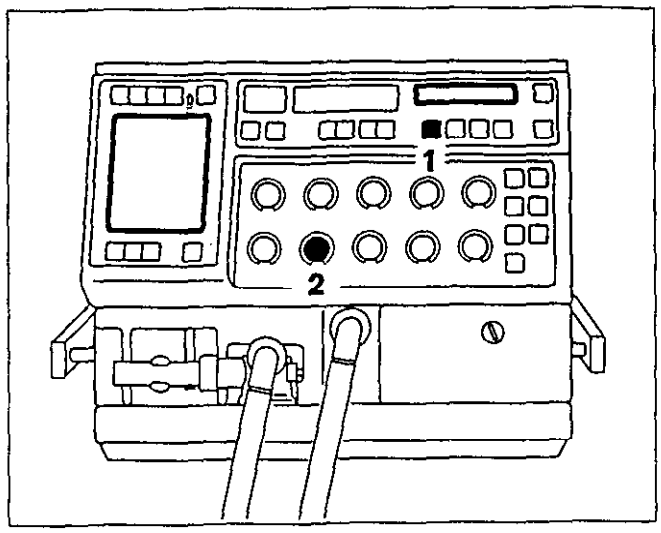
2 Set »pmax« rotary knob so that pmax is about 3 mbar higher than pplat.

Example:

| p: | max | plat | PEEP | mean |
|---|---|---|---|---|
| | 16 | 13 | 0 | 5 |




## Pressure controlled ventilation PCV

for instance for leak-compensating ventilation

- Carry out basic setting, page 23.

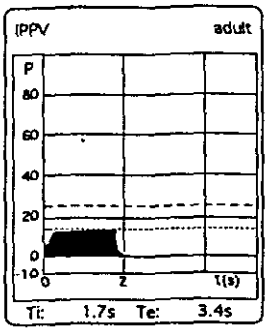
3 Set »pmax« rotary knob to desired ventilation pressure.

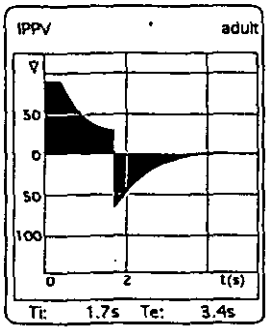
4 Set tidal volume VT about 20% higher than the tidal volume required for the patient.

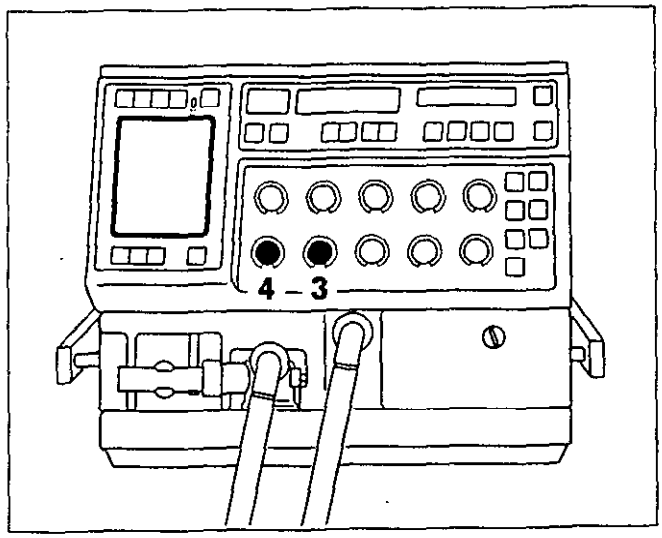
To compensate for leakages:

4 Set tidal volume VT to 2 L.

Example:






B12

## Controlled ventilation IPPV/CPPV

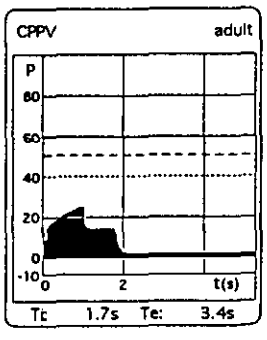
During IPPV, Evita 2 takes over ventilation completely using the pattern of ventilation of the basic setting (page 23), determined by:

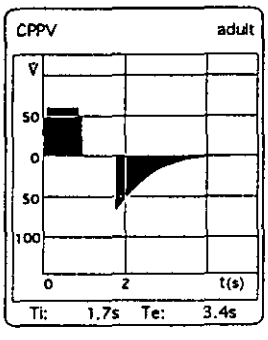
tidal volume $V_T$
frequency f
ratio $T_I$:$T_E$

and optimised for the patient (page 24) using:

insp flow $\dot{V}_{max}$
as well as
$p_{max}$ (including PLV and PCV)

Example:




1 Keep [IPPV] button pressed until green LED remains continuously lit.

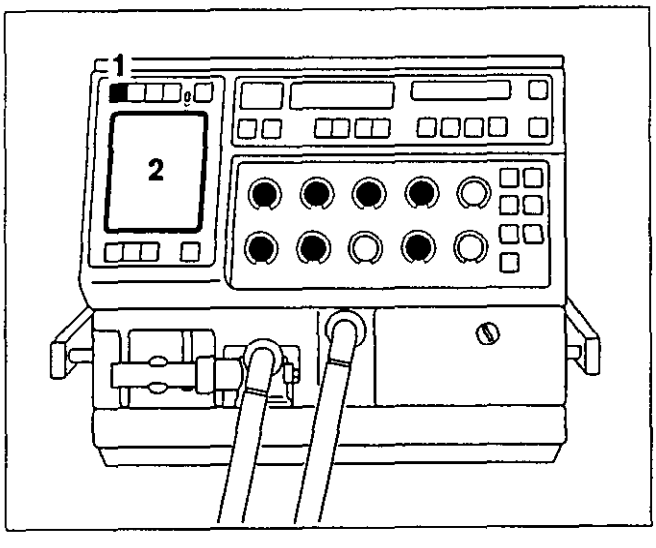
2 Screen display:

**IPPV**

or

**CPPV**
(if PEEP applies)

- Adjust rotary knobs with lit green LEDs.
  = indicators of operation.



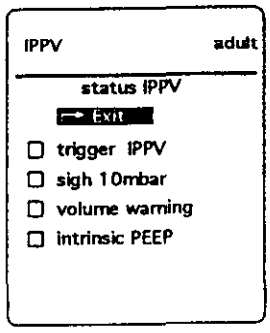


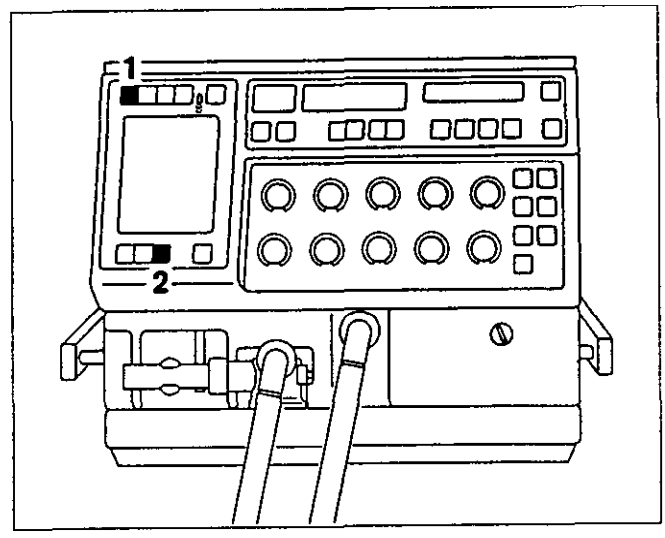

B13

### Recalling status page for IPPV

1 Press [IPPV] button **briefly.**

- Screen display (example)*:




Return to previous screen display:

2 Press [•] button.

* For structural description of status page, see "Recalling status pages", page 63.



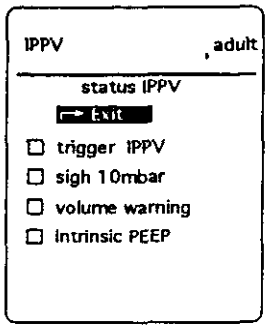
B14

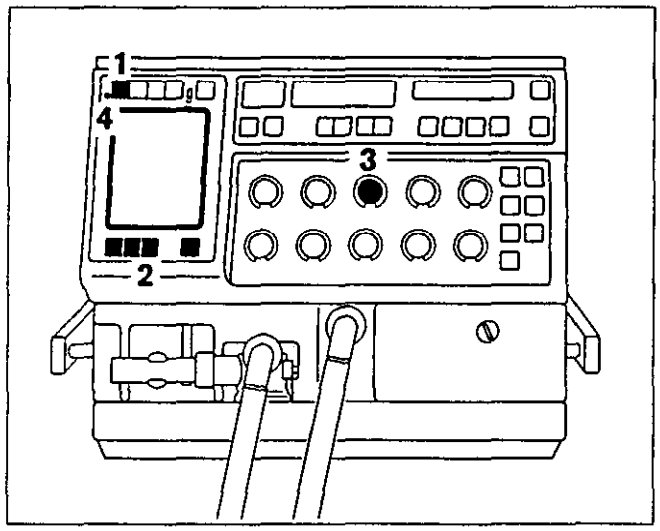
### Setting assisted ventilation IPPV/assist

The patient can control the start of inspiration himself by switching on a trigger:

1 Press [IPPV] button briefly, screen display status page IPPV.

- Display (example):




Switch on trigger*:

2 Select »trigger IPPV« line with [↓] button.

The text is displayed light on a dark background.

2 Confirm with [•] button and press [⧉] button.

The trigger is now switched on.
Trigger sensitivity: 0.7 mbar below PEEP pressure.

3 Adjust f so that it is a little lower than spontaneous breathing, so that it serves as the safety frequency.

4 During each triggered inspiration the green LED »assist« is lit.

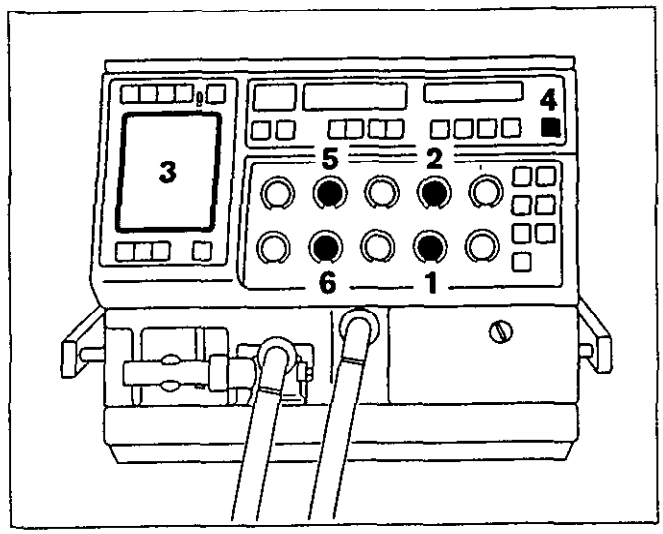
- Set alarm limits for minute volume, page 51.

* Detailed description of the menu-functions, page 64.



C1

***Inverse ratio ventilation IRV***




1 Reduce PEEP

2 Gradually increase TI:TE (via 1:1) to (2:1).

3 Display on screen:

**IRV**

When green LED on rotary knob for TI:TE flashes:

4 Press Reset Check button = setting for TI:TE acknowledged.

5 Slowly reduce insp. flow $\dot{V}_{max}$.

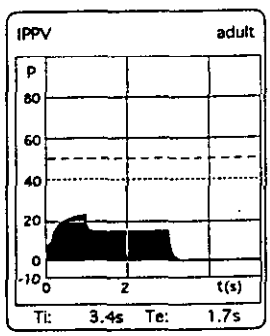
6 Adjust $p_{max}$ to about 3 mbar higher than plateau pressure.

1 Reduce PEEP again, if required.

Note *advice on settings*, page 81 to 84.

In IRV * expiration time is reduced to give more inspiration time; with a longer inspiration time oxygenation is improved.
IRV is preferred for ventilation when distribution is faulty.

Example:




* Literature (2), page 132



C2

**Switching on sigh**
**may be used as intermittent PEEP**

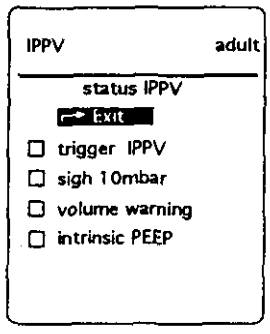
Possible in IPPV, IPPV/assist and ILV.

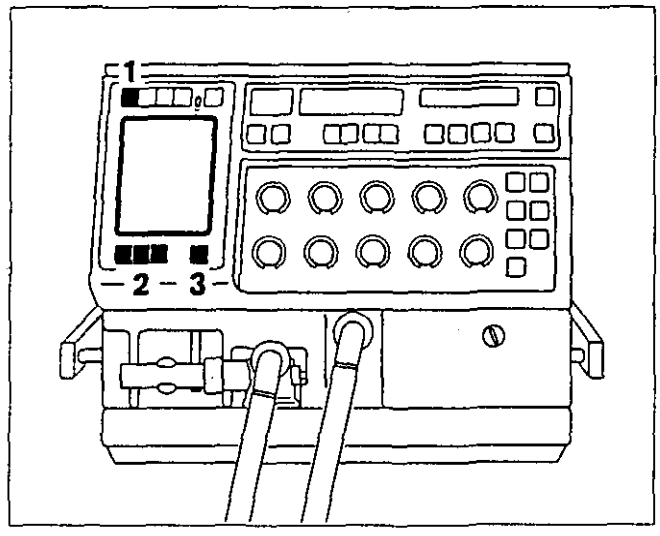
To avoid atelectasis intermittent PEEP can be switched on.

Every 3 minutes, the endexpiratory pressure is increased automatically to the set value for 2 ventilation cycles.

1 Press [IPPV] button briefly, the screen shows IPPV status page.

- Display (example):




Switch on sigh*:

2 Select »sigh« with [↓] button**.

The text appears light on a dark background.
If a different sigh pressure is desired, see "Setting sigh", page 70.

2 Acknowledge with [•] button.

An intermittent PEEP of 10 mbar now occurs every 2 minutes for 2 ventilation cycles.

3 Return to graphic display with [⧉] button.

* Detailed description in appendix, page 117.

** Detailed description of the menu functions, page 64.

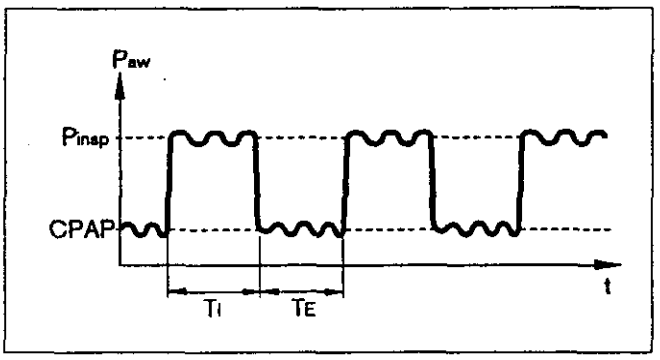


C3

## Setting BIPAP

Biphasic Intermittent Positive Airway Pressure

Spontaneous breathing combined simultaneously with time-cycled, pressure controlled ventilation*. In contrast to controlled ventilation IPPV, during BIPAP spontaneous breathing is possible in every phase of the respiratory cycle.
Evita 2 switches between CPAP and $p_{insp}$. pressure levels in a variable time cycle. The switch-over between the two pressure levels is synchronised with spontaneous breathing.

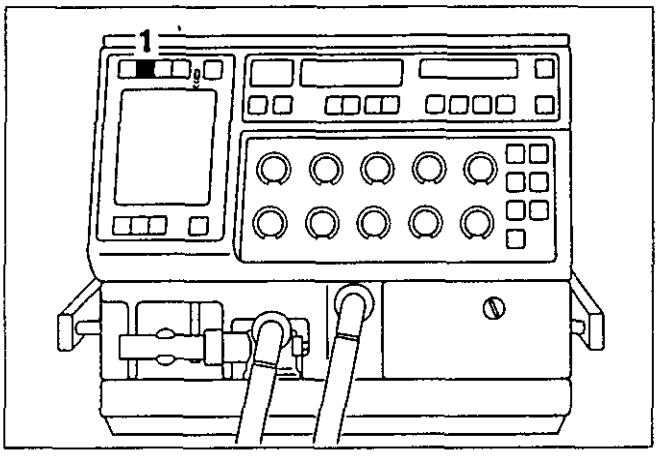



The time cycle is determined by the parameters of the basic setting:

frequency f
ratio TI:TE

The pressure levels result from the settings

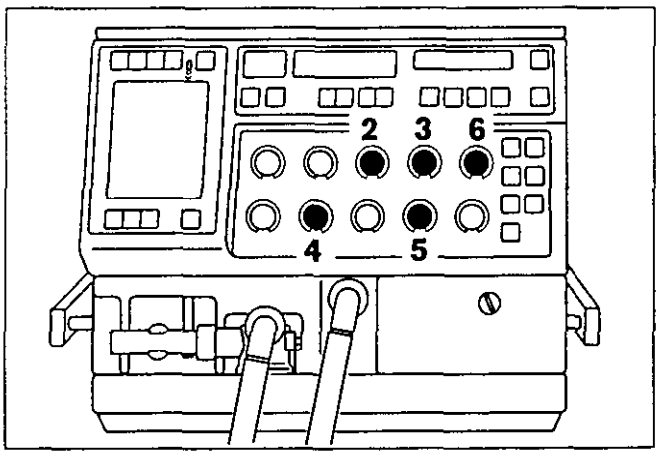
CPAP
$p_{insp}$




1 Keep BIPAP button pressed until the green LED remains continuously lit.

### Setting time cycle

2/3 With »f« and »TI:TE« rotary knobs.




### *Setting »CPAP« and »$p_{insp}$« pressure levels*

4/5 With »$p_{insp}$« and »CPAP« rotary knobs.

### *Setting pressure rise for switch-over from CPAP to* $p_{insp}$

6 With ⌐⌐ rotary knob

left ⌐⌐ stop ≙ about 0 s = very steep
right ⌐/ stop ≙ about 2 s = gradual

Select measured values for display, page 53.

* Detailed description of BIPAP in appendix, page 122.

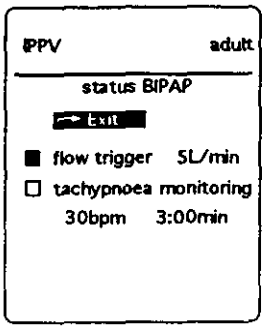


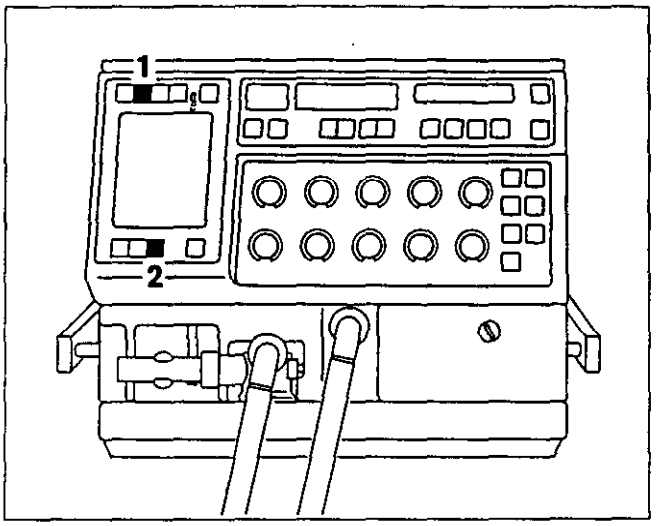
C4

### Recalling status page for BIPAP

1 Press [BIPAP] button briefly.

- Screen display (example):




To return to previous screen display:

2 Press [•] button.

### Other functions

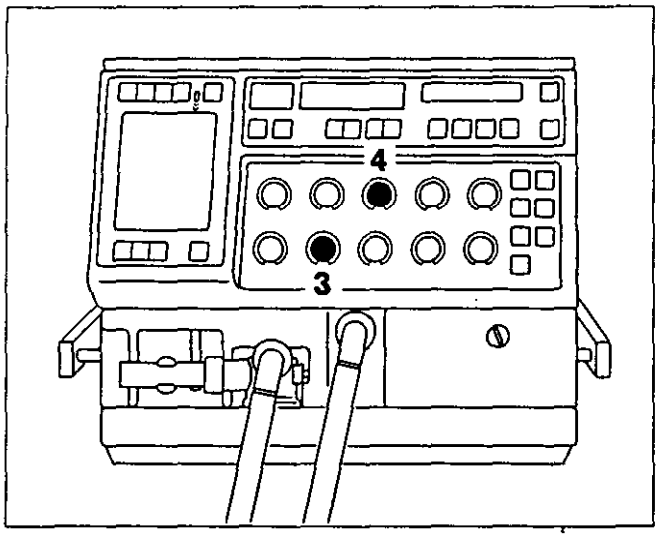
Switching over from the lower pressure level (CPAP) to the upper pressure level ($p_{insp.}$) is synchronised with spontaneous breathing. The sensitivity of synchronisation can be set with the **flow trigger**, page 71.

To detect any increase in dead space ventilation, set **tachypnoea monitoring**, page 68.

Depending on the progress of spontaneous breathing:

3 Reduce »$p_{insp}$« and/or

4 »frequency f« using the rotary knobs.






C5

## Synchronised intermittent mandatory ventilation SIMV

Mechanical ventilation* combined with spontaneous breathing.

The patient can breathe spontaneously and receives intermittent mandatory ventilation strokes at a frequency which corresponds to the IMV frequency fIMV which has been set. The ventilation pattern of the mandatory strokes is determined by the parameters of the basic setting.

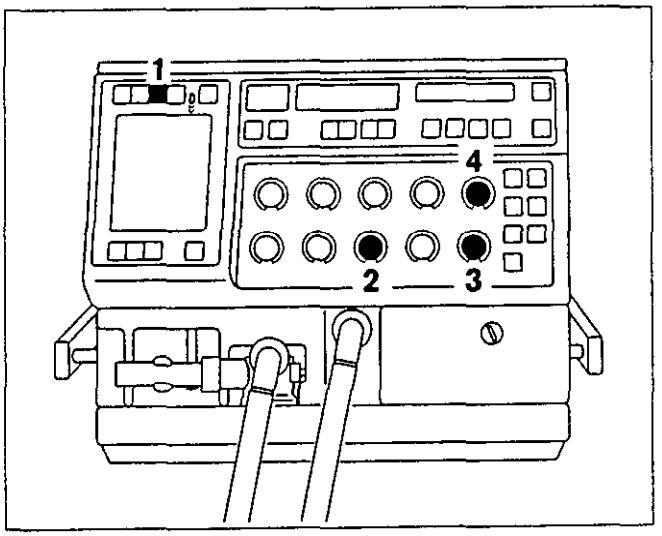
tidal volume $V_T$
frequency f
ratio $T_I$:$T_E$

of which f and $T_I$:$T_E$ determine the duration of the mandatory ventilation strokes.

An automatically adjusted trigger-expectation window always allows the mandatory strokes to be synchronised without increasing IMV frequency.

1 Keep [SIMV] button pressed until the green LED remains continuously lit.

2 Set IMV frequency $f_{IMV}$.




Spontaneous breathing can be supported by ASB** pressure assistance:

3 Set level of ASB pressure assistance.

Adjust rate of pressure rise for ASB:

4 With ⎍ rotary knob

left ⎍ stop ≙ about 0 s = very steep
right ⎍ stop ≙ about 2 s = gradual

Select measured values for display, page 53.

* Detailed description of SIMV in appendix, page 118.
** Detailed description of ASB in appendix, page 120.

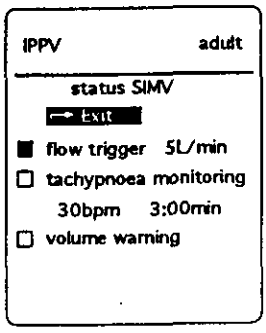


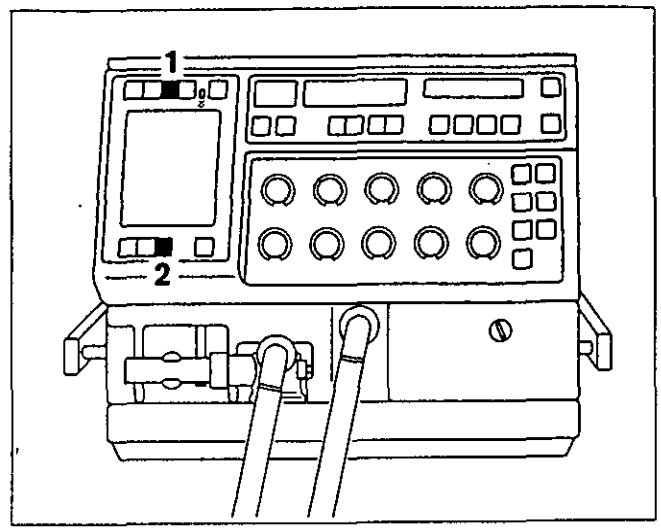
C6

**Recalling status page for SIMV**

1 Press [SIMV] button briefly.

- Screen display (example):




To return to previous screen display:

2 Press [•] button.

For sensitive synchronisation of pressure assistance, adjust **flow trigger** for ASB with menu buttons, page 71. The flow trigger can be set between 1 L/min (very sensitive) and 15 L/min in steps of 1 L/min.

To detect increased dead space ventilation during the spontaneous breathing phase, **tachypnoea monitoring** can be set, page 68.

To check whether the tidal volume $V_T$ is being applied, **volume warning** can be set, page 67.



C7

## Assisted spontaneous breathing ASB

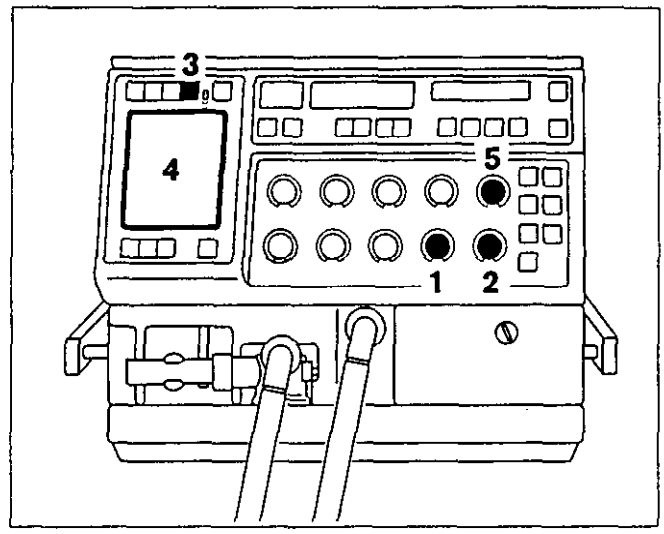
The function of the machine in assisting insufficient spontaneous breathing is similar to that of the anaesthetist who manually assists and monitors the patient's spontaneous breathing by feeling the breathing bag.*

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

The extent of inhalation function taken over by the machine is determined by adjustable pressure assistance, ASB. Any adaptation of the lung mechanics is determined by the adjustable rate of pressure increase:

rapid pressure rise ⎍ = high inspiratory flow

slow pressure rise ⎍ = low, even inspiratory flow




1 Set CPAP.

2 Set ASB pressure assistance.

3 Keep [ASB Spont] button pressed until green LED remains continuously lit.

4 Screen display:

**ASB**
Pressure assistance for CPAP = 0
or
**CPAP/ASB**
when CPAP and pressure assistance apply
or
**CPAP**
when pressure assistance has not been set.

Set rate of pressure rise for ASB:

5 With ⎍ rotary knob

left ⎍ stop ≙ about 0 s = very steep

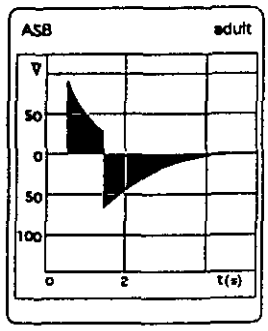
right ⎍ stop ≙ about 2 s = gradual

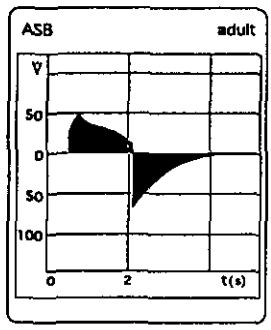
* Detailed description of ASB in appendix, page 120.



C8

*Example:*

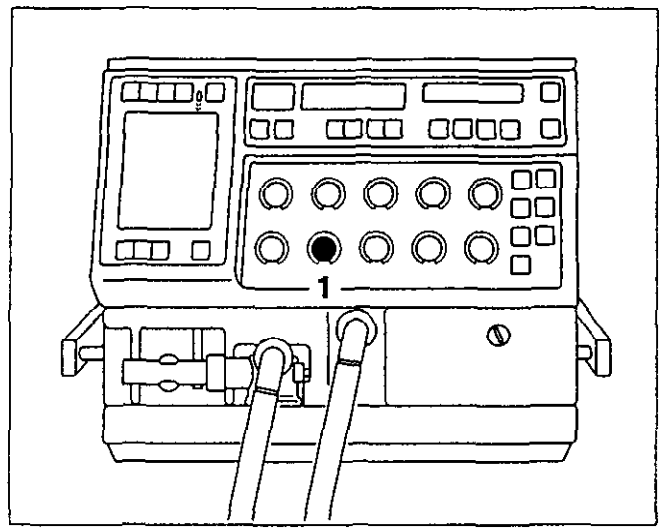



Advice on settings, page 81 to 84.

Setting pressure limitation:

1 Using rotary knob »$p_{max}$«.
About 10 mbar above pressure assistance, ASB, for ASB and CPAP/ASB.
About 10 mbar above CPAP for CPAP.



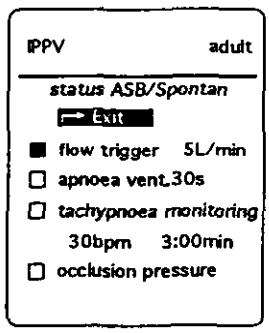

Select measured values for display, page 53.

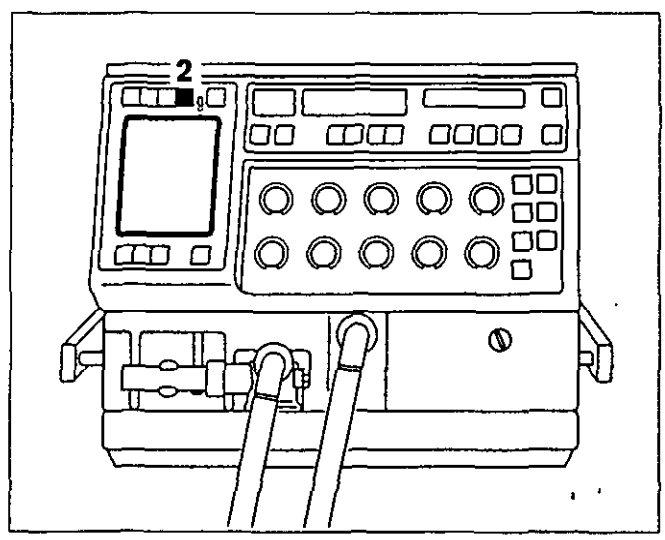
For sensitive synchronisation of pressure assistance set flow trigger – using menu buttons, page 64. The flow trigger can be set between 1 L/min (very sensitive) and 15 L/min in steps of 1 L/min.

**Recalling status page for ASB/spont.**

2 Press ASB/Spont. button briefly.

- Screen display (example):



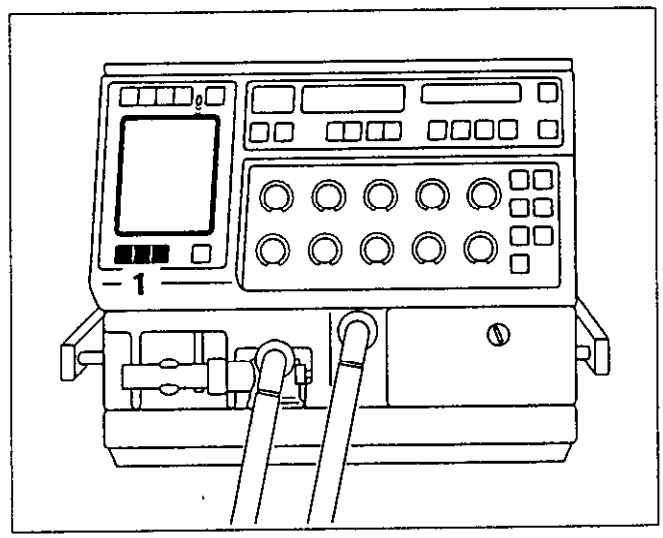
### Adjusting apnoea ventilation

For monitoring spontaneous breathing (for CPAP/ASB) for a stop in breathing with automatic switch-over to IPPV. The reaction time between the moment when breathing stops to the start of controlled ventilation, IPPV, can be set to between 15 and 60 seconds.

**If apnoea occurs**
a visual and acoustic alarm is given by Evita 2 after 15 seconds. After the apnoea time set has passed, apnoea ventilation to the IPPV pattern re-commences.

**This mandatory ventilation remains in force until apnoea ventilation monitoring is re-started by pressing the »Reset/Check« button.**
**Only then can the patient breathe spontaneously.**

The basic settings on the rotary knobs with lit green LEDs give the pattern of ventilation.

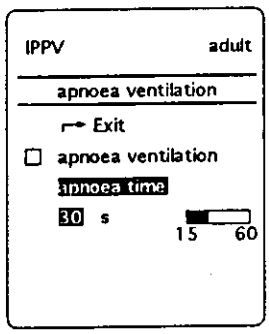



1 Select apnoea time using [↓] * button.

The numerical value appears light on a dark background.

Acknowledge with [•] button.

- Screen display (example):




1 Set apnoea time with [↓] button or [↑], confirm with [•] button.

Activating apnoea ventilation:

1 Use [↑] and [•] buttons.

Apnoea ventilation is ready for operation.

Screen display (example):

**SB -> IPPV**

---

* Detailed description of the menu-functions, page 64.



C10

The parameters of the basic setting identified by lit green LEDs give the pattern of ventilation for apnoea ventilation.

Tidal volume $V_T$
Frequency f
Ratio $T_I$:$T_E$

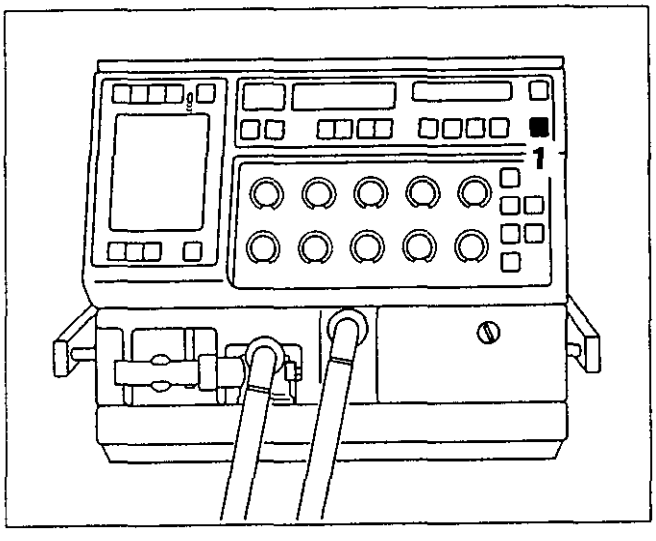
Insp. flow $\dot{V}_{max}$

**Apnoea ventilation comes into operation if breathing stops.**

***If spontaneous breathing occurs again***

Apnoea ventilation must be re-started:

1 Press [Reset Check] button briefly.




To detect any increase in dead space ventilation during spontaneous breathing, set **tachypnoea monitoring**, page 68.

To evaluate neuro-muscular breathing drive, **occlusion *pressure*** *can be measured*, page 72.

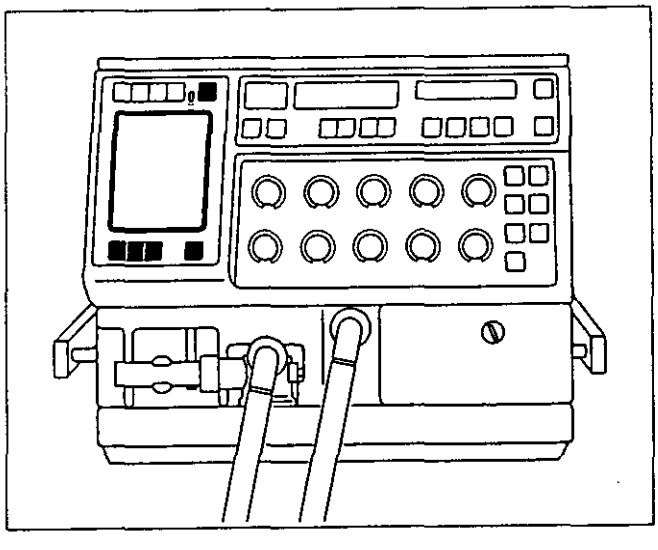
## Other ventilation modes

In addition to the standard ventilation modes IPPV, BIPAP, SIMV and ASB/spont. which can be selected directly with the 4 buttons, Evita 2 provides 4 further ventilation modes.

To use these modes, select [↓] [↑] [•] [knob] in the menu using menu buttons and then activate with the [Menu mode] button.

Once a ventilation mode has been selected it applies until a different mode is selected in the menu.

The selected ventilation mode can be activated when required with [Menu mode] button.



* Detailed description of the menu-functions, page 64.



C11

## BIPAP-SIMV

Combination of time-cycled, pressure controlled ventilation with spontaneous breathing.*

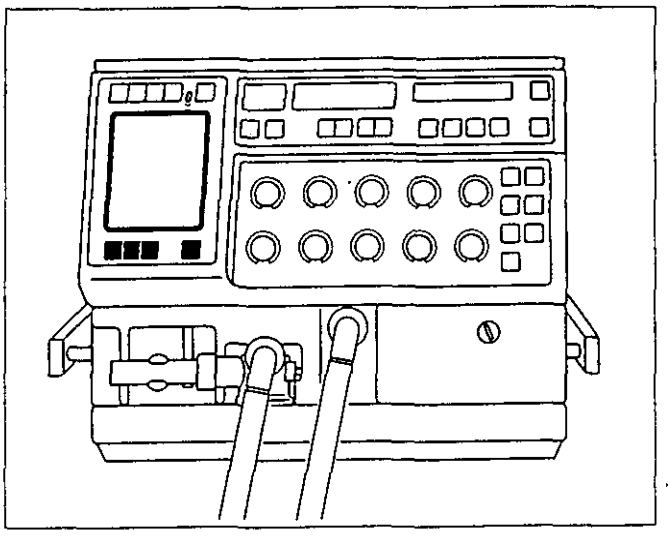
The patient can breathe spontaneously and receives intermittent, pressure controlled ventilation strokes at a frequency which corresponds to the IMV-frequency set. In contrast to SIMV the ventilation strokes are not volume-constant, and spontaneous breathing is possible at the upper pressure level.

The duration of the pressure controlled ventilation strokes is determined by the parameters of the basic settings:

frequency f
ratio $T_I$:$T_E$

The inspiratory pressure is determined by the parameter $p_{insp}$.

An automatically-adjusted trigger window always allows the pressure controlled strokes to be synchronised without increasing IMV-frequency.



### Selecting BIPAP-SIMV

- Use the menu keys** below the screen.

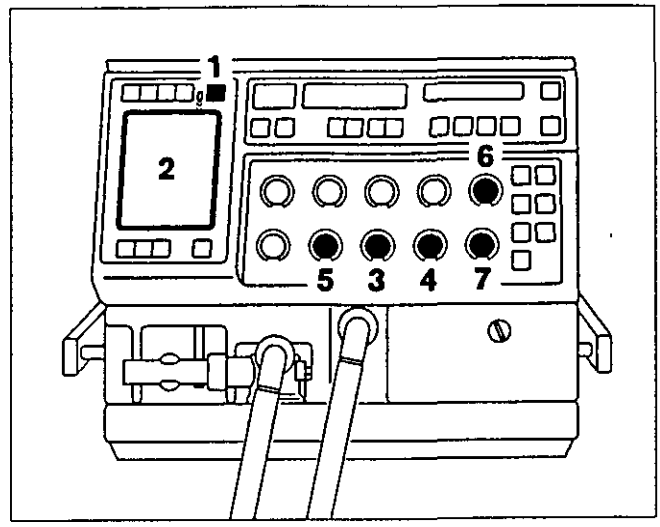


* *Detailed description of BIPAP/SIMV in appendix, page 124.*

** *Detailed description of the menu-functions, page 84.*



C12




**Activating BIPAP-SIMV**

1 Keep [Menu mode] button pressed until green LED remains continuously lit.

2 Screen display:
**BIPAP-SIMV**

3 Set $f_{IMV}$ IMV-frequency

4 Set CPAP.

5 Set inspiration pressure, $p_{insp}$.

6 Set rate of pressure rise with ⎍ rotary knob

left ⎍ stop ≙ about 0 s = very steep

right ⎍ stop ≙ about 2 s = gradual

Spontaneous breathing at CPAP-level can be assisted by ASB:

7 Set level of pressure assistance, ASB.
The rate of pressure rise for ASB is determined by the rate of pressure rise from CPAP level to the upper pressure level, $p_{insp}$.

Select measured values for display, page 53.



C13

### Other functions

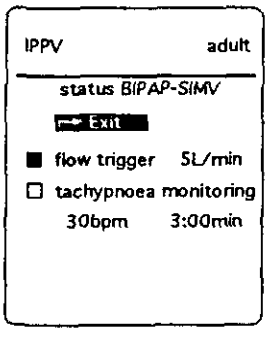
*The sensitivity of the synchronisation of pressure* assistance, ASB, during CPAP and also the synchronisation of pressure controlled strokes are set with **flow trigger**, page 71.

To detect any increase in dead space ventilation during spontaneous breathing, set **tachypnoea monitoring**, page 68.

Note recommended settings on screen, page 79 to 81.

To recall status page for BIPAP-SIMV:

- Press Menu mode button briefly.
- Display (example):



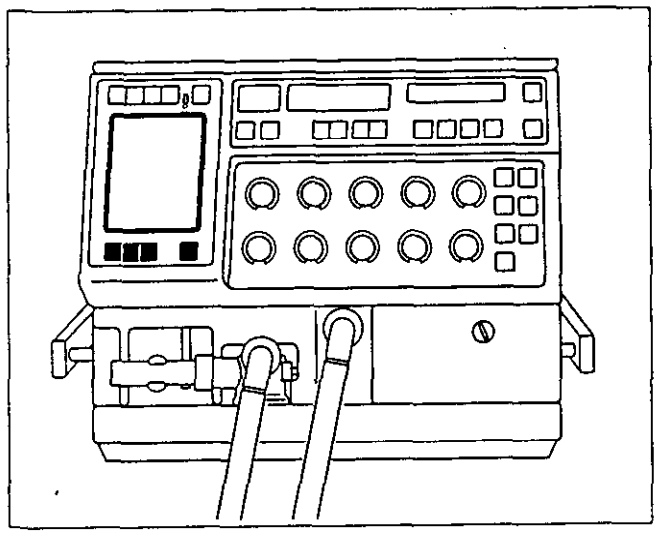



C14

## BIPAP-APRV

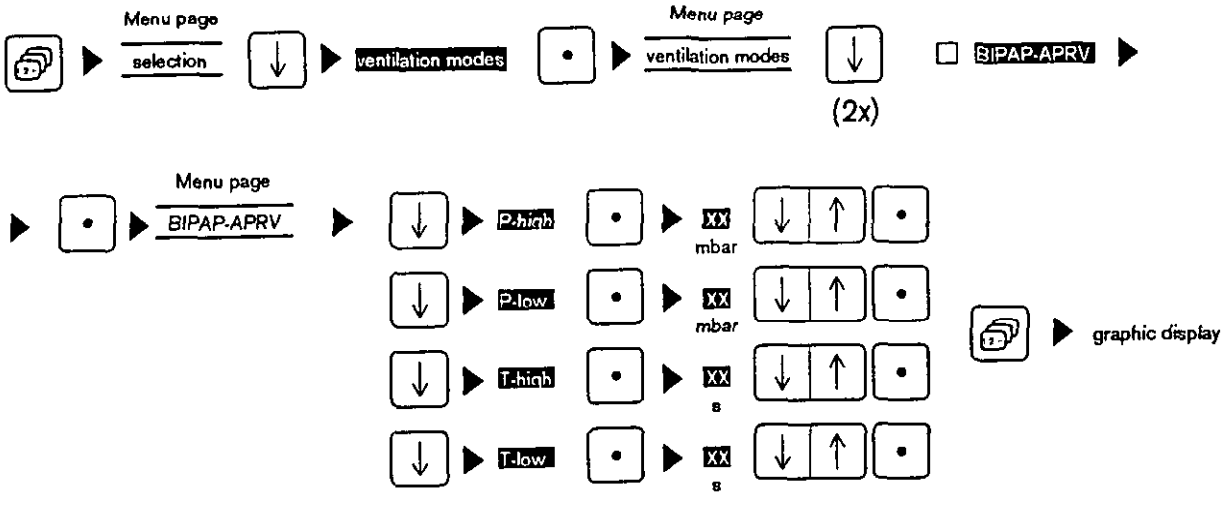
*Airway Pressure Release Ventilation** Spontaneous breathing on two pressure levels (as for BIPAP) with long, independently adjustable time ranges so that very large I:E ratios can be set.

At a variable T high/T low time interval Evita 2 switches between P high and P low pressure levels. The switch-over between the two pressure levels is synchronised with spontaneous breathing.



### *Selecting BIPAP-APRV*

- With the menu buttons below the screen.




* Detailed description of BIPAP-APRV in appendix, page 125.

** Detailed description of the menu functions, page 64.

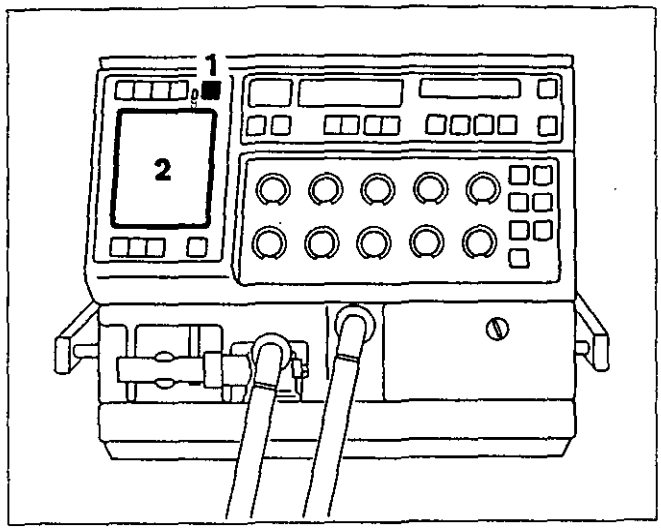


D1

### Activating BIPAP-APRV

1 Keep [Menu mode] button pressed until green LED remains continuously lit.

2 Screen display:
**BIPAP-APRV**




Select measured values for the display, page 53.

### Other functions

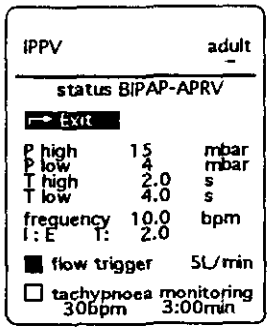
The sensitivity of the synchronisation for pressure controlled strokes is set with the **flow trigger**, page 71.

To detect any increase in dead space ventilation during spontaneous breathing, set **tachypnoea monitoring**, page 68.

Note recommended settings on screen, page 81 to 84.

Recalling status page for BIPAP-APRV:

- Press [Menu mode] button briefly.
- Display (example):




The frequency resulting from T high and T low as well as the breathing time ratio are displayed on the screen as an aid for setting.



D2

## Mandatory minute volume ventilation MMV

Mandatory minimum ventilation* when spontaneous breathing is not yet sufficient but allowing for the patient's spontaneous breathing.

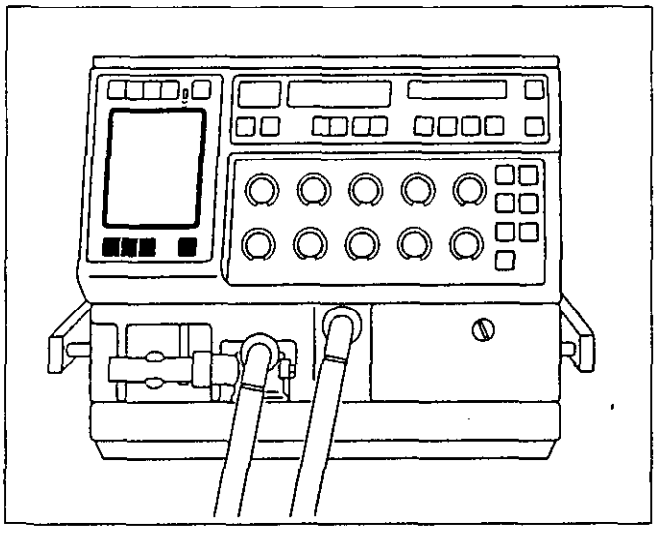
In contrast with SIMV, the mandatory ventilation strokes in MMV are not applied regularly, but only when spontaneous breathing is lower than the set minimum ventilation ($V_T$ x $f_{MV}$). The value for this minimum *ventilation is calculated* by Evita 2 and displayed on the status page.

The frequency of the mandatory strokes is dependent on the degree of spontaneous breathing. If spontaneous breathing is sufficient, there is no mandatory ventilation. When the patient does not breathe spontaneously at all, mandatory ventilation is applied at a frequency which corresponds to the IMV-frequency.

The ventilation pattern for the mandatory strokes is determined by the basic setting parameters:

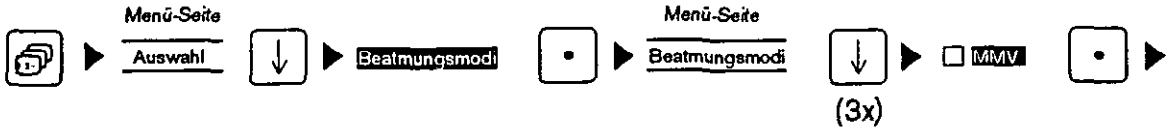
tidal volume $V_T$
frequency f
*ratio* $T_I$:$T_E$

with f and $T_I$:$T_E$ determining the duration of the mandatory ventilation strokes.



### Selecting MMV

- With the menu button** below the screen.



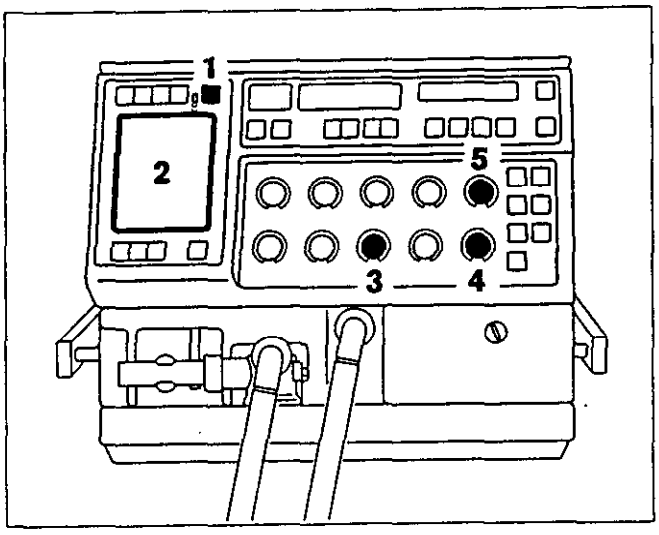


* Detailed description of MMV in appendix, page 126.

** Detailed description of the menu functions, page 64.



D3




### Activating MMV

1 Keep [Menu mode] button pressed until the green LED remains continuously lit.

2 Screen display:

**MMV**

3 Set IMV frequency.

Spontaneous breathing can be assisted by pressure assistance, ASB:

4 Set level of pressure assistance.

Set rate of pressure rise for ASB:

5 With ⎍ rotary knob

left ⎍ stop ≙ about 0 s = very steep

right ⎍ stop ≙ about 2 s = gradual

Select measured values for display, page 53.

### Other functions

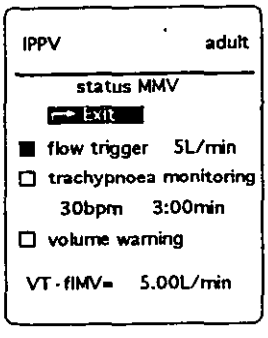
The sensitivity of synchronisation for pressure assistance ASB, can be set with the **flow trigger**, page 71.

To detect any increase in dead space ventilation during the spontaneous breathing phase, set **tachypnoea monitoring**, page 68.

To check whether the set tidal volume $V_T$ is being applied, set **volume warning**, page 67.

Recalling status page for MMV:

- Press [Menu mode] button briefly
- Display (example):






D4

## Setting independent lung ventilation ILV

**ILV** = Independent Lung Ventilation (option)

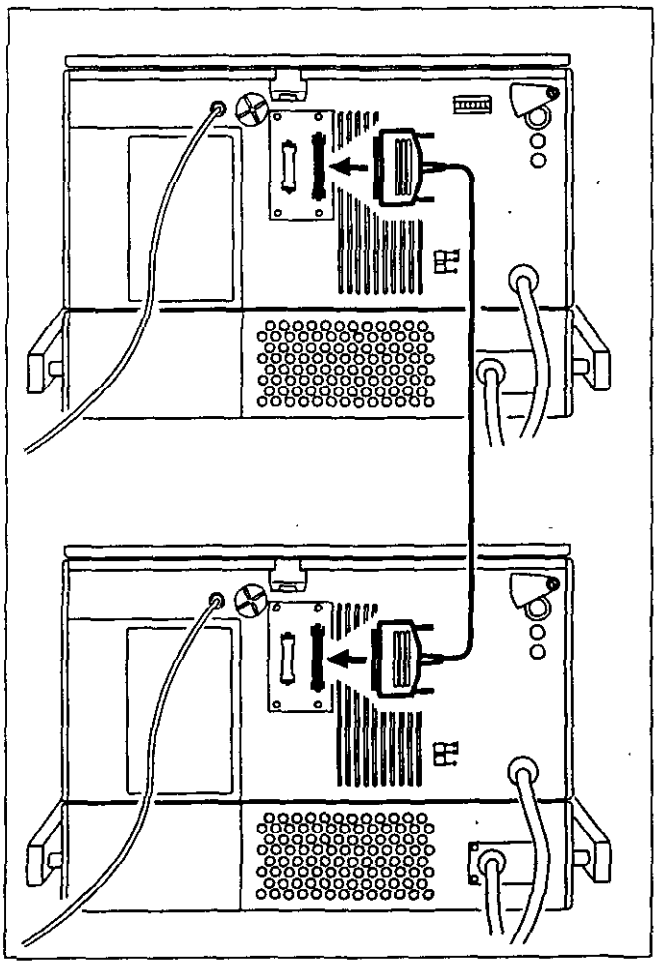
*Synchronous, independent* lung ventilation with 2 Evita 2 machines connected via analogue interfaces. For use in IPPV/CPPV ventilation mode.

***Required***

- *Both machines* must have analogue interfaces (option)
- An »independent lung ventilation« connecting cable to connect the two machines (option).

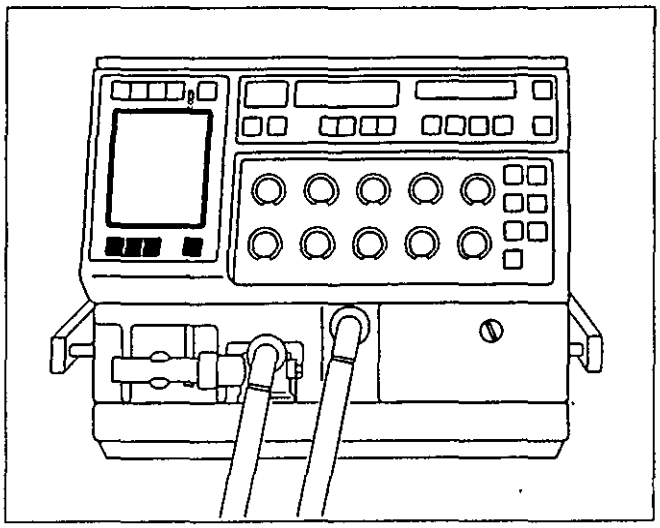
***Preparation***

- Connect the two Evita 2 machines with the connecting cable via their analogue interfaces.





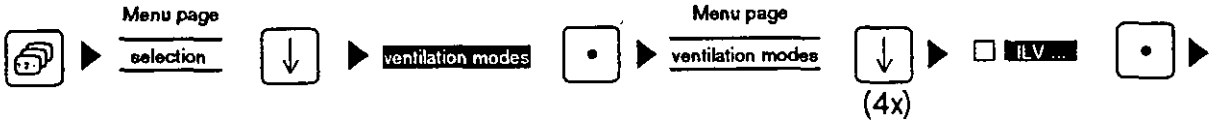
D5

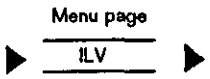


**On the 1st machine = Master**

**Selecting ILV**

- With the menu buttons* below the screen.





or


Master with trigger
Inspiration is controlled with the partial spontaneous breathing impulse of the lung compartment ventilated by the Master machine (comparable to assisted ventilation, IPPV/assist)

Master without trigger
Inspiration is time-cycled. (comparable to controlled ventilation, IPPV)

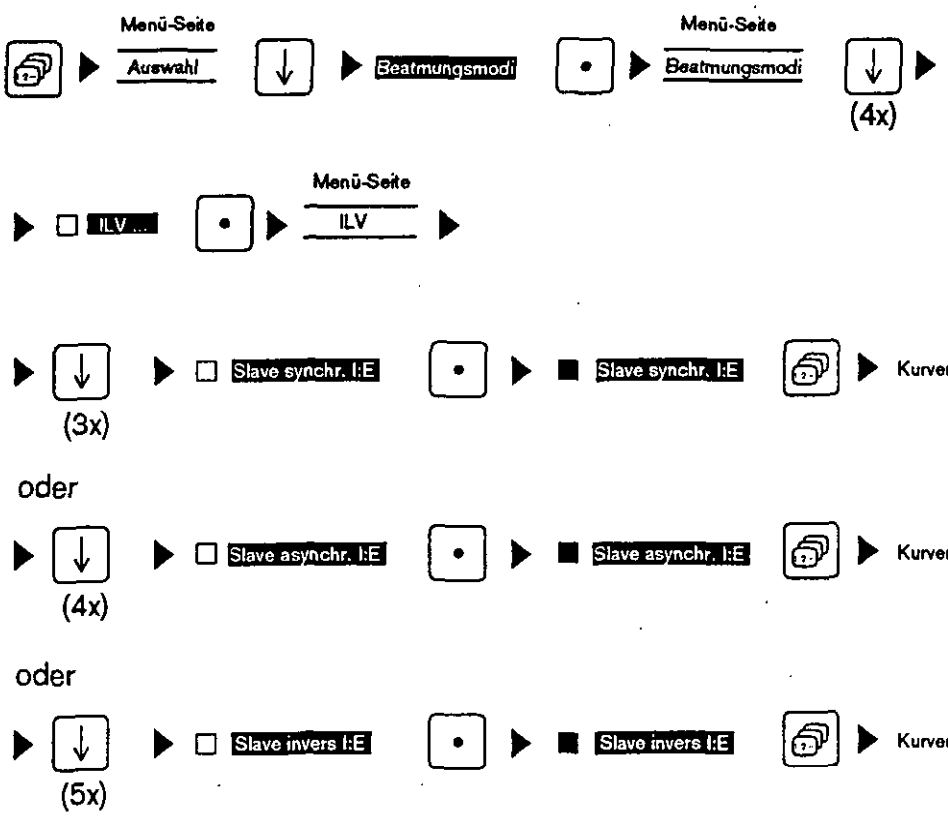
- **Do not activate yet.**

* Detailed description of the menu functions, page 64.



DG

**On the 2nd machine = Slave**




Synchronous I:E:
The I:E ratio of the Slave machine follows that of the Master machine directly.

Or

Non-synchronous I:E:
The start of inspiration and the total duration of the ventilation cycle are under the control of the Master machine; the I:E ratio of the Slave machine can be freely selected.

Or

Inverse I:E:
The start of inspiration on the Slave machine coincides with expiration on the Master machine and the start of expiration on the Slave machine coincides with inspiration on the Master machine.

- **Do not activate yet.**



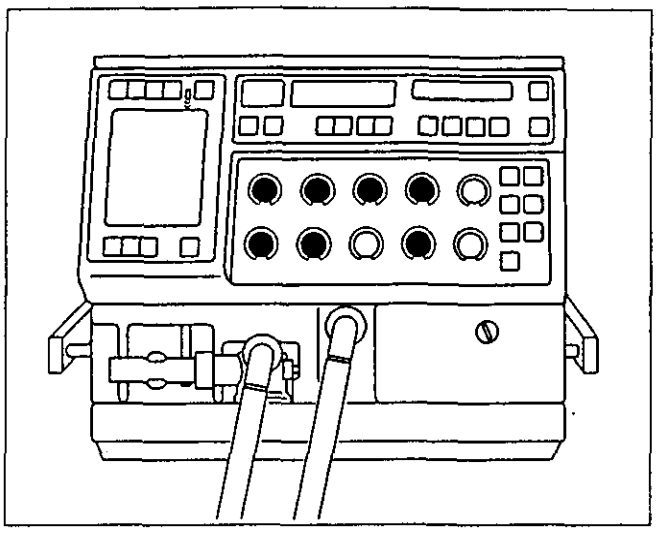
D7

***On the Ist machine = Master***

Set basic pattern of ventilation:

- with the rotary knobs:

| | |
|---|---|
| tidal volume | $V_T$ |
| frequency | f |
| ratio | $T_I$:$T_E$ |
| insp. flow | Vmax |
| $O_2$ conc. | $O_2$ vol.% |
| PEEP/CPAP | |



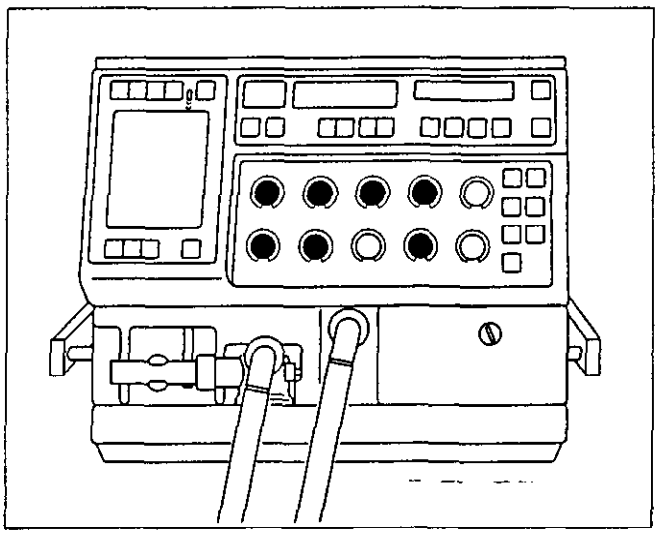
**On the 2nd machine = Slave**

Set basic pattern of ventilation:

- as described for the Ist machine = Master.

The rotary knob »f« does not work directly to make sure that the two lung compartments are not ventilated at different frequencies if the machines are separated accidentally:

- Set f to the **same value** as on the Master machine = safety setting.

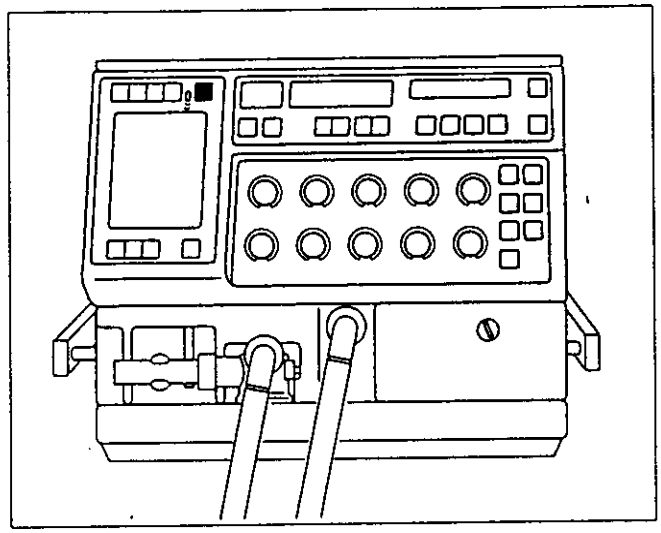




D8

**On both machines**

- Keep [Menu mode] button pressed until green LED remains continuously lit.

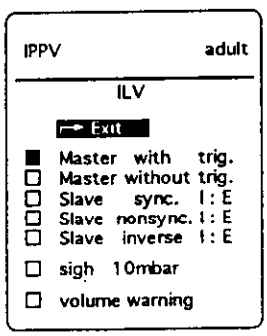


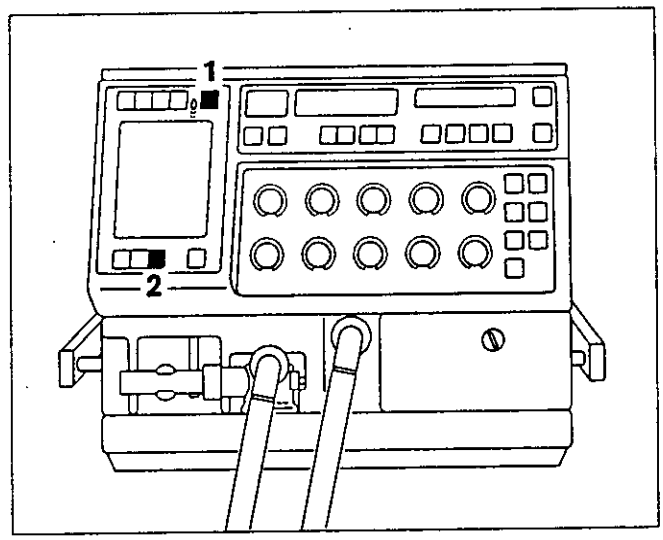
**ILV in operation.**

**Recalling status page ILV**

1 Press [Menu mode] button briefly.

- Screen display (example):




To return to previous screen display:

2 Press [•] button.

To set sigh (intermittent PEEP), page 70.

To check that the set tidal volume $V_T$ is being applied, **volume warning** can be set, page 67.



D9

## *Setting alarm limits*

**Alarm limits for airway pressure**

are automatically linked to $p_{max}$ and PEEP set values.

The upper alarm limit is 10 mbar above $p_{max}$ setting.

The lower alarm limit is 4.5 mbar above the endexpiratory *pressure. It applies during mandatory ventilation strokes* for IPPV, IPPV/assist, SIMV and ILV.

**Alarm limits for $O_2$ concentration**

are automatically linked to set value.

For settings below 60 vol.%:
± 4 vol.%

For settings above 60 vol.%:
± 6 vol.%

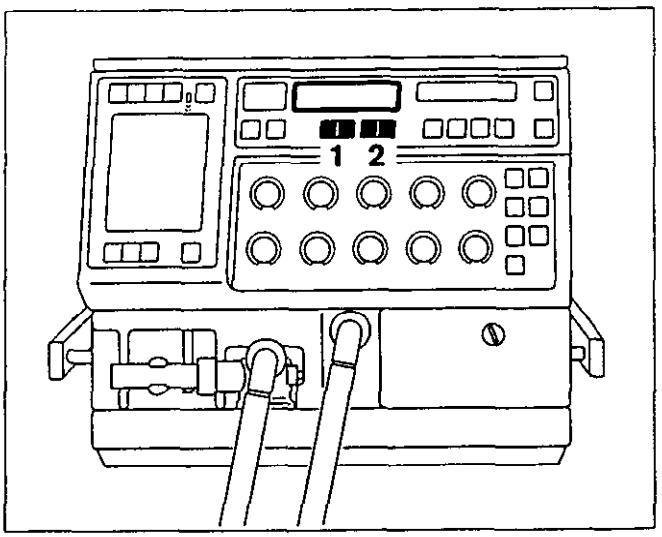
**Setting alarm limits for expiratory minute volume $\dot{V}_E$**

upper alarm limit /▲ :

1 Set with left-hand pair of buttons.

lower alarm limit ▼/ :

2 *set with right-hand pair of buttons.*




- To adjust by individual steps = *press briefly repeatedly.*
- To adjust rapidly = keep pressed for a longer time.

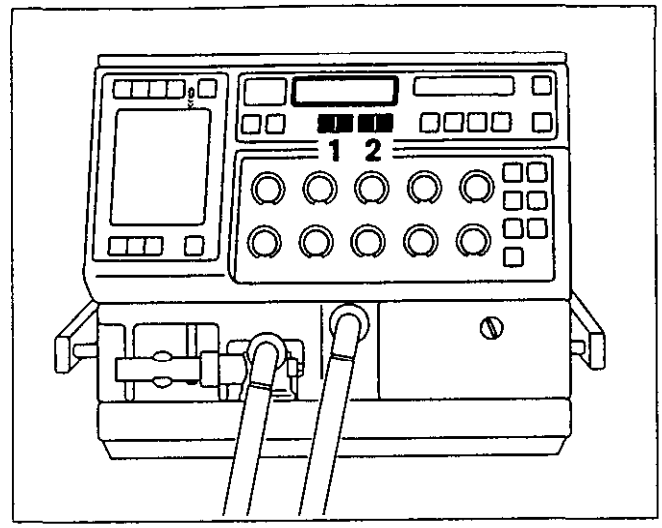


D10

Switching off alarm limits:

1 Increase upper alarm limit /▲ until dashes (– –) appear in the display = switched off.

2 Reduce lower alarm limit ▼/ until dashes (– –) appear in the display = switched off.




**Recommended settings:**

Lower alarm limit: 20 % lower than $\dot{V}_E$

Upper alarm limit: 20 % higher than $\dot{V}_E$

To detect any leakages early, closer alarm limits must be set.



D 11

## Selecting measured value displays

Using [Paw], [T,Vt,f R,C], [Spont] buttons

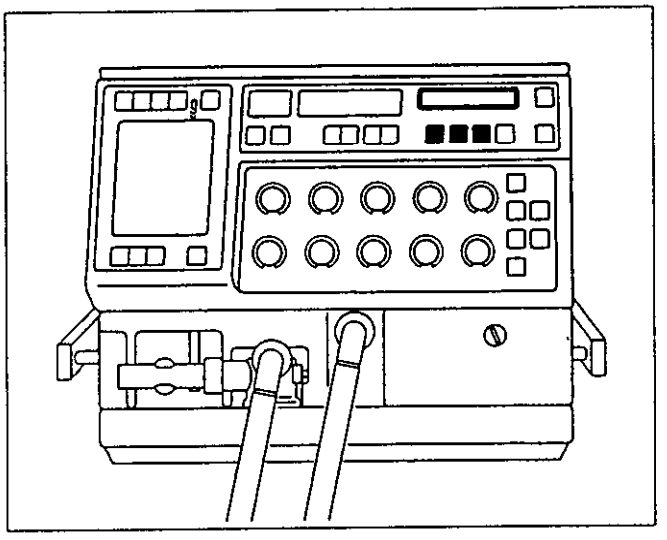
to recall the measured values in the display which relate to each ventilation mode.

Press button once:
to display measured value
Example:

| P: | max | plat | PEEP | mean |
|---|---|---|---|---|
| | 15 | 12 | 5 | 7 |

Press button twice:
to display unit for measured value
Example:

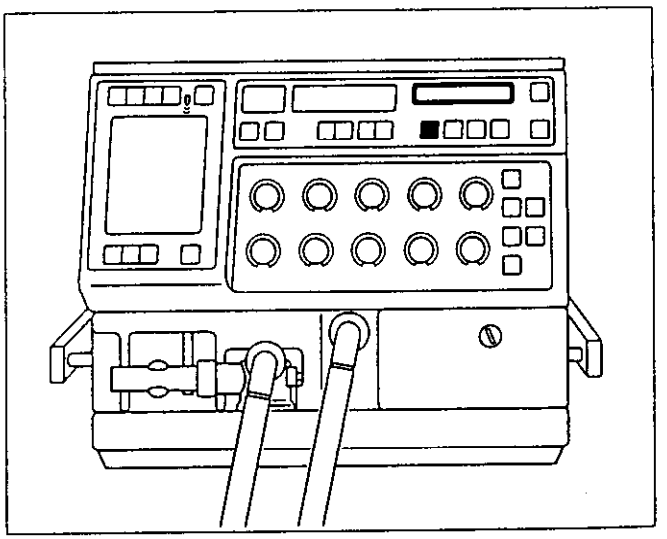
| airway pressure [ mbar ] | | | |
|---|---|---|---|
| max | plat | PEEP | mean |

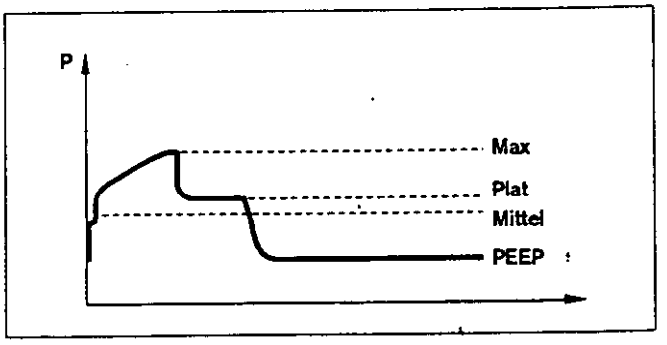


### Displaying measured values for airway pressure Paw

- Press [Paw] button briefly:
- Display for IPPV, SIMV, MMV, ILV modes:

| P: | max | plat | PEEP | mean |
|---|---|---|---|---|
| | XX | XX | XX | XX |



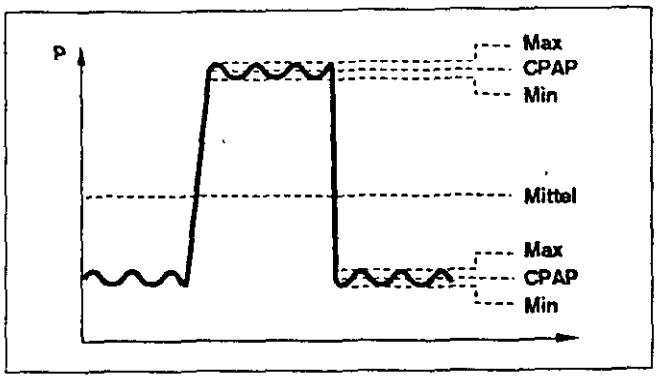





D12

- Display for BIPAP, BIPAP-SIMV, BIPAP-APRV modes:

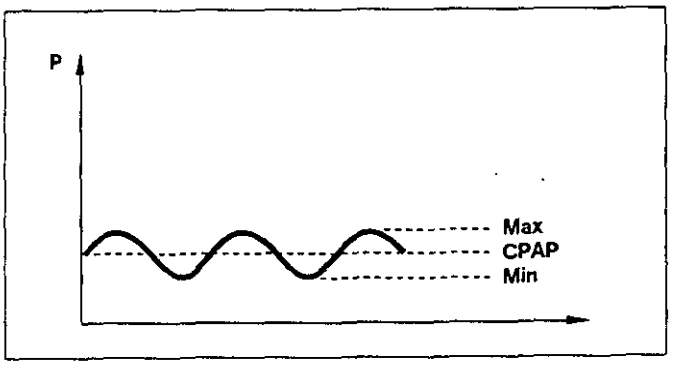
| P: | max | CPAP | min | mean |
|---|---|---|---|---|
| | XX | XX | XX | XX |




Minimum and maximum pressure, and also CPAP, are determined at the end of expiration for each breathing stroke; mean pressure is determined over several breathing strokes.

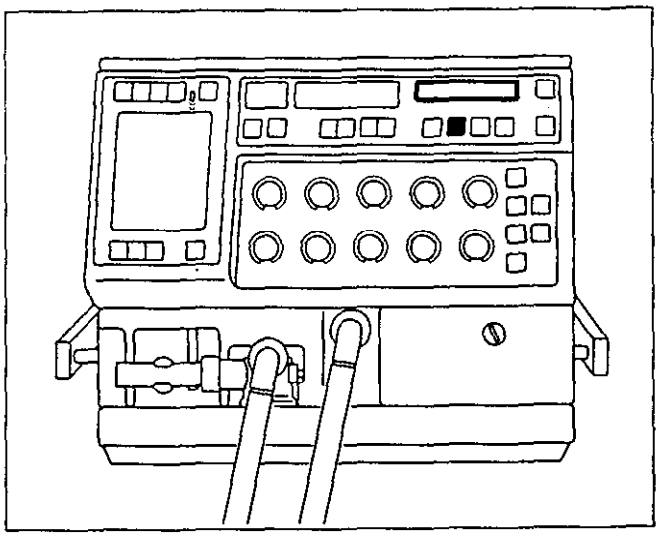
- Display for ASB/spont. ventilation mode:

| P: | max | CPAP | min |
|---|---|---|---|
| | XX | XX | XX |




If apnoea ventilation becomes effective during ASB/spont., Paw values are displayed as for IPPV.

**Displaying measured values for temp, $\dot{V}_{Te}$, f, R and C**



- Press T,VTf / R,C button briefly.
- Display:

| temp | VTe | f | R | C |
|---|---|---|---|---|
| XX | XXXX | XXX | XXX | XXX |

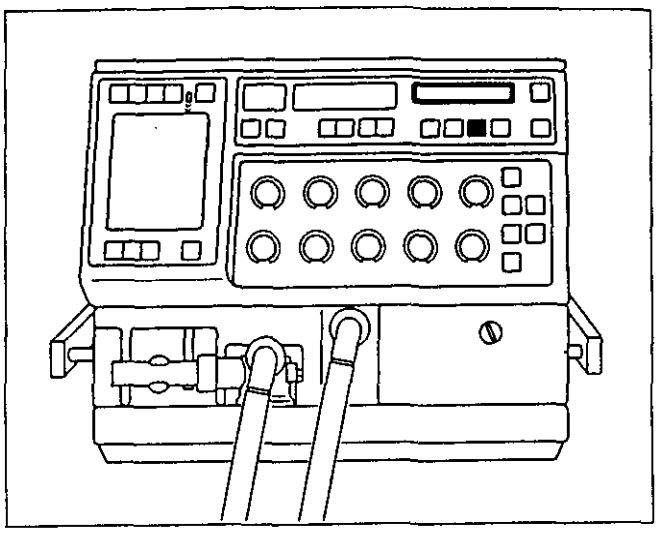
**temp** insp. breathing gas temperature in °C
**$V_{Te}$** tidal volume in mL (expiratory)
**f** frequency in bpm
**R** resistance in mbar/L/s
**C** compliance in mL/mbar

R and C are only determined for IPPV, ILV and active apnoea ventilation. If, as a result of the course of the expiratory flow and pressure curves, no plausible values can be determined, dashes appear on the screen in the display for R and C.



D13

### Displaying measured values of spontaneous breathing



- Press [spont] button briefly
- Display:

| spont: | MVspo | f-spo | CPAP |
|---|---|---|---|
| | XX,X | XX | XX |

**MVspo** spontaneously-breathed minute volume, expiratory in L/min
**f-spo** frequency of spontaneous breathing in bpm
**CPAP** CPAP pressure measured in mbar

Measured values for spontaneous breathing are only displayed in a ventilation mode with a spontaneous portion, otherwise dashes are displayed instead of numerical values.

Evita 2 measures the entire expiratory minute volume. The ratio between the mechanical and the spontaneous share is based on the inspiratory mechanical minute volume and the minute volume supplied for spontaneous breathing. The expiratory portion of the spontaneously-breathed minute volume is calculated from the expiratorily-measured minute volume using this ratio.

Frequency is calculated by the same principle.

In the BIPAP, BIPAP-SIMV and BIPAP-APRV ventilation modes the volume which is supplied to reach the upper pressure level is included in the calculation as mechanical stroke volume. When measuring frequency this stroke is also counted as a mechanical stroke.

ASB strokes are regarded as spontaneous breathing in all ventilation processes.



D14

## Manual start and/or inspiration hold

- May be used in all ventilation modes.
- During manual inflation. Evita 2 limits inspiration to 15 seconds.
- A ventilation stroke is applied in accordance with $V_T$ and insp. flow $\dot{V}_{max}$ settings.
  Therefore a switch to a higher pressure level takes place in the BIPAP, BIPAP-SIMV and BIPAP-APRV ventilation modes.

### Manual start between two breaths

1/2 Set »$V_T$« and »insp. flow $\dot{V}_{max}$« rotary knobs to suit patient.

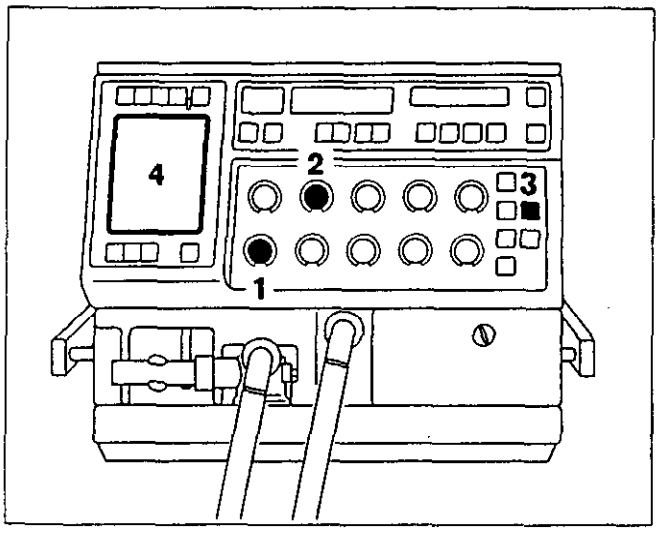
3 Keep [man.- insp. -hold] button **pressed** for as long as inspiration is desired; yellow LED is lit.
However, after 15 seconds inspiration will be stopped,

3 yellow LED in [man.- insp. -hold] button will flash.

4 Screen display:

**Insp. hold inactive**

Next start may commence after 15 seconds, when yellow LED stops flashing.




### Inspiration hold

3 Keep [man.- insp. -hold] button **pressed** for as long as inspiration is desired, yellow LED is lit.
However, after 15 seconds inspiration will be stopped,

3 yellow LED in button will flash.

4 Screen display:

**Insp. hold inactive**

Next hold may commence after 15 seconds, when yellow LED stops flashing.



E1

## Medicament nebulization

Possible in all ventilation modes.

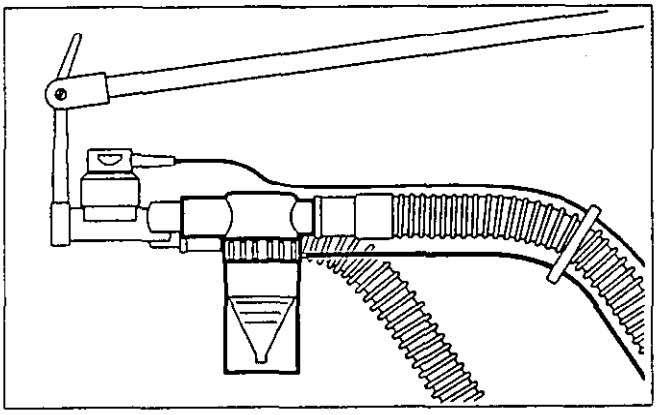
Evita 2 applies medicament aerosol in synchrony with inspiration only in the inspiratory flow phase, and automatically keeps minute volume constant. After aerosol use the flow sensor is cleaned and calibrated automatically – to prevent any malfunctioning.

*The medicament nebulizer is operated with compressed air.*

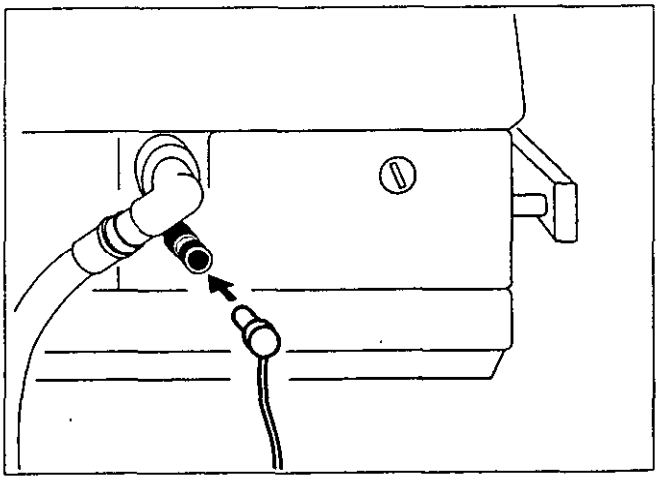
The inspiratory $O_2$ concentration is, therefore, reduced during smaller inspiration flows and higher $O_2$ settings. In an extreme case with a minimal inspiration flow of 6 L/min and an $O_2$ setting of 100 vol.% the inspiratory $O_2$ concentration would be reduced to 70 vol.%.

Prepare medicament nebulizer (84 05 00) in accordance with Instructions for Use.

- Disconnect inspiratory hose from Y-piece.
- Connect nebulizer to the inspiratory side of the Y-piece (beside temperature sensor).
- Connect inspiratory hose to nebulizer.
- Make sure nebulizer is vertical.



- Using clamps, route the compressed air supply lead of the nebulizer back to the machine along the expiratory hose.



- Push probe on supply lead into the socket below the inspiratory connector – as far as it will go.

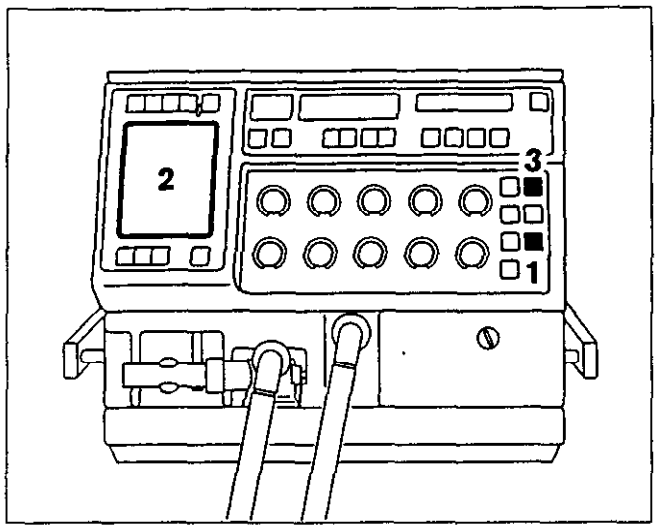
- Fill medicament nebulizer in accordance with Instructions for Use.

**Where other types of medicament nebulizer are used, there may be considerable deviations in tidal volume and inspiratory $O_2$ concentration.**



E2

**While nebulizing medicaments do not use a heat and moisture exchanger.**
**Risk of increased breathing resistance.**




1 Press button, green LED is lit.

2 Screen display:

**nebulizer on**

Nebulizer operates for 10 minutes; nebulization occurs only during inspiratory phase.

Stopping medicament nebulization prematurely:

1 Press button again.

then:

1 green LED goes out,
*the nebulizer is switched off.*

The flow sensor is then automatically cleaned and calibrated.

2 Display on screen:

**flow cal.**

3 Yellow LED in button is lit.

- Remove residual medicament; rinse out lower part of nebulizer with distilled water.

**Effect of aerosols on sensors and filters und Feuchte-Wärme-Tauscher***

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 put a microbial filter on nebulizer outlet or in the expiration side.**

* Literature (3), page 132.



E3

## Oxygen enrichment for bronchial suction

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

After the start of the programme, Evita 2 supplies 100 vol.% $O_2$ for 180 seconds for initial oxygen enrichment (in ventilation mode set).

When disconnection for suction occurs, Evita 2 interrupts the supply, but allows a continuous flow of 100 vol.% $O_2$ to continue. During the time for suction, acoustic alarms are suppressed so that the suction routine is not disturbed. After suction and re-connection, Evita 2 supplies 100 vol.% $O_2$ for 120 seconds for final oxygen enrichment.
During suction and for 2 minutes afterwards the lower alarm limit for minute volume is switched off.

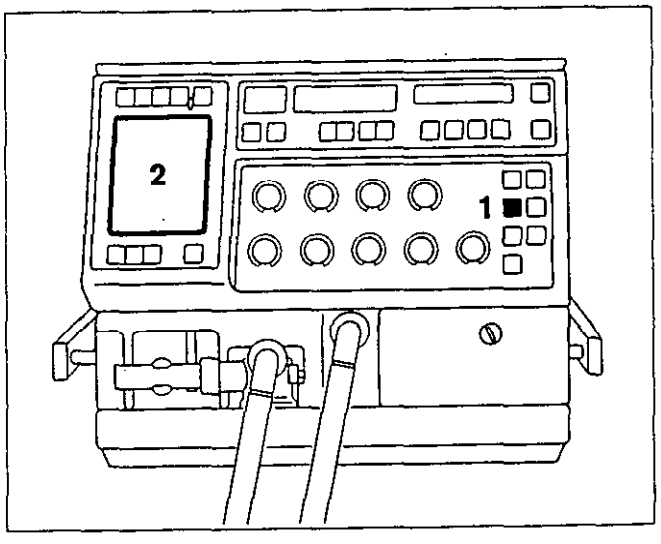
### Before suction

1 Keep [100% $O_2$] button pressed until yellow LED remains continuously lit.
Evita 2 supplies 100 vol.% $O_2$.
If the PEEP setting has not been set to more than 4 mbar, PEEP will be applied automatically at 4 mbar. This PEEP will enable Evita 2 to detect any subsequent disconnection.
The other ventilation parameters remain unchanged.

2 Screen display:

**$O_2$ enrichment 180 s**

For 180 seconds Evita 2 ventilates with 100 vol.% $O_2$.
The time remaining is shown continuously.




### After disconnection for suction

Evita 2 displays the time in seconds which remains for suction.

2 Screen display:

**suction 120 s**

During this phase the machine supplies a continuous flow of 100 vol.% $O_2$.
The time remaining is shown continuously.

The alarm sound is switched off during this time.



E4

***After re-connection***

- After re-connection – or after a maximum of 120 seconds – Evita 2 will return to the ventilation mode set, but 100 vol.% $O_2$ will continue for another 2 minutes in order to complete the post-suction oxygen enrichment.

**Interrupting oxygen enrichment**

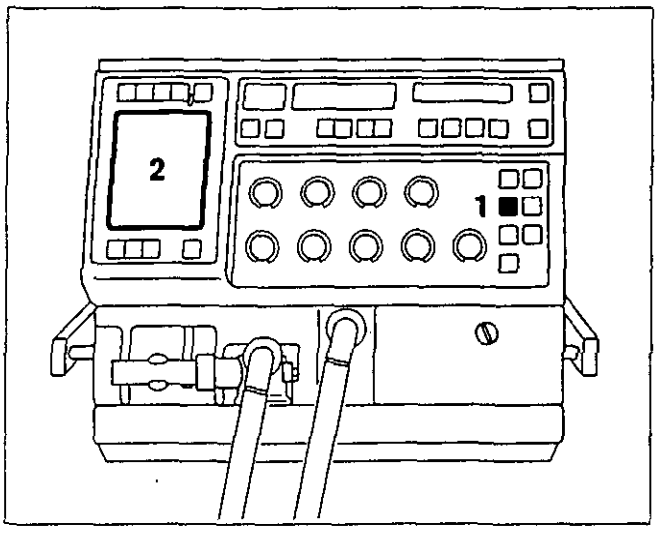
1 Press [100% $O_2$] button briefly.

The yellow LED in the button flashes for 15 seconds.

2 Screen display:

**suction inactive**

Oxygen enrichment cannot occur during this time.




Oxygen enrichment is stopped automatically after 3 minutes if Evita 2 has not detected a disconnection.



ES

## Selecting screen displays

Either for

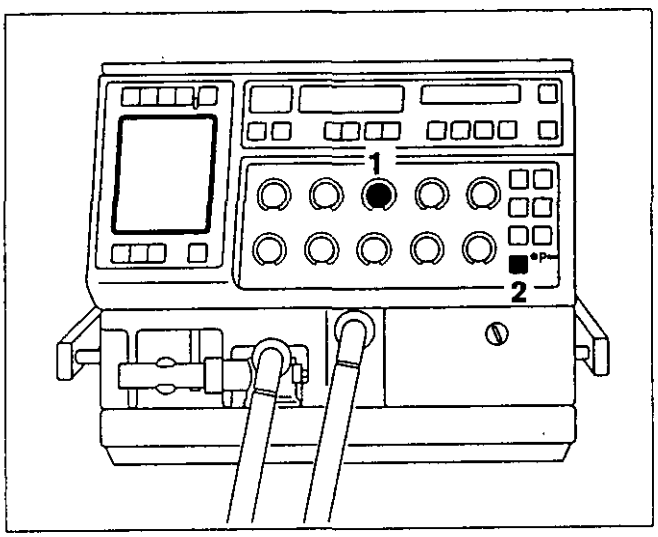
airway pressure Paw (t)
flow $\dot{V}$ (t)

A complete, synchronised pattern of IPPV and SIMV is displayed for frequencies above 5/min. For frequencies greater than 60/min, the screen sweep cannot be less than 1 second.

for SIMV and MMV with frequencies below 5/min, the screen sweep is 12 seconds.

For spontaneous breathing (CPAP) and BIPAP-APRV, the time is variable:

1 Set »f« with rotary knob
e.g. f 10/min screen sweep: 60/10 = 6 seconds.

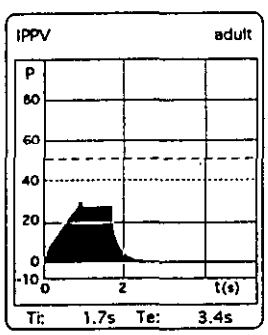



### Paw (t) display

2 Press ⮌ button repeatedly until green LED for Paw is lit:

- Paw (t) graph is displayed on the screen.

  Example:



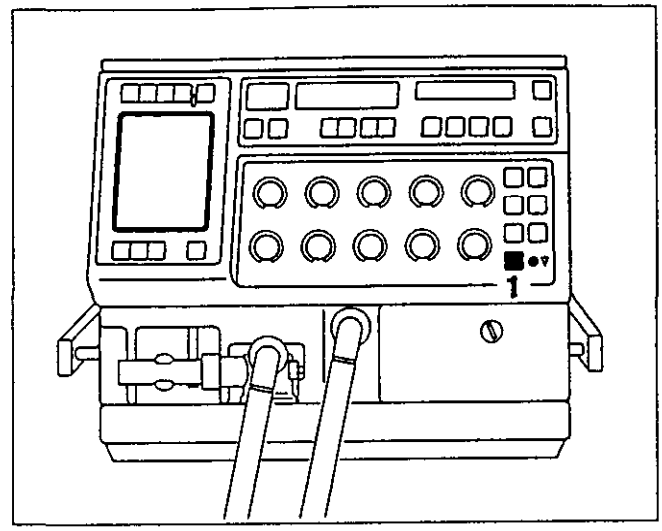

Range: –10 to 100 mbar
Resolution: 1 mbar

The dotted line represents the maximum pressure, $p_{max}$, set and/or the inspiratory pressure, $p_{insp}$, the line of dashes represents the upper alarm limit for airway pressure.



EG

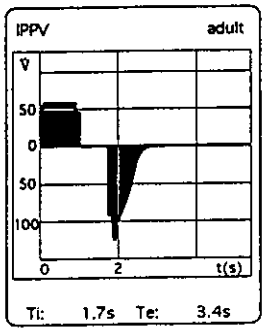
### $\dot{V}$ (t) display




1 Press [⟲] button repeatedly until green LED for $\dot{V}$ is lit.

- The inspiratory and expiratory flow are displayed on the screen as a function of time.

  Example:



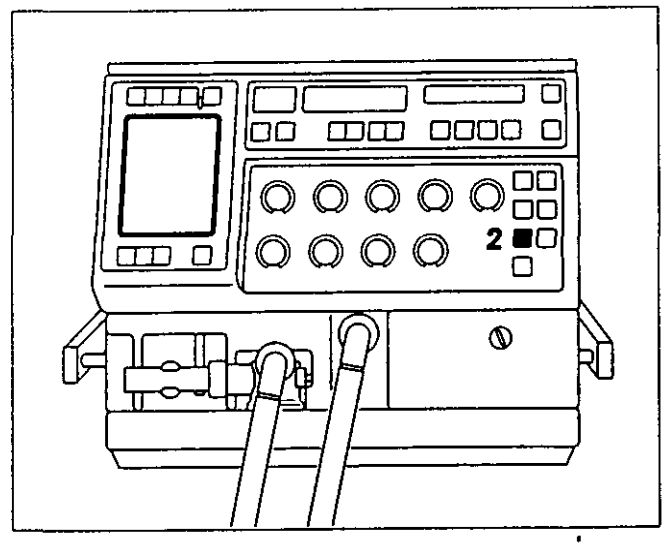

The zero line is located in the centre of the screen.

Range (adult): – 150 to 125 L/min
Resolution: 2.5 L/min

Range (paed.): – 40 to 30 L/min
Resolution: 0.6 L/min

### Frozen screen

The screen can be "frozen" for documentation and evaluation.




2 Press [Stop] button, yellow LED is lit:

The curve is recorded in its entirety and then "frozen".

2 Press button again, yellow LED goes out:

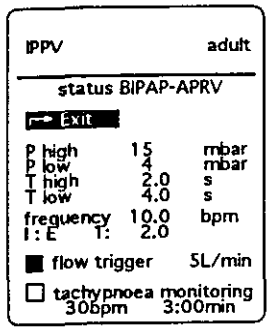
the "frozen" curve disappears; the new curve is recorded continuously.

## Recalling status pages

Evita 2 offers a status page for each ventilation mode with relevant information. The status page can be recalled independently of the ventilation mode being used at the time.

Example:

status for BIPAP-APRV ventilation mode




The display in the top field shows the present ventilation mode (IPPV)
and
the patient mode (adult).

The menu mode which appears below can be activated via the [Menu mode] button.

The display in the bottom field shows all menu function settings which relate to the selected ventilation mode.

- set values, where they are in operation.
- the possible monitoring functions and their set values.
- measurement manoeuvres, where they are possible.

To recall the status page for the ventilation mode:

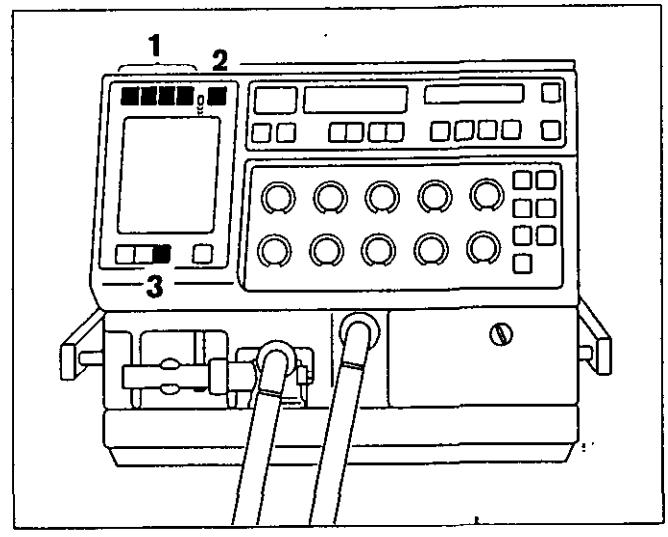
1 Press each button **briefly**,
or, for ventilation modes which are selected via the menu,

2 Press the [Menu mode] button **briefly**.

To return to previous screen display:

3 Press [•] button.

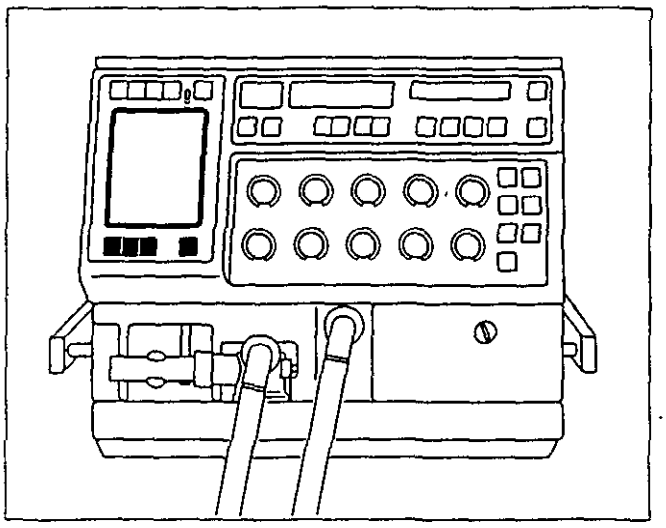
To switch on and switch off menu functions or to change menu settings, see "menu functions", page 64.






E8

## Menu Functions



By using ↓ ↑ • menu buttons below the screen and the □ , ■ , . . . symbols in the menus, additional functions can be selected and configurated, as well as patient modes.

---

↓ ↑ • = decrease, increase, acknowledge

= select basic

Selecting one of the given options (such as *BIPAP*)
status of menu function (e.g. tachypnoea monitoring)

□ = not *operating*
■ = *operating*
. . . = with sub menus

---

### Ventilation modes

BIPAP-SIMV
*Spontaneous breathing on two pressure levels as for* BIPAP, but with the SIMV time model and option of pressure assistance, ASB, at the lower level.

BIPAP-APRV
Spontaneous breathing on two pressure levels as for BIPAP, with fixed pressure rise and increased time range for APRV applications.

MMV
Spontaneous breathing with automatic adjustment of mandatory ventilation to the patient's minute volume requirement.

ILV (optional)
Independent, differentiated, synchronised ventilation with two Evita 2 machines.



E9

**Set values**

Flow trigger
Sensitivity for triggering pressure assistance, ASB, and patient synchronisation in the BIPAP ventilation modes.

Apnoea ventilation
Monitoring of spontaneous breathing (for CPAP/ASB) for stop in breathing and automatic switch-over to IPPV

Trigger IPPV
Allows the patient to control the start of mechanical inspiration in controlled ventilation.

Sigh
Adjustable, intermittent PEEP in controlled ventilation.

**Monitoring**

Tachypnoea monitoring
to detect and warn of any increase in dead space ventilation.

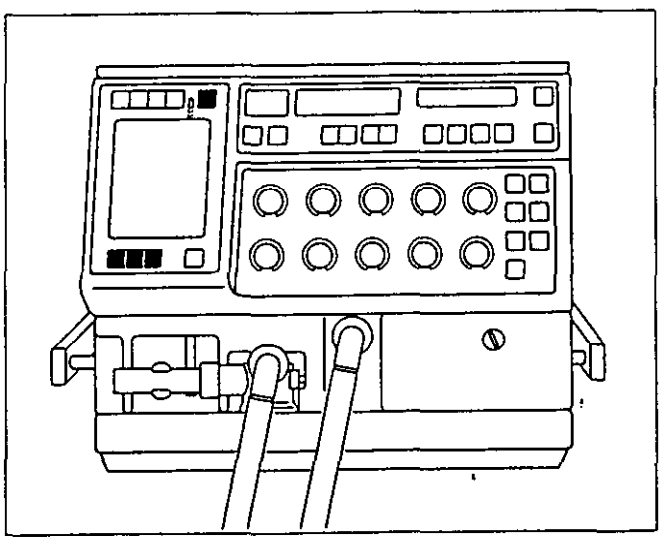
Inspiratory volume warning
detects and warns if the set tidal volume $V_T$ has not been applied, for instance if patient fights the ventilator.

**Measurement manoeuvre**

Intrinsic PEEP
to determine the endexpiratory lung pressure during IPPV/CPPV.

Occlusion pressure
Measure for efficiency of breathing muscles.

***RS 232 interface (optional)***



**Set values, monitoring and measurement manoeuvre**

are selected using [↓] [↑] [•] menu buttons.

**Ventilation modes**

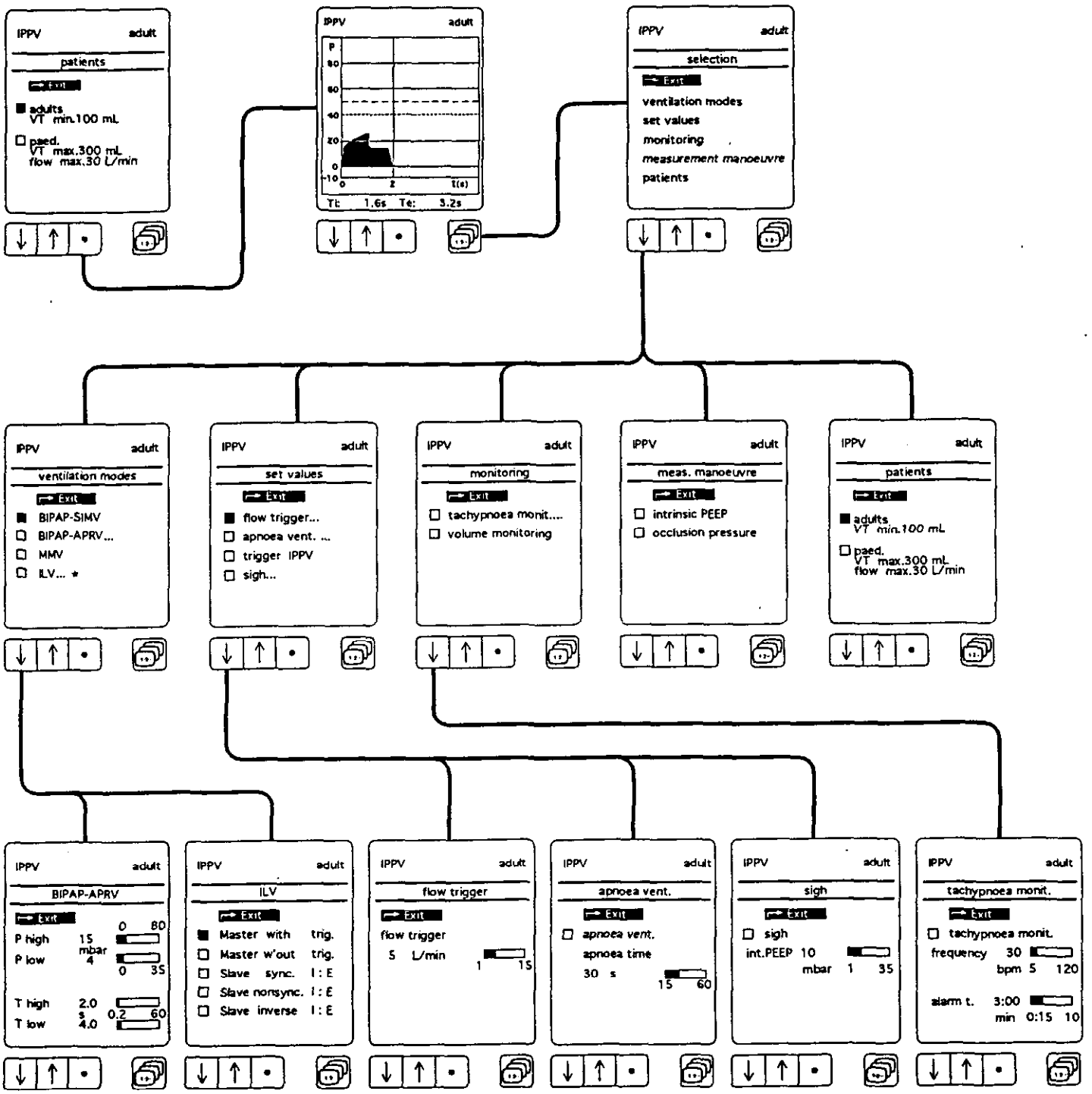
are selected using the menu buttons.

To activate, keep [Menu mode] button pressed until the green LED remains continuously lit.



E10

## Menu summary




* ILV is only displayed when analogue interface has been installed.



E11

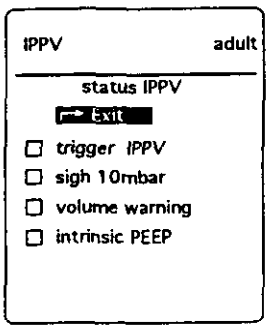
## Setting volume warning

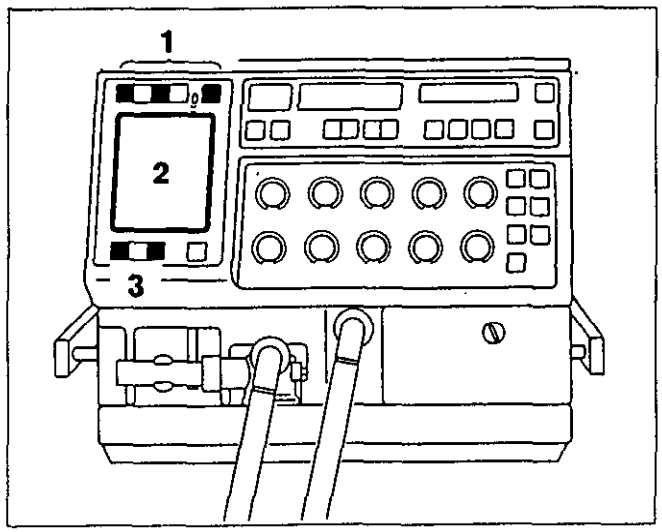
May be used in the IPPV, IPPV/assist, SIMV, MMV, and ILV ventilation modes. Evita 2 detects and warns when the tidal volume, $V_T$, set has not been supplied, e.g. when inspiratory flow is too low, or inspiration time too short or pressure limit too low.

Recalling status page:

1 *Press* appropriate button for ventilation mode briefly.

2 Display (example, *IPPV* status):




3 Switching on volume warning:

Press ↓ * button repeatedly until

**volume warning**

Acknowledge using • button.

**Volume warning is in operation.**

If there is an alarm »volume not constant« is displayed.

If volume warning is not switched on, only the message »volume not constant« will be displayed.

* Detailed description of the menu functions, page 64.

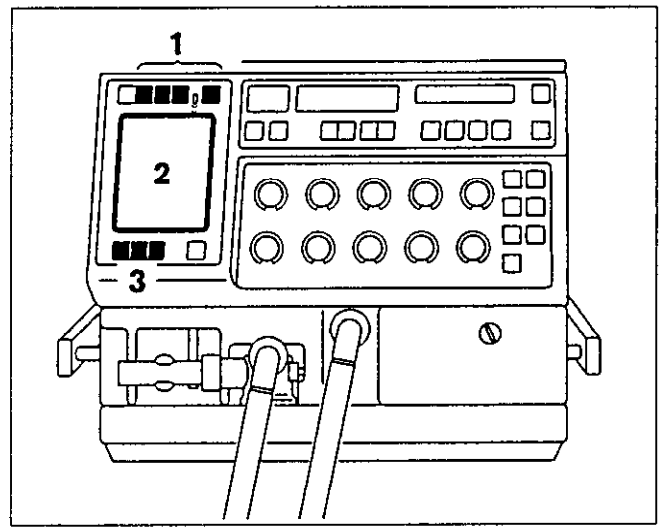


E12

## Setting tachypnoea monitoring

May be used in the BIPAP, SIMV, ASB/spont., BIPAP-SIMV, BIPAP- APRV and MMV ventilation modes.

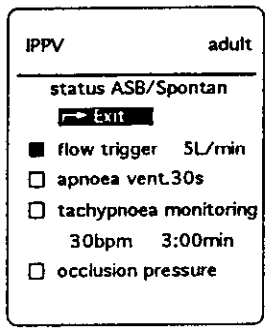
Additional monitoring to prevent a risk of an increase in dead space ventilation. During spontaneous breathing an alarm is given if spontaneous breathing frequency is exceeded for a specified length of alarm time.




Recalling status page:

1 Press appropriate button for ventilation mode briefly.

2 Display (example, status ASB/spont.):




3 Set alarm limit (frequency):
Press [↓] button repeatedly until **XXbpm** is displayed,
confirm with [•] button.

Set the desired frequency with [↓] [↑] buttons,
confirm with [•] button.

3 Set alarm time:
Press [↓] button repeatedly until **XX:XXmin** is displayed,
confirm with [•] button.

Set the desired alarm time with [↓] [↑] buttons,
confirm with [•] button.

* Detailed description of the menu functions, page 64.



E13

The bargraphs next to the numerical values help with setting and indicate setting range.

Recommended settings:
Set the alarm limit (frequency) about 50% above frequency of spontaneous breathing. Set the alarm time to about 1 minute.

- Switching on tachypnoea monitoring:
  Press [↓] button repeatedly

  until ***tachypnoea monitoring*** is displayed,

  Confirm with [•] button.

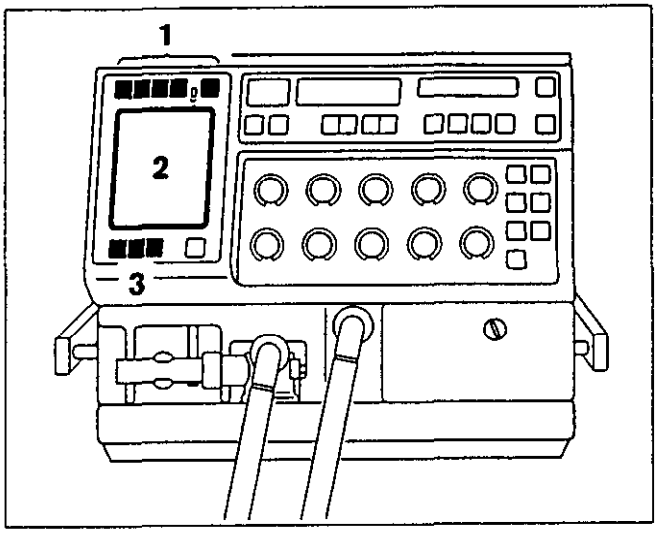
**Tachypnoea monitoring is in operation.**



E14

## Setting sigh

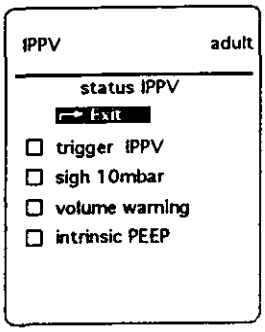
Operates as intermittent PEEP in the IPPV, IPPV/assist and ILV ventilation modes.




Recalling status page:

1 Press appropriate button for the ventilation mode briefly.

2 Display (example, IPPV status):




3 Setting sigh:
Press ↓ * button repeatedly until **XX mbar** is displayed.

Confirm with • button.

Set desired intrinsic PEEP with ↓ ↑ buttons and confirm.

3 Switching on sigh function:
Press ↑ button until ☐ **sigh** is displayed.

Confirm with • button.

### Sigh function is in operation

The sigh** operates as intermittent PEEP every 3 minutes during 2 breathing cycles with the message, **sigh active**, in the display.

---

* Detailed description in appendix, page 111.

** Detailed descrption of the menu functions, page 64.



F1

## Setting flow trigger

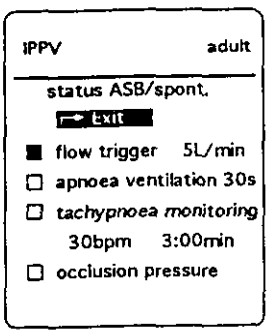
For optimum synchronisation of pressure controlled ventilation strokes in the BIPAP, BIPAP-SIMV and BIPAP-APRV ventilation modes.

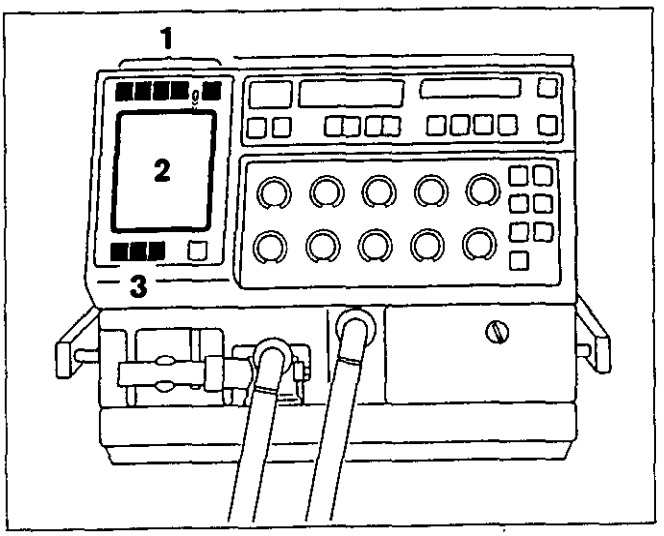
For optimum synchronisation of pressure assistance, ASB, in the SIMV, ASB/spont., BIPAP-SIMV and MMV ventilation modes.

Recalling status page for actual ventilation modes:

1 Press appropriate button briefly.

2 Display (example, ASB/spont. status):




Setting flow trigger:

3 Press [↓] * button repeatedly until flow trigger **XX L/min**

Confirm with [•] button.

Set value with [↑] and [↓] buttons, confirm with [•] button.

The bargraph display next to the numerical value helps with setting and indicates setting range.

1 L/min = very sensitive

---

* Detailed description of the menu functions, page 64.



F2

## Selecting measurement manoeuvre

Evita 2 can measure
**occlusion pressure P 0.1**
and
**intrinsic PEEP**
programme-controlled.

### Using »occlusion pressure« measurement

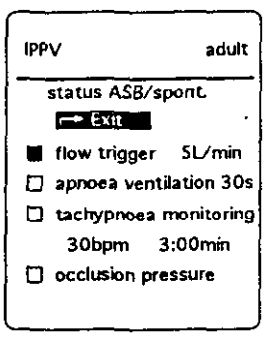
Occlusion pressure*, P 0.1, indicates the negative pressure during short-term occlusion at the start of spontaneous inspiration.
It is a direct measure of the functioning of the neuromuscular breathing drive.
For people with healthy lungs breathing quietly, P 0.1 is 3 – 4 mbar.
Values greater than 4 mbar indicate a high level of breathing drive, which can only be maintained for a limited time.
Values over 6 mbar indicate a risk of exhaustion in a chronically-obstructed patient.

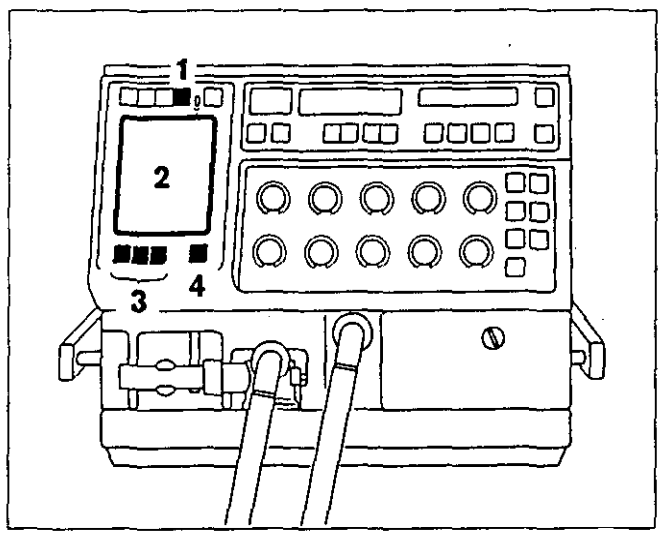
**Measurement can only be carried out in the ASB spont. mode, though preparation for measurement can be done in other operating modes.**

Recalling ASB/spont. status page:

1 Press [ASB Spont] button briefly.

2 Display (example, ASB/spont. status page):




3 Select occlusion pressure:
Press [↓] button briefly until
☐ **occlusion pressure**
Confirm with [•] button.

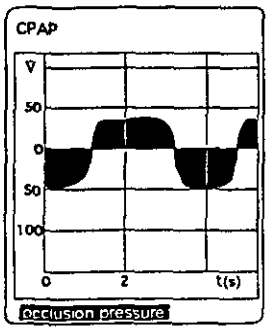
4 Return to basic page using [⧉] button.

* Detailed description in appendix, page 127.

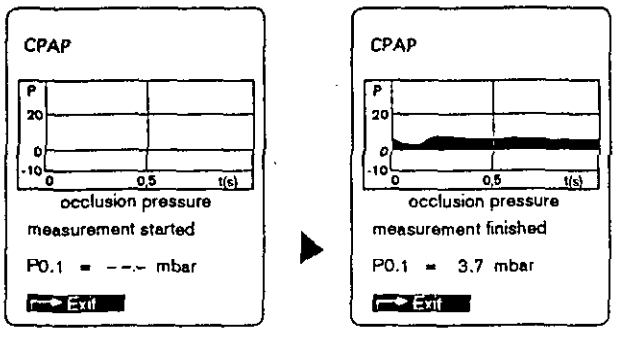


F3

- Display (example):




Start measuring with [•]:




After the measurement manoeuvre:

- Return to graphic display:
  with [•] button
  *or*
  automatically after 2 minutes.



F4

**Using »intrinsic PEEP« measurement manoeuvre**

Intrinsic PEEP* is the actual endexpiratory pressure in the lung during ventilation with IPPV/CPPV.

Due to the dynamic effects of lung mechanics (resistance, compliance, closing volume) and the adjustment parameters of ventilation, the intrinsic PEEP differs from the PEEP in the upper airways.

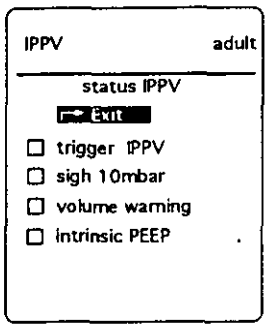
*This procedure measures the "trapped" volume which* results from different PEEP values in the lung and which is not part of gas exchange.

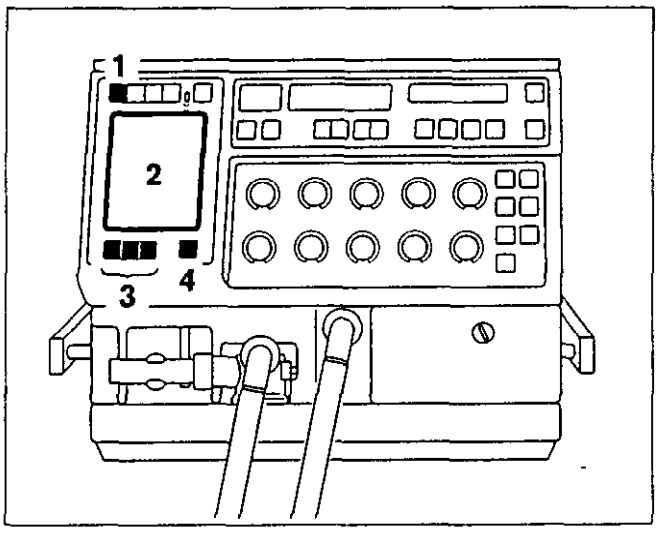
**Measurement can only be carried out in the IPPV or IPPV/assist ventilation modes, though preparation for measurement can be done in other ventilation modes.**

*Recalling IPPV status page:*

1 Press [IPPV] button briefly.

2 Display (example):




3 Select intrinsic PEEP:

Press [↓] button until ☐ **intrinsic PEEP**

Confirm with [•] button.

4 Return to basic page with [⎙] button.

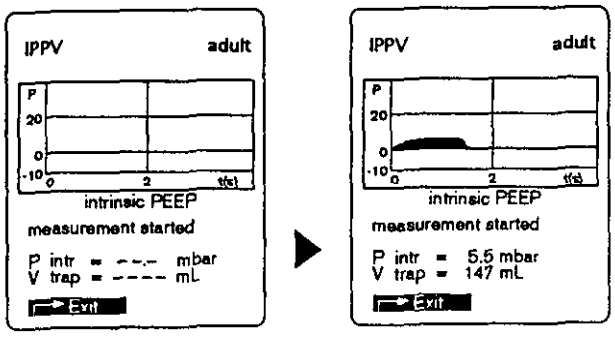
* Detailed description in appendix, page 128.



F5

Start measurement with [•] button.

Example:




After measurement:

- Return to graphic display:
  with [•] button,
  or
  automatically after 2 minutes.



F-6

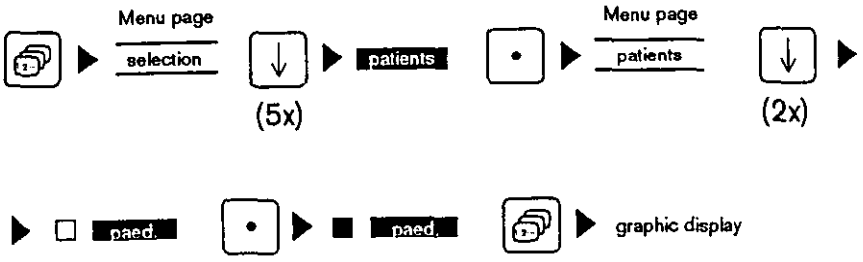
## Selecting adult or paediatric ventilation

### during operation

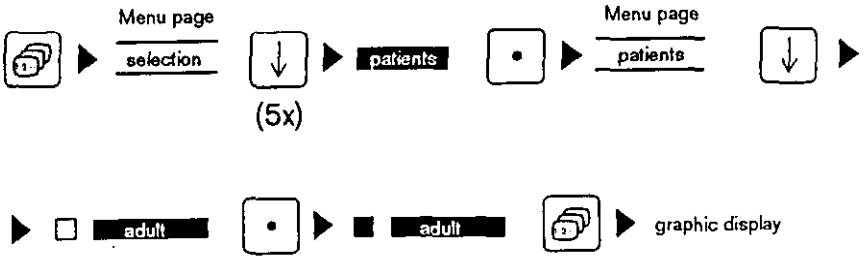
Paediatric ventilation with 0.04 L to 0.3 L tidal volume, $V_T$, and inspiratory flow to 30 L/min

*Adult ventilation from tidal volume* VT = 0.1 L.

**Select paediatric ventilation**




Select adult ventilation






F-7

## Adjusting contrast and setting date/time

Using [Menu select] button below the display window for measured values,

- adjust contrast (for screen and for measured values)

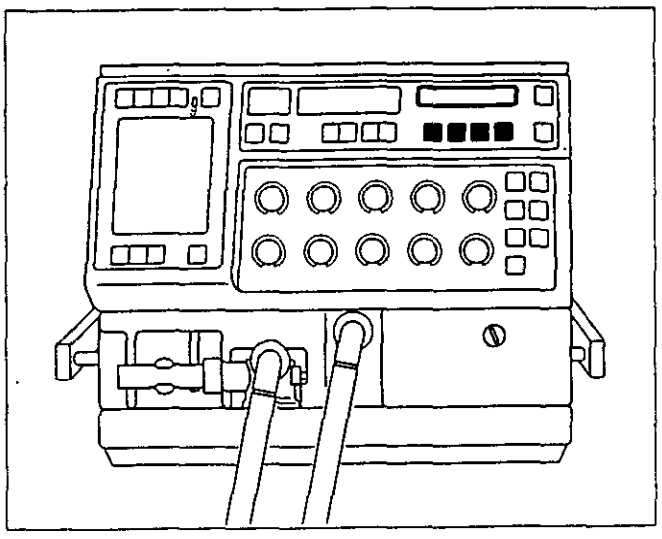
  as well as

- set and display date and time

In the process, all 4 buttons below the display window lose their marked functions. Their new functions are shown in the display above the buttons.

- To select the new function, press the button below the display.
- To set the numerical values, press the appropriate + or – button.

If no button is pressed within 10 seconds, the buttons automatically resume their original functions.

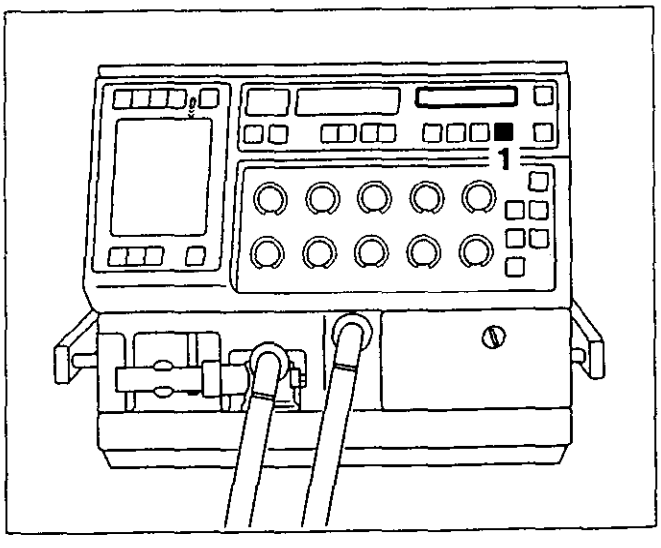


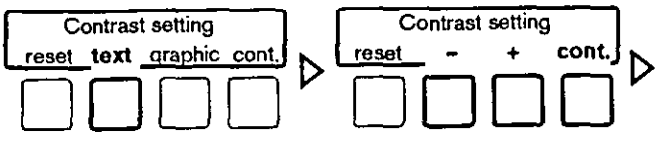
### Adjusting contrast

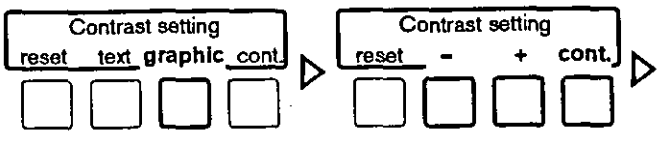
1 Keep [Menu select] button pressed until the green LED *remains continuously lit.*

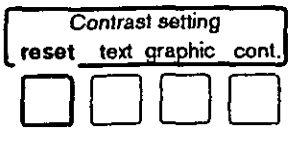
- Select with the buttons marked in bold in the order given.

  Text = text display above the buttons
  Graphics = screen on *left of machine*



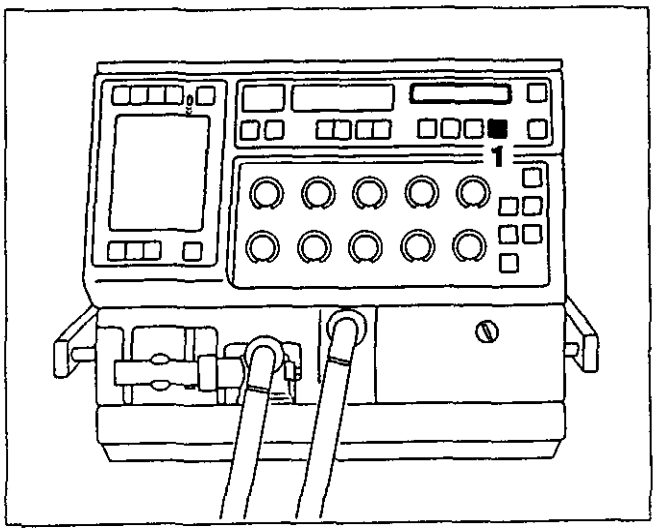


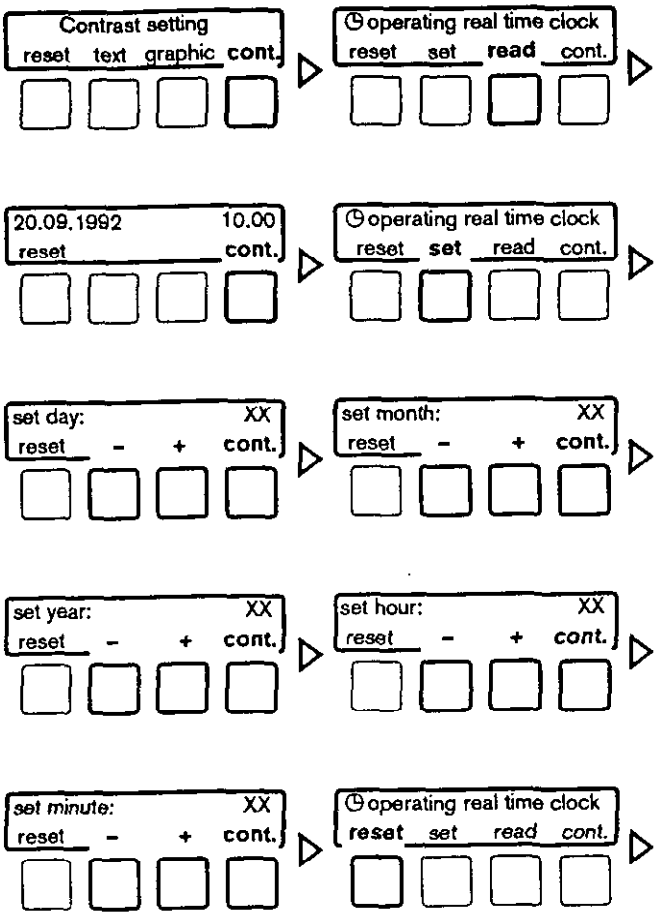

F8

### Displaying or setting date/time

1 Keep [Menu select] button pressed until green LED remains continuously lit.

- Select with the buttons marked in bold in the order given.



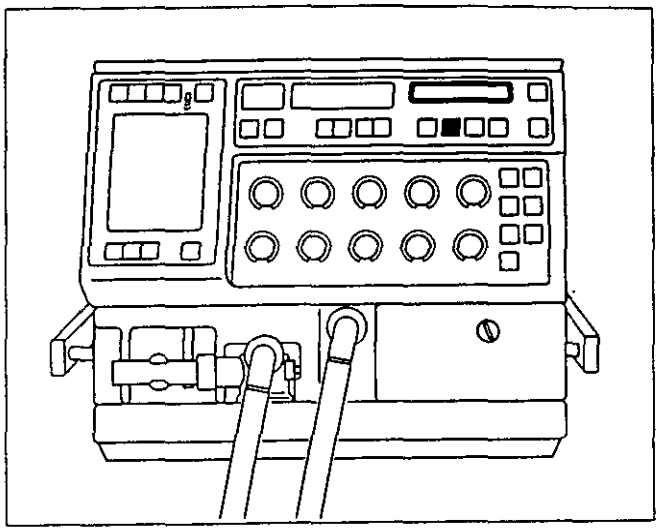






F9

## Regular routines

– **About every hour:**
*Check temperature of inspiratory breathing gas:*



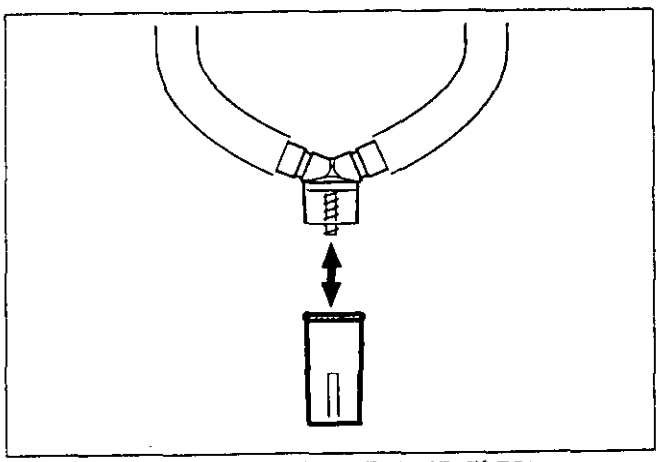
- Press [T,Vt,f R,C] *button briefly:*
- Display:

| temp | VTe | f | R | C |
|---|---|---|---|---|
| XX | X,XX | XX | XX | XX |

°C

– **About every 2 hours:**
Empty water traps in hose system:

- Pull collecting jar off downwards and drain.
A valve automatically closes the water trap. Push back *onto conical connector* on water trap firmly.



– **About every 8 hours:**
Re-fill humidifier with distilled water.

– **About every 24 hours:**
Calibrate flow sensor, page 19.



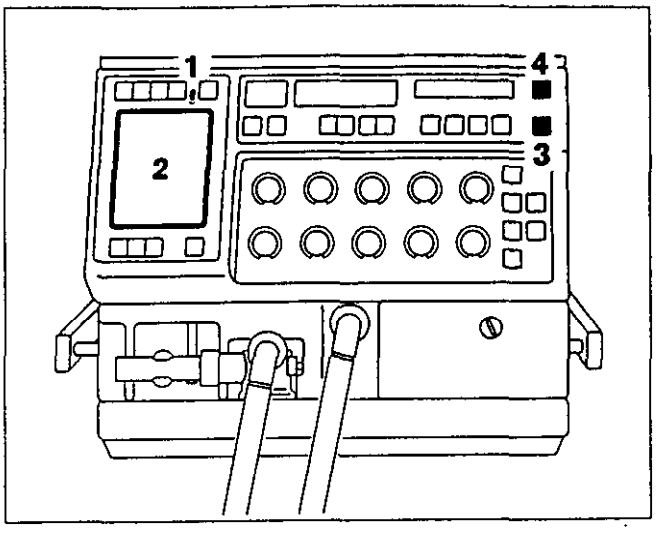
F10

## Alarms

1 The red alarm light flashes, accompanied by alarm sound.

2 Alarm message is displayed on the screen.

- Rectify fault, use "Fault-Cause-Remedy" list, page 104 to 106.




When fault is rectified, the alarm sound ceases.

Acknowledging alarm message:

3 Press [Reset Check] button, the alarm message disappears from the screen.

The alarm sound can be suppressed for 2 minutes:

4 Keep [🔔] button pressed until the yellow LED is lit.

$O_2$ alarm

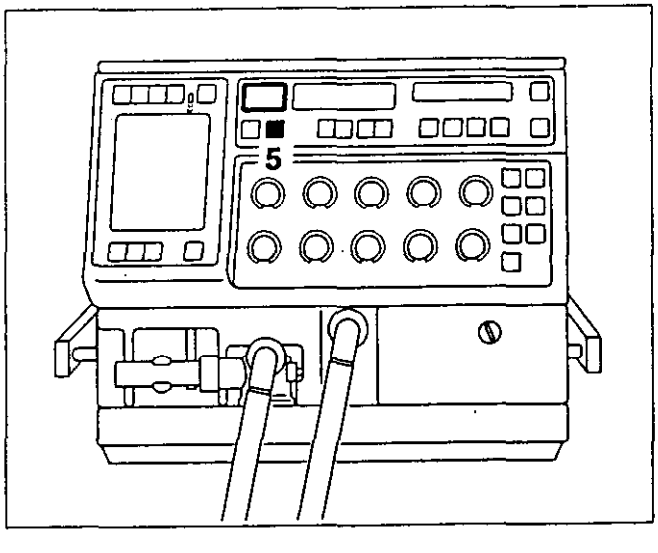
Calibrate $O_2$ sensor, page 17,
or;
replace $O_2$ sensor, page 8.

**Switching off $O_2$ monitoring in exceptional cases**

5 Press [$O_2$ Alarm] button, yellow LED flashes:
**$O_2$ monitoring is switching off permanently.**

Switching $O_2$ monitoring on again:

5 Press [$O_2$ Alarm] button again, yellow LED goes out.





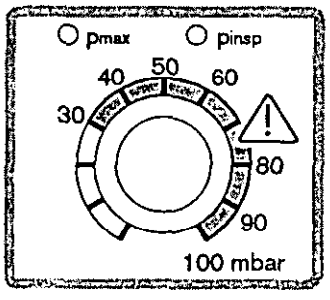

F11

## Recommendations on settings

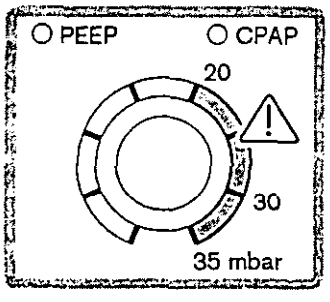
Extreme settings above a defined threshold value or inoperable settings are detected by the machine and displayed as a message on the screen. At the same time the green LEDs (operation indicators) flash on the rotary knobs for setting.

*Extreme settings occur if set values exceed the following* threshold values.

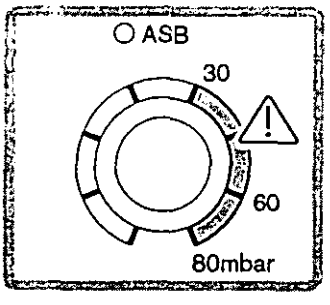
**In such cases Evita 2 limits the operative value to that *of the threshold value. The extreme setting does not* come into operation until the »reset/check« button has been pressed.**



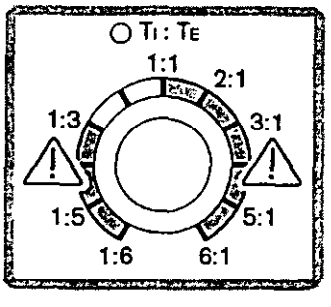

$p_{max}$ : 50 mbar
$p_{insp}$ : 30 mbar and 50 mbar




PEEP : 20 mbar
CPAP : 20 mbar




ASB : 30 mbar and 50 mbar

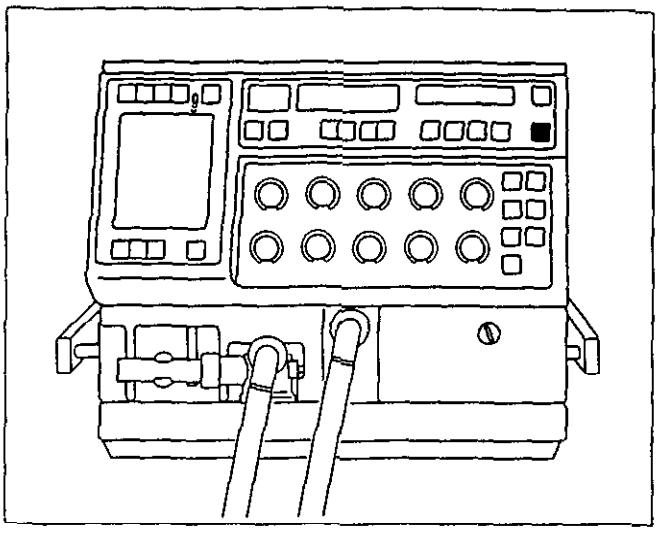



$T_I$ :$T_E$ : greater than 1 : 1
or
smaller than 1 : 3



F12

**Desired, meaningful extreme settings**
come into operation when confirmed.



- Press Reset Check button, the extreme value set is in operation, the green LEDs (operator indicators) remain continuously lit.

When several extreme settings are required:

- Confirm one after another = press Reset Check button.

The message with the highest priority is displayed, then – each time the Reset Check button is pressed, the next lower priority is displayed.

When switching from one ventilation mode to another, the extreme settings which have already been acknowledged are transferred and do not need to be confirmed again. However, for safety reasons extreme settings of TI:TE must be confirmed after each change of ventilation.

**To protect the patient other extreme settings are limited to the threshold value, the setting does not come into operation for:**

| | |
|---|---|
| insp. flow $\dot{V}$ | : above 30 L/min for paediatric use |
| $V_T$ | : above 300 mL for paediatric ventilation<br>below 100 mL for adult ventilation |
| $p_{insp}$ | : above 80 mbar |

***Inoperable settings***
occur when two settings are not compatible, as for example, when the ASB pressure has been set lower than CPAP and pressure assistance does not come into operation.
Under certain circumstances Evita 2 limits a setting to prevent an inoperable setting from coming into operation. Inoperable settings cannot be confirmed and must be replaced by another setting.



F13

**Extreme settings which only come into operation after confirmation**

| Message | Setting |
|---|---|
| **Check ASB** | ASB > 50 mbar and ASB > 30 mbar |
| **Check CPAP** | CPAP > 20 mbar |
| **Check PEEP** | PEEP > 20 mbar |
| **Check $p_{max}$** | $p_{max}$ > 50 mbar |
| **Check $p_{insp}$** | $p_{insp}$ > 50 mbar and $p_{insp}$ > 30 mbar |
| **Check $T_I$:$T_E$** | $T_I$:$T_E$ < 1 : 3 |
| **IRV** | $T_I$:$T_E$ > 1 : 1 |

**Extreme settings which are limited by the machine**

| Message | Setting/Cause | Remedy |
|---|---|---|
| ***flow max. 30 L/min*** | Insp. flow $\dot{V}$ setting above 30 L/min for paediatric ventilation. | Set insp.flow $\dot{V}$ to values below 30 L/min. |
| ***$V_T$ max. 300 mL*** | $V_T$ setting above 300 mL for paediatric ventilation. | Set tidal volume $V_T$ to values below 300 mL. |
| ***$V_T$ min. 100 mL*** | $V_T$ setting below 100 mL for adult ventilation. | Set tidal volume $V_T$ to values above 100 mL. |
| ***$p_{insp}$ max. 80 mbar*** | Insp. pressure setting above 80 mbar. | Set insp. pressure $p_{insp}$ to values below 80 mbar. |
| ***Frequency min. 5 bpm*** | Frequency setting below 5 bpm.<br>*Frequencies f below 5 bpm only come into operation* in BIPAP. | Set frequency f to values above 5 bpm. |

**Non-operable settings**

| Message | Cause | Remedy |
|---|---|---|
| **ASB inactive**<br>**Check ASB** | ASB pressure setting is below CPAP. | Increase ASB pressure. |
| **Check IMV freq.** | IMV frequency is above IPPV frequency. | Increase IPPV frequency or reduce IMV frequency. |
| **Check $p_{max}$/ASB** | ASB pressure is above $p_{max}$. | Increase $p_{max}$. |
| **Check $p_{insp}$/ASB** | ASB pressure is above $p_{insp}$. | Reduce ASB pressure. |
| **Check $p_{max}$/BIPAP** | BIPAP-APRV pressure is above $p_{max}$. | Increase $p_{max}$. |
| **Check $p_{max}$/CPAP** | CPAP pressure is above $p_{max}$. | Increase $p_{max}$ |

Continued on next page



F14

**Non-operable settings**

| Message | Cause | Remedy |
|---|---|---|
| **Check $p_{insp}$/CPAP** | CPAP is above $p_{insp}$. | Reduce CPAP. |
| **Check $p_{max}$/int.P** | Intermittent PEEP is above $p_{max}$. | Increase $p_{max}$. |
| **check $p_{max}$/PEEP** | PEEP is above $p_{max}$. | Increase $p_{max}$. |
| **Exp. time too short** | Display during ILV: expiration time is below 0.5 s. | Reduce IPPV frequency |
| **Insp. hold inactive** | Button was pressed for more than 15 s. | Release button. |
| **IPPV frequency Slave?** | Display during ILV: setting f on Slave machine differs from setting f on Master machine. | Check f on Slave machine. |
| **Sigh inactive Check int. PEEP** | Intermittent PEEP is below PEEP. | Increase intermittent PEEP |
| **Volume not constant pressure limited** | Tidal volume $V_T$ set cannot be supplied, because pressure limit is in operation. | |
| **Volume not constant time limited** | Tidal volume $V_T$ set cannot be supplied, because inspiration time is too short. | Increase insp. flow $\dot{V}_{max}$, or reduce f, or increase $T_I$:$T_E$. |



61

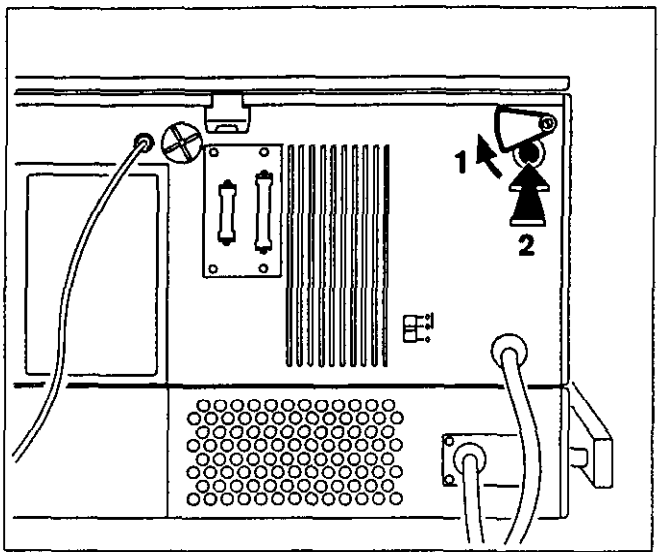
## Shut-down

Following disconnection of patient:

At the back:

1 Push protective cap on mains switch aside,
2 Push button in until stop and release = OFF.

- *Mains switch of Aquapor to 0.*
- Pull out all connectors for electrical and pneumatic supply.



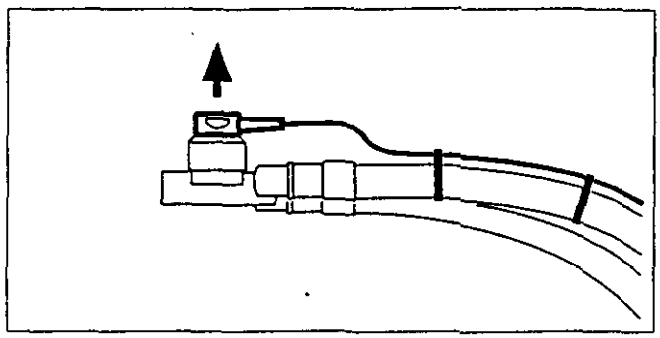



G2

## Stripping down

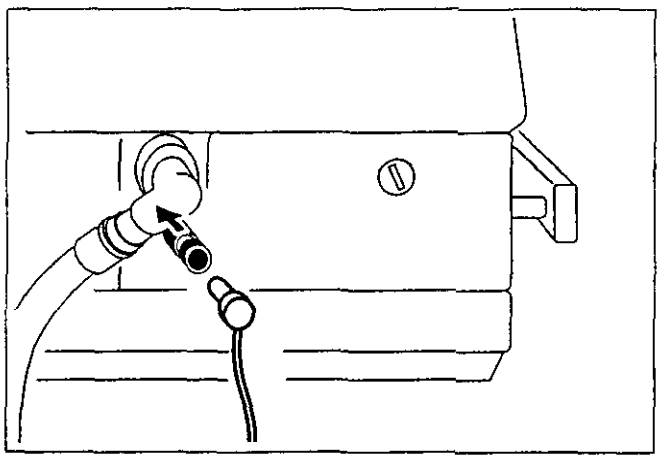
### Disconnecting ventilation hoses

- Drain water traps in hose system.



- Remove temperature sensor from Y-piece – do not tug on the cable.
  Remove sensor probe from machine, detach cable from clamps.

- Remove hoses from Y-piece and from sockets on the machine.
- Remove water traps, medicament nebulizer and Y-piece.
  Remove collecting jars from water traps.



- Release the supply tube probe on the medicament nebulizer = push back ring on coupling.



63

### Removing flow sensor

1 Push sensor to the left as far as it will go and
2 pull out.

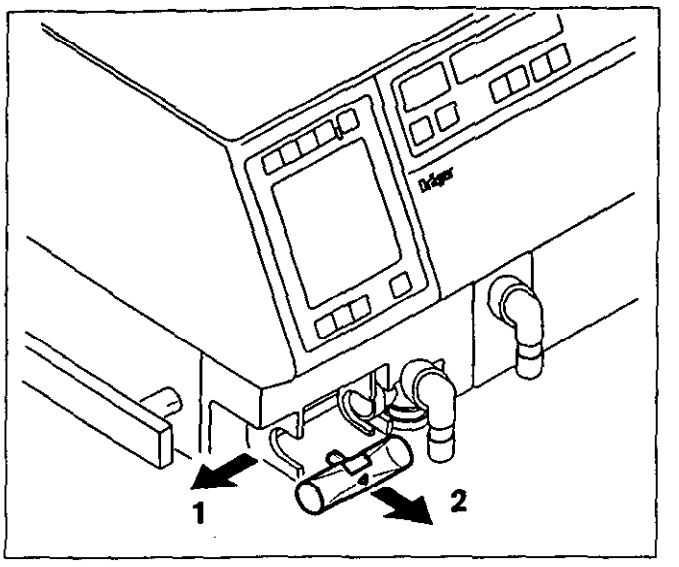
If contamination may have occurred:

- remove and discard flow sensor.

If not,

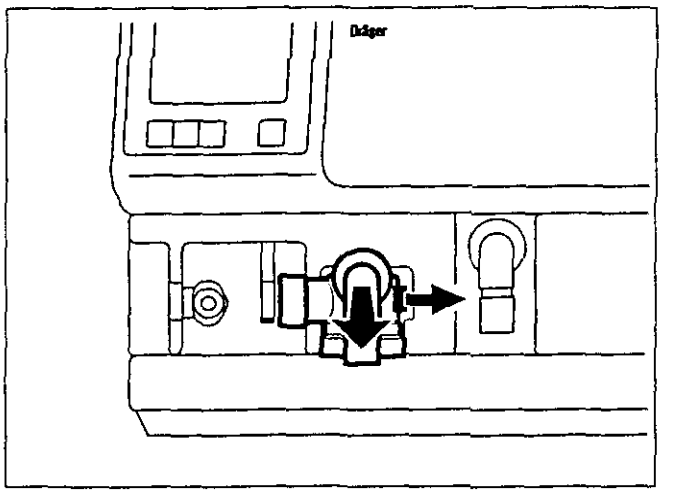
- re-use flow sensor after calibration.

  The flow sensor cannot be sterilized and cannot be disinfected.



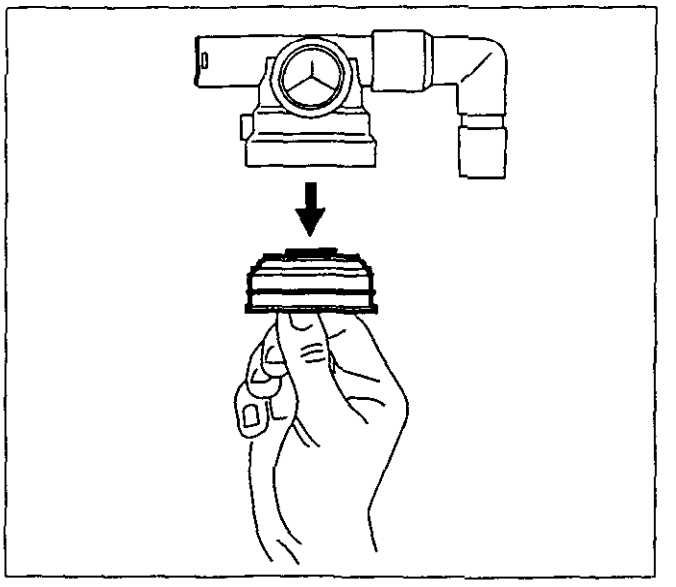

### Detaching patient system

- Push catch to the right and simultaneously pull off patient system.



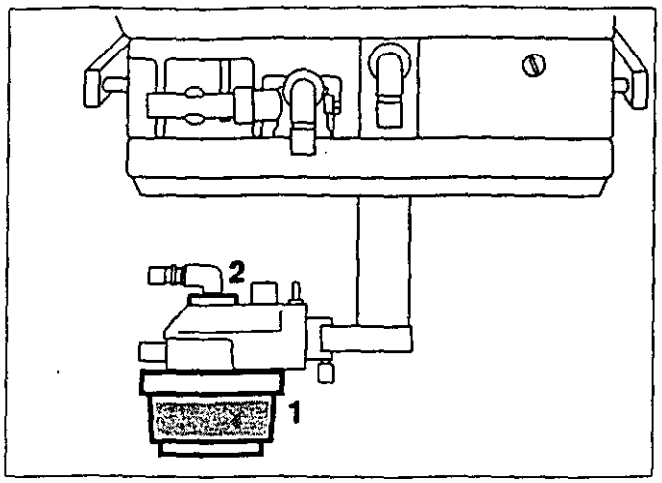
### Only strip down patient system if badly soiled

- Unscrew stopper by hand and remove together with the diaphragm.
- Do not disassemble patient system any further.





64




**Disassembling Aquapor**

1 Unscrew Aquapor bowl with float and drain distilled water.

2 Unscrew nut and remove lid.

**For the Fisher & Paykel MR 730 humidifier follow relevant Instructions for Use.**

## Disinfecting/Cleaning

Use surface disinfectants. For material compatability use disinfectants based on:

- aldehydes,
- alcohol,
- quaternary ammonium compounds
- phenol-based compounds

Damage to material may occur if **any disinfectants** are used which are based on:

- 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 (DGHM: German Society for Hygiene and Microbiology) list are used.
The DGHM list (pmhp-Verlag, Wiesbaden) gives the composition of each disinfectant. For countries where the DGHM list is not available, we recommend the types of disinfectants given above.

### Wipe disinfection

Basic machine without hose system,
Aquapor without bowl and float,
gas-connecting hoses,
temperature sensor

- Disinfect by wiping with Buraton (Messrs. Schülke & Mayr, Norderstedt), for instance.
  Observe manufacturer's instructions.

Or:

### Disinfect in Aseptor disinfection chamber

Basic machine without hose system, without cooling-air filter
and without ambient-air filter,
Aquapor without bowl and float,
gas-connecting hoses,
temperature sensor.

- Remove obvious stains first with disposable cloth.
- Remove cooling-air filter, page 102.
- Remove ambient-air filter, page 103.
- Dry parts well; damp parts cause unpleasant smells.
- Place basic machine, Aquapor and accessories in Aseptor and disinfect in accordance with Aseptor Instructions for Use.

Afterwards:

- Replace cooling-air filter, page 102

  and

- Replace ambient-air filter, page 103.

### Disinfection with moist heat

All disassembled parts:
Ventilation hoses,
water traps and their collecting jars,
Aquapor bowl with float and socket,
Y-piece, medicament nebulizer, patient system or their parts, if these are badly soiled.

- Disinfect with moist heat (93°C/10 minutes) in a cleaning and disinfecting machine.
  **Use only cleaning agent.**
- After disinfection with moist heat steam sterilize **patient system and individual parts** at 134°C to make sure that no water remains in the pressure measuring line and possibly causes some malfunction.

If no washing machine is available:

**Bath disinfection**

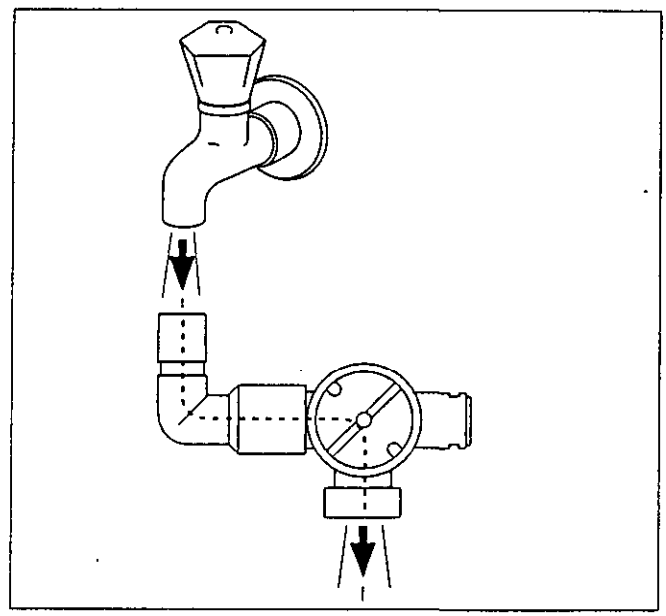
- Disinfect with Sekusept, Messrs. Henkel, for instance. Observe manufacturer's instructions.

  Then rinse with clean water – preferably from a soft water supply – and shake water out thoroughly. Allow parts to dry well.

- *After rinsing steam-sterilize* **patient system and individual parts** at 134°C.

Or

- Rinse patient system with clean water, preferably from a soft water supply. Shake water out throroughly.
- After rinsing thoroughly, dry patient system.
- After drying, steam-sterilize at 134°C.



**Sterilizing**

All other disassembled parts, and also the temperature sensor, can then be sterilized:

- Steam sterilize parts at 134°C.

**Do not use ethylene oxide for sterilization.**

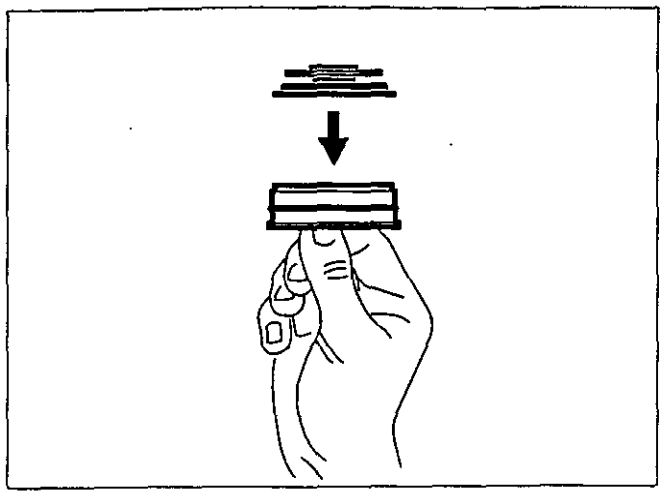


G7

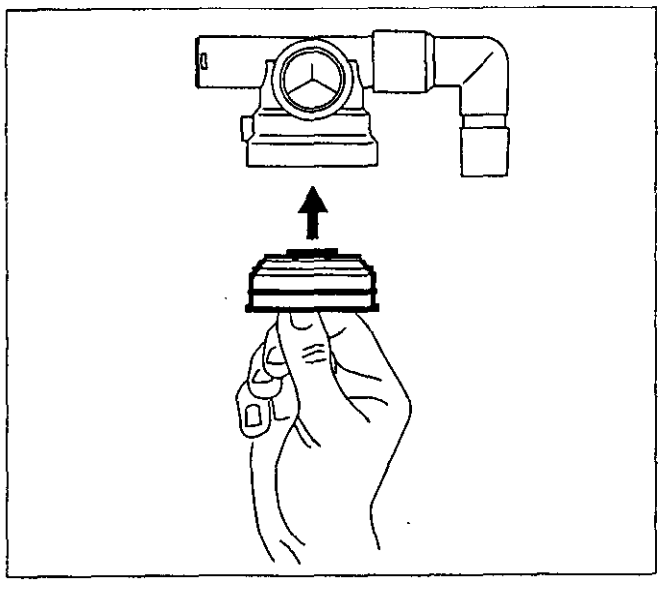
### Assembling patient system

The parts must be completely dry to prevent any malfunctioning.

- Hold stopper by the flange and place diaphragm on the collar of the lock. Be careful to fit diaphragm correctly.



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



### Before re-using on patient

- Assemble machine as described in "Preparation" on pages 7 to 13.
- Carry out tests of readiness for operation, page 92.



G8

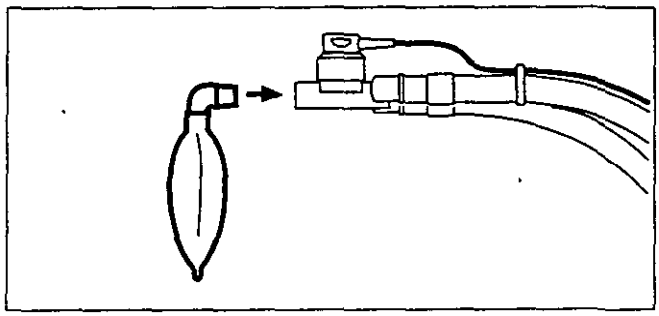
# Testing Readiness for Operation

Carry out each time Evita 2 is assembled. The machine is ready for operation when completely re- assembled, page 7 to 13, and the O2 sensor and flow sensor are calibrated, page 17 to 19.

**Connecting adult test lung 84 03 201**
for adult hose set

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

- Push elbow connector onto patient connection of Y-piece.



An LS 800 lung simulator and a Dräger demonstration thorax M 20558 can be used instead of a test lung.

**Preparing lung simulator LS 800**

1 Attach the tracheal tube to the bottom connector on the pressure gauge using a standard conical fitting.

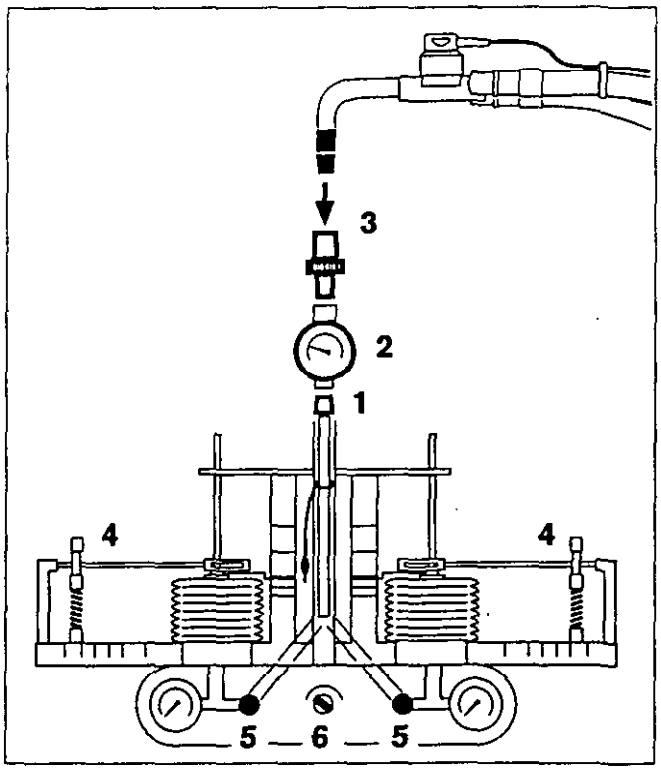
2 Push the pressure gauge with the tracheal tube onto connector on LS 800; inflate cuff.

3 Push the Ø 22/Ø 15 standard adaptor into pressure gauge, and push corrugated hose on Evita onto adaptor.

4 Set compliance to 20 mL/mbar on both sides.

5 Set resistance to 2 mbar/L/s on both sides.

6 Set leakage to 0.






G9

# Testing Readiness for Operation

**Preparing demonstration thorax M 20 558**

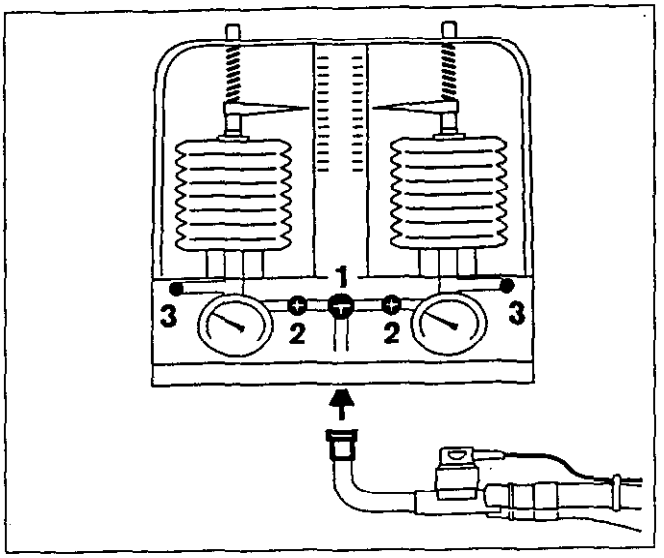
- Push corrugated hose on Evita 2 onto connecting port at back.

1 Three-way valve in T-position: both bellows in use.

- Basic compliance = 40 mL/mbar maintained, do not increase spring force by applying sleeves.

2 Set screws to large cross section: resistance = minimum.

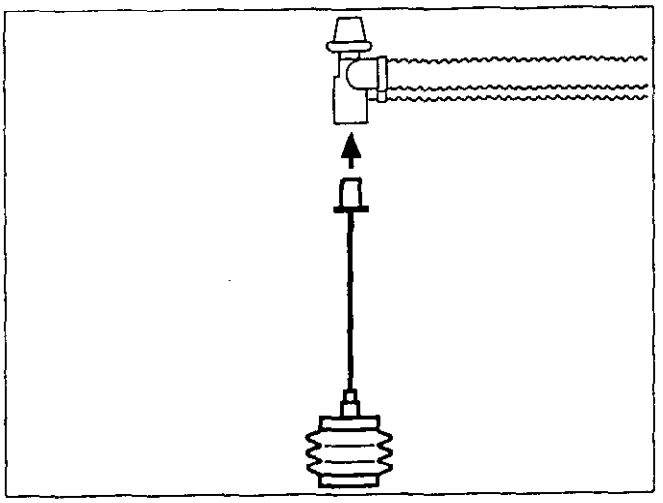
3 Tighten screws completely: no leakage simulation.




**Connecting child test lung 84 09 742**
for children's hose set

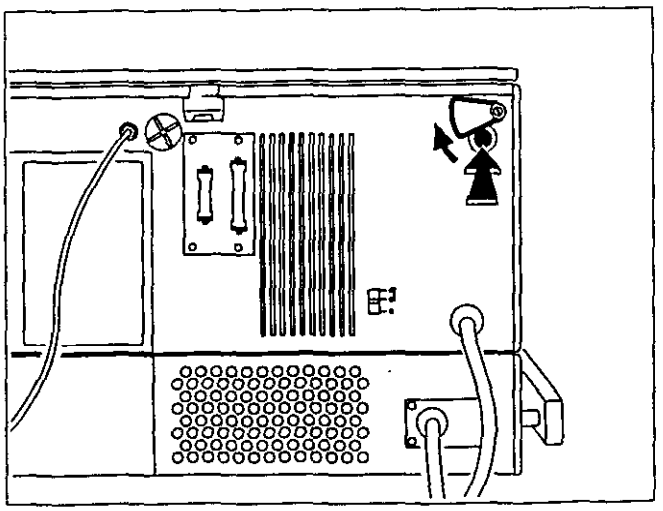
The test lung consists of a CH 12 tracheal tube to simulate resistance of the airways and a small bellows to simulate compliance.

- Insert connector into Y-piece.



**Checking mains power failure alarm**

- Remove mains power plug.
- Push mains switch at the left on the back in until stop = ON.
  Intermittent alarm sound commences, remaining constant for about 20 seconds; if this does not happen, recharge battery, page 14 – "Charging storage battery for mains failure alarm".
- Push protective cap of mains switch aside. Push button in fully to the stop and release = OFF: Alarm sound ceases.
- Re-connect mains power plug.





G 10

**Leak test of adult hose set**

- Switch on machine.
- Select adult ventilation, page 22.

1 Keep [IPPV] button pressed *until the green LED remains continuously lit.*

2 Rotary knob »$V_T$« to 0.1 L.

3 »Insp. flow $\dot{V}_{max}$« to 6 L/min.

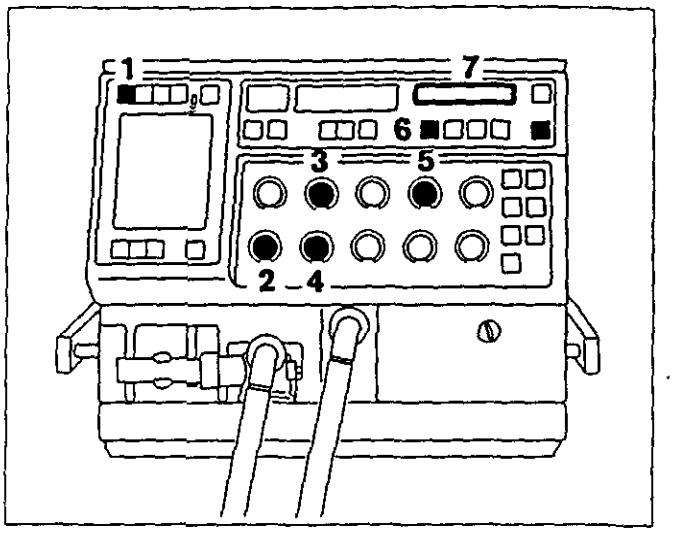
4 »$p_{max}$« to 80 mbar, confirm with [Reset Check] button.

5 »Ti:Te« to 4:1, *confirm* with [Reset Check] button.

- Other rotary knobs to "green dot".

6 Press [Psw] button.

- Remove test lung, keep Y-piece sealed.




7 *Observe display:*

| P : | max | plat | PEEP | mean |
|---|---|---|---|---|
| | XX | XX | XX | XX |

- When a peak pressure, Pmax, of 80 mbar has been reached, the plateau pressure, $p_{plat}$, must be **not more than 15 mbar below** $p_{max}$.
- If peak pressure remains below 80 mbar, the plateau pressure, $p_{plat}$, must be **not more than 10 mbar below** $p_{max}$.
- Re-connect test lung to Y-piece.



G11

***Leak test of childrens hose set***

- Switch on machine.
- Select paed. ventilation, page 22.
- Set and keep sealed – as described for adult hose set, but with rotary knob »$V_T$« set to 0.04 L.
- Observe display:

| P: | max | plat | PEEP | mean |
|---|---|---|---|---|
| | XX | XX | XX | XX |

- When a peak pressure, $p_{max}$, of 80 mbar has been reached, the plateau pressure, $p_{plat}$, must be **not more than 15 mbar below** $p_{max}$.
- If peak pressure remains below 80 mbar, the plateau pressure, $p_{plat}$, must be **not more than 10 mbar below** $p_{max}$.

- Re-connect test lung to Y-piece.



G 12

**Checking functioning of adult ventilation**

Select adult ventilation.

1 Rotary knob »$V_T$« to 0.5 L.

2 Rotary knob »$p_{max}$« to 45 mbar.

3 Rotary knob »PEEP« to 10 mbar.

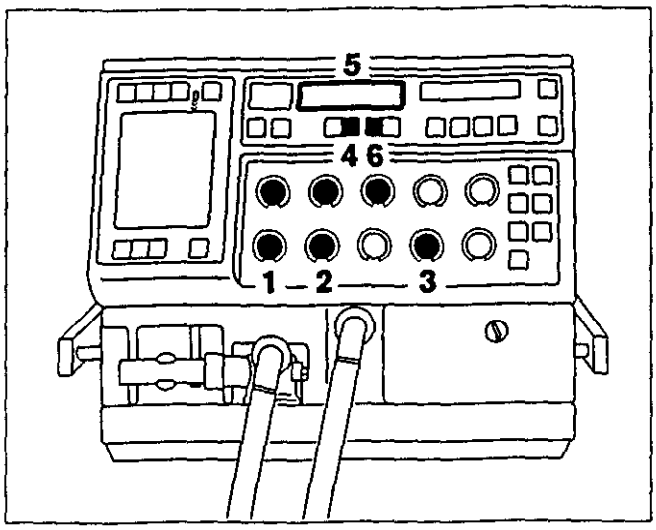
- Other rotary knobs to »green dot«.

4 Keep [↑] button pressed until:

5 upper alarm limit: /▲ – – = OFF.

6 Keep [↓] button pressed until:

5 lower alarm limit: ▼/ – – = OFF.

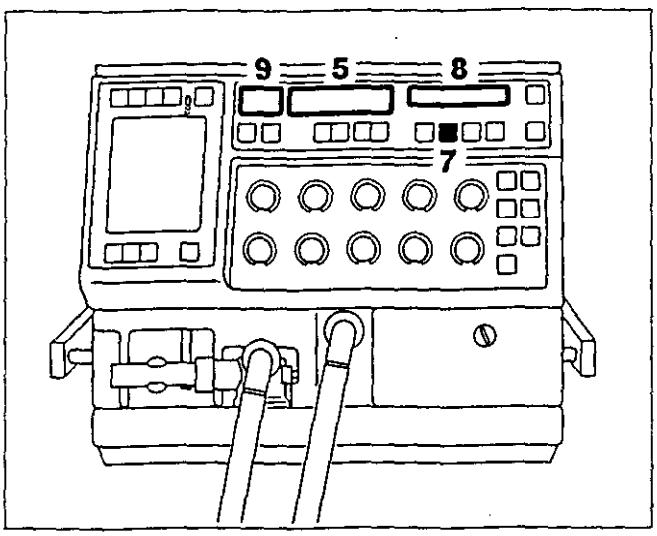



7 Press [T,VT/ R,C] button; green LED is lit.

8 Display:

| temp | VTe | f | R | C |
|---|---|---|---|---|
| XX | 500 | 12 | XX | XX |

(± 100) (± 1)




5 Display in window for minute volume:

| VE | 6 |
|---|---|
| L/min | |

(±10%)

9 Display for $O_2$ conc.:

| $O_2$ | 30 |
|---|---|
| Vol.-% | |

(± 3 Vol.-%)



G13

**Checking functioning of paediatric ventilation**

- Select paediatric ventilation.

1 Rotary knob »$V_T$« to 0.04 L.

2 Rotary knob »$p_{max}$« to 45 mbar.

3 Rotary knob »Insp. flow $\dot{V}_{max}$« to about 25 L/min.

4 Rotary knob »PEEP« to 10 mbar.

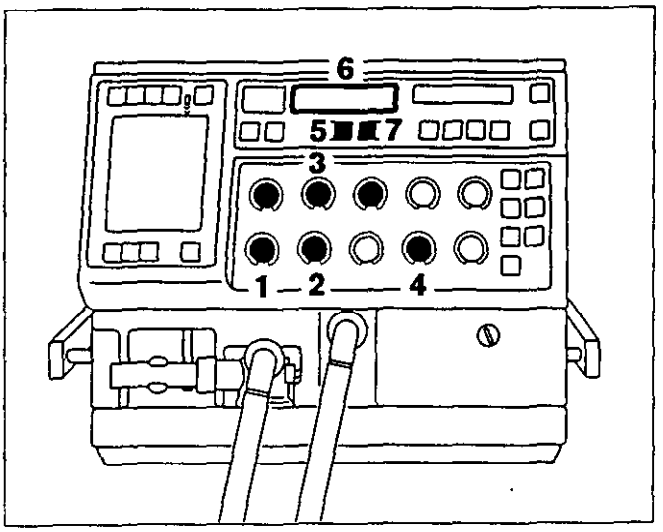
- Other rotary knobs to »green dot«.

5 Keep [↑] button pressed until:

6 upper alarm limit: /▲ – – = OFF.

7 Keep [↓] button pressed until:

6 lower alarm limit: ▼/ – – = OFF.




7 Press [T,Vt,f R,C] button; green LED is lit.

8 Display:

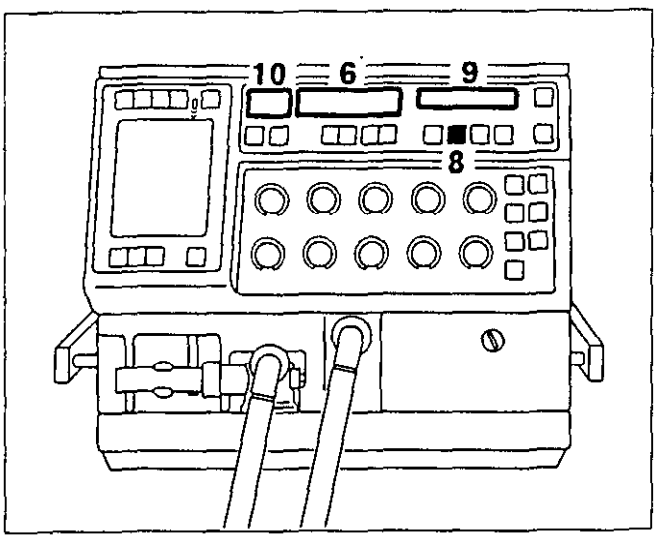
| temp | VTe | f | R | C |
|---|---|---|---|---|
| XX | 40 | 12 | XX | XX |
| | (± 10) | (± 1) | | |

6 Display in window for minute volume:

| $\dot{V}_E$ 0,5 L/min | (±0,1%) |
|---|---|

10 Display for $O_2$ conc.:

| $O_2$ 30 Vol.-% | (± 3 Vol.-%) |
|---|---|






A2

### Checking PEEP

1 Press [⇄] button repeatedly until green LED for $P_{aw}$ is lit.

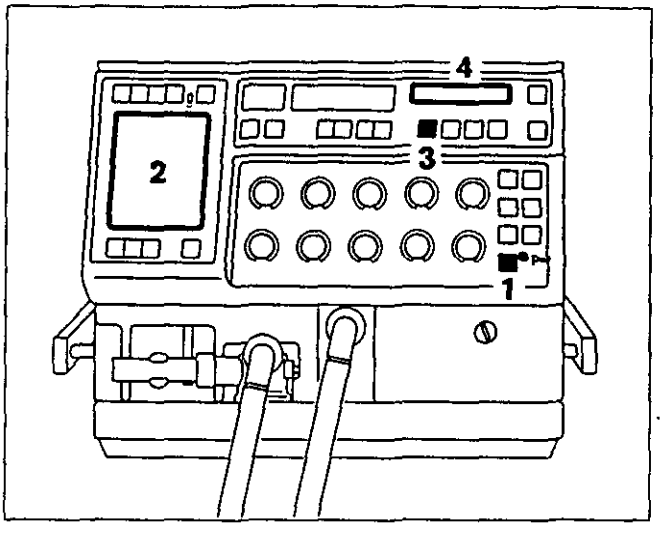
2 $P_{aw}$ (t) is displayed on the screen.

3 Press [$P_{aw}$] button, green LED is lit.

4 Display:

| P: | max | plat | PEEP | mean |
|---|---|---|---|---|
| | XX | XX | 10 | XX |

(± 2)




2 Display on the screen:
In the $P_{aw}$ (t) display the endinspiratory pressure (plat) and the endexpiratory pressure (PEEP) remain constant.

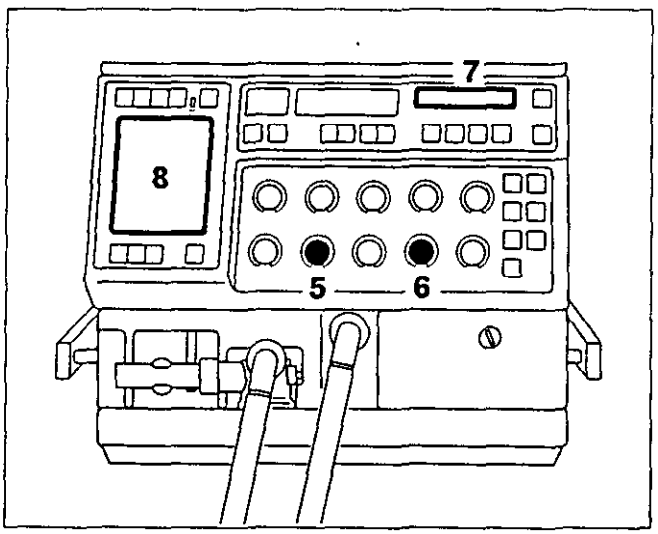
### Checking pressure limitation $p_{max}$

5 Rotary knob »$p_{max}$« to 20 mbar.

6 Rotary knob »PEEP« remains at 10 mbar.

7 Display:

| P: | max | plat | PEEP | mean |
|---|---|---|---|---|
| | 20 | 20 | 10 | XX |
| | (± 2) | (± 2) | (± 2) | |



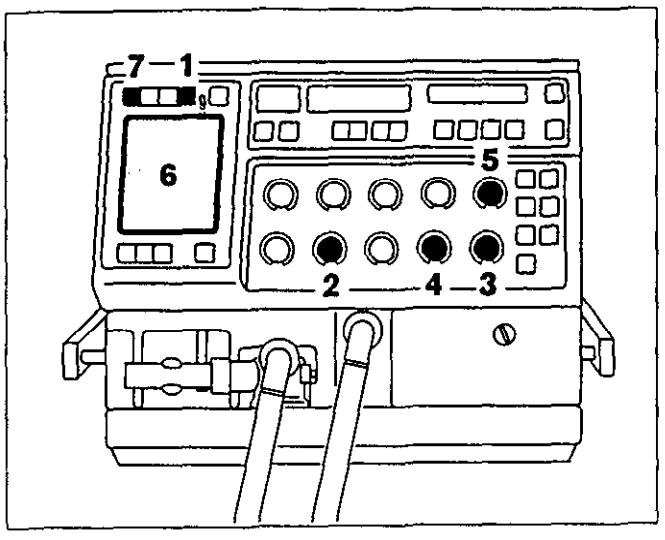

8 Display on screen:

**volume not constant**

and/or

**pressure limited**

The inspiratory pressure is limited to about 20 mbar.




**Checking CPAP/ASB**

1 Keep [ASB Spont] button pressed until green LED remains continuously lit.

2 Rotary knob »$p_{max}$« to 30 mbar.

3 Rotary knob »ASB« to 20 mbar.

4 Rotary knob »PEEP« remains at 5 mbar.

5 Rotary knob »⌐¬« at 0.5 seconds.

6 Display on screen:

**CPAP/ASB**

- Squeeze the test lung gently and release:

6 Endinspiratory pressure:
20 ± 3 mbar

- Machine switches to expiration:

6 Endexpiratory pressure:
5 ± 3 mbar

7 Keep [IPPV] button pressed until green LED remains continuously lit.

6 Display on screen:

**CPPV**

3/4 Other rotary knobs to »green dot«.



A4

**Checking pressure relief**

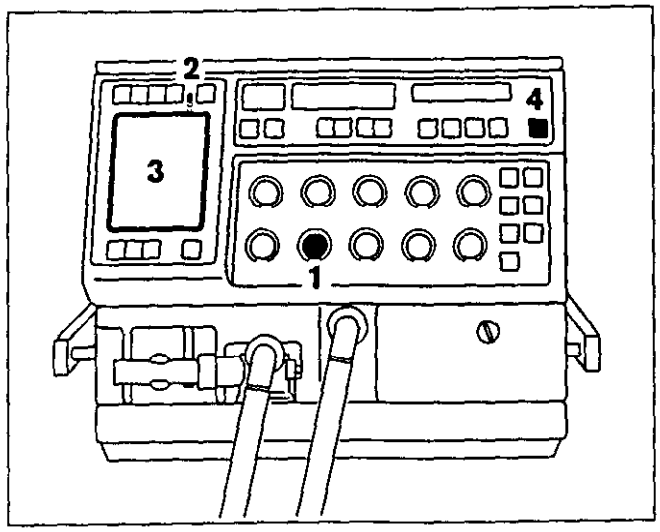
1 Rotary knob »pmax« to 20 mbar

- Squeeze test lung out completely during an inspiration:
- inspiration will be stopped.

2 Red alarm lamp flashes; intermittent sound commences.

3 Display on the screen:

**airway pressure high**
**breathing sys. vented**




Then:

2 red alarm light goes out, intermittent sound ceases.

3 Display on screen:

**airway pressure high**

remains.

4 Press [Reset Check] button:

3 The display on the screen disappears.

**The machine is operational when all tests have been carried out satisfactorily.**



A5

# Maintenance Intervals

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

| | |
|---|---|
| O2 sensor capsule | Replace sensor capsule if display: **O2 meas. inop.**, and if calibration is not possible, page 8.<br>Disposal, page 102. |
| Ambient-air filter | Replace after 1 year, page 103.<br>Dispose of in normal way. |
| Cooling-air filter | Clean or replace after 4 weeks, page 102.<br>Replace every year.<br>Dispose of in normal way. |
| Lip seals of connecting plate on back of patient system | To be replaced by trained service personnel every year. |
| NiCd battery for *mains* power alarm failure | To be replaced by trained service personnel every 2 years.<br>Disposal, page 102. |
| Lithium battery for data storage | To be replaced by trained service personnel every 2 years.<br>Disposal, page 102. |
| Pressure reducer | Complete overhaul every 6 years by trained service personnel.<br>We recommend DrägerService. |
| Equipment check and service | Every six months by trained service personnel. |
| Regular safety checks | Every six months by trained service personnel. |

If the glass on the LCD display breaks, a liquid chemical may escape. This should not be allowed to come into contact with the human body. In emergencies, clean affected skin with soap.

---

* According to DIN 31 051 the following definitions apply:

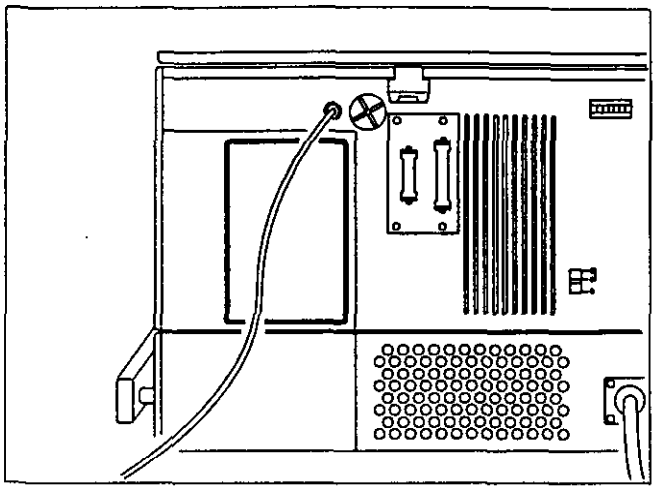
| | |
|---|---|
| Inspection | = determining actual condition |
| Service | = measures to maintain required condition |
| Repair | = measures to re-establish required condition |
| Maintenance | = inspection, service and repair |



A6

## Replacing cooling-air filter

- Remove cooling-air filter from holder on the back of the machine.
- Replace, or clean in warm water with detergent added; dry well.
- Replace dry cooling-air filter in holder taking care not to crease it.



## Correct disposal of batteries, accumulators and electrochemical sensors

Batteries, accumulators and $O_2$ sensors

- do not throw in a fire; risk of explosion.
- do not open using force; risk of corrosion.
- do not re-charge batteries.

Batteries and accumulators must be disposed of as special waste:

- In accordance with local waste disposal regulators.

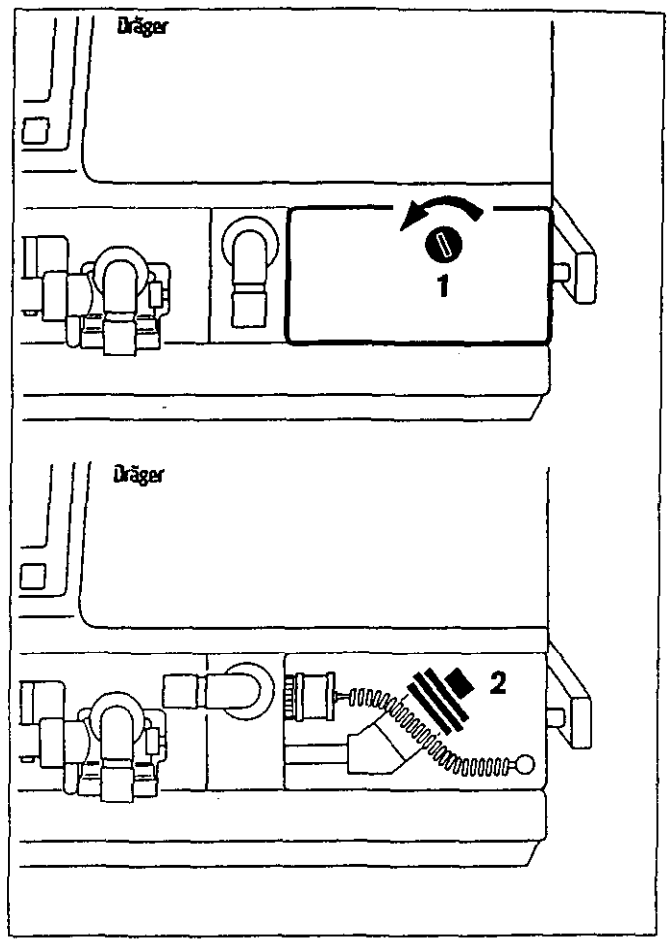
  Information may be obtained from the local environmental and public health authorities or from approved waste disposal companies.



A7

## Removing and replacing ambient-air filter

- during disinfection in the Aseptor.
- replace filter every year.




1 Loosen screw with coin, remove protective cover.

2 Take ambient-air filter out of rubber sleeve.
The filter cannot be disinfected.

After disinfecting Aseptor or after replacement

- Re-insert ambient-air filter in rubber sleeve, with arrow pointing towards rubber sleeve.
- Replace protective cover, tighten screen with coin.



A8

# Fault – Cause – Remedy

The alarm messages on the indicator panel are given in order of priority.
If, for example, two faults are recognised simultaneously, the more serious fault will be displayed.

The following table is an aid for recognising causes of alarms and their speedy remedies.

| Message | Fault | Remedy |
|---|---|---|
| **Ventilation alarms:** | | |
| **MV low** | Leak in breathing system. | Establish leak-proof breathing system. |
| | Loss of volume due to pressure limitation. | Correct ventilation pattern. |
| | Flow sensor not calibrated, or faulty. | Calibrate flow sensor, p. 19, replace if necessary. |
| | Malfunction of machine. | Call DrägerService. |
| **MV high** | Flow sensor not calibrated, or faulty. | Calibrate flow sensor, p.19, replace if necessary. |
| | Malfunction of machine. | Call DrägerService. |
| **airway pressure high** | Patient "fights" the ventilator. | Change ventilation pattern or tranquilise if necessary, or change ventilation modes. |
| **airway pressure low** | Leaking cuff. | Inflate cuff and perform pressure low leak test. |
| | Leak or disconnection. | Check hose system for tight connections, tighten clamping screw on patient system. |
| **FiO2 low** | $O_2$ sensor not calibrated. | Calibrate $O_2$ sensor, page 17. |
| | Faulty $O_2$ mixer. | Call DrägerService. |
| **FiO2 high** | $O_2$ sensor not calibrated. | Calibrate $O_2$ sensor, page 17. |
| | Faulty $O_2$ mixer. | Call DrägerService. |
| **apnoea** | Flow sensor not calibrated, or faulty. | Calibrate flow sensor, page 19, replace if necessary. |
| | Patient's spontaneous breathing ceases. | Apply controlled ventilation. |
| **volume not constant** | Due to pressure or time limitation, the set tidal volume $V_T$ has not been given. | Prolong inspiratory time (reduce $f_{IPPV}$, increase $T_I$:$T_E$) or increase inspiratory flow V or $p_{max}$. |
| **ASB > 4 s** | The ASB cycle was switched off 3 times due to time limitations. | Leak test ventilation system. |
| **high frequency** | Patient breathes with a high spontaneous frequency. | |
| **temperature high** | Breathing gas temperature greater than 40°C. | Switch off humidifier. Call DrägerService. |



AS

| Message | Fault | Remedy |
|---|---|---|
| **Machine alarms:** | | |
| **air supply down** | Air supply pressure too low. | Establish pressure higher than 3 bar. |
| **$O_2$ supply down** | $O_2$ supply pressure too low. | Establish pressure higher than 3 bar. |
| **pressure meas. inop** | Fluid in patient system. | Replace the patient system then clean and dry, page 87. |
| | Malfunction of pressure measurement. | Call DrägerService. |
| **mixer inop** | Faulty $O_2$ mixer. | Use separate manual ventilation device without delay.<br>Call DrägerService |
| **malfunction fan** | Temperature in machine too high. | Check fan, clean cooling-air filter, or call DrägerService. |
| **fan defect** | Failure of fan. | Call DrägerService. |
| **flow sensor?** | Flow sensor not properly connected to socket. | Fit flow sensor correctly, page 7. |
| **flow meas. inop** | Faulty flow sensor. | Calibrate flow sensor, page 19, or replace. |
| | Malfunction of flow measurement. | Call DrägerService. |
| **suction inactive** | Oxygen enrichment for bronchial suction not possible. | Rectify machine alarm. |
| **exp. valve inop** | Patient system not screwed on tight. | Tighten clamping screw. |
| | Flow sensor not calibrated, or faulty. | Repeat flow sensor calibration, page 19, replace if necessary. |
| | Patient system faulty. | Replace patient system. |
| **fail to cycle** | Machine does not supply any gas. | Check $p_{max}$ and PEEP setting. |
| | Machine faulty. | Call DrägerService. |
| **$O_2$ meas. inop** | $O_2$ sensor provides invalid measured values. | Calibrate $O_2$ sensor, page 17 or replace, page 8, or call DrägerService. |
| **$O_2$ cal. inactive** | $O_2$ supply interrupted. | Push probe on $O_2$ connecting hose into the terminal unit to the stop, tighten $O_2$ connecting hose on machine connection. |
| | Oxygen enrichment for bronchial suction switched on. | Switch off oxygen enrichment for bronchial suction. |
| | Other faults as described under "pressure meas. inop" and and "flow meas. inop". | Rectify as described under "pressure meas. inop" and and "flow meas. inop". |

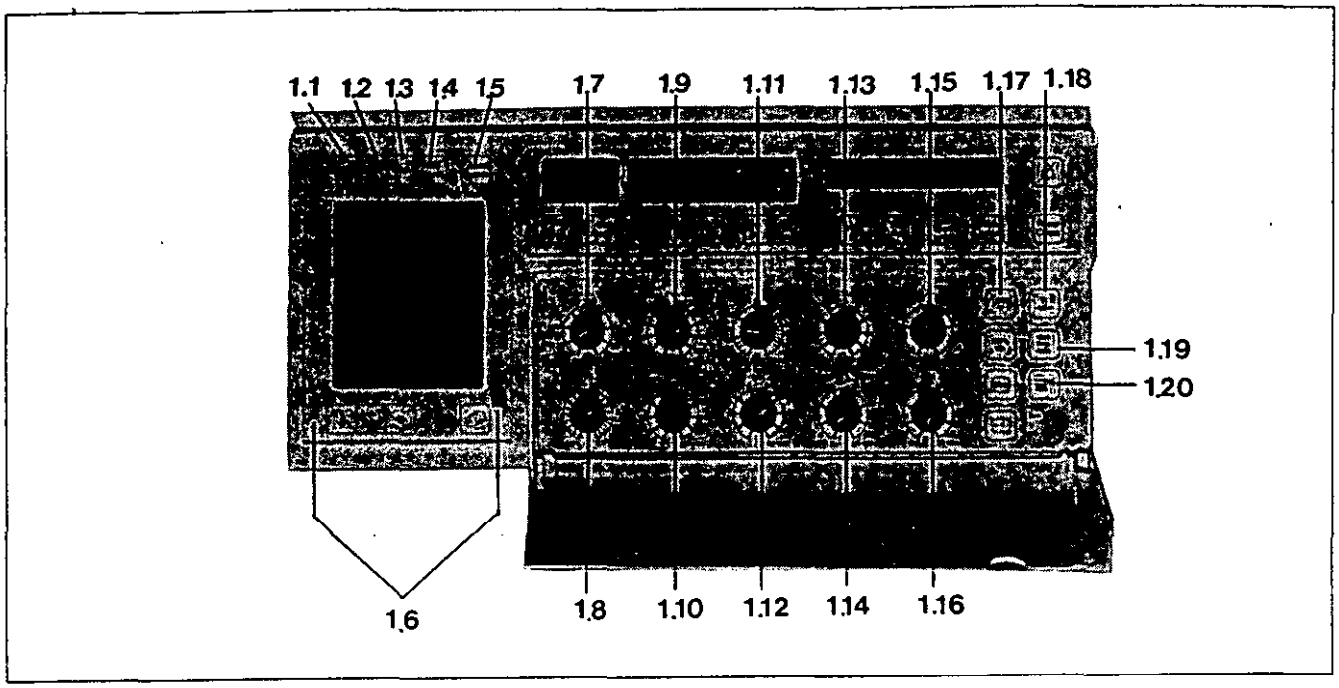


A10

| Message | Fault | Remedy |
|---|---|---|
| **Machine alarms:** | | |
| **$O_2$ cal. interrupted** | Y-piece not disconnected within 1 minute for $O_2$ calibration.<br>Y-piece re-connected during calibration.<br>Flow resistance of hose system too high. | Repeat $O_2$ calibration, page 17.<br><br>Rectify resistances (e.g. kinked hose, different Y-piece). |
| **temperature sensor?** | Temperature sensor plug has been disconnected during operation.<br>Cable broken. | Re-connect plug.<br>Replace temperature sensor. |
| **temp meas. inop** | Sensor faulty. | Replace temperature sensor, page 10. |
| **sync. inop** | During bilateral ventilation, connection between two Evita 2s has been broken. | Check connecting cable<br>or<br>Call DrägerService. |
| **device failure** | | Call DrägerService. |
| **breathing sys. vented** | Safety valve has opened, e.g. caused by coughing fit. | Increase "$p_{max}$" setting. |
| **RS 232 inop** | | Call DrägerService. |



A11




**Control panel**

1.1 Button for IPPV ventilation mode;
green LED »assist« next to button is lit when inspiration is triggered.

1.2 Button for BIPAP ventilation mode

1.3 Button for SIMV ventilation mode

1.4 Button for *spontaneous breathing in combination* with ASB

1.5 Button for executing menu ventilation modes such as MMV

When activated, the green LED in each button is lit, ventilation mode is indicated on the screen.

1.6 Buttons for additional menu functions such as MMV

1.7 Rotary knob for inspiratory $O_2$ concentration
$O_2$ vol.%

1.8 Rotary knob for tidal volume, $V_T$

1.9 Rotary knob for insp. flow, $\dot{V}_{max}$

1.10 Rotary knob for limitation of inspiratory pressure, $p_{max}$, and also $p_{insp}$

1.11 Rotary knob for IPPV frequency, f

1.12 Rotary knob for IMV frequency, $f_{IMV}$

1.13 Rotary knob for I:E ratio, $T_I$:$T_E$

1.14 Rotary knob for PEEP/CPAP

1.15 Rotary knob for pressure increase during ASB

1.16 Rotary knob for pressure assistance ASB

Rotary knobs 1.7 to 1.16 each have a green LED as an operation indicator. Depending on the ventilation mode selected, the LEDs are lit when rotary knobs have to be set.

1.17 Button for calibrating $O_2$ measurement;
yellow LED is lit during calibration.

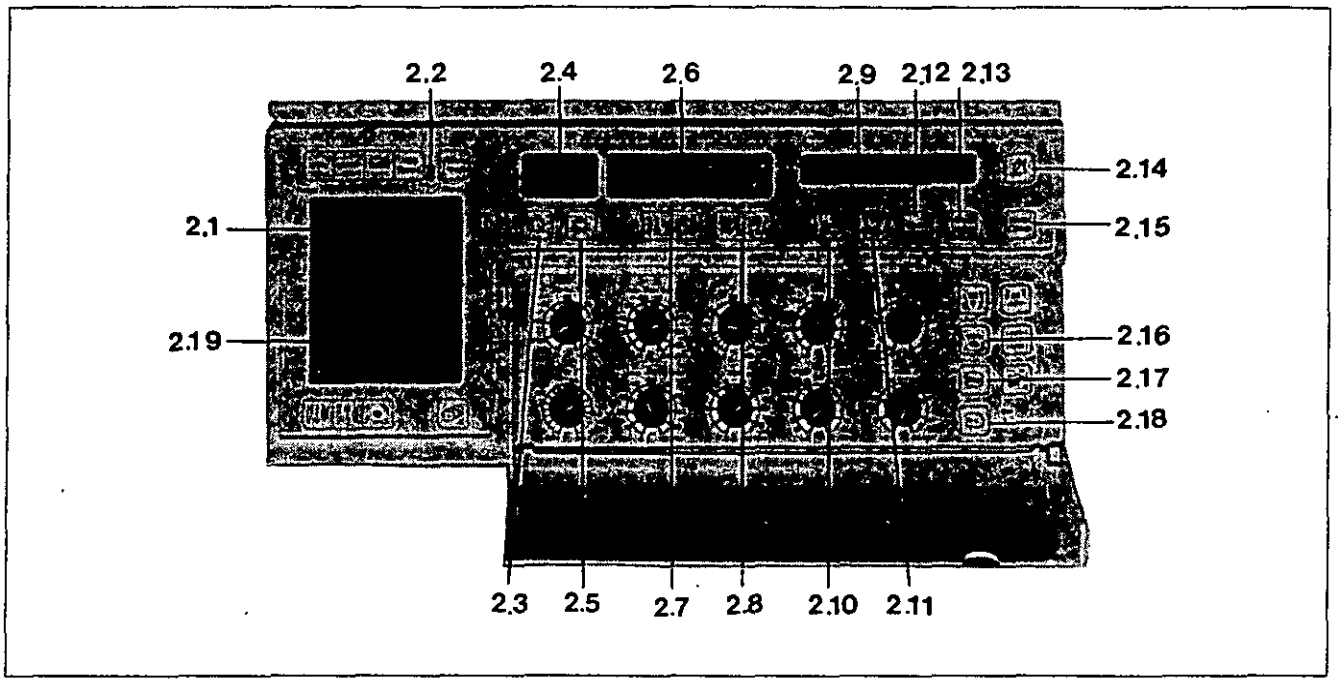
1.18 Button for cleaning and zero adjustment of flow sensor;
yellow LED is lit during zero adjustment.

1.19 Button for manual start and inspiratory hold;
yellow LED is lit when inspiration is started manually or extended.

1.20 Button for switching medicament nebulizer on for 10 minutes;
green LED is lit whilst the medicament nebulizer is in operation.



A 12




**Display panel**

2.1 Status/alarm displays at top of screen
2.2 Red alarm light which flashes during an alarm
2.3 Button to switch on lighting of status and alarm displays on screen 2.1 and measured value displays 2.9
2.4 LED display of $O_2$ concentration $O_2$ vol.%
2.5 Button to switch off $O_2$ monitoring
Yellow LED flashes when $O_2$ monitoring switched off.
2.6 LED display of expiratory minute volume $\dot{V}_E$ L/min with upper and lower limit value.
2.7 Pair of buttons to adjust upper limit value $\dot{V}_E$
( ↓ = decrease, ↑ = increase)
2.8 Pair of buttons to adjust lower limit value $\dot{V}_E$
( ↓ = decrease, ↑ = increase)
2.9 Measured value displays

2.10 Button to select data on airway pressure:
- peak pressure max
- plateau pressure plat
- pos. endexp. press. PEEP
- mean pressure mean

The data is displayed on measured value display 2.9

2.11 Button to select data on inspiratory gas:
- temperature temp
- tidal volume VTe
- frequency f
- resistance R
- compliance C

2.12 Button to select data on spontaneous expiration:
- minute volume MVspo
- spontaneous frequency f-spo
- spontaneous breathing with pos. airway pressure CPAP

The green LED lights in buttons 2.10, 2.11, 2.12 when activated. By pressing buttons 2.10, 2.11, 2.12 twice, the dimensions of measurement are indicated.

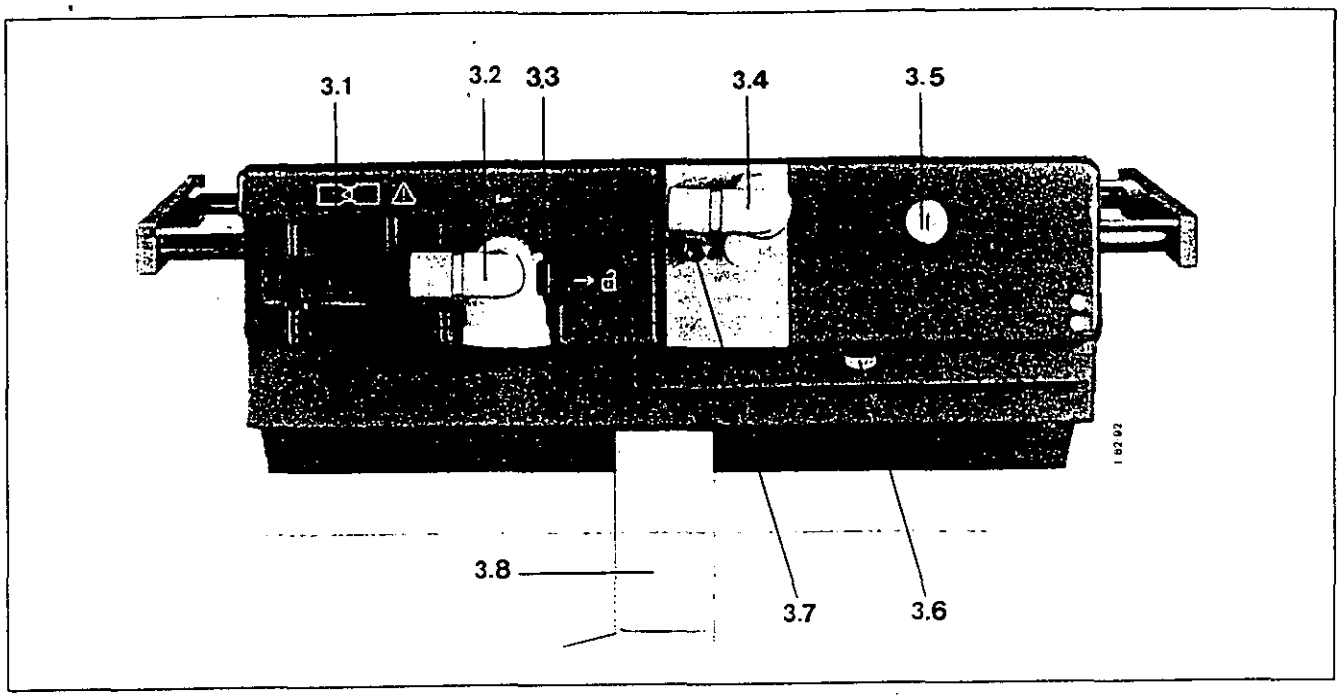
2.13 »Menu Select« button to adjust contrast setting of display and screen, for reading and setting of clock.
2.14 Button to suppress alarm sound for about 2 minutes,
yellow LED lights when in use.
2.15 Button to reset alarm when fault is rectified.
Used to reactivate alarm sound at the same time.
2.16 Button for oxygen enrichment during bronchial suction.
2.17 Button to freeze screen display 2.18;
yellow LED lights when in use.
2.18 Button to select
- airway pressure Paw (t)

or
- flow $\dot{V}$ (t) with green LED graphic display on screen 2.19

2.19 Screen



A13




**Front-connections**

3.1 Connection for flow sensor

3.2 Patient system with expiratory port (swivels)

3.3 Stopper for patient system

3.4 Inspiratory port (swivels)

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

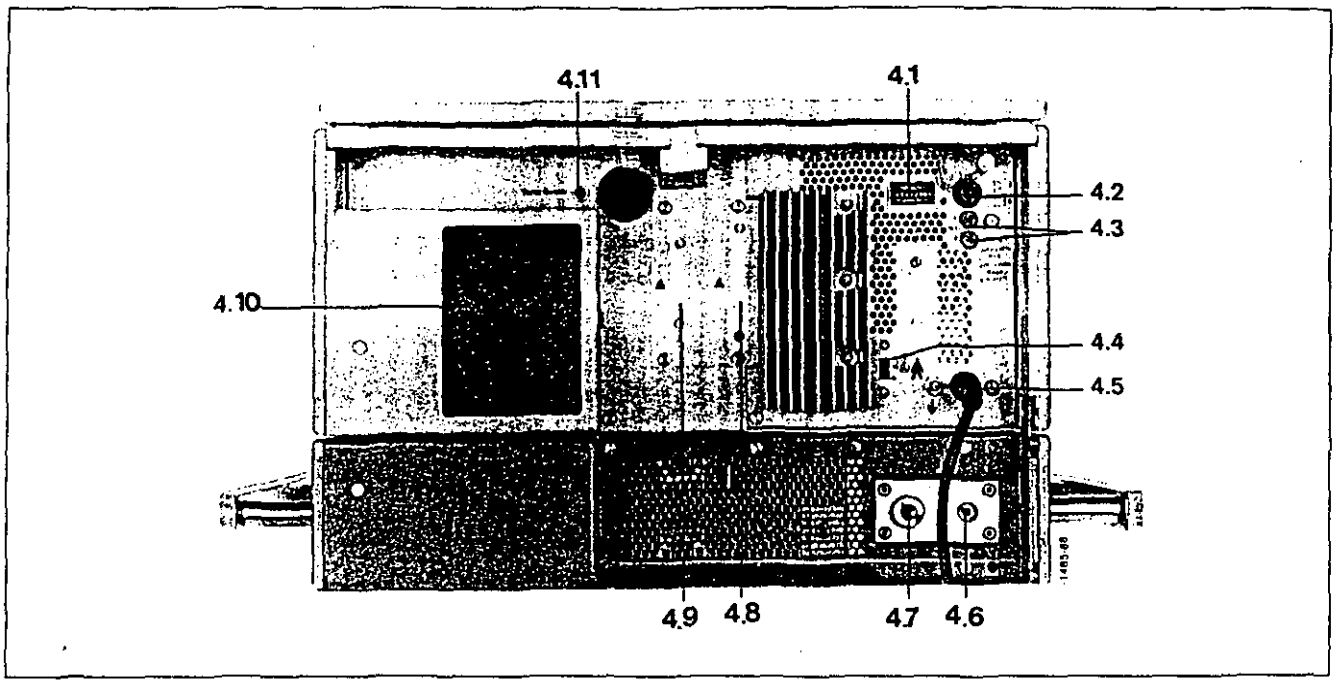
3.6 Drawer for Instructions for Use and checklist

3.7 Compressed-air coupling for operating medicament nebulizer.

3.8 Holder for Aquapor (humidifier) (swivels)



A14




**Back (of machine)**

4.1 Time meter

4.2 Mains switch

4.3 Mains fuse (2 x)

4.4 Switch for connection or disconnection of earth

4.5 Potential equalisation connection

4.6 Connection for compressed oxygen

4.7 Connection for compressed air

4.8 Drägerbus connection (optional)

4.9 Connection for RS 232 interface (optional)

4.10 Cooling-air filter for fan

4.11 Socket for temperature sensor

≙ DIN IEC 601, section 19, table 4:
max. permissible earth leakage current 0.5 mA



B1

### Environmental conditions

| | |
|---|---|
| For operation: | |
| temperature | 15 to 40°C |
| atmospheric pressure | 530 to 1100 hPa |
| rel. humidity | 0 to 90% |
| For storage: | |
| temperature | – 20 to 60°C |
| atmospheric pressure | 530 to 1100 hPa |
| rel. humidity | 0 to 90% |

### Set values

| | |
|---|---|
| Ventilation frequency for IPPV | 5 to 100/min |
| Ventilation frequency for IMV | 0 to 60/min |
| Ventilation frequency for BIPAP | 2 to 100/min |
| I:E ratio $T_I$:$T_E$ | 6 : 1 to 1 : 6 |
| Tidal volume $V_T$ | |
| paediatric | 0.04 to 0.3 L |
| accuracy | ± 10 % of set value or ± 10 mL, whichever the greater value. |
| adult | 0.1 to 2.0 L |
| accuracy | ± 10% of set value or ± 25 mL, whichever the greater value. |
| Inspiratory flow $\dot{V}_{max}$ | |
| paed. | 6 to 30 L/min |
| adult | 6 to 120 L/min |
| Inspiratory pressure-limitation $p_{max}$ | 0 to 100 mbar |
| $O_2$ concentration | 21 to 100 vol.% |
| accuracy | ± 5% of set value or ± 2 vol.% whichever the greater value |
| Positive endexspiratory pressure PEEP or continuous positive airway pressure CPAP or interm. PEEP | 0 to 35 mbar |
| Trigger sensitivity Δ ptr (differential pressure below PEEP) for IPPV and for SIMV | 0.7 mbar, fixed trigger |



B2

| | |
|---|---|
| Pressure support ASB | 3 to 80 mbar |
| rise time for increase in pressure support | 0 to 2 s |
| Trigger sensitivity | 1 to 15 L/min |
| Sensitivity of patient synchronisation in BIPAP mode | 1 to 15 L/min |
| BIPAP-APRV | |
| pressure levels $P_{low}$, $P_{high}$ | 0 to 35 mbar, 0 to 80 mbar |
| level times $T_{low}$, $T_{high}$ | 200 ms to 60 s |
| Apnoea ventilation | |
| apnoea time | 15 to 60 s |
| Independent lung ventilation (optional) | |
| Master | with trigger/without trigger |
| Slave | sync./nonsync./inverse I:E |

**Performance Data**

| | |
|---|---|
| Control principle | time-cycled, volume-constant pressure controlled |
| Intermittent PEEP frequency | 2 cycles every 3 minutes |
| Medicament nebulization | for 10 minutes during inspiratory flow phase |
| 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 | $T_{0...90} \leq 5$ ms |
| Supply system for spontaneous breathing and ASB | Adaptable CPAP system with high initial flow |
| max. flow rate | 2 L/s in 8 ms |
| Machine compliance (with Aquapor and patient tubing system) | ≤ 2mL/mbar |

Additional functions:

| | |
|---|---|
| Inspiratory relief valve | Opens if compressed 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 display***

| | | |
|---|---|---|
| $O_2$ concentration | | 5 to 99 vol.% |
| accuracy | | ± 3 vol.% |
| Expiratory minute volume $\dot{V}_E$ | | 0 to 99 L/min |
| accuracy | | ± 8% of measured value |
| to...90 | | about 35 |
| Tidal volume $V_{Te}$ | | 0 to 3999 mL |
| accuracy | | ± 8% of measured value |
| Frequency f | | 0 to 150/min |
| accuracy | | ± 1/min |
| to...90 | | about 35 s |
| Insp. breathing gas temperature | | 18 to 51°C |
| accuracy | | ± 1°C |
| Airway pressure-data | | 0 to 99 mbar |
| During ventilation | | |
| peak pressure | max | |
| plateau pressure | plat | |
| pos.endexp.pressure | PEEP | |
| mean pressure | mean | |
| During spontaneous breathing | | |
| max. airway pressure | max | |
| continuous positive airway pressure | CPAP | |
| min. airway pressure | min | |
| During BIPAP | | |
| max. airway pressure | max | |
| continuous positive airway pressure | CPAP | |
| min. airway pressure | min | |
| mean pressure | mean | |
| accuracy | | ± 2 mbar |



B4

| | | |
|---|---|---|
| Spontaneous breathing-data | | |
| spont. breathed minute volume | MVspo | 0 to 99 L/min |
| accuracy | | ± 8% of measured value |
| spontaneous breathing frequency | f-spo | 0 to 80/min |
| accuracy | | ± 1/min |
| *Computed value displays* | | |
| compliance | C | 1 to 250 mL/mbar |
| accuracy | | ± 10% of measured value |
| resistance | R | 1 to 200 mbar/L/s |
| accuracy | | ± 10% of measured value |
| Graphic displays | | |
| airway pressure | Paw (t) | – 10 to 100 mbar |
| resolution | | 1 mbar |

**Monitoring**

| | |
|---|---|
| Expiratory minute volume $\dot{V}_E$ | |
| alarm upper alarm limit | when upper alarm limit has been exceeded |
| setting range | OFF, 41 to 0.1 L/min |
| alarm lower alarm limit | when lower alarm limit has been crossed |
| Setting range | OFF, 0.1 to 41 L/min |

The two alarm limits cannot overlap.

| | |
|---|---|
| Airway pressure $P_{aw}$ | |
| *alarm upper alarm limit* | *when the $p_{max}$ value* (set on the rotary knob for $p_{max}/p_{insp}$) is exceeded by more than 10 mbar |
| alarm lower alarm limit (effective for all mandatory ventilation strokes except MMV) | given when the PEEP value (set on the rotary knob for PEEP) has not been exceeded by more than 4.5 mbar during 96 msec and 2 successive breathing strokes |



B5

| | |
|---|---|
| range | both alarm limits are automatically allocated to the set values $p_{max}$ and PEEP |
| Insp. $O_2$ concentration $FiO_2$ | |
| alarm upper alarm limit | when the upper alarm limit has been exceeded for more than 20 seconds |
| alarm lower alarm limit | when the lower alarm limit has been crossed for more than 30 seconds |
| range | both alarm limits are automatically allocated to the set value:<br>below 60 vol.% - ± 4 vol.%<br>60 vol.% and above - ± 6 vol.% |
| Insp. breathing gas temperature | |
| alarm upper alarm limit | when 40°C has been reached. Evita 2 can also be operated without temperature sensor, if it was not connected when switching on. |
| Tachypnoea monitoring | |
| alarm | when, during spontaneous breathing, the breathing frequency has been exceeded for a certain time (alarm time) |
| setting ranges | |
| frequency | 5 to 120/min |
| alarm time | 15 s to 10 min |
| Volume warning | |
| alarm | when the set tidal volume $V_T$ has not been supplied. |

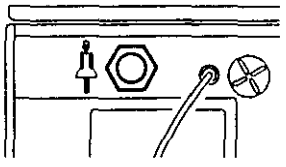
The alarms are visual and audible; the audible alarm can be switched off for 2 minutes.

**Operating data**

| | |
|---|---|
| Mains power connection | Range: 220 V to 240 V<br>or : 100 V to 127 V<br>50/60 Hz |
| Current | |
| at 230 V | max. 1.2 A |
| at 100 V | max. 2.2 A |
| Power consumption | about 125 W |
| Machine fuses | |
| range 100 V to 127 V | M 4 A DIN 41571 (2x) |
| range 220 V to 240 V | M 2 A DIN 41571 (2x) |



B6

| | |
|---|---|
| Gas supply | |
| $O_2$ gauge pressure | 3 bar – 10% to 6 bar |
| $O_2$ connection thread | M 12 x 1 female |
| air gauge pressure | 3 bar – 10% to 6 bar |
| air connection thread | M 20 x 1.5 male |
| | Gas must be dry and free from oil and dust. |
| Gas consumption of control system | Compressed air or $O_2$ about 2.0 L/min |
| Supply for pneumatic medicament nebulizer | Compressed air (or $O_2$ if compressed air is not available) max. 2 bar, max. 10 L/min |
| Sound pressure level (for free field measurement over a reflecting surface) | max 47 dB (A) |
| Dimensions (W x H x D) | |
| basic machine | 530 x 270 x 400 mm |
| *machine with trolley* | *580 x 1315 x 660 mm* |
| Weight | |
| *basic machine* | *about 23 kg* |
| basic machine with trolley incl. cabinet 8H | about 65 kg |
| Machine outputs | |
| analogue output Drägerbus (optional) | with additional p.c.b. for output of analogue data and digital status messages |
| digital output (optional) | with additional p.c.b. for output and receipt via an RS 232 C interface |
| Automatic gas switch-over | during gas failure (inlet pressure < 1.5 bar) the machine switches to the other gas |
| Central alarm (optional) *Built-in plug on the back of Evita 2* for connection to house telephone system to trigger a central alarm |  |
| Operating voltage | max. 24 V= |
| *Current* | *max. 250 mA* |
| Power consumption | max. 3 W |
| Potential-free make-and-break contact |   |

**Manufacturer's guarantee of radio interference suppression**

We guarantee that Evita 2 is radio-screened in accordance with the guidelines laid down in the German Instruction 1046.

## Sigh

as intermittent PEEP, operates in IPPV, IPPV/assist and ILV.

The purpose of 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 prolonged period is required to open them.

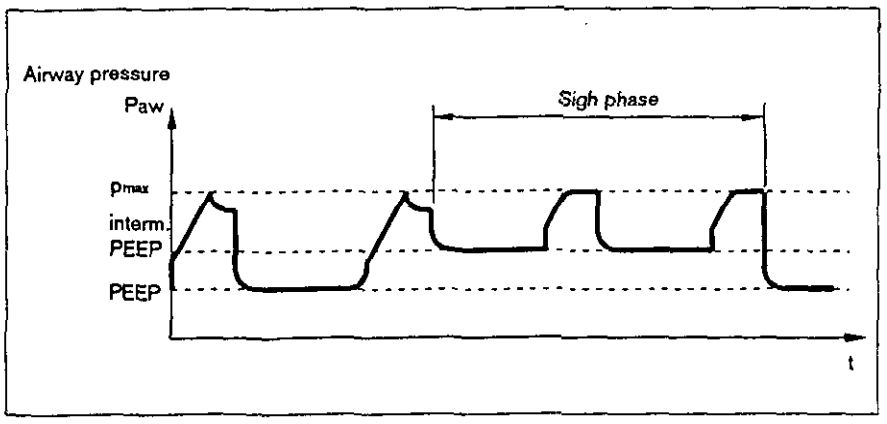
In many cases the sigh function is achieved by increasing the ventilation stroke; however, due to the short time available, the filling of the "slow" alveoli is only marginally improved.

In the Evita 2 the sigh operates during expiration with an intermittent PEEP.

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

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

During the sigh phase, the "volume not constant" alarm is not in operation.






88

## SIMV
## Synchronised Intermittend Mandatory Ventilation

Combination of machine ventilation and spontaneous breathing.

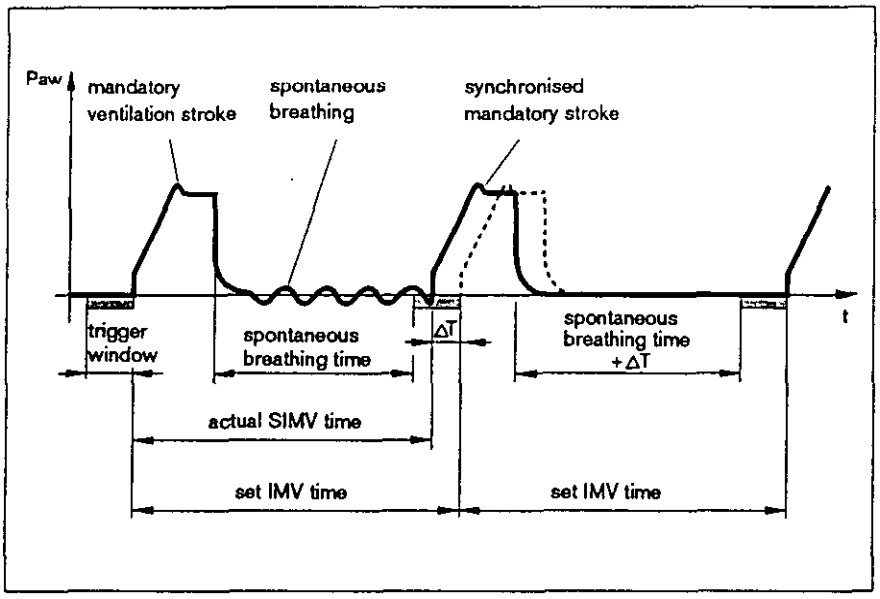
SIMV enables the patient to breathe spontaneously in regular prescribed cycles, with the mechanical mandatory ventilation strokes providing a minimum ventilation during the remaining cycles.
The minimum ventilation is controlled by the two set values tidal volume $V_T$ and IMV-frequency $f_{IMV}$, resulting from $V_T$ x $f_{IMV}$.

The ventilation pattern results from set values $V_T$, insp. flow, $\dot{V}_{max}$, IPPV-frequency $f_{IPPV}$ and Ti:TE. To prevent the mandatory ventilation stroke being applied during the expiratory phase, the trigger device of the machine ensures that the ventilation stroke can be controlled by the patient within a "trigger window" and is thereby synchronised with the inspiratory spontaneous breathing phase.

The trigger window is 5 seconds long. If the expiration time is less than 5 seconds, the trigger window is extended over the entire spontaneous breathing time.

As the synchronisation of the mandatory ventilation stroke reduces the effective SIMV time, which would result in an undesirable increase in effective IMV-frequency, Evita 2 prolongs the subsequent spontaneous breathing time by the missing time difference $\Delta T$ – thus preventing an increase in SIMV frequency. The parameter $f_{IMV}$ remains constant. This parameter, together with $V_T$, sets the minimum ventilation.

If the inspiratory volume of the patient is considerable 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 inspiratory time. In this way the other factor responsible for minimum ventilation, tidal volume $V_T$, remains constant.






89

During the spontaneous breathing phases the patient can be assisted with ASB.

As part of the continuing weaning process, the IMV frequency on the ventilator is further reduced until finally the required minute volume is supplied entirely by spontaneous breathing.



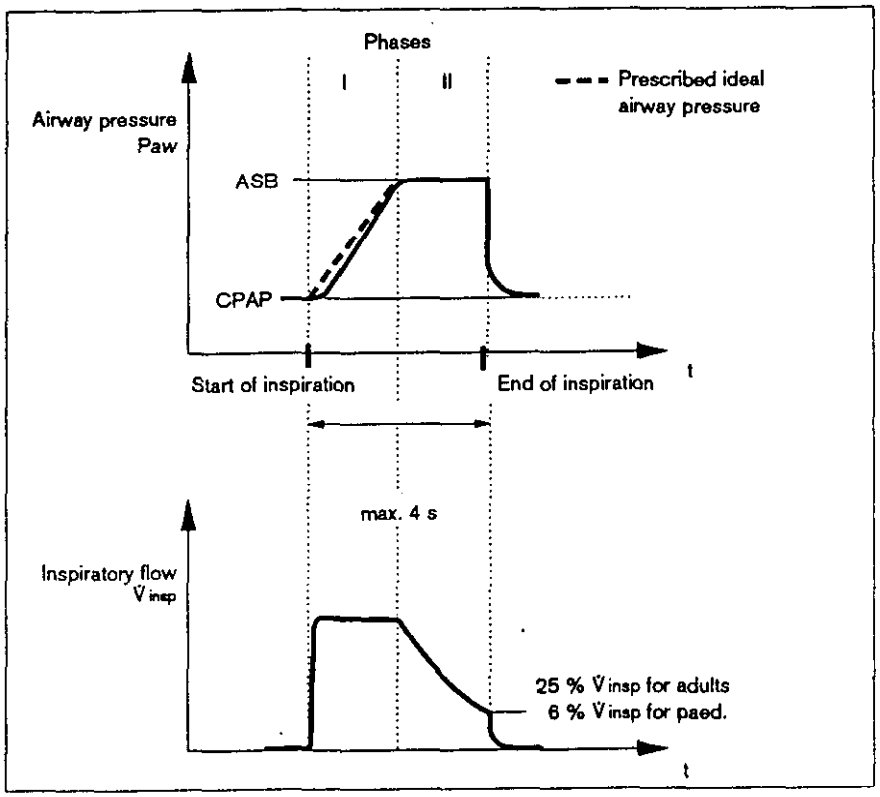
B10

## ASB
## Assisted Spontaneous Breathing

Pressure support of 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 at the slightest inspiratory effort.

Pressure support by ASB is started:

- when the spontaneous inspiratory flow reaches the set value of the flow trigger, or at the latest
- if 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 – adjustable to the breathing requirement of the patient.



B11

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

With a slow increase in pressure 
Evita 2 starts gently with regular inspiratory flow. The patient has to take over more breathing and the breathing muscles are being stimulated.

With the adjusted pressure increase and ASB pressure, the patient determines the required inspiratory flow by his own breathing activity, which can rise in 8 ms to 2 L/s.

ASB is terminated:

- when inspiratory flow returns to zero during phase 1; i.e. when patient exhales or fights the ventilator
  or
- when the inspiratory flow in phase II falls below a certain ratio of the maximum value previously supplied:
  for adult ventilation 25 % $\dot{V}_{insp}$
  for paediatric ventilation 6 % $\dot{V}_{insp}$
  or
- after 4 seconds at the latest if the two other criteria have not come into operation.

  If the 4 seconds criteria comes into operation three times in succession, Evita 2 sounds an alarm, and warns of a possible leak in the ventilation system.



BN

## BIPAP
### Biphasic Positive Airway Pressure

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

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

The frequency of the change-over is kept constant, even though synchronisation occurs via a trigger time window with a fixed time constant.

As new clinical research has shown ** this easy 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 as this results principally from the pressure difference between the set values for PEEP and $p_{insp}$.

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 consequently minute volume, are not constant the alarm limits for minute volume must be adjusted with care.

The display of the expiratorily-measured tidal volume $V_T$ must be used to set the required differential between the two pressure levels. Any increase in differential will cause an increased BIPAP ventilation stroke.

* Literature (7), page 132

** Literature (8), page 132

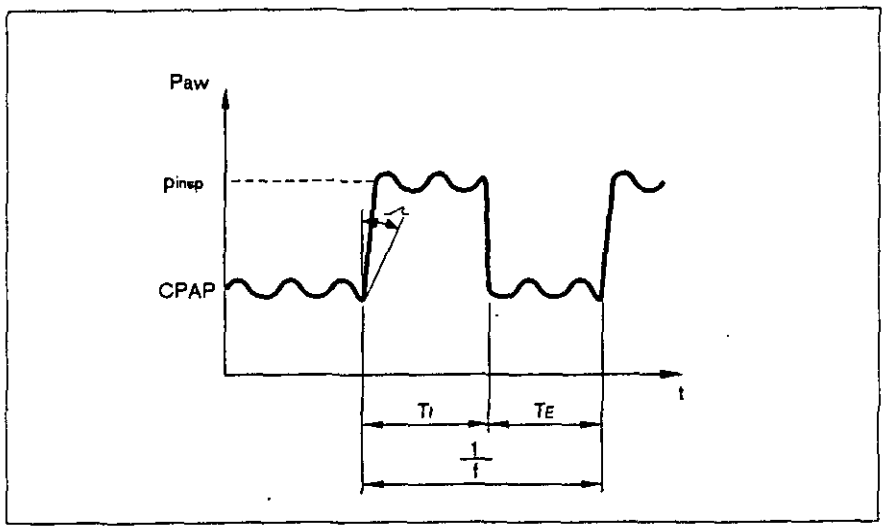


B13

### Using BIPAP

As for IPPV, the time pattern is set using the basic setting parameters, frequency f and I:E ratio. The resulting inspiration and expiration times are calculated by Evita 2 and displayed in the bottom screen below the curve setting. As for all ventilation modes, the lower pressure level is set with the parameters PEEP/CPAP, the upper pressure level with the parameter $p_{insp}$ Only the $p_{max}/p_{insp}$ setting needs to be changed to switch over from the IPPV mode to the BIPAP mode as the time remains the same.

The steepness of increase from the lower pressure level to the upper pressure level is controlled by using the rotary knob ⍼ . The operative time for the increase in pressure cannot become greater than the set inspiratory time, $T_I$, thus guaranteeing that the upper pressure level is reached safely during inspiration. The transition from controlled ventilation, via the weaning phase, to complete spontaneous breathing is achieved by a gradual reduction of inspiratory pressure, $p_{insp}$, and/or frequency, f.






B14

### Using BIPAP-SIMV

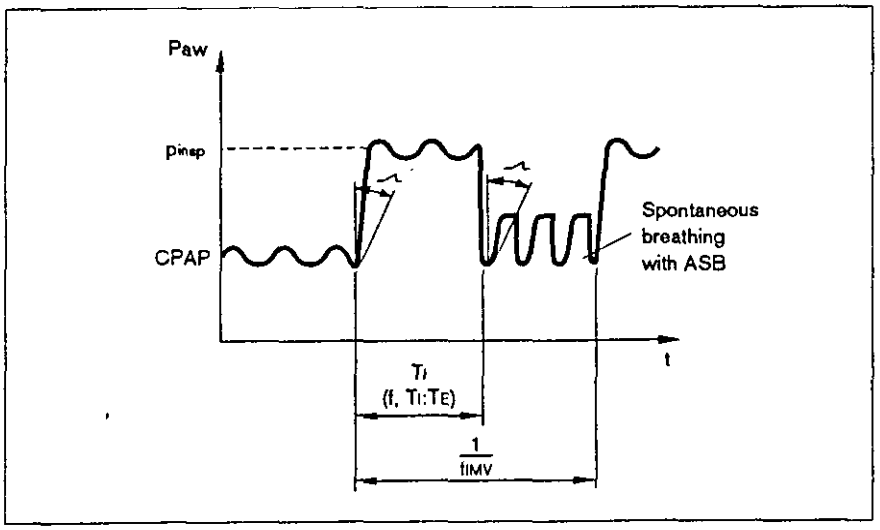
BIPAP offers the option of weaning through the frequently used SIMV concept and the benefits for the patient's spontaneous breathing of BIPAP which have been discussed above.

In this situation ASB gives additional pressure support to spontaneous breathing at the lower pressure levels. The frequency at which the pressure changes is determined by IMV-frequency, $f_{IMV}$, so that the inspiratory time remains constant and only the length of the lower pressure level (CPAP) is changed. Inspiratory time results from the frequency, f, and the $T_I$:$T_E$ ratio setting adapted to the patient's needs.

The resulting inspiratory time is displayed on the screen below the curve display.

The other settings - CPAP, $p_{insp}$, and the steepness of pressure increase from the lower to the upper pressure level are carried out in the same way as for BIPAP.

If ASB is used to support spontaneous breathing at the lower pressure level, the same steepness of pressure increase comes into operation.






C1

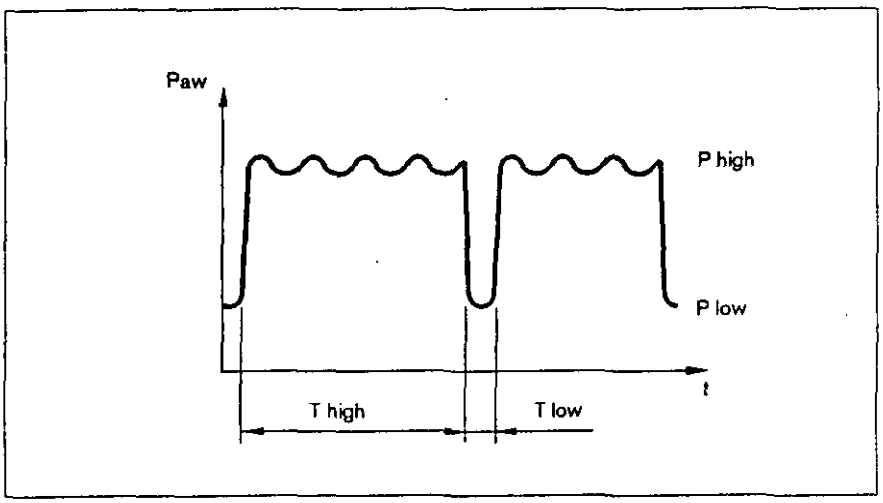
### Using BIPAP-APRV

APRV Airway Pressure Release Ventilation

Spontaneous breathing at continuous positive airway pressure with brief pressure release. This mode is available for patients with a faulty gas exchange. The patient breathes spontaneously at the high pressure level, P high, for a set time, T high. For very short expiratory times, T low, Evita 2 switches to a low pressure level P low. The normal lung areas are emptied but the "slow" lung areas only change volume to a lesser extent.

In this way the ventilation/perfusion ratio can be improved for patients with a faulty gas exchange.

The parameters, P high, P low, T high and T low, used for BIPAP- APRV are set using the menu; the steepness of pressure increase has a fixed duration of 64 msec.




* Literature (7), (8), (9), (10), page 132



C2

## MMV
### Mandatory Minute volume Ventilation

In contrast to SIMV, the MMV ventilation mode gives mandatory ventilation 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 IMV-frequency $f_{IMV}$ and results from the product $V_T \times f_{IMV}$.

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 used. If spontaneous breathing is insufficient, intermittent mandatory strokes of adjusted tidal volume $V_T$ are given. If there is no spontaneous breathing at all, the mandatory strokes are at the set IMV frequency.

Evita 2 continuously balances the difference between spontaneous breathing and pre-selected minimum ventilation. As soon as the balance becomes negative and spontaneous breathing is insufficient, Evita 2 gives a mandatory ventilation stroke of the adjusted tidal volume, and the balance goes back into credit.

It is our experience that patients breathe irregularly. Cycles of weak breathing are followed by strong breathing. In order to allow for such individual fluctuations, the balancing process takes into account the extent by which the minimum ventilation may have been exceeded.
Evita 2 acts to restore the balance within not more than 7.5 seconds after apnoea.

In so doing, the Evita 2 adapts automatically to the preceding spontaneous breathing until the mandatory ventilation stroke is applied:

If the spontaneous breathing comes close to the adjusted minimum ventilation, the machine reacts quickly within the IMV period. If the patient's preceding spontaneous breathing was significantly higher than the adjusted minimum ventilation, Evita 2 will tolerate a longer breathing pause. In the extreme event of sudden apnoea following a cycle of strong spontaneous breathing, reaction time is about 7.5 seconds plus the trigger time, with a minimum of 1 IMV time.

Reaction times which are longer than 15 seconds can however only occur if minimum ventilation with very low IMV frequency was set at corresponding low values. In that case, Evita 2 will sound an apnoea-alarm which ceases as soon as the mandatory ventilation strokes are applied. Where the IMV frequency was adjusted at values lower than 4/min – corresponding to an IMV time greater than 15 seconds – with no spontaneous breathing inbetween the strokes - the apnoea alarm will sound regularly. This occurs to prevent irregular spontaneous breathing resulting in the early triggering of mandatory ventilation strokes with a simultaneous, persistent low-ventilation alarm sound.



C3

## Measurement of occlusion pressure

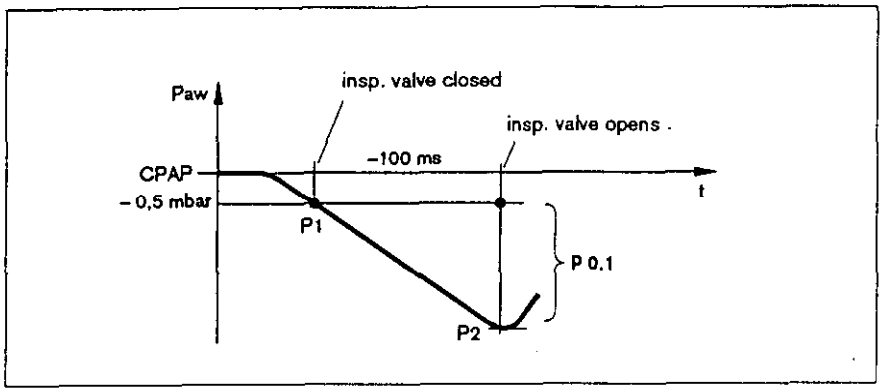
Can only be carried out in the ASB/spont. ventilation mode.

Occlusion pressure is a measurement of breathing drive during spontaneous breathing.

Evita 2 keeps the inspiratory valve closed after one expiration and measures the airway pressure produced by the inspiratory effort during 100 ms.

The 100 ms time interval starts when a negative pressure of – 0.5 mbar is measured as a result of the inspiratory effort.

A second pressure value is measured after 100 ms. Simultaneously, the inspiratory valve is opened, the patient may breathe normally again.




The difference between the pressure values P2 – P1 is the occlusion pressure P 0.1



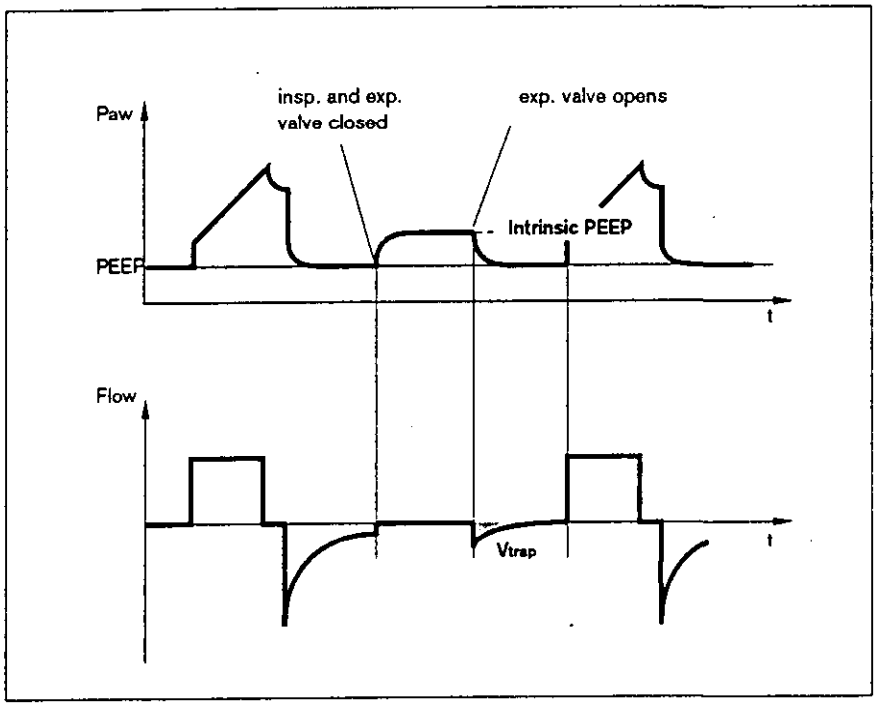
C4

## Measurement of intrinsic PEEP

Can only be carried out in the IPPV/assist ventilation mode.

Evita 2 keeps the inspiratory valve and the expiratory valve closed during a complete mechanical inspiration phase, so that it is impossible for gas either to flow into the breathing system from inspiration or escape from it. During this closed phase, pressure equalisation takes place between the lung and the breathing system. Evita 2 measures the pressure curve.

The start value corresponds to PEEP, the value at the end of the closed phase is the intrinsic PEEP.




At the end of the inspiratory phase, Evita 2 opens the expiratory valve and measures expiratory flow, which is generated by intrinsic PEEP. The lung is de-pressurised to PEEP.

The integrated flow corresponds to the volume $V_{trap}$ trapped in the lung by intrinsic PEEP.



C5

## Abbreviations used

| Abbreviation | Explanation |
|---|---|
| APRV | Airway Pressure Release Ventilation<br>Spontaneous breathing at continuous positive airway pressure with short-term pressure release. |
| ASB | Assisted Spontaneous Breathing<br>(Pressure Support) |
| BIPAP | Bilevel Intermittent Positive Airway Pressure<br>Ventilation mode for Continuous Positive Airway Pressure Breathing with two different pressure levels. |
| BIPAP-SIMV | Spontaneous breathing with two pressure levels (as for BIPAP), but including SIMV time pattern and ASB pressure support. |
| BIPAP-APRV | Airway Pressure Release Ventilation<br>Spontaneous breathing at continuous positive airway pressure with short-term pressure release. |
| bpm | Breaths per minute |
| C | Compliance |
| CPAP | Continuous Positive Airway Pressure |
| CPPV | Continuous Positive Pressure Ventilation |
| CPPV/Assist | Continuous Positive Pressure Ventilation with assist |
| Δ ptr | Differential trigger pressure independent of PEEP. |
| f | Frequency |
| Fail to cycle | Machine does not detect inspiration |
| $FiO_2$ | Insp. $O_2$ Concentration |
| f-spo | Spontaneous breathing frequency |
| ILV | Independent Lung Ventilation<br>Bilateral ventilation with 2 ventilators. |
| IMV | Intermittent Mandatory Ventilation |
| interm. PEEP | Intermittent Positive Pressure Ventilation = expiratory sigh. |
| Intrinsic PEEP | Mean pressure in the lungs at the end of expiration. |
| IPPV | Intermittent Positive Pressure Ventilation I |
| IPPV/Assist | Intermittent Positive Pressure Ventilation with assist |
| IRV | Inversed Ratio Ventilation |
| ISO 5369 | International Standard: Breathing Machines for Medical Use – Lung Ventilators |
| KG | Body weight (kg) |



CC

| Abbreviation | Explanation |
|---|---|
| MMV | Mandatory Minute Volume Ventilation |
| MVspo | Spontaneous breathed minute volume |
| P 0.1 | 100 ms occlusion pressure |
| $P_{aw}$ | Airway pressure |
| $p_{insp}$ | upper pressure level for PRV |
| $p_{max}$ | maximum pressure |
| $p_{plat}$ | endinsp. pressure |
| PEEP | pos. endexp. pressure |
| $p_{mean}$ | mean pressure |
| PCV | Pressure Controlled Ventilation |
| PLV | Pressure Limited Ventilation |
| R | Resistance |
| SB | Spontaneous Breathing |
| SIMV | Synchronized Intermittent Mandatory Ventilation |
| $T_I$:$T_E$ | Ratio inspiratory time: expiratory time |
| $\dot{V}$ | Insp. and exp. flow |
| $\dot{V}_E$ | Expiratory minute volume |
| $\dot{V}_{max}$ | Inspiratory flow |
| $V_{Te}$ | Expiratory tidal volume |
| $V_{trap}$ | Volume trapped in the lung by intrinsic PEEP, exhaled during subsequent expiration. |



C7

| Symbol | Explanation |
|---|---|
|  | Switch alarm sound off for 2 minutes |
|  | Calibrate $O_2$ sensor |
|  | Calibrate flow sensor |
|  | "Freeze" screen contents |
|  | Switch on medicament nebulizer |
|  | Selector button for Paw (t) or $\dot{V}$ (t) |
|  | Switch on illumination for screen and window for measured value displays. |
|  | Selecting or increasing/reducing value |
|  | Confirm |
|  | Select basic page on screen |
| | Status of menu function (e.g. tachypnoea monitoring) |
| □ | not operating |
| ■ | operating |
| ... | with sub menus |
|  | cursor |
|  | observe Instructions for Use |
|  | DIN IEC 601, para 19, table 4:<br>max. permissible earth current 0.5 mA |
|  | Insert flow sensor |
|  | Unlocking |



C8

## Literature


(1) Baigelman, W., Bellin, S. J., Pearce et al, L.:
Relation of inspired oxygen fraction to hypoxemia in mechanically ventilated adults. Critical Care Medicine 12 (1984), 486

(2) Baum, M., Benzer, H., Mutz, N., Pauser, G., Tonczar, L.:
Inversed Ratio Ventilation (IRV)
Die Rolle des Atemzeitverhältnisses in der Beatmung beim ARDS
Anaesthesist 29 (1980), 592-596

(3) Geyer, A., Goldschmied, W., Koller, W., Winter, G.:
Störung der Gerätefunktion bei Anbringung eines Bakterienfilters in den Exspirationsschenkeln des Beatmungssystems
Anaesthesist 34 (1985), 129-133

(4) Baum, M., Benzer, H., Putensen, Ch., Koller, W., Putz, G.:
Biphasic Positive Airway Pressure (BIPAP) – eine neue Form der augmentierenden Beatmung
Anaesthesist 38 (1989), 452-458

(5) Luger, Th.J., Putersen, Ch., Baum, M., Schreithofer, D., Morawetz, R.F., Schlager, A.:
Entwöhnung eines Asthmatikers mit Biphasic Positive Airway Pressure (BIPAP) unter kontinuierlicher Sufentanil Gabe
Anaesthesist (1990) 39: 557-560

(6) Hensel, I.:
Atemnotsyndrom nach Beinahe-Ertrinken
Rettung durch neuartiges Beatmungsprogramm?
Rettungsdienst 11 (Nov. 1991), 737-739

(7) Meyer, J.:
Neue Beatmungsformen
Anästhesiol. Intensivmed. Notfallmed. Schmerzther.
26 (1991) 337 - 342

(8) Vincent, J.-L.:
Yearbook of Intensive care and Emergency Medicine
Springer-Verlag 1993

(9) Stock MC, Downs JB, Frolicher D (1987):
Airway pressure release ventilation.
Critical Care Medicine 15:462 - 466

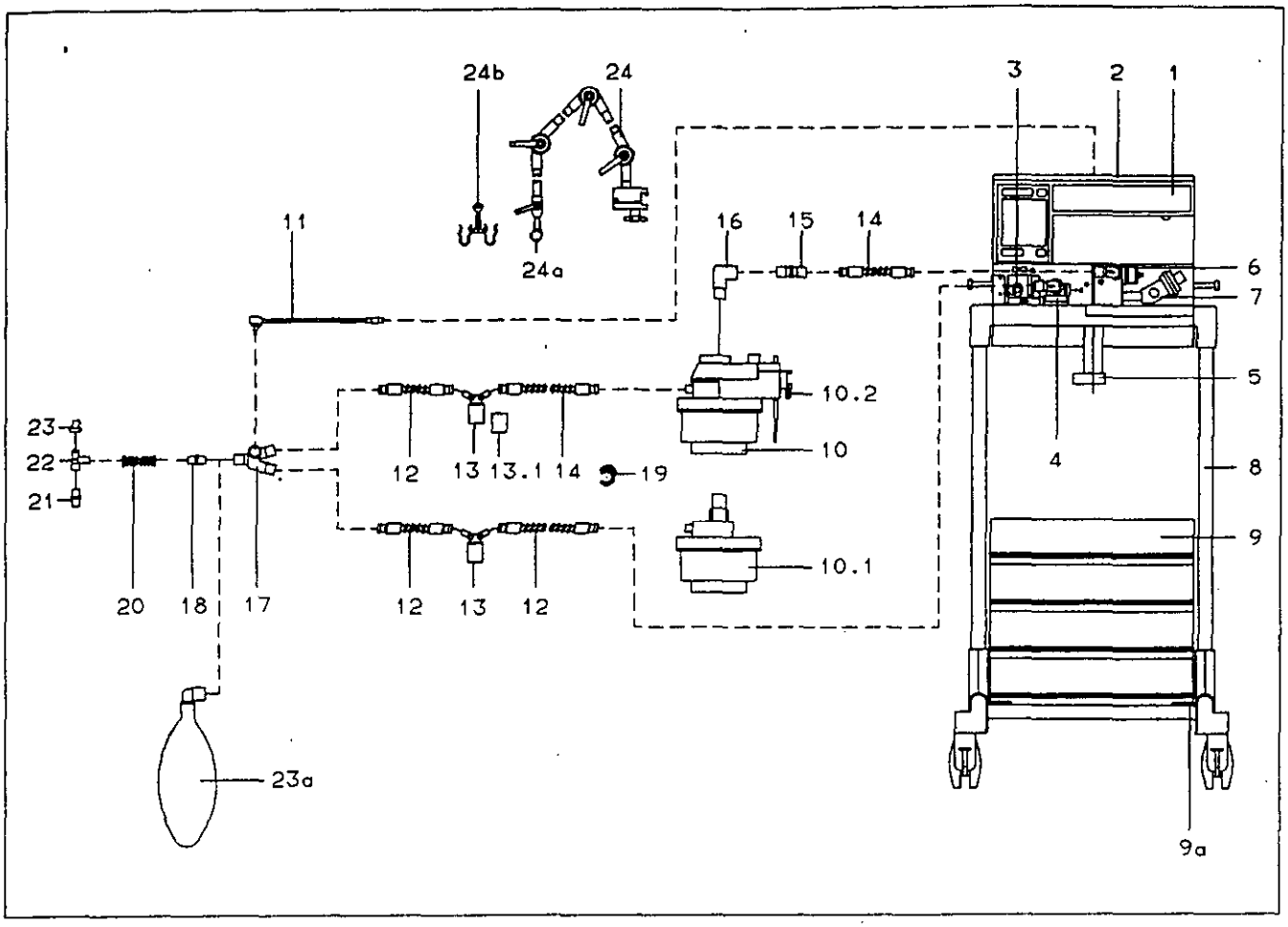
(10) Räsänen J, Cane R, Downs J, et al. (1991):
Airway pressure release ventilation during acute lung injury: A prospective multicenter trial.
Critical Care Medicine 19:1234 - 1241

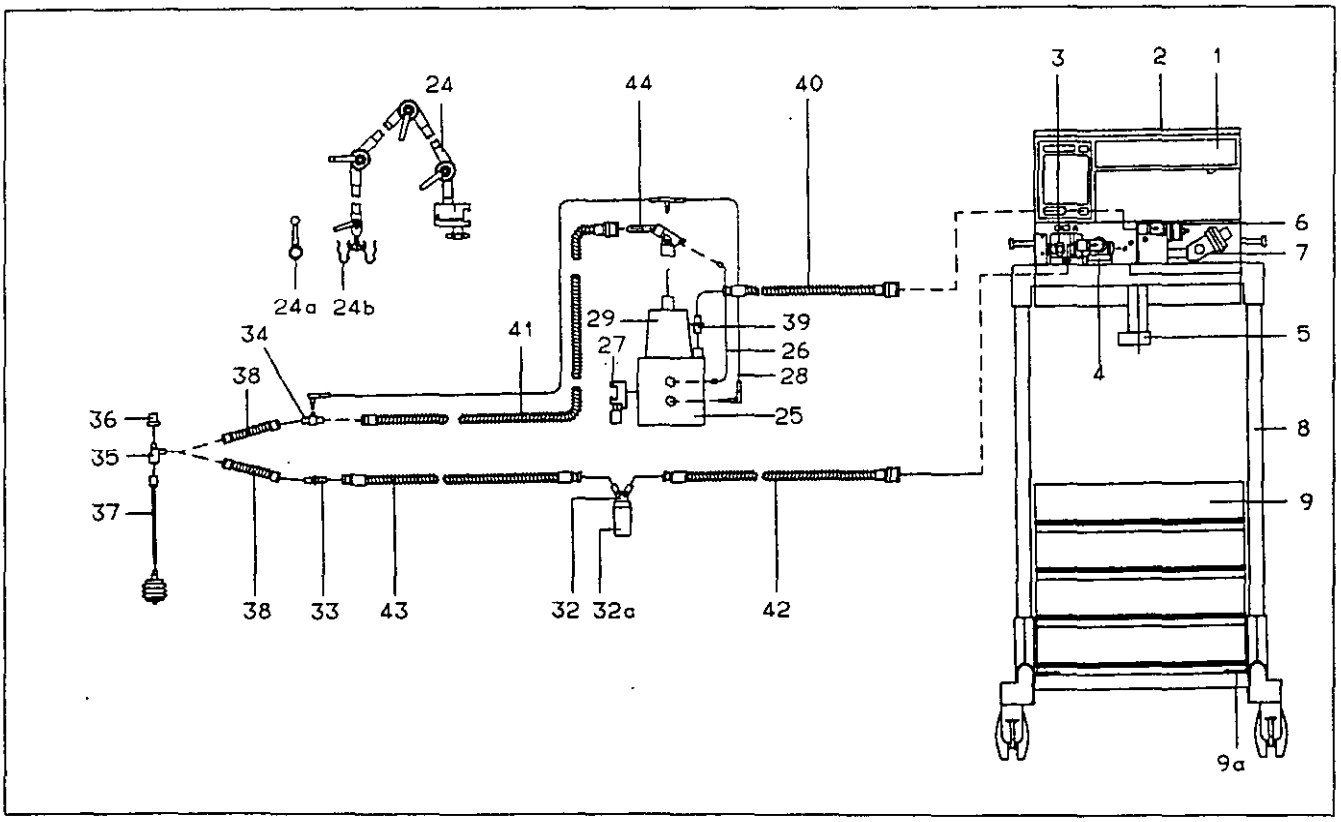



C9

# Parts List

**for the identification and replacement of parts**






C 10

| Item No. | Name/Description | Order No. |
|---|---|---|
| 1 | Evita 2 | 84 10 860 |
| 2 | Instrument tray | 84 08 343 |
| 3 | Flow sensor (set of 5) | 84 03 735 |
| 4 | Patient system | 84 10 580 |
| 5 | Bracket (for Aquapor) | 84 08 959 |
| 6 | $O_2$ sensor housing | 68 50 259 |
| | $O_2$ sensor | 68 50 645 |
| 7 | Ambient-air filter | 84 06 430 |
| 7a | Cooling-air filter (back of Evita 2, no illustr.) | 84 08 360 |
| 8 | Trolley | 84 08 900 |
| 9 | Cabinet 8H, 360mm high (4 drawers) | M 31 796 |
| 9a | Set of cabinet mountings for trolley | 84 09 018 |
| 10 | Aquapor (220-240 V) | 84 05 020 |
| 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 | Tubing (hose) set, adult (blue socket) | 84 120 92 |
| 12 | Spiral hose, adult, silicone 0.6m | 21 65 627 |
| 13-13.1 | Water trap | 84 04 985 |
| 13.1 | Water container | 84 03 976 |
| 14 | Spiral hose, adult, silicone 0.35m | 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 12.5 (set of 10) | M 23 841 |
| 19 | Hose clamp | 84 03 566 |
| 20 | Corrugated hose | 84 02 041 |
| 21 | Catheter connector, adult | |
| | Set of catheter connectors, adult, size 6 to 13 (set of 12) | 84 03 685 |
| 22 | Adaptor | 84 03 076 |
| 23 | Cap (set of 5) | 84 02 918 |
| 23a | Adult test lung (bag) | 84 03 201 |
| 24-24b | Hinged arm | 84 09 609 |
| 24a | Bracket | 84 09 746 |
| 24b | Hose clamp | 84 09 841 |
| 25-26 | Humidifier, basic unit, MR730 (F&P) | 84 11 046 |
| 26 | Hose heater adaptor | 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, no illustr.) | 84 11 073 |
| 31 | Single-strand wire, 1.5 (no illustr.) | 84 11 050 |
| 32-43 | Hose set, children's (F&P) | 84 12 081 |
| 32-32a | Condensation trap Ex | 84 09 627 |
| 32a | Water container | 84 03 976 |
| 33 | Double conical connector | 84 09 897 |
| 34 | Temperature sensor mounting | 84 11 044 |
| 35 | Adaptor K90 | 84 03 075 |
| 36 | Cap | 84 01 645 |
| 37 | Bellows K, compl. | 84 09 742 |
| 38 | Corrugated hose flex, 0.13 m | 84 09 634 |
| 39 | Catheter connector, size 11 | M 19 351 |
| 40 | Spiral hose K, silicone, 22/10, 0.40 m | 21 65 856 |
| 41 | Spiral hose K, silicone, 22/10, 1.10 m | 21 65 651 |
| 42 | Spiral hose K, silicone, 22/10, 0.60 m | 21 65 821 |
| 43 | Spiral hose K, silicone, 10/10, 0.60 m | 21 65 848 |
| 44 | Hose heater, 1.10 m | 84 11 045 |



C11

# Order List

| Name/Description | Order No. |
|---|---|
| **Basic machine** | |
| Evita 2 | 84 10 860 |
| **Accessories required for operation** | |
| Hinged arm | 84 09 609 |
| $O_2$ connecting hose 3 m | M 29 231 |
| or | |
| $O_2$ connecting hose 5 m | M 29 251 |
| Compressed air connecting hose 3 m | M 29 239 |
| or | |
| Compressed air connecting hose 5 m | M 29 259 |
| Trolley | 84 08 900 |
| $O_2$ sensor capsule | 68 50 645 |
| Flow sensor (set of 5) | 84 03 735 |
| **For adult ventilation** | |
| Temperature sensor | 84 05 371 |
| Aquapor humidifier | 84 05 020 |
| 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), including adaptor, hose heater | 84 11 097 |
| 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 K (Fisher & Paykel)<br>consisting of hose heater 84 11 045, patient hoses, water traps, Y-piece, catheter connectors | 84 12 081 |
| **Special accessories** | |
| Wall bracket, module 2000, type13<br>alternative to trolley | 84 08 613 |
| Pneumatic medicament nebulizer | 84 05 000 |



C12

# Order List

| Name/Description | Order No. |
|---|---|
| For manual ventilation: | |
| Resutator 2000 | 81 20 046 |
| Child Resutator 2000 | 21 20 984 |
| Baby Resutator 2000 | 21 20 941 |
| Hook for Resutator 2000 | M 26 349 |
| Adult test lung (bag) | 84 03 201 |
| For trolley: | |
| Cabinet 8H, 360 mm high | 2M 18 095 |
| Set of cabinet mountings for trolley | 84 09 018 |
| Modification set - socket strip | 84 09 021 |
| Modification set - $O_2$ distributor | 84 09 010 |
| RS 232 interface | 83 06 525 |
| Analogue interface DrägerBus | 83 03 940 |
| Cable for DrägerBus | 83 02 510 |
| Capnodig for $CO_2$ measurement | 82 90 000 |
| Oxisat 2<br>for non-invasive measurement of functional $O_2$ saturation | 82 00 679 |
| Breathing-air compressor, 220 . . . 280 V | 84 10 165 |
| Breathing-air compressor, 100 . . . 170 V<br>for supplying Evita 2 with compressed air | 84 10 173 |
| **Spare set for sterilization** | |
| Evita 2<br>Patient system | 84 10 580 |
| For adult ventilation: | |
| Hose set, adult | 84 06 550 |
| Patient part for Aquapor | 84 05 029 |
| Temperature sensor | 84 05 371 |
| Pneum. medicament nebulizer | 84 05 000 |
| For paediatric ventilation: | |
| Hose set, children's (Fisher & Paykel) | 84 12 082 |
| Humidifier chamber, MR 340 | 84 11 047 |
| incl. filter paper for humidifier chamber (set of 100) | 84 11 073 |



C 13

# Order List

| Name/Description | Order No. |
|---|---|
| **Replacement parts** | |
| For Evita 2: | |
| O2 sensor capsule | 68 50 645 |
| Ambient-air filter | 84 06 430 |
| Cooling-air filters (set of 10) | 84 08 360 |
| Lip seals for connecting plate behind patient system* | 84 07 689 |
| NiCd battery for mains failure alarm* | 83 01 856 |
| Lithium battery for data protection* | 18 17 582 |
| Flow sensor (set of 5) | 84 03 735 |
| 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 |
| 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, "children", silicone, 22/10, 1.10 m | 21 65 600 |
| Spiral hose, "children", silicone, 22/10, 0.60 m | 21 65 821 |
| Spiral hose, "children", silicone, 10/10, 0.60 m | 21 65 848 |
| Spiral hose, "children", silicone, 10/10, 0.40 m | 21 65 656 |
| Corrugated hose flex, 0.13 m | 84 09 634 |
| Catheter connector, size 11 (set of 10) | M 19 490 |
| Cap | 84 01 645 |
| Adaptor, "children" 90 | 84 03 075 |
| Double conical connector | 84 06 897 |
| * Replacement must be carried out by trained service personnel | |



C14

# Order List

| Name/Description | Order No. |
|---|---|
| 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 |



1.D1

# Index





D2

D3

These Instructions for Use apply only to
**Evita 2**
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.*

**Drägerwerk**
**Aktiengesellschaft**
Germany
Moislinger Allee 53 – 55
D-23542 Lübeck
(4 51) 8 82 - 0
2 68 07 - 0
FAX (4 51) 8 82-20 80

MT/ST 06.93

**90 28 110** - GA 5664.300 e

1st edition - May 1993
*Subject to alteration*

Printed in Germany / Serien-Nr.: ARFJ-F001 / Printed on chlorinefree paper

D4