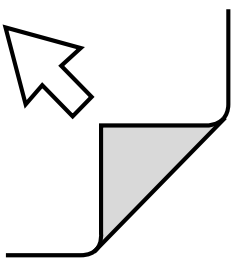
Babylog 8000 plus

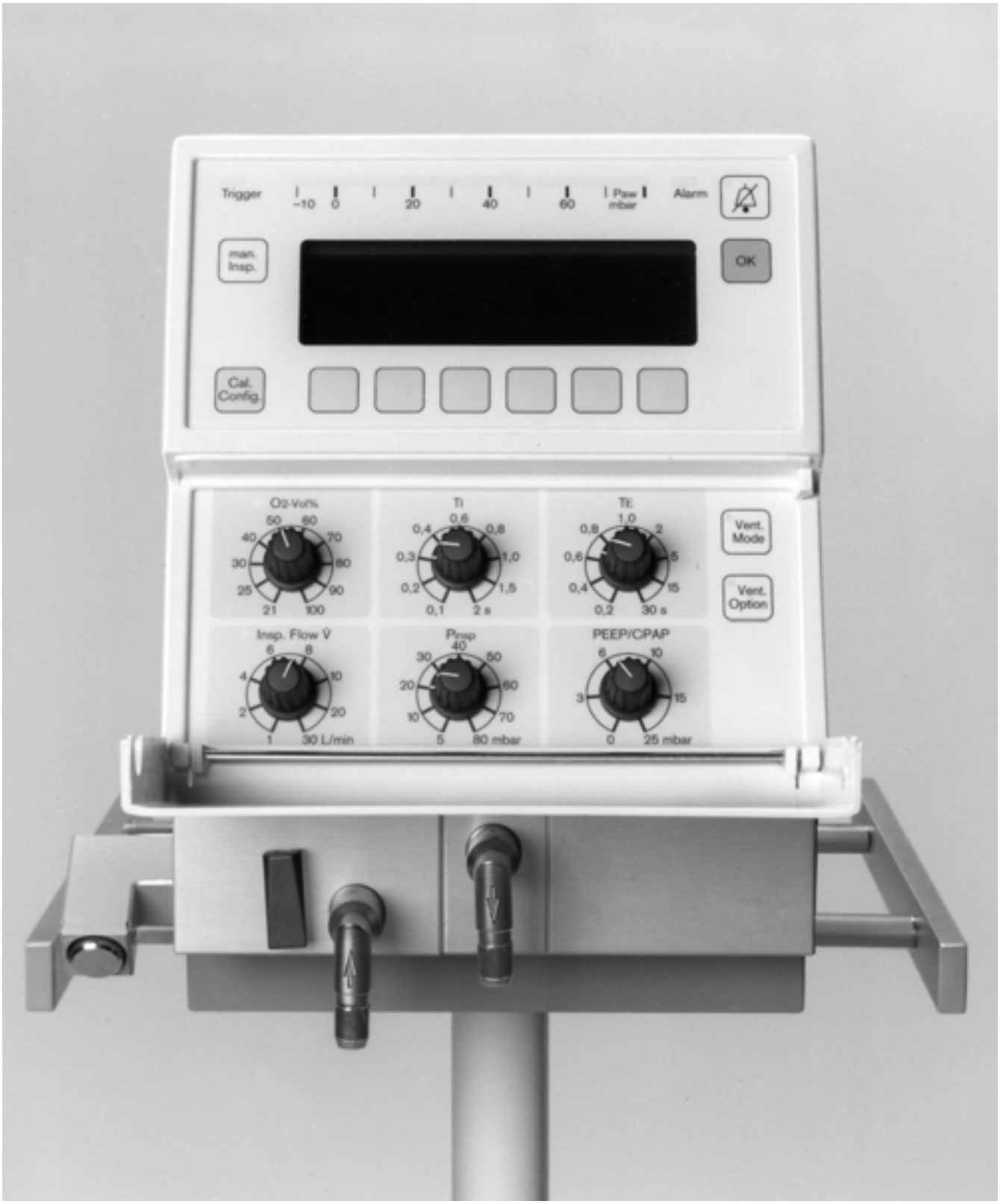
Intensive Care Ventilator for Neonates

Instructions for Use

Software 5.n

2-1111-96

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O2-Vol%
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PEEP/CPAP
6
10
3
15
0
25 mbar

2-112496

How to use this manual

Headings on the top right of left of the page show the manual sub-section titles.

Page text and pictures give a step by step user guide to the Babylog.

Text in the left hand column explains the operation of the unit and bullet points give logical steps to achieve optimum use.

The right hand column gives a pictorial and graphic guide which relates to the referenced text.

Calibration

For oxygen measurement:
- This is done automatically every 24 hours during operation.
- It must be done manually each time the sensor is replaced.
- It may be done manually at any time.

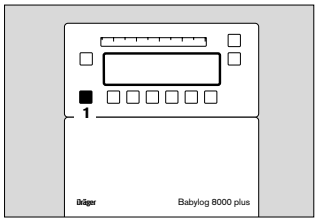
For flow measurement:
- This must be done each time the ventilator is switched on and
- each time the sensor is replaced.

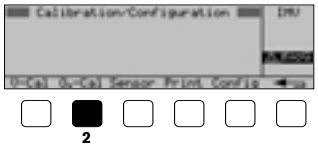
For pressure measurement:
- This is done automatically each time the ventilator is switched on.

Calibrating the O2 sensor manually

This is required only when the sensor is replaced, but may be done at any time.

1 Press the key »**Cal. Config.**«.





2 Press the key »**O2-Cal**«.

3 After about 5 minutes, the display »**O2-Cal**« disappears from the status window, indicating that calibration is complete.

If you do not yet have a Babylog 8000 plus unit, the photograph on the fold-out page will help you to understand this manual.

Contents

For Your Safety and that of Your Patients

Strictly follow the Instructions for Use

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

Maintenance

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

Accessories

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

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.

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

Dräger Medizintechnik GmbH

Intended Use

Babylog 8000 plus 5.n
Long-term ventilator for premature and newborn babies and for infants weighing up to 20 kg.
It is intended for use on the intensive-care ward.
The unit is operated by a doctor or by nursing staff as instructed by a doctor.
All users must be suitably instructed and must be familiar with the Instructions for Use.

Use of the ventilation modes

– **IPPV/IMV** (**I**ntermittent **P**ositive **P**ressure **V**entilation and **I**ntermittent **M**andatory **V**entilation)
Controlled ventilation according to a predetermined pattern and frequency, regardless of the patient's spontaneous breathing.

– **SIPPV** (**S**ynchronized **I**ntermittent **P**ositive **P**ressure **V**entilation)
Controlled ventilation with a predetermined pattern or predetermined tidal volume, synchronised with each spontaneous breath by the patient.

– **SIMV** (**S**ynchronized **I**ntermittent **M**andatory **V**entilation)
Controlled ventilation with a predetermined pattern or predetermined tidal volume and frequency, synchronised with the patient's spontaneous breathing. The patient breathes spontaneously between the synchronised ventilation strokes.

– **PSV** (**P**ressure **S**upport **V**entilation) – optional
Synchronised ventilation with a predetermined inspiration pressure or predetermined tidal volume. The patient determines the duration of the inspiration and the ventilation frequency.

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

The above ventilation modes can be combined with the following special functions:

– **VG** (**V**olume **G**uarantee) – optional
Volume-controlled ventilation. The units automatically regulates the inspiration pressure in order to achieve the predetermined tidal volume.
This can be combined with SIPPV, SIMV and PSV.

– **HFV** (**H**igh **F**requency **V**entilation) – optional
High-frequency ventilation for patients weighing up to about 2 kg. This can be combined with IPPV/IMV or CPAP.

– **VIVE** (**V**ariable **I**nspiratory **V**ariable **E**xpiratory Flow)
Separately adjustable continuous flow during the expiration phase of the mandatory ventilation. This cannot be combined with HFV.

The ventilator monitors
inspiratory oxygen concentration,
airway pressure,
tidal volume and
breathing rate (for panting breathing).

The Babylog 8000 plus can be equipped with an interface for the transfer of measured data and settings to units such as patient monitors or computers.

If necessary, the ventilator can also be combined with a medical nebulizer.

Always operate the unit under the supervision of qualified medical personnel in order to allow immediate help in the case of a malfunction!

Extractive monitors
can generate a vacuum in the airway if the inspiration tube becomes blocked!
Connect the sampling line of the extractive monitor only via the adapter with safety valve 84 12 448.

Do not use this ventilator together with flammable gases or anaesthetic agents, as this may incur a fire or explosion hazard.

Do not use mobile radiotelephones within 10 metres of the ventilator!
Mobile radiotelephones may interfere with the functions of electromedical equipment and thus endanger the life of the patient.

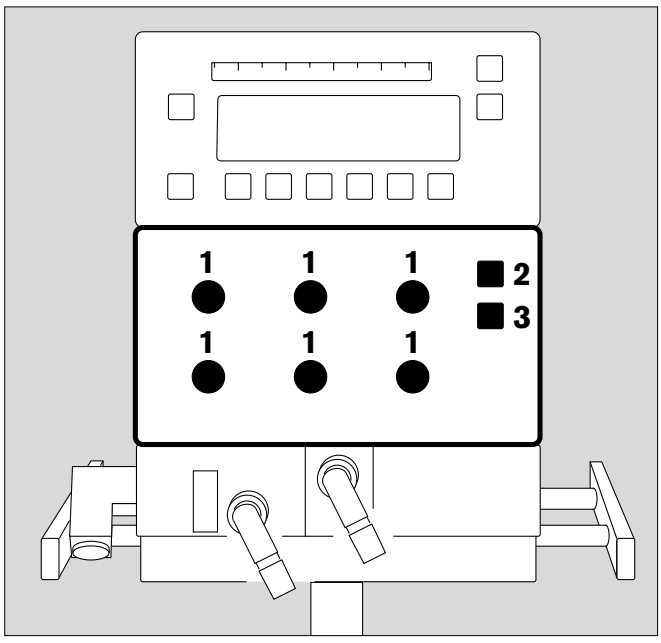
If the integrated apnoea monitor is switched off, use a separate apnoea monitoring device!

Operating Principle

Contents

Layout of the front panel

The front panel consists of the **control panel** and the **display panel** with a screen.



Control panel

This carries the keys for ventilation modes and rotary knobs for adjusting important ventilation parameters.

The rotary knobs which can be adjusted for current selected ventilation modes are indicated by green LEDs. These LEDs blink if any adjustments are limited internally or still need to be acknowledged.

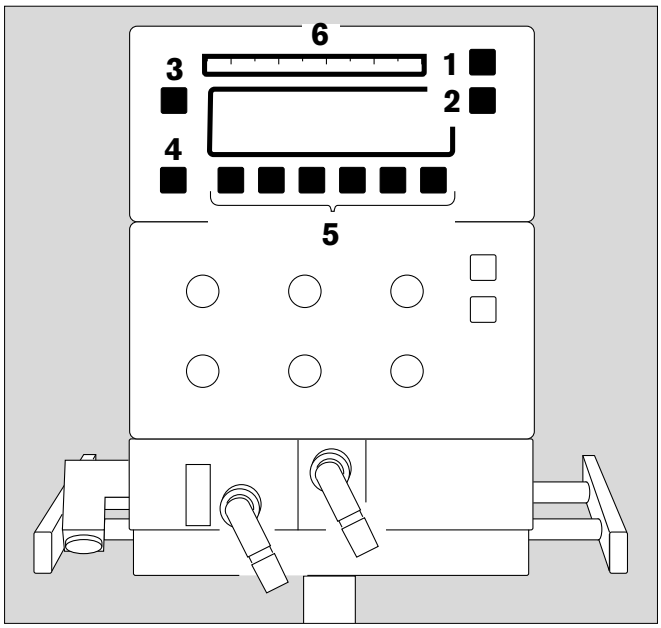
1 Rotary knobs for ventilation parameters.

2 Pressing the key **»Vent. Mode«** selects the menu for ventilation modes.

3 Pressing the key **»Vent. Option«** selects the menu for additional functions for ventilation modes.

Display panel

This carries the screen, the pressure display and various keys with fixed or variable functions.



1 Pressing the key » 🔔 « suppresses audible alarms for 2 minutes.

2 Pressing the key »**OK**«acknowledges messages or settings.

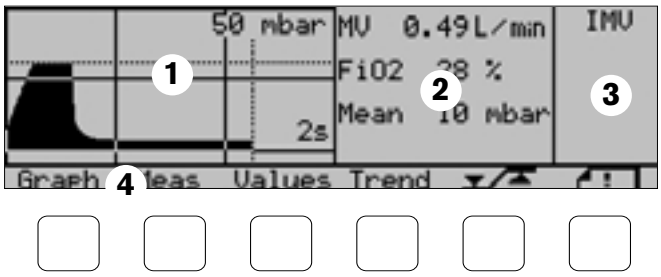
3 Pressing the key »**man. Insp.**« initiates manual inspiration breaths.

4 Pressing the key »**Cal. Config.**« selects the calibration menu.

5 The six keys below the screen are used in various menus for selecting monitoring functions and ventilation modes.

6 The bargraph display above the screen shows airway pressure.

Layout of the screen



1 The graphics window displays either the pressure curve or the flow curve, as desired.

2 The measured-value window displays measured values such as MV, FiO_2, Mean in numerical format.

3 The status window displays the currently selected ventilation mode and other status information.

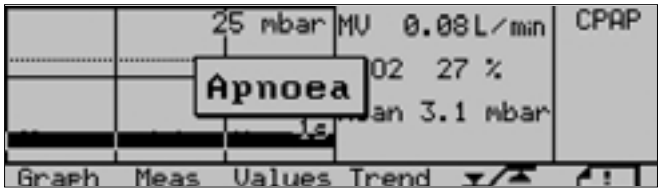
4 The menu line gives the current function of the menu key in text and symbols.

In some cases, the graphics window and the measured-value window are combined to form a single window.

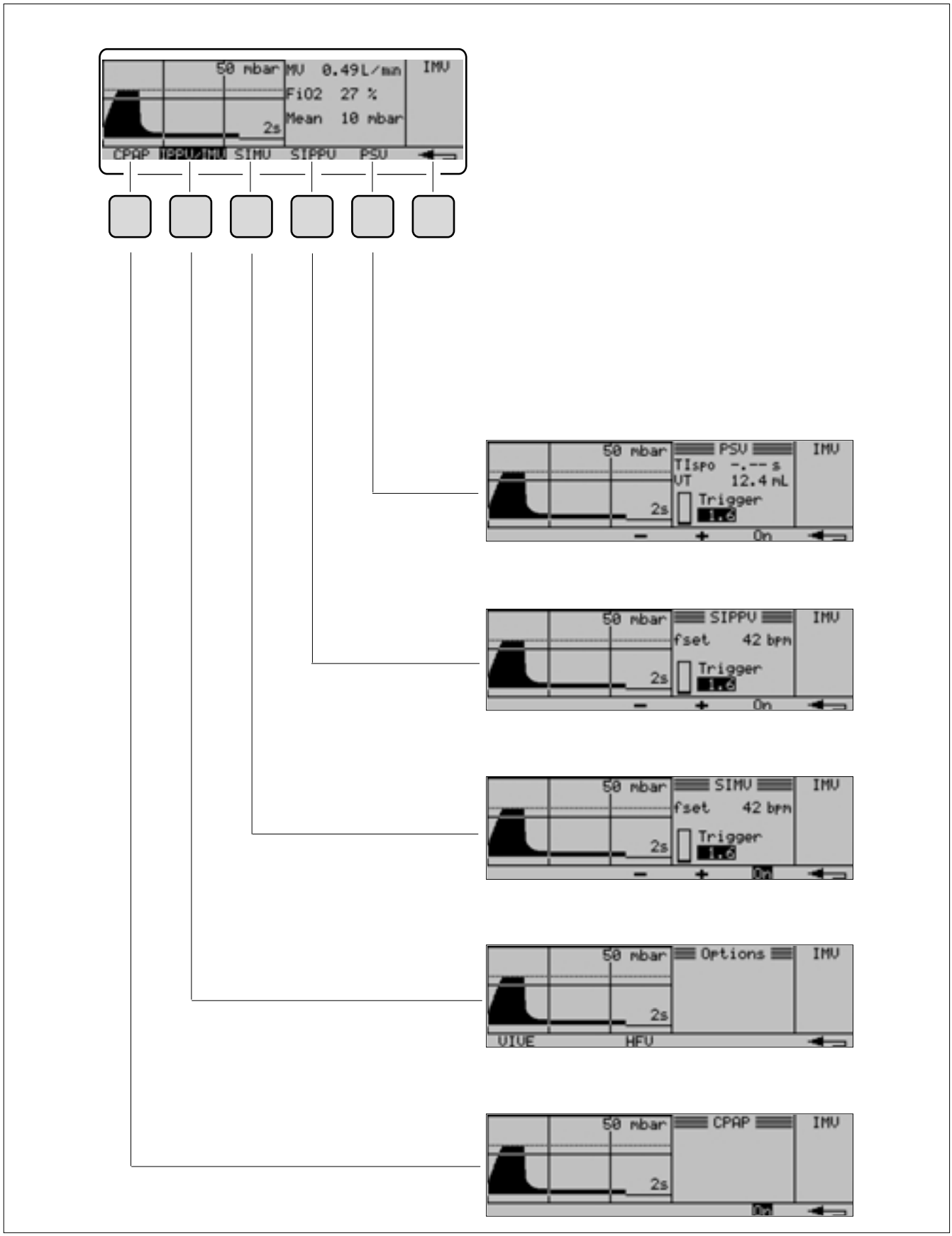
Messages are displayed in a superimposed window on the current display:

Display (example):

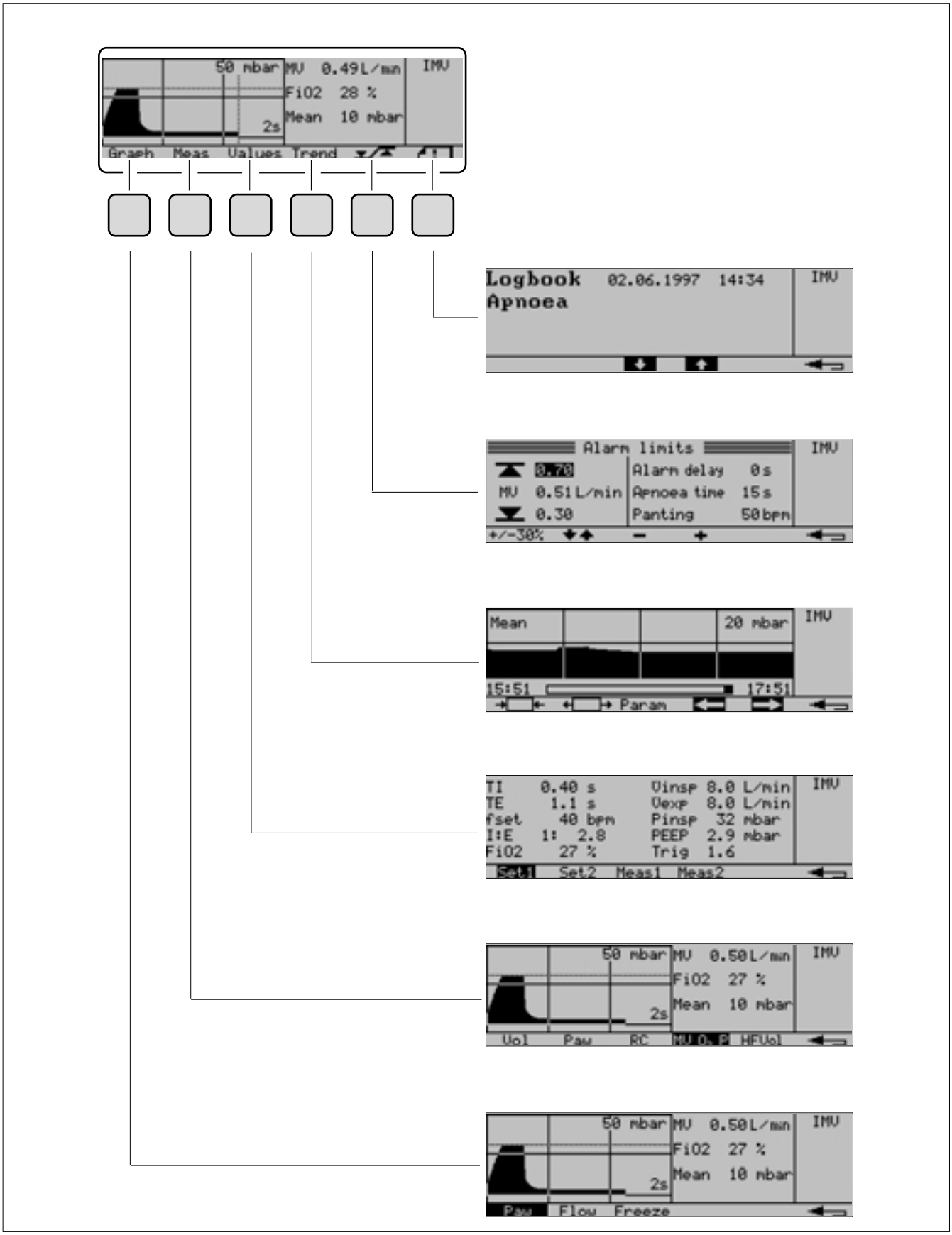
Apnoea



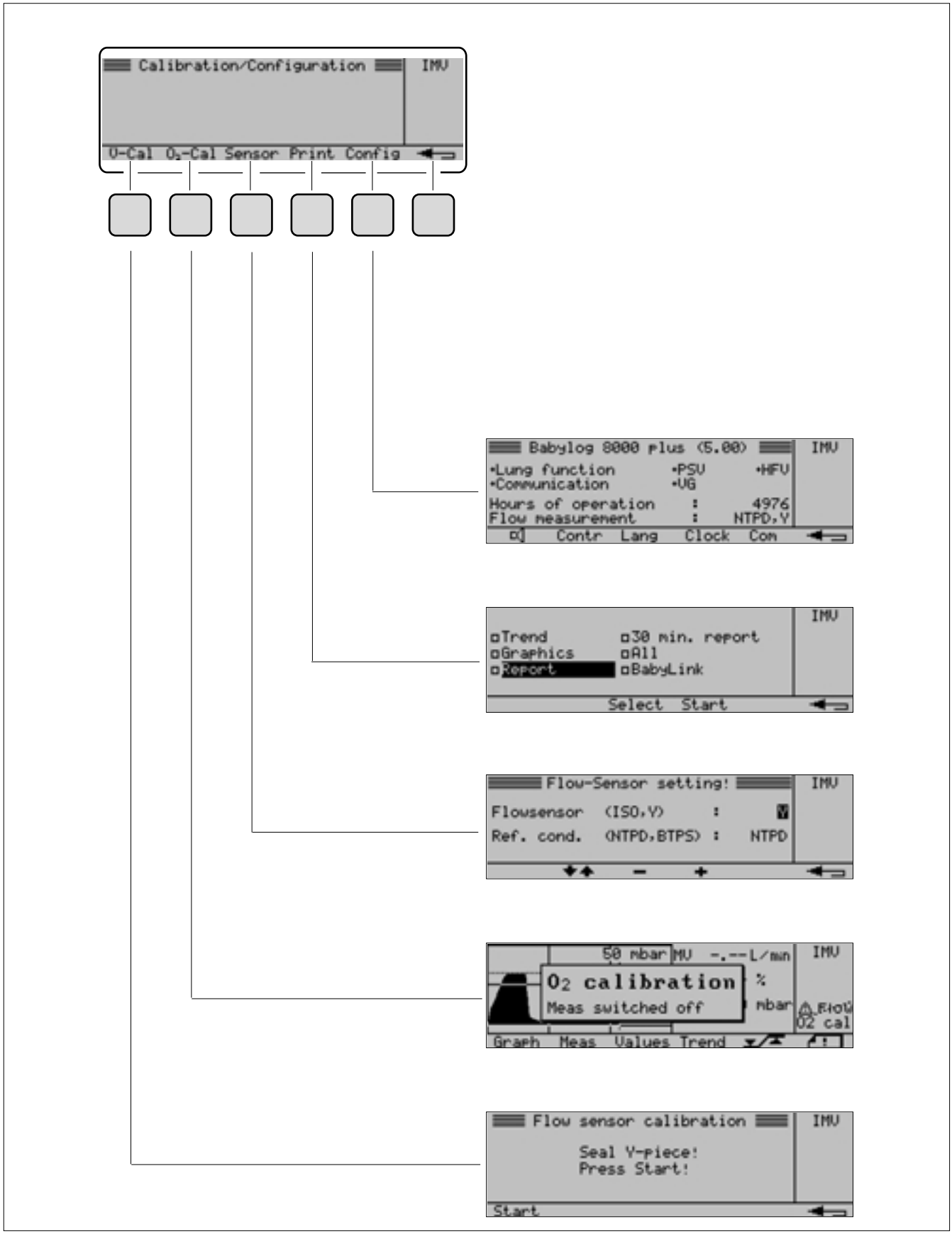
Ventilation menu



Monitoring menu



Calibration/configuration menu

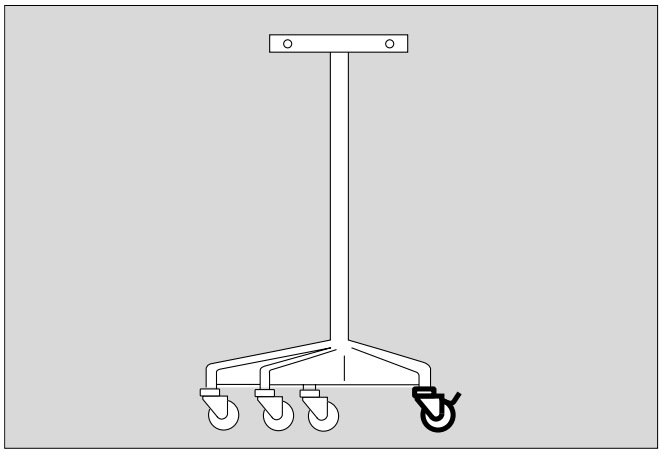


Preparation

Contents

Mounting Babylog 8000 plus on a trolley

- Turn the trolley so that the two lockable castors are on the right.

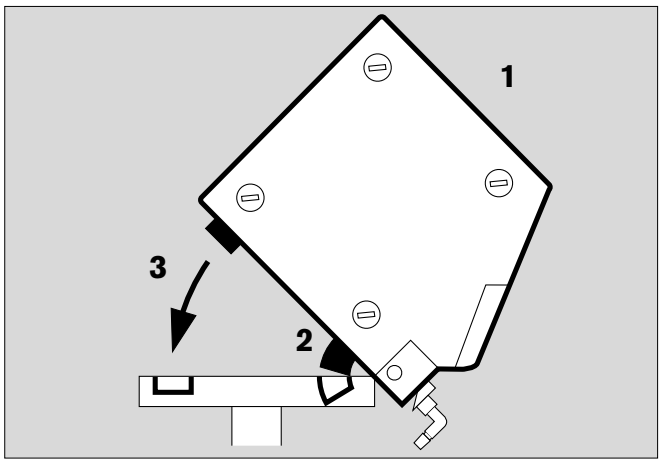


Mount the Babylog 8000 plus on the trolley in this position:

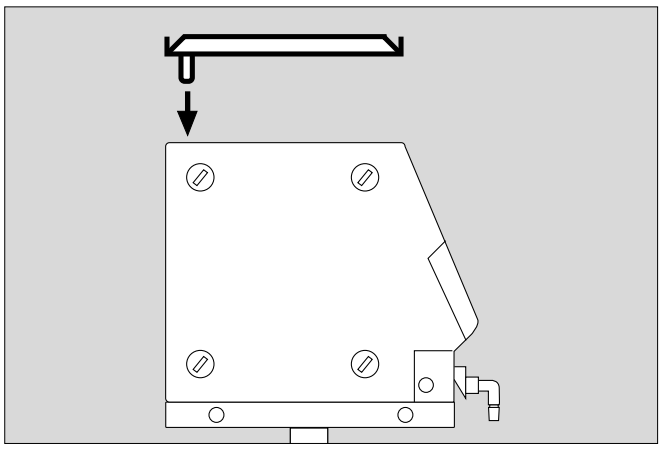
1 Tilt the Babylog 8000 plus forwards.

2 Engage the front latches in the slots of the mounting plate.

3 Lower the Babylog 8000 plus, insert the rear latches in the slots of the mounting plate and secure the unit with the knurled screws on the rear.



- Place the shelf on the Babylog 8000 plus, engaging the two tabs in the slots at the rear of the unit.



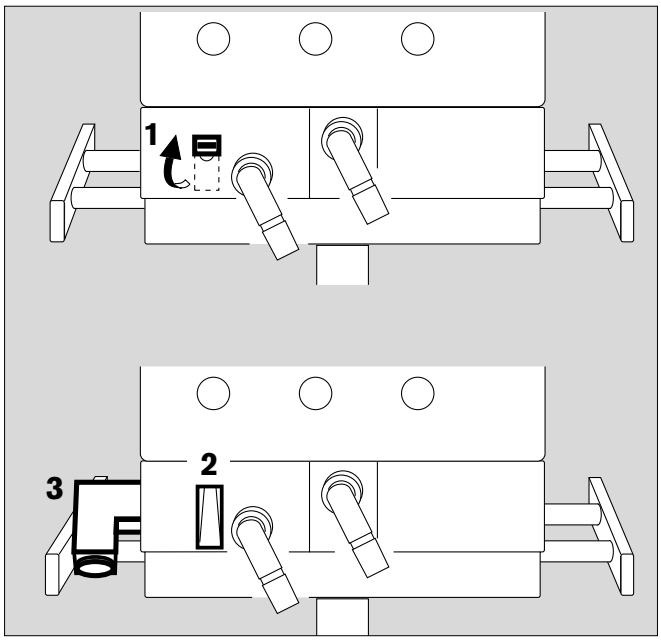
Do not place containers with liquids on or above the unit!
Any liquid entering the ventilator may impair its operation!

Inserting the expiration valve

Use a sterile expiration valve!

1 Lift the lever upwards to unlock the expiration valve.

- Slide the expiration valve as far as possible onto the guide rods.



2 Push the lever down again to lock the expiration valve.

3 Fit the silencer on the exhaust nozzle of the expiration valve.

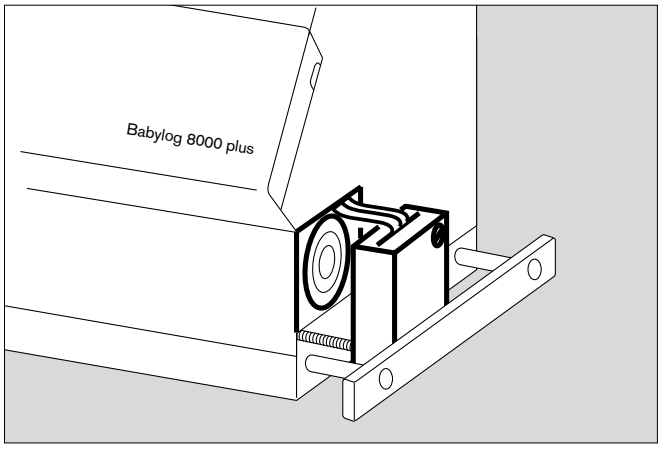
Inserting the O_2 sensor

This must be done:

– before the ventilator is used for the first time,

– when the sensor is exhausted and can no longer be calibrated.

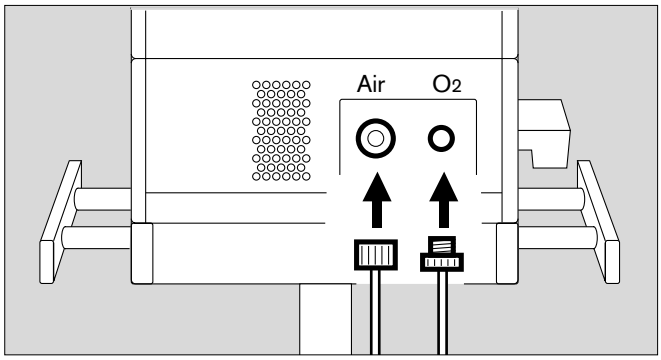
- Unscrew the two slotted screws in the cover on the right-hand side and pull the cover out.
- Pull out the exhausted O_2 sensor.
- Insert the new O_2 sensor with the circular printed wiring towards the cover.
- Press the cover into place and tighten the two screws.
- Allow the O_2 sensor to run for 15 minutes and then calibrate the O_2 measurement manually (page 24).
- Dispose of the old O_2 sensor as special waste (page 93).



Connecting the gas supply

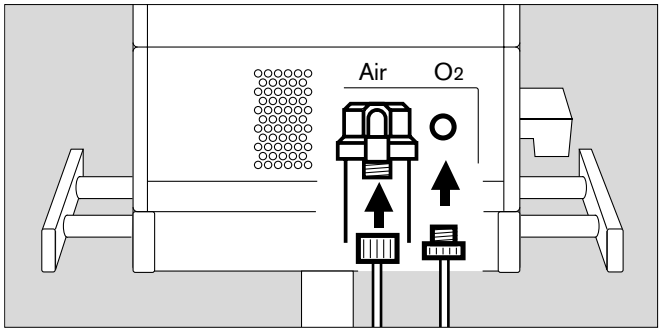
- Screw the medical air and oxygen hoses into the rear of the Babylog 8000 plus and insert the plug connectors into the wall outlets.*

  The gases must be dry and connectors free of oil and dust!



If the medical air is supplied from a compressor:

- Screw the high-pressure water trap 84 12 628 onto the air connector and screw the medical air hose into the high-pressure water trap.



Connecting the electrical supply

The mains voltage must lie within the supply voltage range specified on the rating plate on the rear of the ventilator.

Either: 100 V ~ to 127 V ~

or: 220 V ~ to 240 V ~

- Insert the mains plug of the Babylog 8000 plus into the outlet socket.

Breathing gas humidifier

– The humidifier must comply with the standard EN ISO 8185.

– The hose resistance must be less than 20 mbar/L/s (inspiratory resistance ≤12 mbar/L/s, expiratory resistance ≤ 8 mbar/L/s).

– The combination of the humidifier with the Babylog 8000 plus should not impair the safety and function of either unit.

- Prepare the humidifier for use as described in the related Instructions for Use.

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* pr EN 794-1, Ventilation equipment:
"If the unit is used with O_2, adequate ventilation must be provided in order to avoid an increased risk of fire due to an O_2 concentration of more than 24 % by volume".

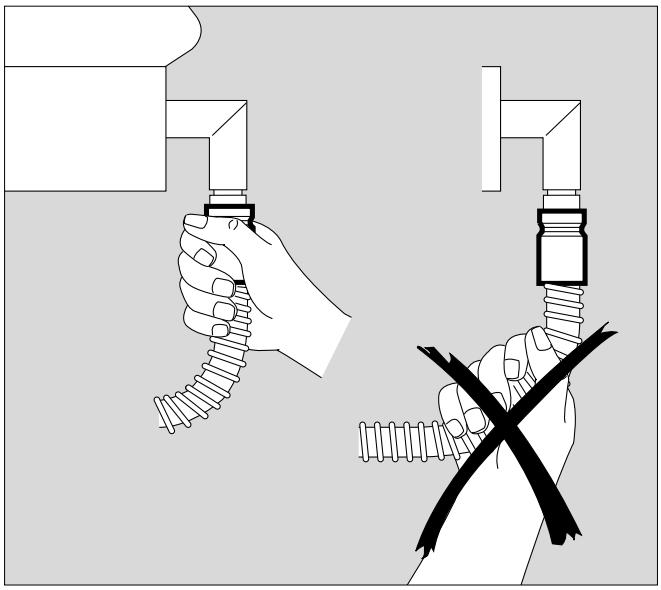
Connecting the ventilation hoses

Only use antistatic or non-conductive hoses, to avoid risk to the patient.

Only use hose systems that are described here or if they have an internal diameter of at least 10 mm, since the measurement of the airway pressure may otherwise be impaired!

- Fit the ventilation hoses on the nozzles. observing the permissible hose lengths (in metres).

- **Always hold the hoses by their sleeves when fitting and removing them since they can otherwise be damaged.**



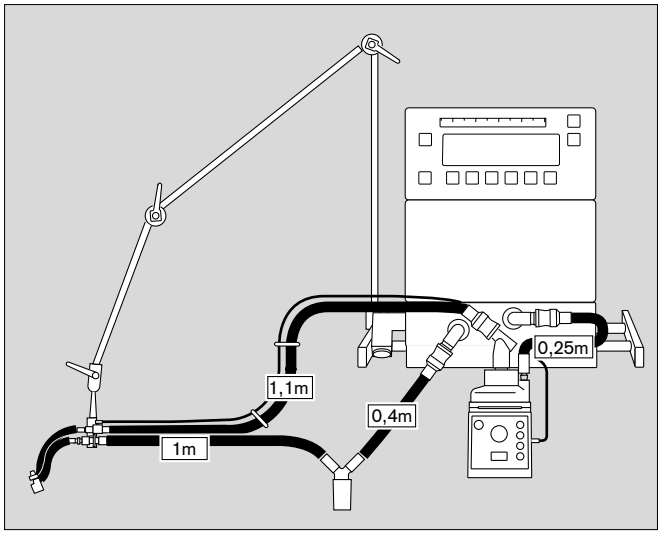
When not using in combination with an incubator

Use the hinged arm with claw:

- Swing both nozzles downwards or towards the patient.

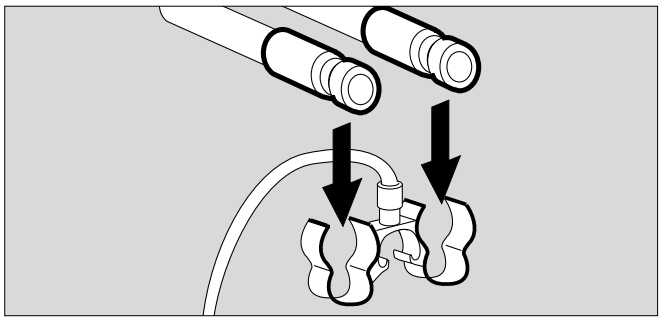
- Fit the ventilation hoses on the nozzles. observing the permissible hose lengths (in metres).

- Install the water trap in a vertical position.



When using with incubator 8000

- Install the water trap in a vertical position.
- Mount the holder for the ventilation hoses in the incubator.
- Press the rubber sleeves of the ventilation hoses into the clamp of the holder.



Installing the bacterial filter (optional)

A bacterial filter can be fitted on the inspiration side in order to protect against contamination.

- Use modification kit 84 10 230.

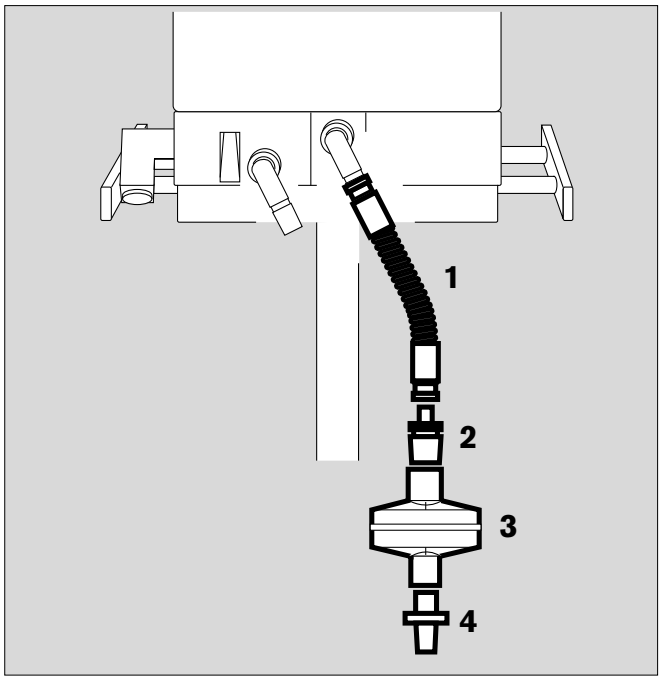
1 Fit the 0.25 metre ventilation hose to the inspiration nozzle.

2 Insert the 15/22 diameter adapter in the ventilation hose.

3 Plug the bacterial filter into the adapter.

4 Plug a size II catheter connector into the bacterial filter.

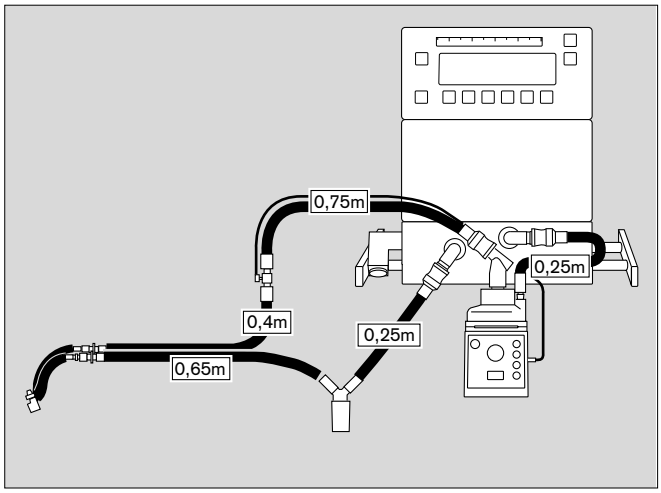
- Connect the ventilation hoses.
- Observe the Instructions for Use for the bacterial filter.



For high-frequency ventilation (HFV)

Use the "HF Fisher & Paykel" hose set 84 11 153.
The low compliance of this hose system reduces the damping of high frequency oscillations, thus ensuring adequate gas volumes.

- Fit the ventilation hoses on the nozzles, observing the permissible hose lengths (in meters).
- Install the water trap in a vertical position.



Installing the Y-piece and the flow sensor

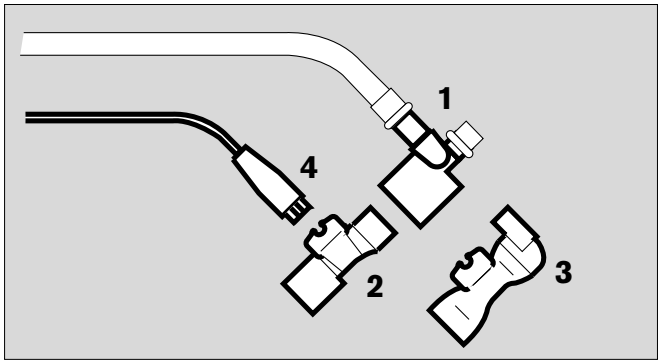
1 Plug the Y-piece into the ventilation hoses.

2 Plug an ISO flow sensor into the Y-piece.
Or:

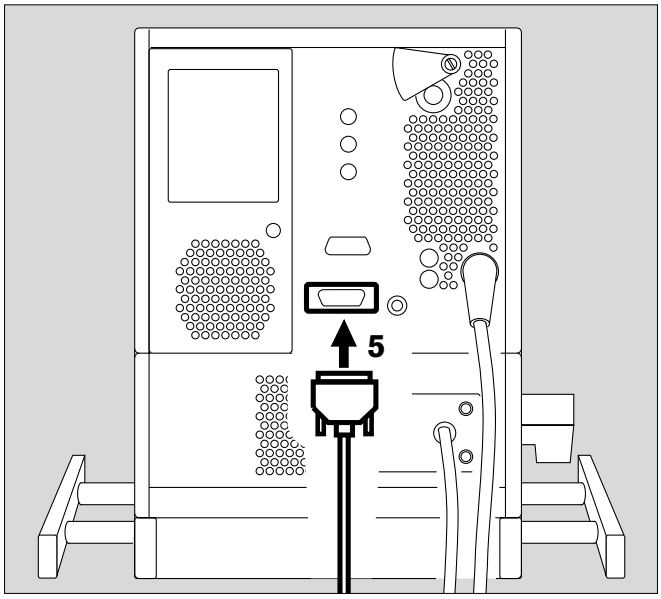
3 Use a Y-piece with an integrated flow sensor.

4 Insert the plug of the flow-sensor cable into the flow sensor.

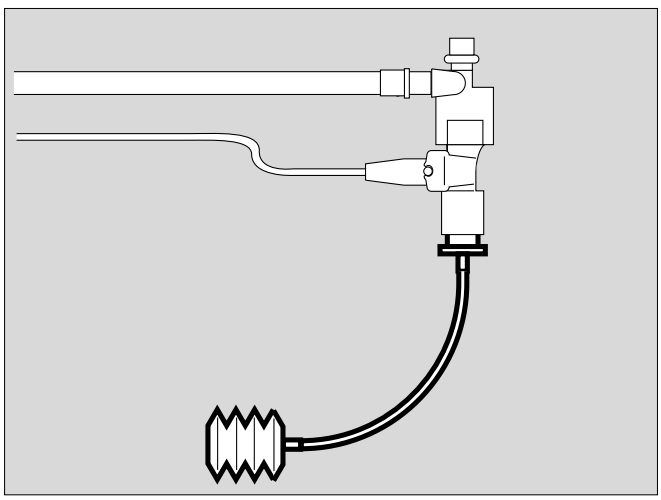
- Lay the cable along the ventilation hoses to the ventilator.
- Positioning the Y-piece:
  The patient side should point about 45° downwards in order to prevent condensation from collecting in the flow sensor.



5 Insert the plug of the flow-sensor cable into the socket on the rear of the ventilator and secure it with attached screws.



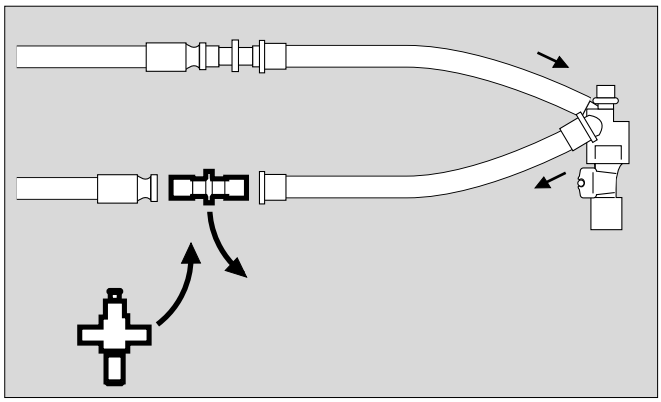
- Connect the test lung to the Y-piece.
  The test lung consists of a bellows (compliance: 0.5mL/mbar), a tracheal tube CH 12, approx. 165 mm long, and a connector.



When an extractive monitor is used,
a vacuum may be generated in the airway if the inspiration hose becomes blocked.

For this reason:

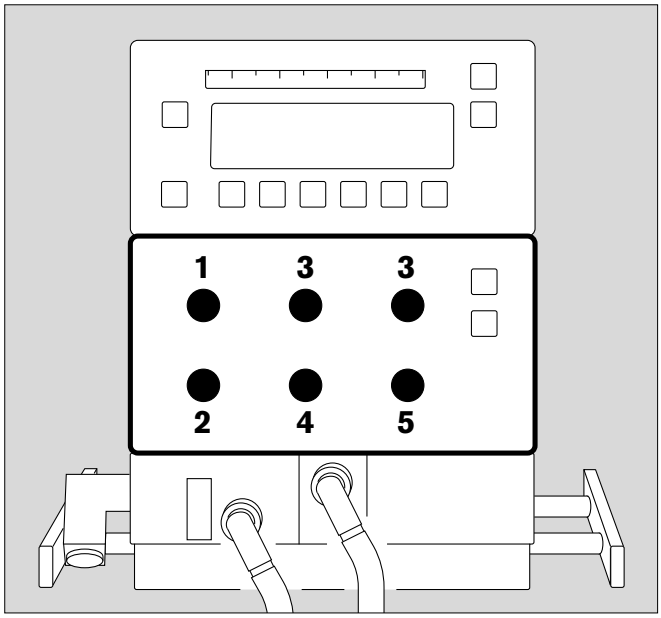
- Connect the sampling line of the extractive monitor only via the adapter with safety valve 84 12 448. The Luer lock connector must be at the top in order to avoid the formation of condensation.



Before using for the first time

The built-in battery for the power-failure alarm is charged during normal operation of the ventilator. Before the ventilator is used for the first time, or after a long idle period, it should be switched on for 30 minutes in order to charge the battery sufficiently.

Use the following settings in order to prevent alarms during this charging period:



1 Set the rotary knob »**O_2-Vol%**« to 21

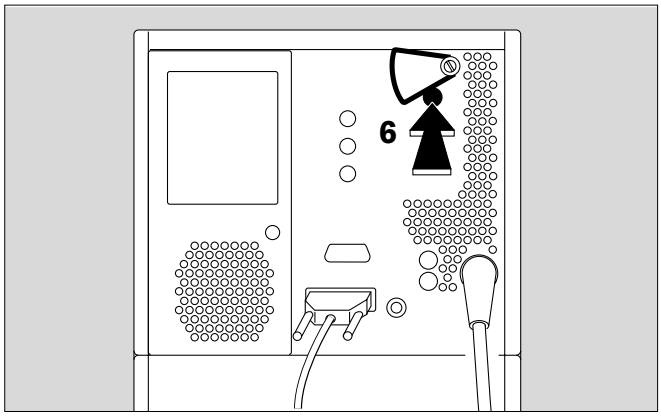
2 Set the rotary knob »**Insp. Flow $\dot{V}$** « to 5

3 Set the rotary knobs »**TI**« to 0,4 »**TE**« to 0,6

4 Set the rotary knob »**P_{insp}**« to 20

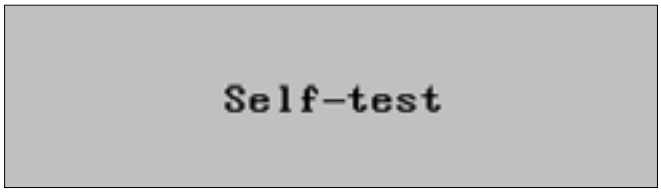
5 Set the rotary knob »**PEEP/CPAP**« to 3.

6 Switch on the ventilator by pressing the power switch on the rear until it locks.



- Display

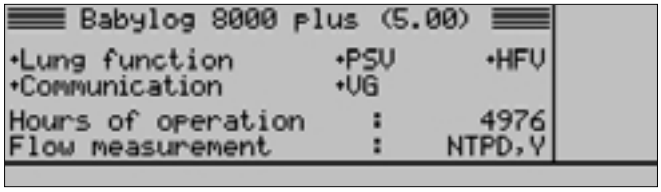
  The unit executes a self-test of its internal memory. All LEDs light and a short continuous tone sounds, followed by a tone sequence.



Then

- Display (example):

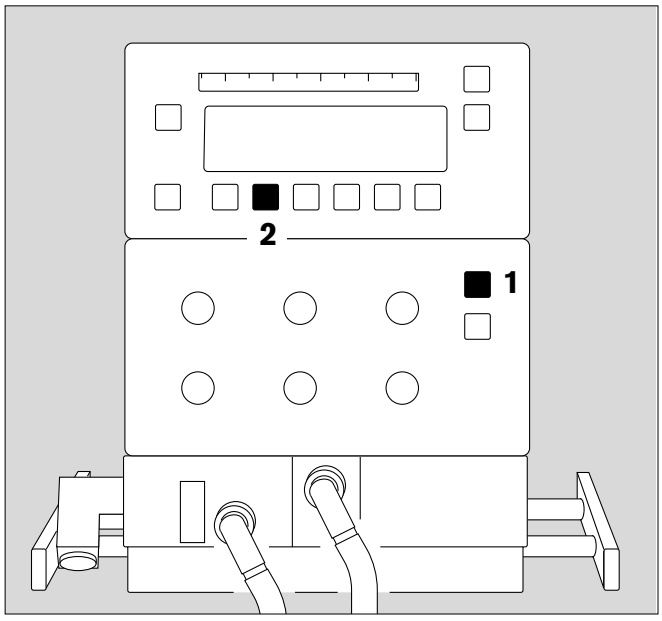
  The software version, the operating hours and optional features are displayed.



1 Press the key »**Vent. Mode**«.

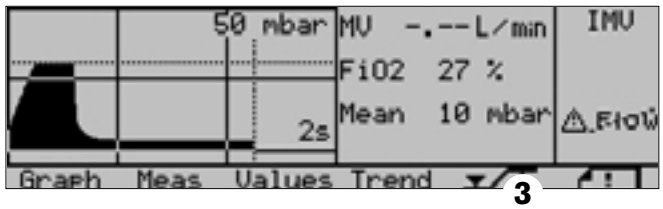
2 Press the key »**IPPV**«.
Press the key »**On**«.

Press the key » ⇥ «.



- Display (example):

3 The symbol ▼/▲ for the alarm limits blinks to request adjustment of the alarm limits.



Calibration

For oxygen measurement:

– This is done automatically every 24 hours during operation.
– It must be done manually each time the sensor is replaced.
– It may be done manually at any time.

For flow measurement:

– This must be done each time the ventilator is switched on and
– each time the sensor is replaced.

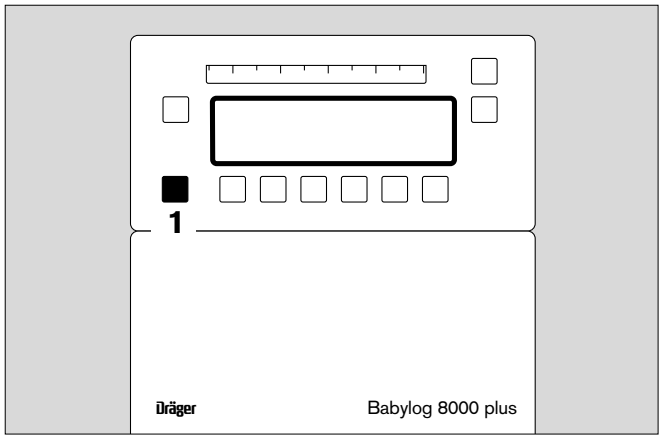
For pressure measurement:

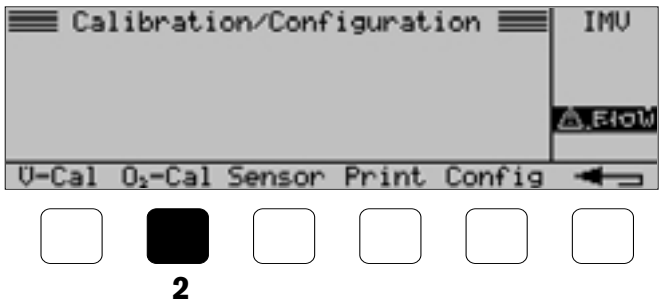
– This is done automatically each time the ventilator is switched on.

Calibrating the O_2 sensor manually

This is required only when the sensor is replaced, but may be done at any time.

1 Press the key »**Cal. Config.**«.



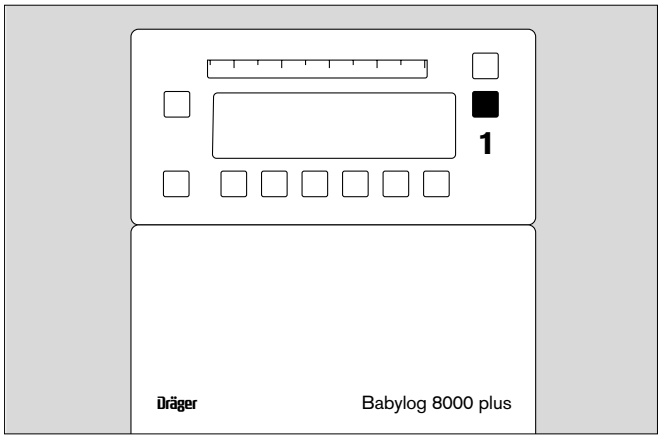


2 Press the key »**O_2-Cal**«.

3 After about 5 minutes, the display »**O2-Cal**« disappears from the status window, indicating that calibration is complete.

To clear the text message on the screen:

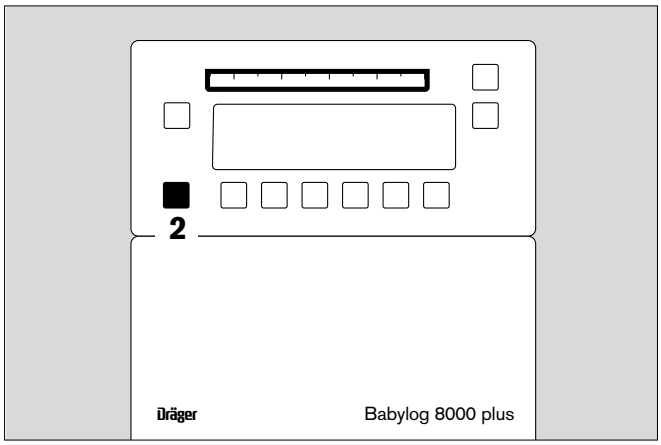
1 Press the key »**OK**«.



Calibrating the flow sensor

– This must be done each time the ventilator is switched on,
– each time the sensor is assembled for use and
– each time the flow sensor is replaced.

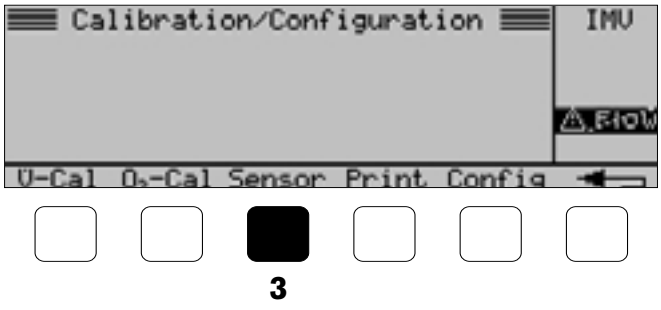
2 Press the key »**Cal. Config.**«.



For optimum accuracy:
select the flow-sensor type (ISO or Y) so that the flow measurement is matched to the sensor being used.

3 Press the key »**Sensor**«.

- Move the cursor to the line **Flowsensor** » ✚✚ and
- select **ISO** or **Y** with the key » ✚ « or » ▬ «



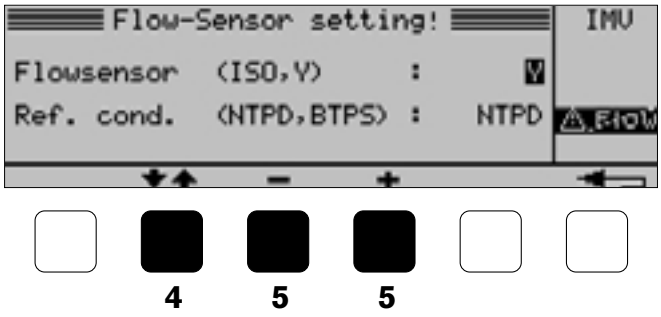
Select the reference conditions:

NTPD (ambient temperature 20 °C, atmospheric pressure 1013 mbar, dry gas) or

BTPS (body temperature 37 °C, ambient pressure, gas saturated with moisture).

4 Move the cursor to the line **Ref. cond.** with the key » ✚✚ « .

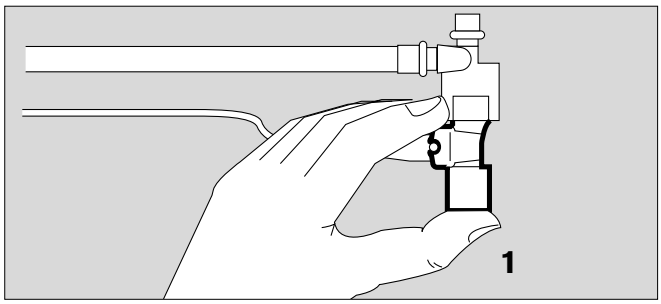
5 Select NTPD or BTPS with the key » ✚ « or » ▬ «.



Calibration:

- Press the keys »**Cal. Config**« and » V-Cal «.

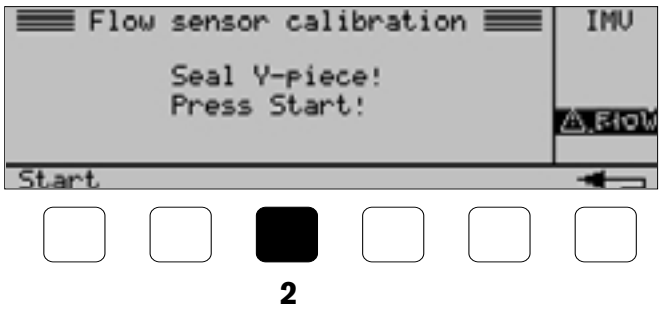
1 Remove the tube connector and seal the patient side of the Y-piece with, for example, a sterile glove. No gas may flow through the Y-piece during calibration (since the zero point is calibrated).



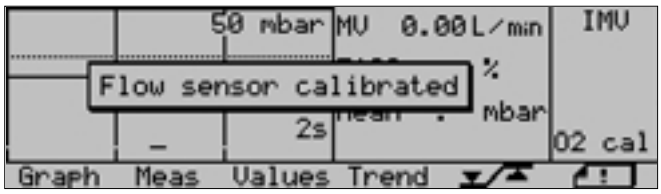
- Display

2 Press the key »**Start**«.

After about 1 second, the display » ⚠ Flow « disappears from the status window, indicating that the sensor has been calibrated.



- Display



- Connect the tube again.

If calibration is unsuccessful:

- replace the sensor insert or the flow-sensor cable (page 27).

If the flow sensor has to be replaced during operation, and cannot be calibrated immediately, it should be noted that the measuring accuracy may be reduced.

- Recalibrate the flow sensor as soon as possible.

If the cable of the flow sensor is temporarily disconnected, it is not necessary to calibrate the sensor again.

Replacing the insert of the flow sensor

This must be done if the following message is displayed:

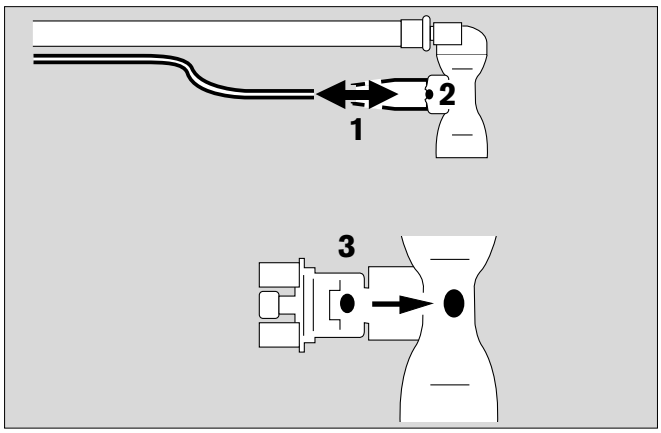
Flow sensor inop
Meas switched off

1 Disconnect the plug from the flow sensor.

2 Press the buttons on both sides and simultaneously pull the insert out of the Y-piece.

3 Align the two marks and slide the new insert into the Y-piece until it locks into position.

1 Connect the plug to the insert again, ensuring that the bar in the insert engages with the slot in the plug.



- Calibrate the flow sensor (page 26).

Checking the ventilator

The entire check must be executed each time before the ventilator is used.
Items 3 to 7 must be checked each time the hose system is replaced.

A copy of this checklist should be available next to the ventilator.

- Tick off the items in this checklist next to the ventilator with a pencil and then sign it and enter the date.

Dräger Babylog 8000 plus 5.n Serial No. _____	**Checklist for Babylog 8000 plus 5.n** Knowledge of the Instructions for Use is essential. Delete inapplicable items, write in any additional features.	Date_____ _____ Signature

Inspection before each use

What	How	Check
1 Gas supply	Screw the medical air and oxygen hoses into the rear of the unit, insert the plug.	Hose screwed in tightly, plug connected.
2 Breathing system	Expiration valve Hoses Water traps	Securely seated Complete Vertical position at lowest point
	Flow sensor plug	Plugged in
	Connect a test lung with tracheal tube CH 12, internal diameter 2.5, and connector to the Y-piece.	
3 Leak test	Switch on the Babylog 8000 plus.	Display **Calibrate flow sensor!**
	Press the key »**OK**«, Select ventilation mode **CPAP**: Press the keys »**Vent. Mode**«, »**CPAP**« and »**On**«. Turn rotary knob »**Pinsp**« to 80, »**Insp. Flow V̇**« to 2, Press the key »**OK**«, Press and hold the key »**man. Insp.**« :	Bargraph display: (**80** ±2) mbar
4 Functional test **Flow calibration**	Calibrate the flow sensor.	Display **Flow sensor calibrated**
Airway pressure	Set lower MV alarm limit to 0 L/min and upper MV alarm limit to 15 l/min. Select ventilation mode **IPPV** by setting the following buttons: »**Pinsp.**« to 20, »**Insp. Flow V̇**« to 10, »**TI**« to 0,4, »**TE**« to 0,6, »**PEEP/CPAP**« to 0, then »**PEEP/CPAP**« to 10, Press the key »**OK**«.	Ventilation according to the selected inspiration and expiration times. Bargraph display: insp. (**20** ±4) mbar exsp. (**0** ±2) mbar exsp. (**10** ±2) mbar

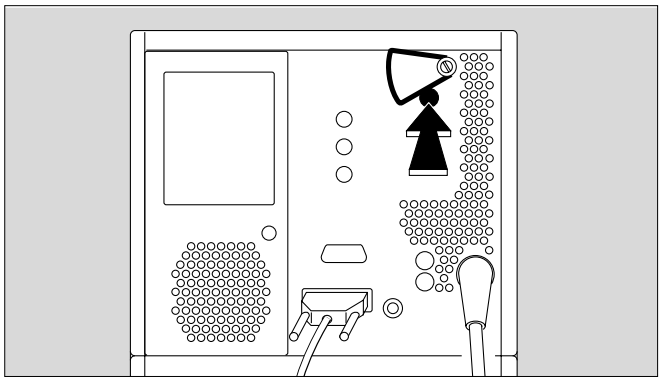
What	How	Check
5 Apnoea monitor	Select ventilation mode CPAP.	**Apnoea** and audible alarm Display (after max. 30 seconds)
6 Minute volume	Select ventilation mode **IPPV / IMV** and set the lower MV alarm limit to 1 L/min. Reset lower and upper MV alarm limits to the specified values.	**MV low** and audible alarm Display (after max. 30 seconds)
7 Airway pressure	Kink the expiratory ventilation hose to block it.	Display: **Airway pressure high** or **Hose kinked?** and audible alarm Ventilation is interrupted and the airway pressure drops below 5 mbar (bargraph display). After about 5 seconds, ventilation is resumed and then immediately interrupted again. This cycle is repeated.
	Release the expiratory ventilation hose again and disconnect the connector from the Y-piece.	Display after max. 15 seconds: **Airway pressure low** or **Leak in hose system?** **Check setting!** and audible alarm. Bargraph display: ≤4 mbar
	Set the rotary knob »**PEEP/CPAP**« back to 0 and connect the Y-piece again.	

Operation

Contents

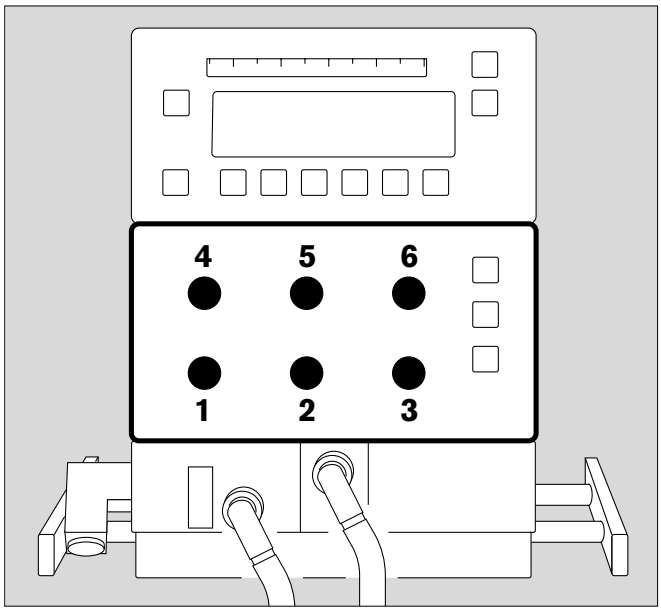
Putting into service

- Switch on the ventilator by pressing the mains switch on the rear until it locks in position.
- Calibrate the flow sensor (page 25).



- Before connecting, set the following rotary knobs specifically for each patient:

1 **»Insp. Flow $\dot{V}$ «**
2 **»P_{insp}«**
3 **»PEEP«**
4 **»O_2-Vol%«**
5 **»TI«**
6 **»TE«**



- Connect to the patient.
- Estimate the necessary tidal volume VT.
  Recommendation:
  about 5 to 6 mL/kg body weight.

Regular actions

- Top up the breathing gas humidifier with distilled water.
- Empty the water traps in the ventilation hoses, observing the hospital's hygiene regulations.

Overview of the Ventilation Modes

The Babylog 8000 plus can operate in five different ventilation modes, which can also be modified by activating additional functions.

Ventilation modes

IPPV/IMV **I**ntermittent **P**ositive **P**ressure **V**entilation/ **I**ntermittent **M**andatory **V**entilation
Controlled ventilation according to a predetermined pattern and frequency, regardless of the patient's spontaneous breathing.

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

SIPPV **S**ynchronised **I**ntermittent **P**ositive **P**ressure **V**entilation
Controlled ventilation with a predetermined pattern or predetermined tidal volume, synchronised with each spontaneous breath by the patient.

SIMV **S**ynchronised **I**ntermittent **M**andatory **V**entilation
Controlled ventilation with a predetermined pattern or predetermined tidal volume and frequency, synchronised with the patient's spontaneous breathing. The patient breathes spontaneously between the synchronised ventilation strokes.

PSV **P**ressure **S**upport **V**entilation
Synchronised ventilation with a predetermined inspiration pressure or predetermined tidal volume. The patient determines the duration of the inspiration and the ventilation frequency.

Additional functions

VG **V**olume **G**uarantee
Volume-controlled ventilation. The unit automatically regulates the inspiration pressure in order to achieve the predetermined tidal volume.
This can be combined with SIPPV, SIMV and PSV.

HFV **H**igh-**F**requency **V**entilation
High-frequency ventilation for patients weighing up to about 2 kg. This can be combined with IPPV/IMV or CPAP.

VIVE **V**ariable **I**nspiratory and **V**ariable **E**xpiratory Flow
Variable Inspiratory Variable Expiratory flow
Separately adjustable continuous flow during the expiration phase of the mandatory ventilation. This cannot be combined with HFV.

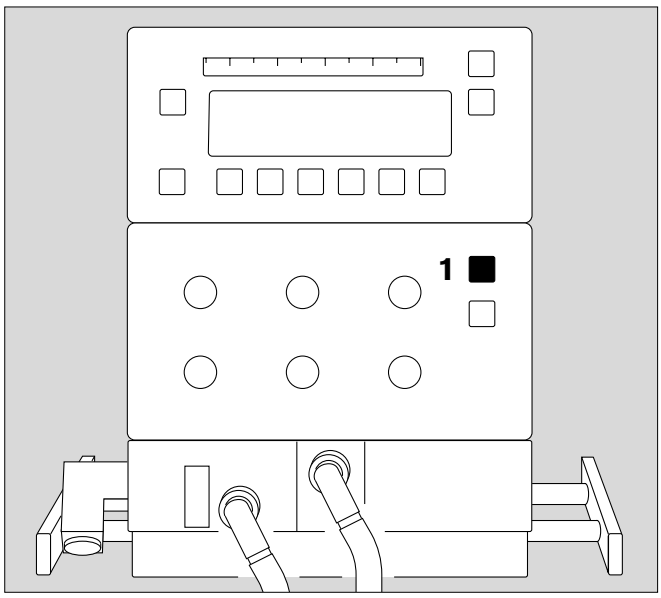
The following table shows the possible combinations of ventilation modes and additional functions:

	IPPV/IMV	SIPPV	SIMV	PSV	CPAP
VG		●	●	●	
HFV	●				●
VIVE	●	●	●	●	●

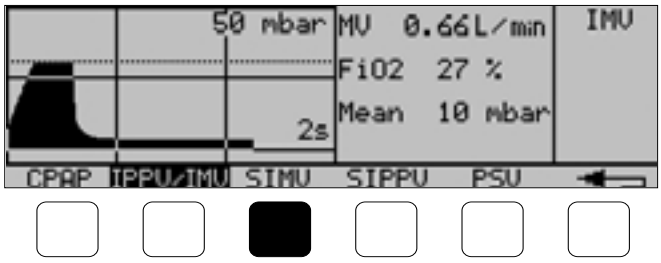
Selecting the Ventilation Mode and Additional Functions

Example: switching from IPPV/IMV to SIMV with volume guarantee VG.

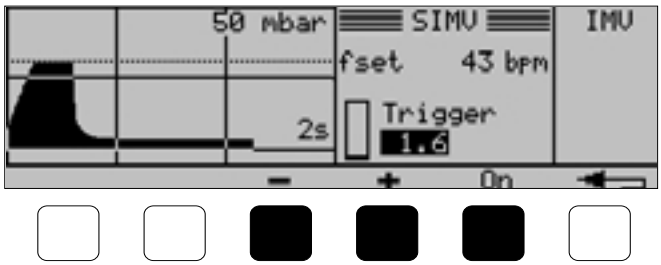
1 Press the key »**Vent. Mode**«.



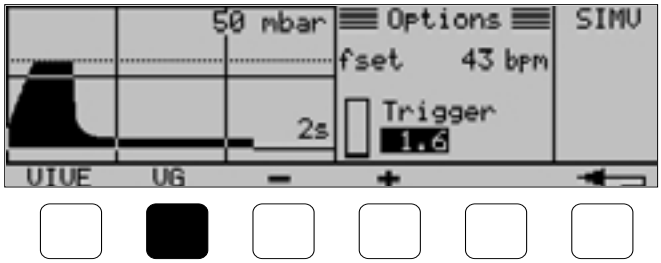
- Press the key »**SIMV**«
  For the time being, the Babylog 8000 plus continues to run in IPPV/IMV mode.



- The trigger volume can be adjusted with the keys » ✚ « or » ━ «.
- Press the key »**On**«.
  The Babylog 8000 plus now switches to SIMV mode.

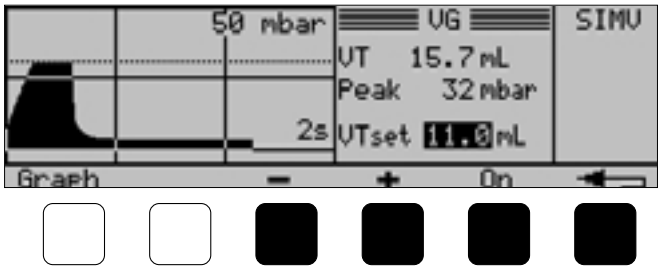


- Press the key »**VG**«.



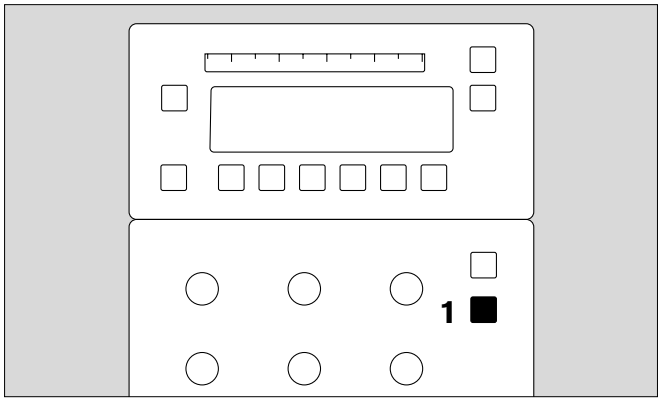
- Set the desired tidal volume VT with the keys » ✚ « or » ━ «.
- Press the key »**On**«.

  The Babylog 8000 plus now operates in SIMV mode with volume guarantee.



  Exit from the menu:

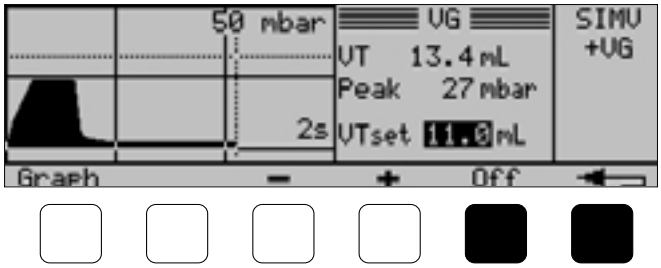
- Press the key» ⬅ «.



  Switching off the additional function VG:

1 Press the key »**Vent. Option**«.

- Press the key »**VG**« and »**Off**«.



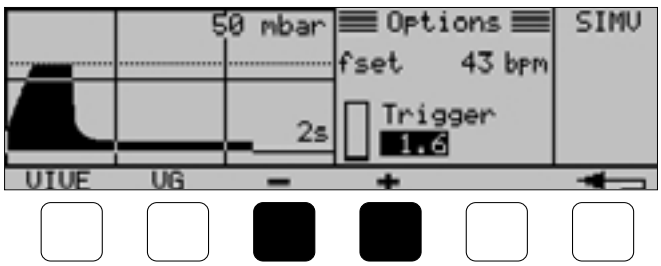
  Exit from the menu:

- Press the key » ⬅ «.

Adjusting the trigger volume (trigger sensitivity)

The trigger volume is the volume of gas the patient must breathe in to trigger a ventilation stroke. It is set in the menu for the ventilation mode or in the menu as an additional function.

Example: setting in the menu for SIMV

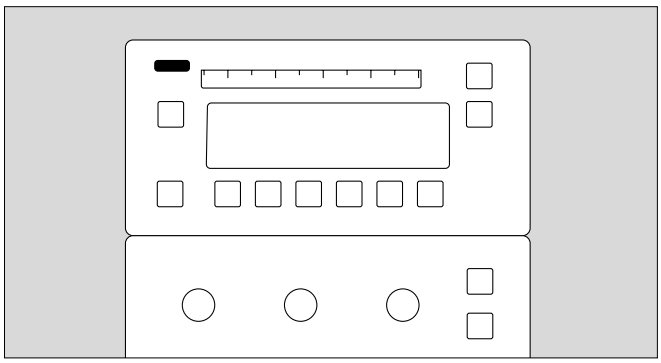


- Press the key » ✚ « for a larger trigger volume (= lower sensitivity).
- Press the key » ━ « for a smaller trigger volume (= higher sensitivity).

  Recommendation:
  Start with a low trigger volume
  (= higher sensitivity).

  If self-triggering occurs, increase the trigger volume. Adjustment range: 1 to 10, corresponding to about 0.02 to 3 mL.

  A larger trigger volume delays the ventilation stroke.



- **Trigger** is displayed each time a ventilation stroke is triggered.

IPPV / IMV

Intermittent **P**ositive **P**ressure **V**entilation
Intermittent **M**andatory **V**entilation

Time-controlled, pressure-limited ventilation with a predetermined pattern for patients without spontaneous breathing – with or without pressure plateau.

Switching on IPPV/IMV

- Press the keys »**Vent. Mode**«, »**IPPV/IMV**«, »**On**«.

IPPV/IMV can be combined with:

– high-frequency ventilation HFV (page 46)

– separate expiration flow VIVE (page 48).

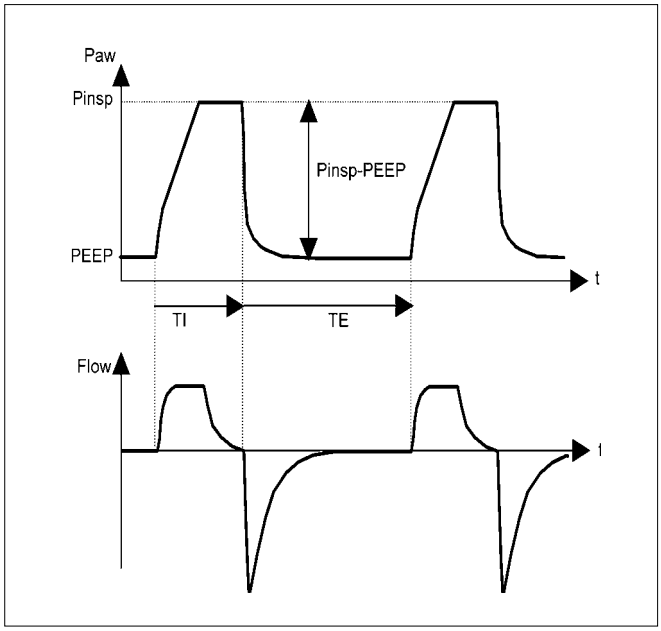
Ventilating with pressure plateau

The inspiration pressure is limited to Pinsp. If the plateau is so long that the flow drops to zero towards the end of the inspiration time, the tidal volume VT is proportional to the ventilation pressure.

VT = (Pinsp – PEEP) · C

C = compliance of the patient's respiratory system.

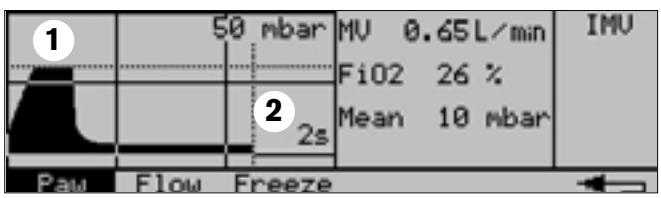
The tidal volume VT is controlled via the pressure difference PInsp - PEEP.
Limiting the pressure to PInsp prevents damaging pressures if, for example, the compliance becomes lower.
The pressure plateau promotes the diffusion of the breathing gas in the lungs.



Setting the pressure curve:

- Press the keys »**Graph**« and »**Paw**«

Display (example):



1 The current setting of the pressure limit PInsp.

2 The end of the currently set inspiration time TE.

Exit from the menu:

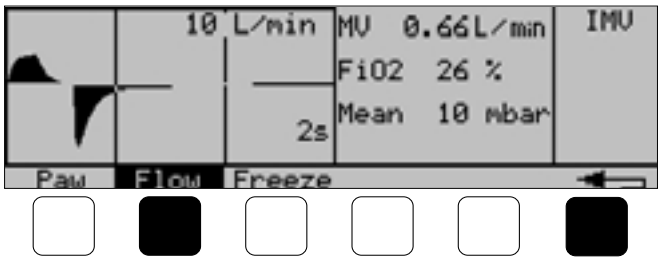
- Press the key » ⏎ «.

Displaying the flow curve:

- Press the keys »**Graph**« and »**Flow**«.

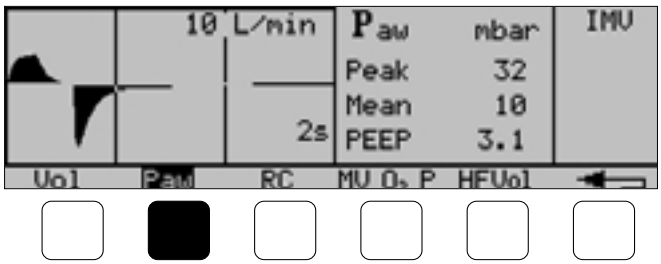
Exit from the menu:

- Press the key » ⇦ «.



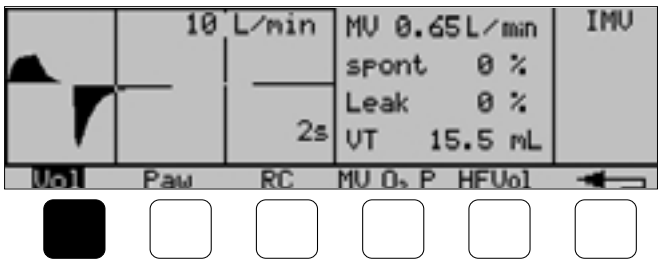
Displaying the measured pressure values:

- Press the keys »**Meas**« and »**Pressure**«.
- Use the rotary knobs »**Pinsp**«, »**PEEP**«, »**TI**«, »**TE**« and »**V̇ insp**« to set the desired ventilation pattern.



Displaying the measured volume values:

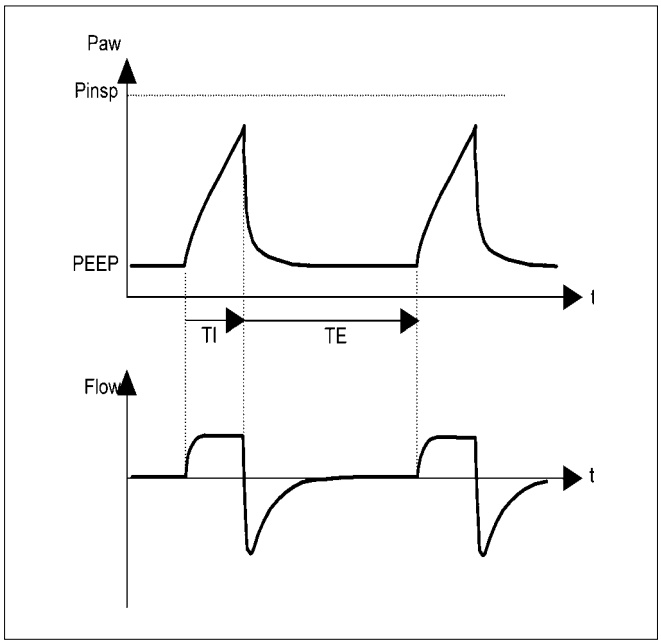
- Press the key »**Vol**«.
- Adjust the rotary knobs »**Pinsp**« and »**PEEP**« so that the desired tidal volume VT is applied.



Setting the Alarm Limits: see page 49.

Ventilation without a pressure plateau

This is equivalent to volume-controlled ventilation. The peak pressure is determined by the settings for TI and V̇ .



The tidal volume VT is approximately:

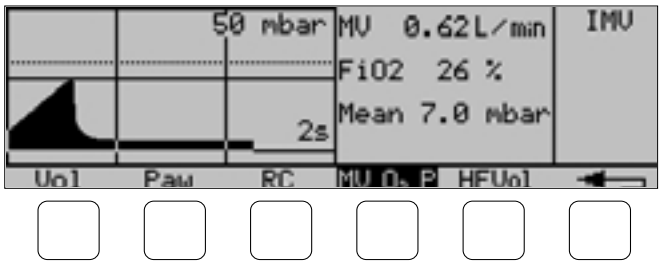
$$VT = TI \cdot \dot{V}\,insp \cdot \frac{C}{C + Cs}$$

TI = inspiration time
V̇ insp = continuous flow
C = compliance of the patient's respiratory system
Cs = compliance of the hose system

The tidal volume VT is controlled with the aid of the flow and the inspiration time.

Displaying the pressure curve:

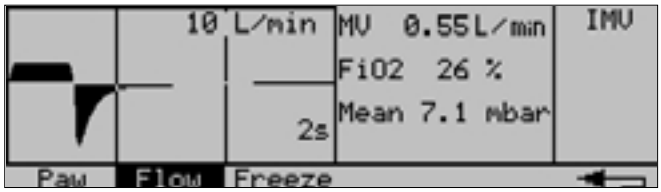
- Press the keys »**Graph**« and »**Paw**«.
- Press the key » ⇐ «.



- Use the rotary knobs »**PEEP**«, »**TI**«, »**TE**« and »**V̊ insp**« to set the desired ventilation pattern.

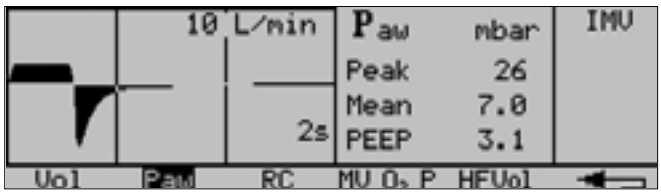
Displaying the flow curve:

- Press the keys »**Graph**« and »**Flow**«.
- Press the key » ⇐ «.



Displaying the measured pressure values:

- Press the keys »**Meas**« and »**Paw**«.

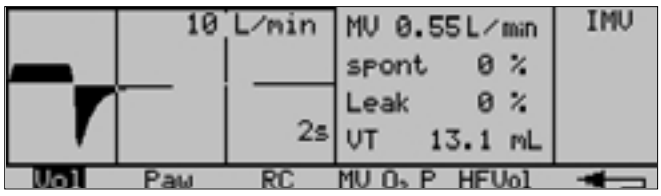


Displaying the measured volume values:

- Press the keys »**Meas**« and »**Vol**«.

Exit from the menu:

- Press the key » ⇐ «.



- Adjust the rotary knobs »**V̊ insp**« and »**TI**« so that the desired tidal volume VT is applied.
- Adjust the rotary knob »**Pinsp**« to the value which is not to be exceeded.

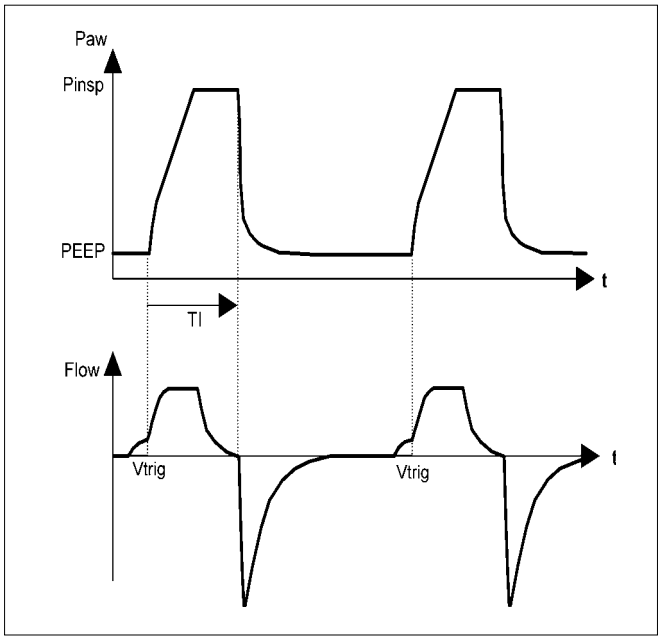
- Setting the Alarm Limits: see page 49.

SIPPV

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

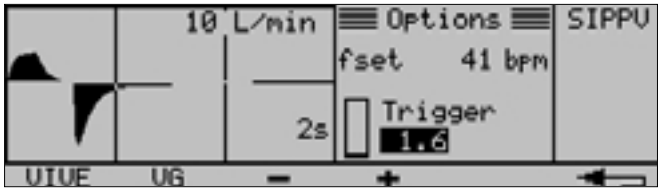
Ventilation with a predetermined pattern, synchronised with the patient's spontaneous breathing. The patient determines the ventilation frequency.

If the patient suffers apnoea, ventilation is executed at the frequency determined by TI and TE.



- Press the keys »**Vent. Mode**«, »**SIPPV**« and »**On**«.

Combining SIPPV with VG: see page 44.
Combining SIPPV with VIVE: see page 48.



- Adjust the rotary knobs »**Pinsp**«, »**PEEP**«, »**TI**« and »**V̇ insp**« to obtain the desired ventilation pattern – with or without a plateau, as for IPPV/IMV.
- Setting the trigger volume: see page 35.
- Adjust the inspiration time »**TI**« to match the patient´s spontaneous breathing.
- Set the frequency of the background ventilation with »**TE**«.
- If self-triggering occurs, increase the trigger volume.
- Setting the Alarm Limits: see page 49.

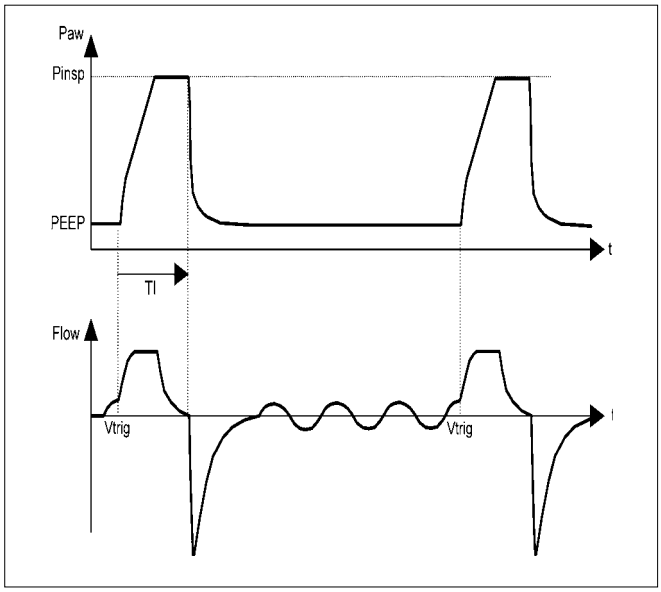
SIMV

Synchronized **I**ntermittent **M**andatory **V**entilation

Ventilation with a predetermined pattern or predetermined frequency, synchronised with the patient's spontaneous breathing. The patient can breathe spontaneously between the synchronised ventilation strokes, but does not receive pressure support.

This mode is useful for weaning the patient from ventilation.

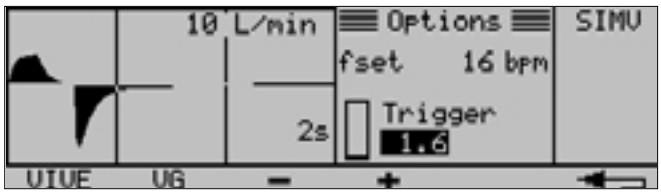
If the patient suffers apnoea, ventilation is executed at the frequency determined by TI and TE.



- Press the keys »**Vent. Mode**«, »**SIMV**« and »**On**«

SIMV combined with:

– Combining SIMV with volume guarantee VG: see page 44.
– Combining SIMV with separate expiratory flow VIVE: see page 48.



- Adjust the rotary knobs »**Pinsp**«, »**PEEP**«, »**TI**«, »**TE**« and »**V̇ insp**« to obtain the desired ventilation pattern – with or without a plateau, as for IPPV/IMV and the frequency.

- Adjusting the trigger volume: see page 35.

- Adjust the inspiration time »**TI**« to match the patient's spontaneous breathing.
- If self-triggering occurs, increase the trigger volume.
- Setting the alarm limits: see page 49.

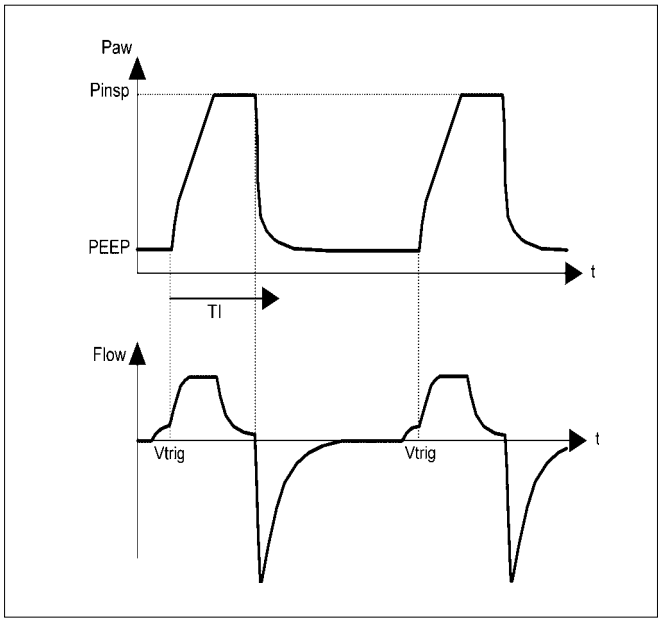
PSV

Pressure **S**upport **V**entilation

Pressure-supported ventilation synchronised with the patient's own breathing. The patient determines the duration of the inspiration and the ventilation frequency.
The ventilation stroke is terminated when the inspiratory flow drops to about 15 % of the peak flow or, at the latest, after TI.

This mode is intended for spontaneously breathing patients with sufficient regulation of their breathing who are to be supported with an adjustable inspiratory pressure. Particularly suitable for weaning the patient from ventilation.

If the patient suffers apnoea, ventilation is executed at the frequency determined by TI and TE.

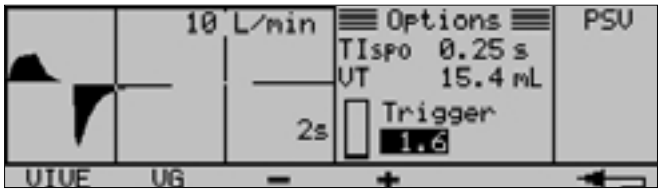


- Press the keys »**Vent. Mode**«, »**PSV**« and »**On**«.

Combining SIMV with:

– separate expiratory flow VIVE: see page 48.
– Combining SIMV with volume guarantee VG: see page 44.

- Adjust the rotary rotary knobs »**Pinsp**«, »**PEEP**« and »**V̇ insp**« to obtain the desired ventilation pattern.
  – Ventilate only with a plateau!



The actual inspiration time and the tidal volume are displayed.

- Adjust **TI** for the maximum permissible inspiration time.
- Adjust the frequency of the background ventilation with **TE** .
- Adjusting the trigger volume: see page 35.
- If self-triggering occurs, increase the trigger volume.
- Setting the alarm limits: see page 49.
- Use PSV only at a leakage rate of up to about 40 %.

CPAP

Continuous **P**ositive **A**irway **P**ressure

The Babylog 8000 plus applies a continuous flow and adjusts the airway pressure to the PEEP/CPAP level.

- Press the keys »**Vent. Mode**«, »**CPAP**« and »**On**«.

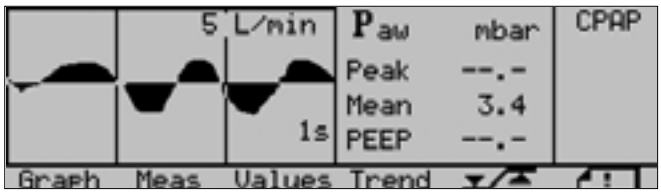
Combining CPAP with

– separate expiratory flow VIVE: see page 48.
– Combining CPAP with high-frequency ventilation HFV: see page 45.

- Adjust the CPAP level with the rotary knob PEEP/CPAP.
  Adjust the flow V̇ insp to meet the patient's requirements.

Displaying the flow curve:

- Press the keys »**Graph**« and »**Flow**«.



Exit from the menu:

- Press the key » ⇐ «.

Displaying the measured pressure values:

- Press the keys »**Meas**« and »**Paw**«.

Exit from the menu:

- Press the key » ⇐ «.

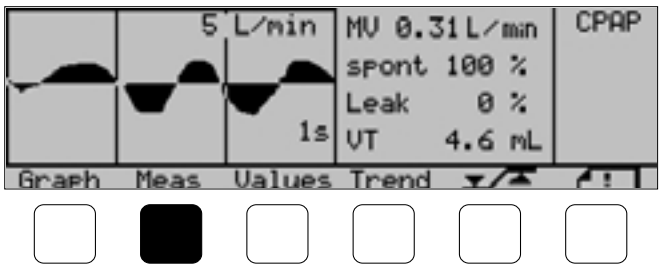
The mean pressure "Mean" should be the same as the selected PEEP/CPAP value.

The peak and PEEP values are not displayed in ventilation mode CPAP.

- Set the rotary knob Pinsp to a value about 5 mbar above the PEEP/CPAP value.

Displaying the measured volume values:

- Press the keys »**Meas**« and »**Vol**«.



Exit from the menu:

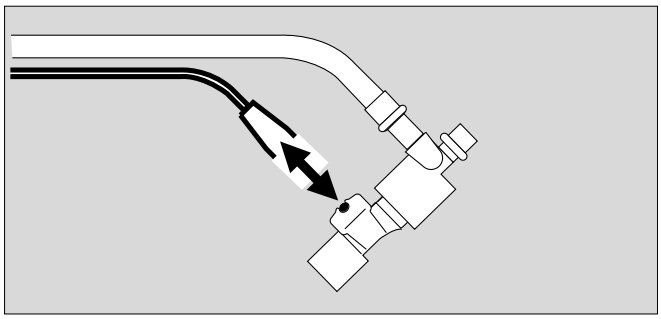
- Press the key » ⇐ «.

- Check the spontaneously breathed volumes.

Setting the alarm limits: see page 49.

CPAP with nasopharyngeal tube

Due to the leakage from the patient's mouth, it is not possible to monitor the minute volume or to check for apnoea. Therefore either switch off flow measurement:



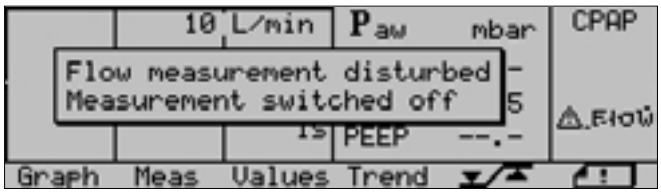
- Remove plug from Y-piece.

  or

- Set lower MV alarm limit to 0 and set apnoea time to OFF (see under "Set alarm limits").

  No monitoring of the lower minute volume and no apnoea alarm activation.

- Display:



- Press the key »**OK**«. Flow measurement is now switched off.

  Note that the minute volume is no longer monitored and there is no apnoea alarm!

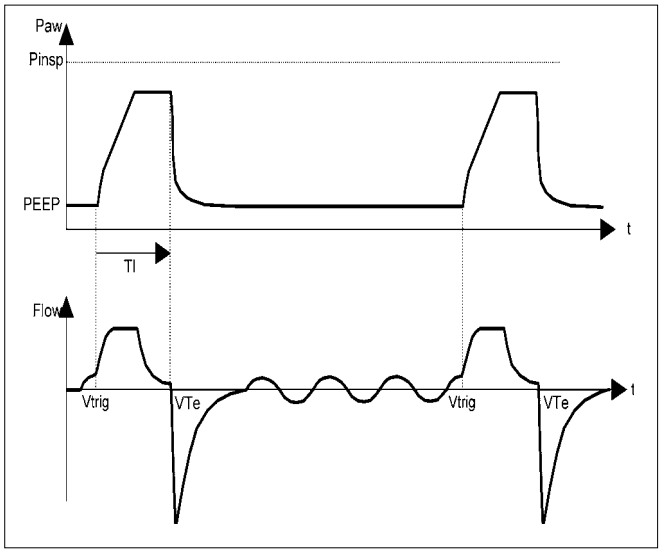
Volume guarantee VG (optional)

This can be combined with the ventilation modes SIPPV, SIMV and PSV.

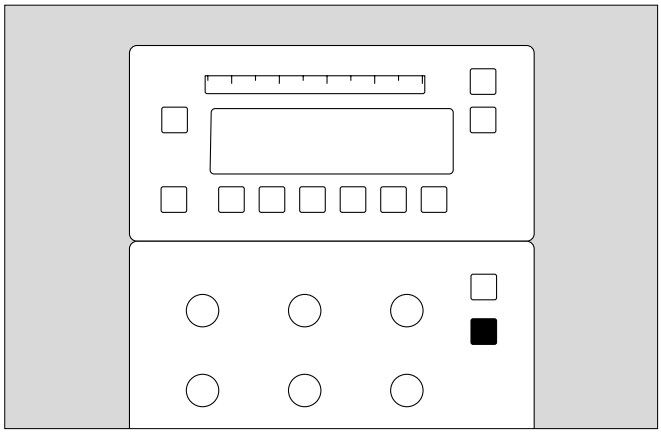
The inspiratory plateau pressure is automatically regulated between Pinsp and PEEP such that the set tidal volume VTSET is applied.

VG requires a ventilation mode with a plateau.

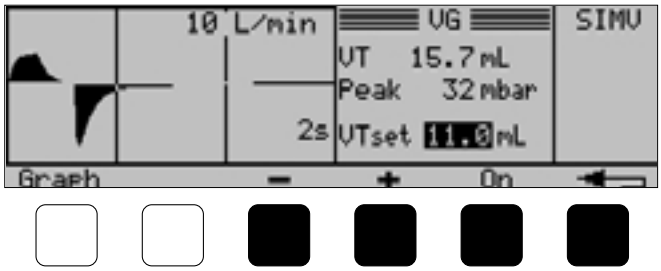
This function is used for patients who are to be ventilated with a constant tidal volume.



- Press the key »**Vent. Option**«.



- Press the key »**VG**« and set the desired tidal volume VTSET with the keys » ✚ « and » ━ « .
- Press the key »**On**«.
  The tidal volume and the peak pressure of the regulated ventilation stroke are displayed.



- Adjust the rotary knobs »**TI**«, »**TE**«, »**PEEP**« and »**V̇ insp**« to obtain a ventilation pattern. with a plateau.
- Adjust the rotary knob »**Pinsp**« to the maximum permissible value which is not to be exceeded.

Exit from the menu:

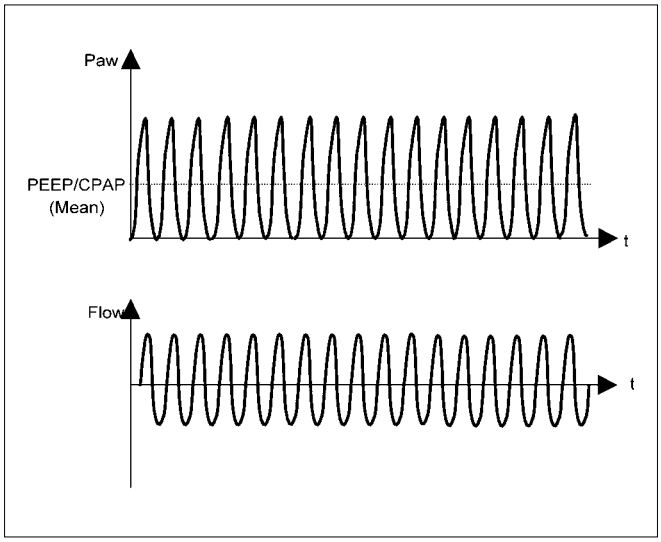
- Press the key » ⏎ «.

High-frequency ventilation HFV (optional)

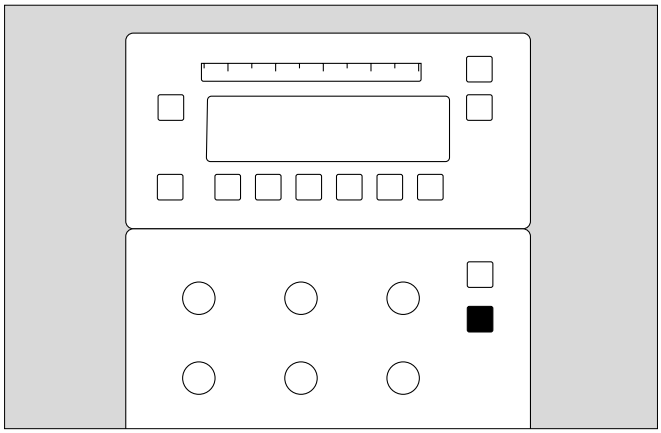
High-frequency ventilation around the PEEP/CPAP level, which acts as the mean pressure. The high-frequency pulses are superimposed at the selected frequency around the mean pressure.

Suitable for patients with a body weight of up to about 2 kg,

for ventilating with reduced stress on the lungs.

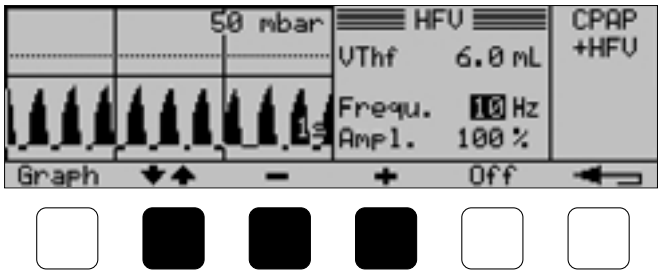


- Press the keys »**Vent. Mode**«, »**CPAP**« and »**On**«.
- Press the key »**Vent. Option**«.



- Press the key »**HFV**« and
- move the cursor to the line **Frequ.** with the key »✚ ▲« .
- Adjust the frequency of the HF oscillations with the keys »✚ « and »▬ «.
- Move the cursor to the line **Ampl.** with the key »✚ ▲ «.
- Adjust the amplitude with the keys » ✚ « and » ▬ «.
- Press the key »**On**«.
- Adjust the mean airway pressure with the rotary knob »**PEEP/CPAP**«.
  This must be at least 3 mbar.

  Observe the tidal volume VThf and/or the diffusion coefficient DCO2 and, if necessary, correct the amplitude and frequency.



High-frequency ventilation with IMV

This is a combination of high-frequency ventilation and intermittent expansion strokes.

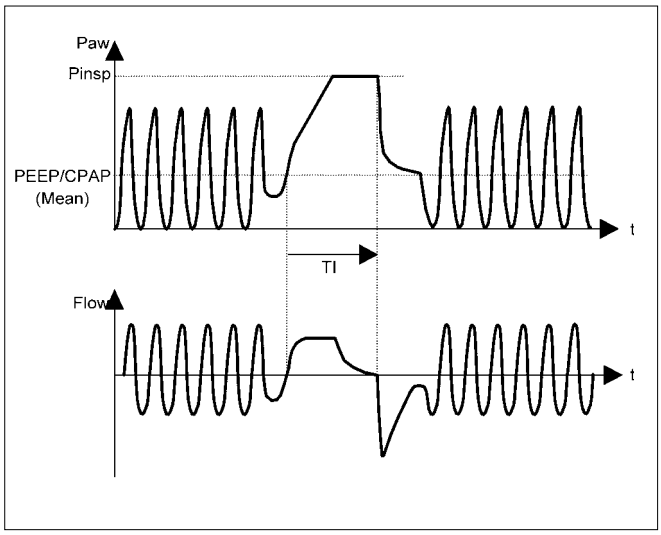
During the HF oscillations, the mean pressure is that set for PEEP/CPAP.

The high-frequency pulses are superimposed at the selected frequency over the mean pressure.

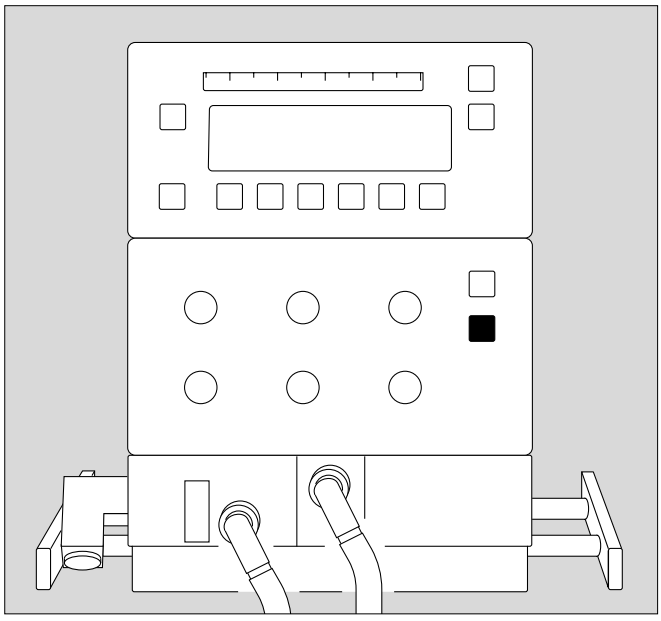
This function is used for flushing the dead space volume,

for ventilating with reduced pressure stress on the lungs,

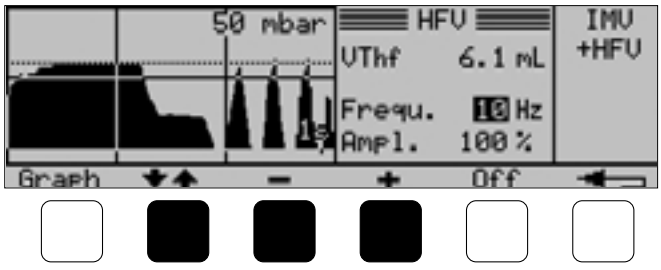
for patients with a body weight of up to about 2 kg.



- Press the keys »**Vent. Mode**«, »**IPPV/IMV**« and »**On**«.



- Press the key »**HFV**«and
- move the cursor to the line **Frequ.** with the key »✚✚«.
- Adjust the frequency of the HF oscillations with the keys » ✚ « and » ━ « .
- Move the cursor to the line **Ampl.** with the key »✚✚«.
- Adjust the amplitude with the keys » ✚ « and » ━ «.
- Press the key »**On**«.



- Adjust the mean airway pressure with the rotary knob »**PEEP/CPAP**«. This must be at least 3 mbar.
- Adjust the duration and frequency of the IMV strokes with the rotary knobs »**TI**« and »**TE**«.
- Adjust the pressure limiting for the IMV strokes with the rotary knob »**Pinsp**«.
- Observe the tidal volume VThf and/or the diffusion coefficient DCO_2 and, if necessary, correct the amplitude and frequency.

Separating expiratory flow VIVE

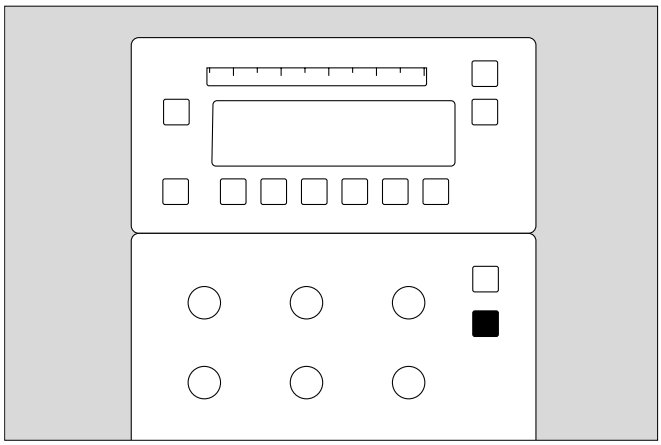
VIVE (Variable Inspiratory and Variable Expiratory Flow)
The continuous expiratory flow V̇ exp can be adjusted independently of the continuous inspiratory flow V insp. The inspiratory flow is effective during ventilation strokes, while the expiratory flow is effective during spontaneous breathing phases.

An increased expiratory flow V̇ exp can be used in order to

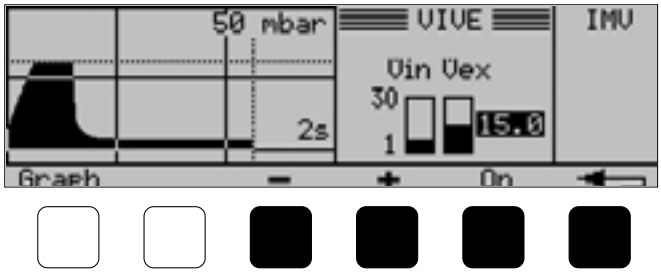
– provide the patient with a higher flow for spontaneous breathing than that used for the ventilation strokes;
– promote flushing of the dead space volume in the Y-piece by means of increasing turbulence in the hose system;
– permit separate adjustment of the pattern of manually initiated ventilation strokes in CPAP mode.

A reduced expiratory flow V̇ exp can be used in order to save oxygen and thus reduce costs.

- Press the key »**Vent. Option**«.

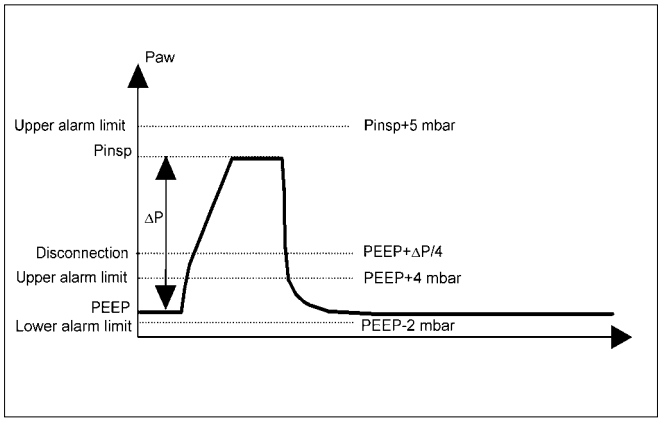


- Press the key »**VIVE**« and adjust the expiratory flow with the keys » ✚ « and » ▬ «.
- Press the keys »**On**« and » ⏎ «



Setting alarm limits

The alarm limits for monitoring of the following parameters are set automatically:



Airway pressure

Upper alarm limit for ventilation strokes:	Pinsp + 5 mbar
Upper alarm limit for expiration or CPAP:	PEEP/CPAP + 4 mbar
Lower alarm limit:	PEEP/CPAP – 2 mbar
Alarm limit for disconnection:	$\frac{\text{Pinsp} - \text{PEEP}}{4} + \text{PEEP}$

O_2 concentration

Upper alarm limit:	»**O2-Vol.%**« + 4 Vol.%
Lower alarm limit:	»**O2-Vol.%**« – 4 Vol.%

For a description of the alarm criteria, see "Technical Data" on page 106.

Manual adjustment
is used for the alarm limits for minute volume MV, apnoea and breathing frequency:

Lower alarm limit MV ⧗:	from 0 to upper alarm limit
Upper alarm limit MV ⧗:	from lower alarm limit to 15 L/min
»**Alarm delay**« time: (delays the alarms "MV low" and "VT low")	0 to 30 seconds
Apnoea time:	5 to 20 seconds. Over 20 seconds = OFF. When ventilating very small patients, the apnoea monitoring can be switched off in order to avoid false alarms. **In this case, a separate apnoea monitoring device must be used!**
»**Panting**« frequency:	20 to 200 bpm. Less than 20 bpm = OFF.

In the monitoring menu, press the key » ▼/▲ «.

- Display (example):

- Select the desired alarm parameter with the key » ▼▲ «.
- Adjust to the desired value with the keys » + « and » − «.
  Repeated short depressions of the keys adjust the value in single steps.
  Pressing and holding the key adjusts the value rapidly.

Recommendation for adjustment of the MV alarm limits
Once the measured value for the minute volume has stabilised:

- press the key »±**30%**«. The lower alarm limit now lies 30 % below the actual minute volume and the upper alarm limit lies 30 % above the actual volume, but not higher than 15 L/min.

Exit from the menu:

- Press the key » ↵ «.

Special functions

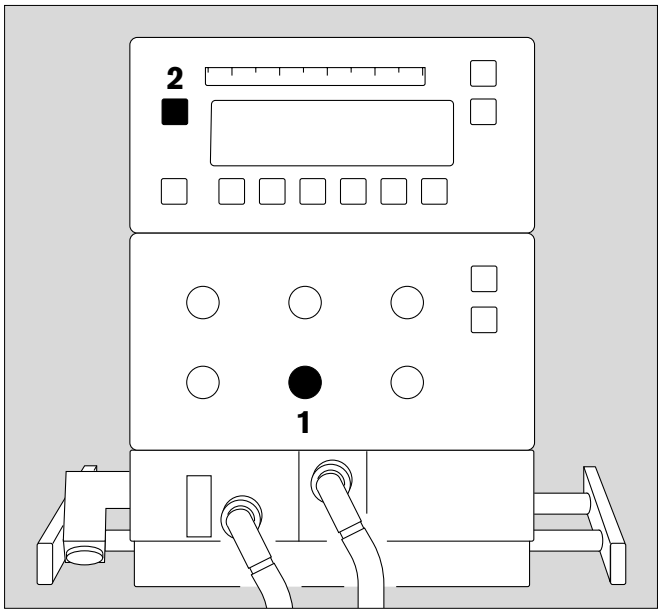
Starting inspiration manually

This function is active in any ventilation mode, regardless of the TI and TE settings.

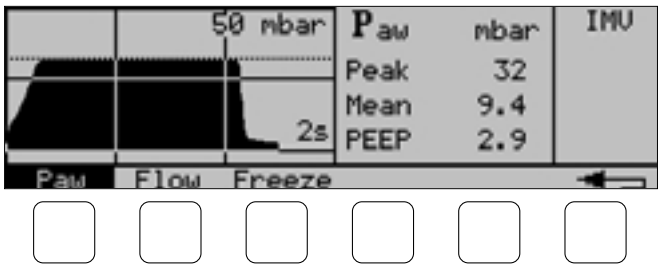
All other parameter settings remain effective.

1 Limit the inspiration pressure with the rotary knob »**Pinsp.**«.

2 Press and hold the key »**man Insp.**« for as long as the inspiration is to last, for example for X-ray examination of the thorax with maximum inspiration.
The inspiration is terminated after a maximum of 5 seconds and a further inspiration is possible only after a waiting period of 5 seconds.



- Display (example):



Nebulizing medicaments (optional)

This is possible in any ventilation mode.

Pre-requisites:

medical-air socket on the rear of the ventilator and modification kit 84 11 025.

Aerosols may block the expiration valve, thus impairing ventilation. For this reason, the expiration valve must be replaced by a clean, sterile one immediately after nebulization.

Aerosols may block the filters, thus impairing ventilation.

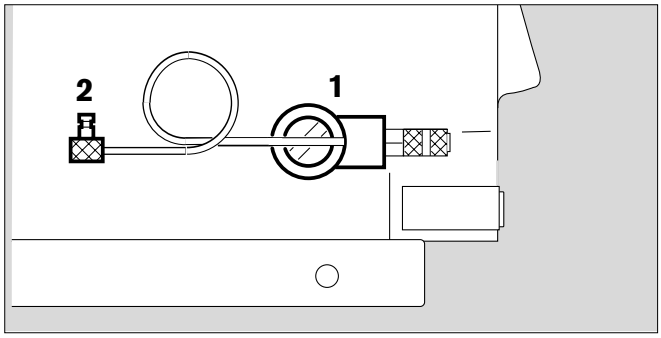
- Do not install microbacterial filters on the outlet side of the nebulizer or in the expiration side.

Preparation

Install the coupling:

1 On the left side of the ventilator, remove the lower securing screw of the case with a coin and secure the coupling under this screw.

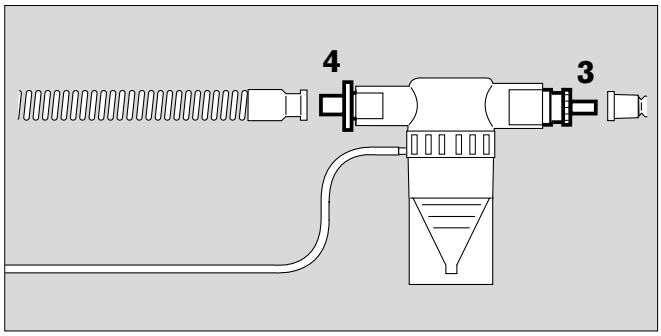
2 Push the plug into the socket on the rear of the ventilator until it locks into position.



- Prepare the nebulizer for use as described in the related Instruction for Use and then

3 insert the nozzle in the outlet and

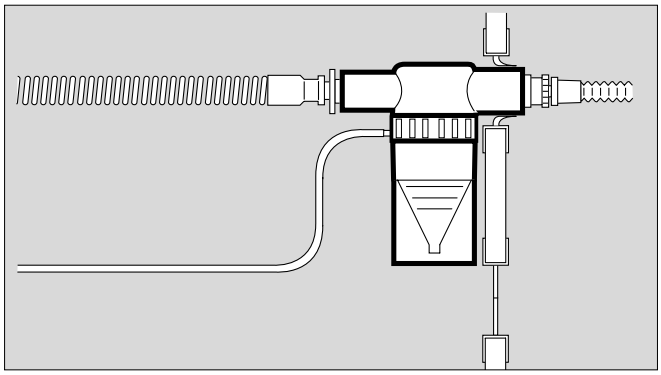
4 insert an 11 mm diameter catheter connector into the inlet.



- Open the inspiration hose and connect the nebulizer between then open ends.

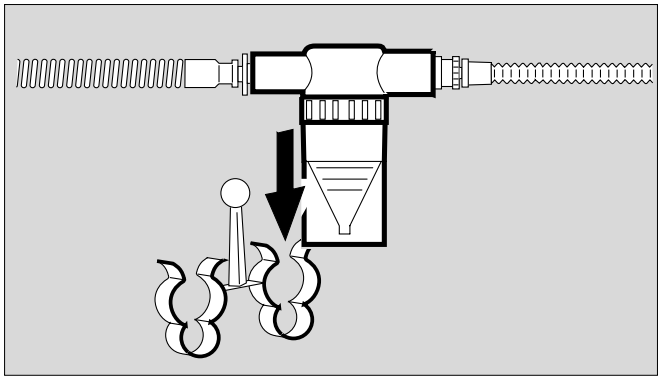
When using with an incubator

- Insert the outlet of the nebulizer in the top hose port of the incubator.



When using without an incubator

- Press the rubber sleeve into the clip on the hinged arm.



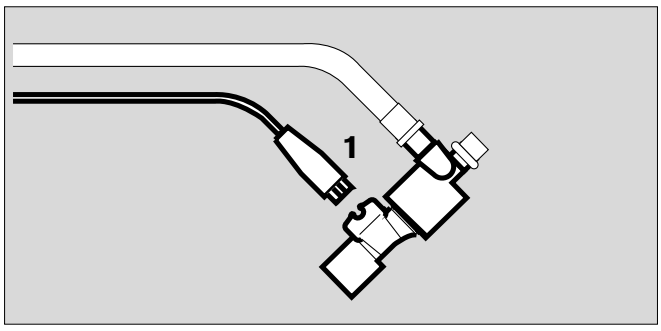
- Adjust the nebulizer to a vertical position and fill it.

Since the flow sensor would be soiled by medicament aerosols,

first:

1 disconnect the plug from the flow sensor and

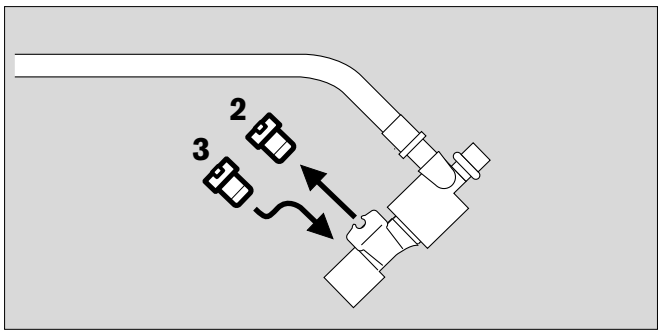
- acknowledge the resulting alarm on the Babylog 8000 plus.



Then:

2 pull out the sensor insert and

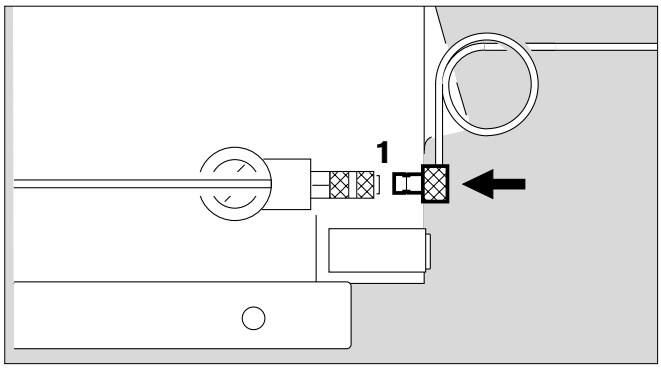
3 fit the sealing plug 84 11 024 (provided in the conversion kit "Medicament nebulizer").



Remember that there is no monitoring of the minute volume and no apnoea alarm when the flow sensor is not fitted!

Starting nebulization

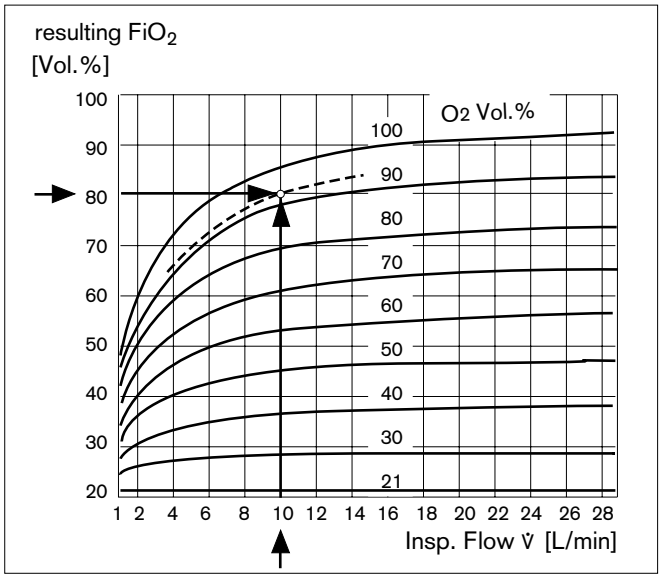
1 Insert the plug of the supply line into the socket and press it in until it locks.



Features of medicament nebulization

The nebulizer nebulizes continuously, but the aerosol generate during expiration does not enter the lungs.

Since the nebulizer is driven by medical air, the oxygen concentration FiO_2 drops and, during nebulization, is not the same as the indicated value.



If FiO_2 must remain constant:

- Increase the oxygen concentration with the rotary knob »**O_2-Vol%**« for the duration of the aerosol application. The necessary setting can be determined from the diagram on the right.

Example:

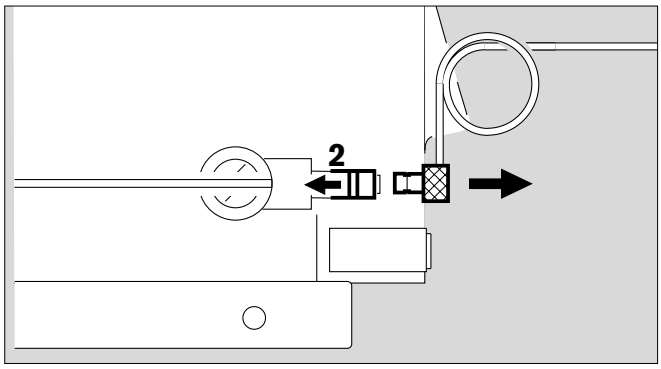
Insp. Flow V̇ = 10 L/min
O_2-Vol.% = 80 Vol.%

during application of the aerosol, set the rotary knob »**O_2-Vol%**« to about 90 vol.%.

Discontinuing nebulization

2 Pull the socket back to release the plug.

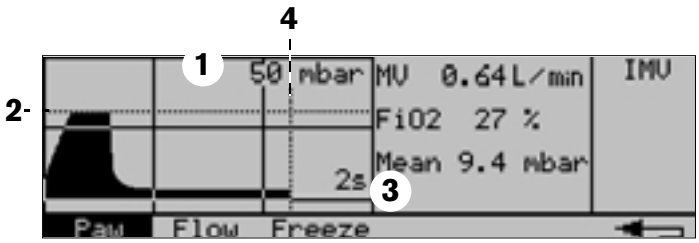
- Empty any remaining medicament from the nebulizer, remove the nebulizer from the ventilator and prepare the nebulizer for re-use as described in the related Instructions for Use.
- Install the insert in the housing of the flow sensor and insert the plug.
- Fit a clean expiration valve (page 17).



Displaying curves and measured values

Airway pressure curve Paw

- In the monitoring menu, press the keys »**Graph**« and »**Paw**«.



Display (example):

1 Pressure axis scale (50 mbar)

2 Pressure limit »Pinsp.«
(dotted horizontal line)

3 Time axis scale (2 s)

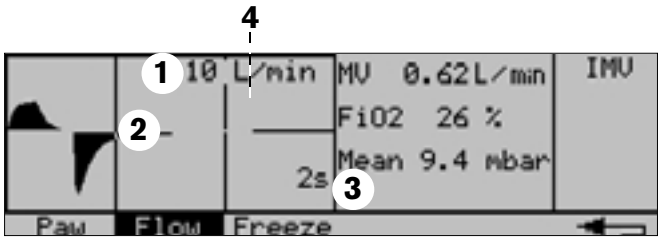
4 End of selected expiration time TE
(dotted vertical line)

Exit from the menu:

- Press the key » ⏎ «.

Displaying the flow curve

- In the monitoring menu, press the keys »**Graph**« and »**Flow**«.



Display (example):

1 Flow axis scale (10 L/min)

2 Zero line

3 Time axis scale (2 s)

4 End of selected expiration time TE
(dotted vertical line)

Exit from the menu:

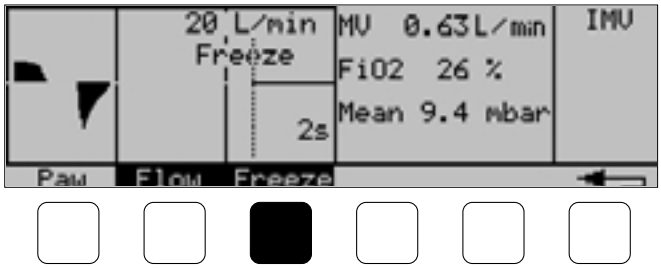
- Press the key » ⏎ «.

Freezing curves

- In the sub-menu »Graph«, press the key »**Stop**«.

Cancelling the freeze function:

- Press the key »**Stop**« again. Continuous monitoring of the curve is resumed.

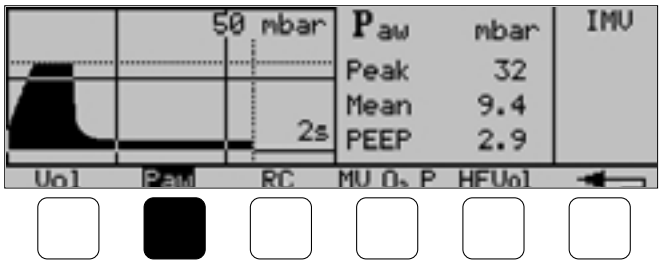


Exit from the menu:

- Press the key » ⇐ «.

Displaying measured pressure values

- In the monitoring menu, press the keys »**Meas**« and »**Paw**«.
- Display (example):



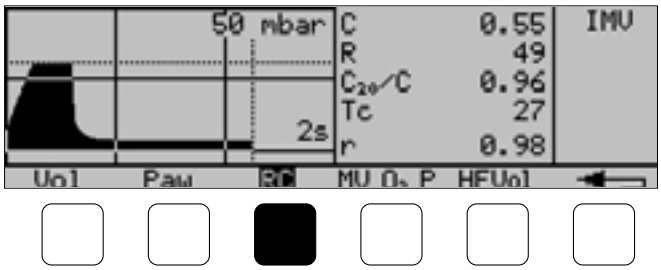
Peak = peak pressure of the preceding breathing cycle
Mean = mean pressure of the preceding breathing cycle
PEEP = final expiratory pressure of the preceding breathing cycle

Exit from the menu:

- Press the key » ⇐ «.

Displaying lung values

The Babylog 8000 plus calculates the resistance and compliance of the patient's lung using linear regression analysis.



- In the monitoring menu, press the keys »**Menu**« and »**RC**«.

  R = resistance of the airway, including the tube

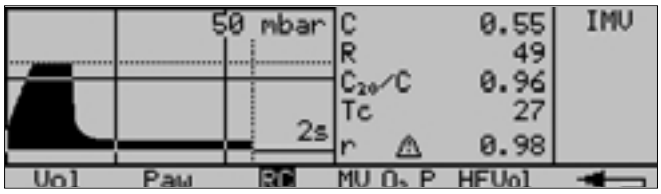
  C = dynamic compliance of the respiratory system

  TC = time constant of the respiratory system in milliseconds

  C20/C = index which indicates overdistension of the lungs:
  C20/C < 0.8: lungs may be overdistended.
  This can only be used with ventilation modes using no plateau (see page 125).

  r = correlation coefficient of the linear regression analysis

  See page 125 for calculation of the parameters.
  After manual inspiration, the display of the ventilation curves is automatically frozen for one minute. The curves and the related measured values can then be assessed together.



  Switching curves: see page 55
  Cancelling the "freeze" function: see page 56

  If the warning symbol is displayed beside the value for r, the measured values may be false due, for example, to a leak.

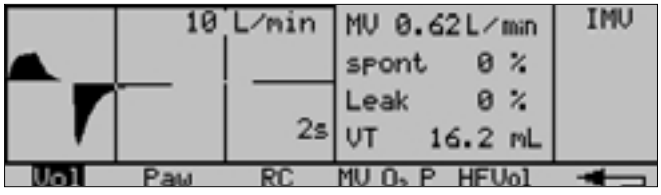
  Exit from the menu:

- Press the key » ⊣▭ «.

Displaying measured volume values

- In the monitoring menu, press the keys »**Meas**« and »**Vol**«.

- Display (example):



  MV = expiratory minute volume

  spont. = spontaneous breathing component of the minute volume (in %)

  Leak = Leak in the tube (see the description in the Appendix, page 123)

  VT = expiratory tidal volume of the preceding breathing cycle

  Exit from the menu:

- Press the key » ⊣▭ «.

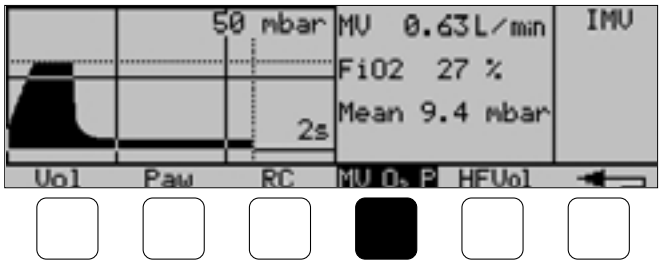
Combinations of measured values

- In the monitoring menu, press the keys »**Meas**« and »**MV O2 P**«.
- Display (example):

  MV = expiratory minute volume

  FiO2 = measured inspiratory oxygen concentration

  Mean = mean value of the airway pressure of the preceding breathing cycle



Exit from the menu:

- Press the key » ⇐ «.

Displaying the measured volume values of high-frequency ventilation (HFV)

- In the monitoring menu, press the keys »**Meas**« and »**HFVol**«.
- Display (example):*

  MVmin = inspiratorially measured minute volume L/min] resulting from mandatory ventilation

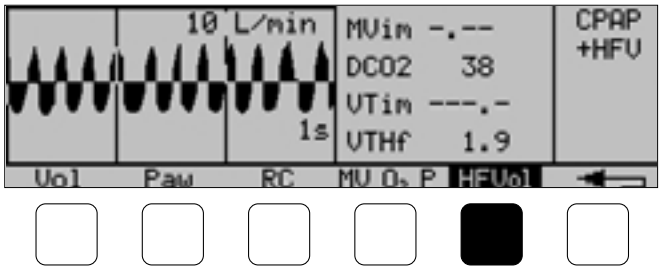
  DCO2 = gas transport coefficient [mL^2/s]

  DCO2 = $VTHf^2 \cdot f$

  f = frequency [Hz] of the high-frequency pulses

  VTim = inspiratorially measured tidal volume [mL] of mandatory ventilation

  VTHf = inspiratorially measured tidal volume [mL] of high-frequency ventilation



Exit from the menu:

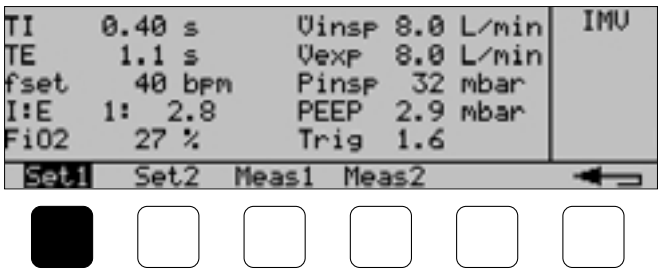
- Press the key » ⇐ «.

* Only if the HFV option is installed
See the Appendix, page 120, for a detailed description of HFV.

Displaying all settings

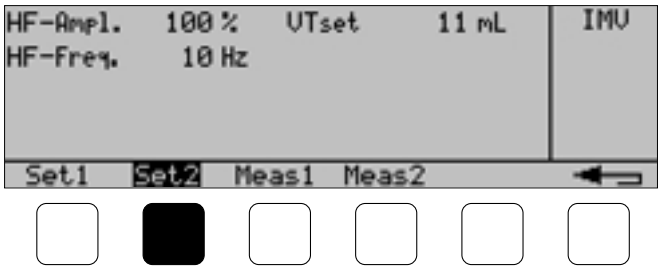
- In the monitoring menu, press the key »**List**«.
  All settings are displayed.

- Display (example):



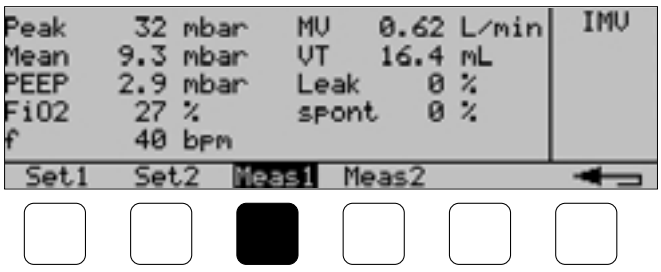
To display further settings:

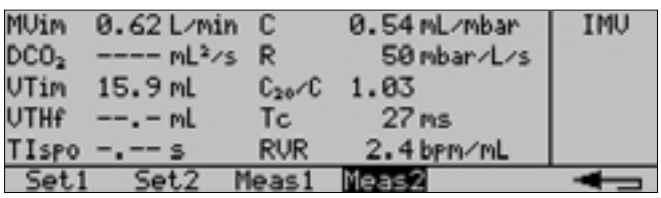
- Press the key »**Set2**«.



Displaying all measured values

- Press the key »**Meas1**« or »**Meas2**«.
  All measured values are displayed in the two windows.
- Display (example):





Exit from the menu:

- Press the key »⇤« .

Displaying trends

The trends of some of the measured values over the preceding 24 hours are stored in the trend memory, namely:

FiO_2	Inspiratory oxygen concentration
Mean	Mean pressure
MV	Minute volume
C	Dynamic compliance
R	Resistance
RVR*	Rate Volume Ratio the ratio breathing rate (frequency) : tidal volume (see page 127)

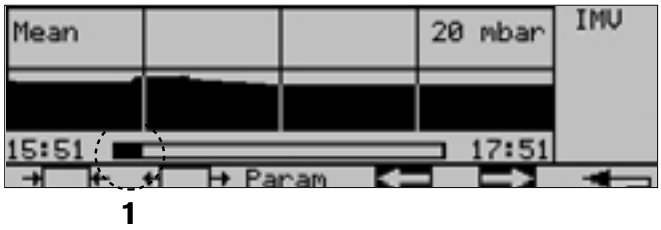
- In the monitoring menu, press the key »**Trend**«.

- Display (example):

  A window containing a section of the contents of the trend memory is displayed. The width of this window and its position within the memory can be adjusted as required.

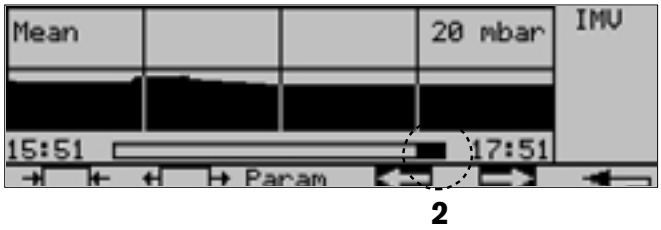
- Select the desired measured value with the key »**Param**«.
- Adjust the width of the window with the keys » ⇥|⇤ « and » ⇤|⇥ «. The maximum width is 24 hours and the minimum width is 2 hours. The times displayed are the beginning and end of the selected section.
- Move the window as required with the keys » ⇦ « and » ⇨ «:

1 Slider at the left end of the bar:
the window is located at the beginning of the trend memory.



1

2 Slider at the right end of the bar:
the window is located at the end of the trend memory.



2

Exit from the menu:

- Press the key » ⇤| « .

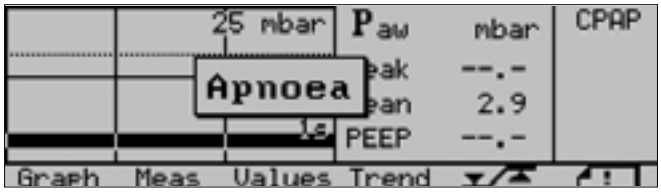
* RVR can be used as an indicator for the chances of successful weaning from the respirator.

Messages

are displayed in a hierarchical sequence, depending on their importance. If, for example, two faults are detected simultaneously, the message for the more critical fault will be displayed first.
The messages are displayed in a window which is superimposed on the existing screen display.

At the same time, one of three specified tone sequences sounds in order to indicate the importance of the message.

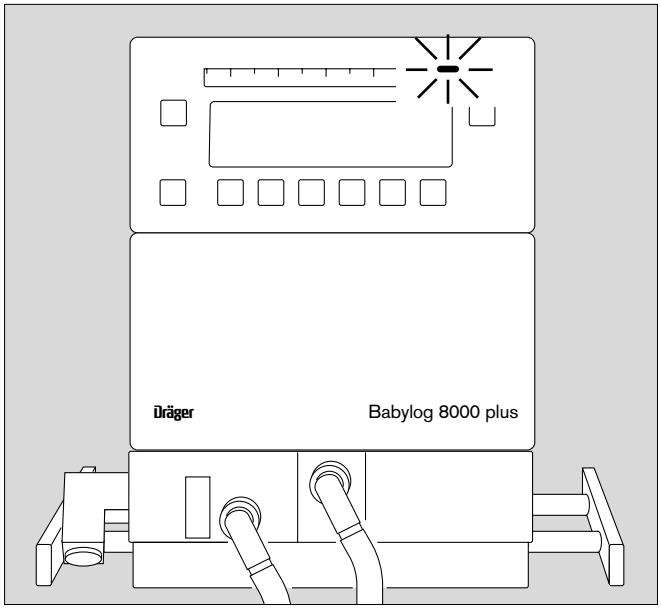
- Display (example):



The message disappears when its cause no longer exists.

Alarm messages
The red alarm lamp blinks and an intermittent tone sounds.

The alarm indicates a life threatening situation, such as a kinked hose, **immediate action** is necessary.



Caution messages
The red alarm lamp blinks and a three-tone sequence sounds repeatedly.

Caution messages indicate situations where action will be required soon in order avoid a potential life threatening situation. You should react accordingly and rectify the situation within 2 minutes.

Advisory messages
The tone sequence sounds once.

Advisory messages remind you of special functions or draw your attention to a specific situation.

Suppressing the message and audible signal for about 30 seconds:

1 Press the key »**OK**«.

Each message is automatically recorded in the log of the ventilator.

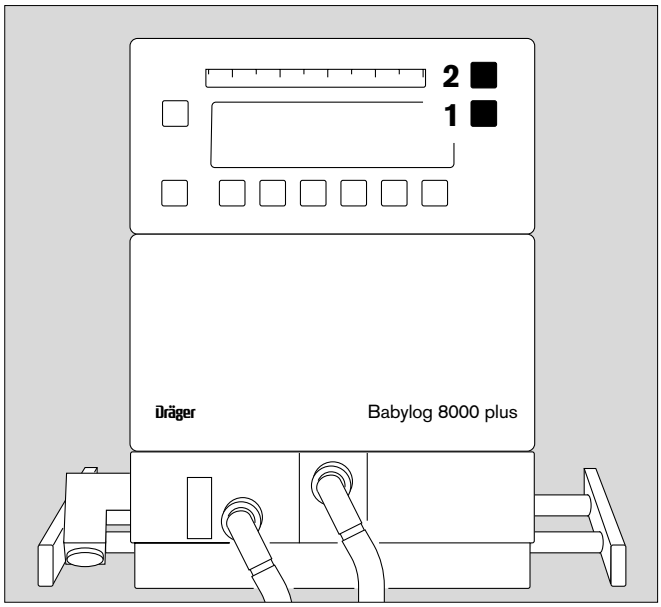
Suppressing the warning/alarm tone for 2 minutes

2 Press the key » 🔔 «.

Switching the warning/alarm tones on again:

2 Press the key » 🔔 « again.

A summary of the fault messages with their causes and remedies, can be found on page 78 etc.



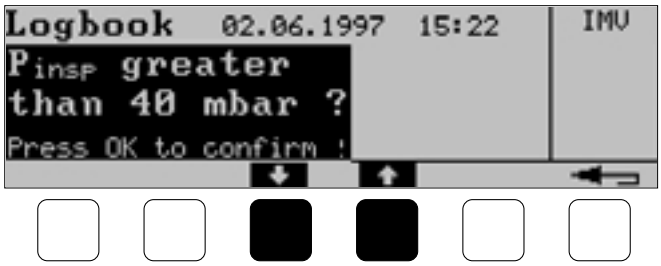
Reading the log

Each alarm, caution and advisory message is written into the electronic log of the ventilator.
Each entry contains the time of the message and its text, and indicates whether the message was acknowledged (normal display) or not (highlighted).

- In the monitoring menu, press the key »[!]« = log.

- Scroll up and down through the log with the keys » ↓ « and » ↑ «.

- Display (example):



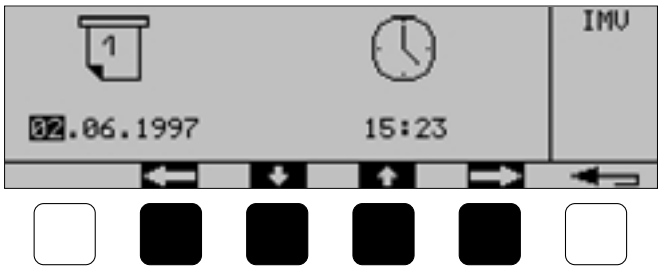
Exit from the menu:

- Press the key »↵«.

Configuration

Setting time and date

- Press the keys »**Cal. Config.**«, »**Config**« and »**Clock**«.
- Use the keys » ⇦ « and » ⇨ « to highlight the parameter to be changed.
  (Example: 02).
- Adjust the value with the keys » ↓ « and » ↑ «.
- Display (example):



Exit from the menu:

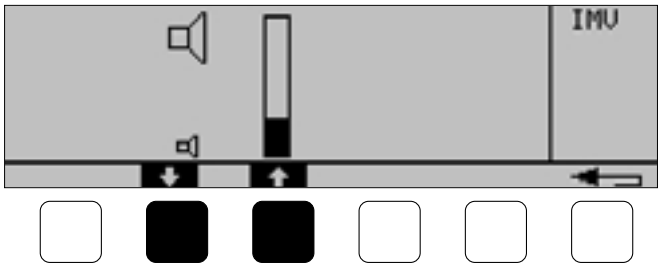
- Press the key » ↵ «.

  The setting remains stored even if the ventilator is switched off.

Adjusting the loudness of the alarm tone

- Press the keys »**Cal. Config.**«, »**Config**« and » 🔊 «.

- Display (example):
- Adjust the loudness with the keys » ↓ « and » ↑ «. Each time a key is depressed, a test tone sounds with the currently selected loudness.
  The vertical bargraph represents the loudness.



Exit from the menu:

- Press the key » ↵ «.

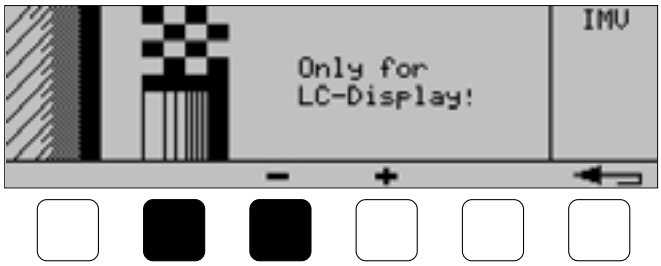
  The setting remains stored even if the ventilator is switched off.

Adjusting the screen contrast

This can be done only on units with an LCD screen.
The screen contrast can be optimised to suit the user's viewing angle.

- Press the keys »**Cal. Config.**«, »**Config**« and »**Contr**«:

- Display (example):



A test pattern is displayed on the screen.

- Adjust the contrast with the keys » ↓ « and » ↑ « for optimum visibility.

Exit from the menu:

- Press the key » ↵ «.

The setting remains stored even if the ventilator is switched off.

Selecting the display text language

Available are: american, german, english, spanish, french, italian, dutch, japanese and swedish.

- Press the keys »**Cal. Config.**«, »**Config**« and »**Language**«:

- Display (example):

- Select the desired language with the keys » ↓ « and » ↑ «.

Exit from the menu:

- Press the key » ↵ «.

The setting remains stored even if the ventilator is switched off.

Analogue and digital interfaces
(optional)

These interfaces can be used for:
analogue output of measured values,
output of reports,
communication with a patient monitor or a personal computer with, for example, the programme BabyView (or a similar programme) for graphical and numerical presentation of ventilation parameters.

All transmitted data are for information only and should not be used as the sole basis for therapeutical decisions!

The connected devices should be installed in the same room as the Babylog 8000 plus, and not less than 1.5 metres away from the patient.*

Each of the two **analogue outputs** transmits one of the available measured values.

The **RS232 interface**
is used to send information to a printer, namely:

- reports,
- contents of the trend memory,
- measured-value curves
  or
- to send data to a patient monitor or a PC.

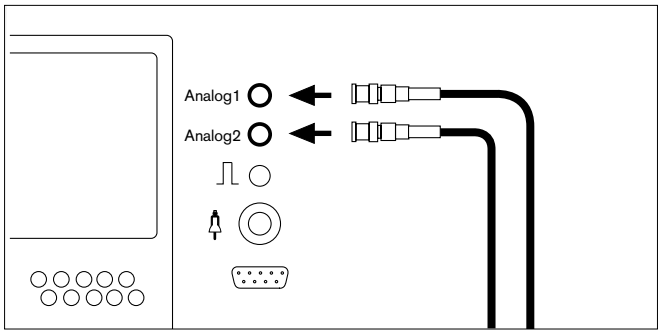
The **pulse output** ⎍ indicates the following events:

- triggered mandatory stroke,
- mandatory stroke,
- alarm.

Analogue output of measured values

One measured value, such as VT, Paw, Flow, ..., can be connected to each of the outputs **Analog1** and **Ananlog2**, with a voltage range of 0 to 10 V.

- Connect a recorder (internal resistance ≥ 1 MΩ) via a cable 83 06 487 (see also "Technical Data" on page 108).



- Select the measured value signal and the scale range (page 72).

* Required by EN 60601-1-1

⎍ – Signal from pulse output

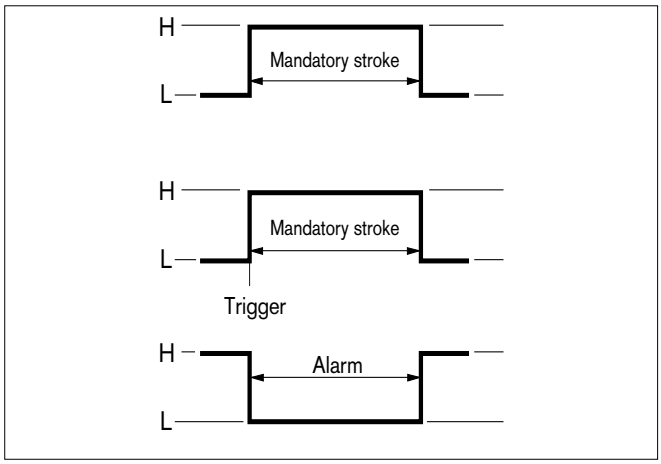
The ⎍ signal at the pulse output indicates events during ventilation, such as each mandatory stroke or each triggered mandatory stroke. This signal can be only high (H) or low (L) (see also "Technical Data" on page 108).

Depending on the setting, the pulse has the following waveform:

Mandatory stroke
H level during the mandatory stroke, otherwise L level.

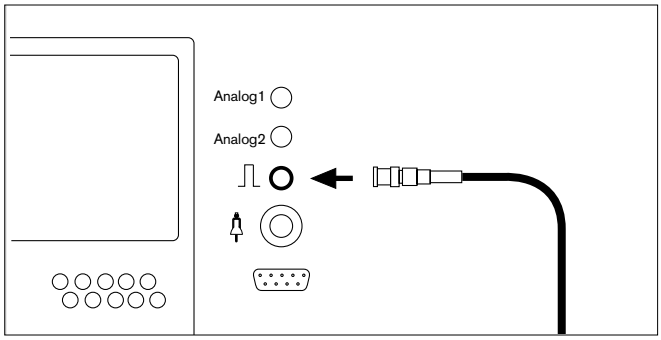
Triggered mandatory stroke
H level during a mandatory stroke initiated by the trigger function, otherwise L level.

Alarm
H level while an alarm condition exists, otherwise L level.



- Connect a recorder (internal resistance ≥ 1 MΩ) via a cable 83 06 487

- Select the desired signal (see "Configuring the interfaces" on page 73).



Printing

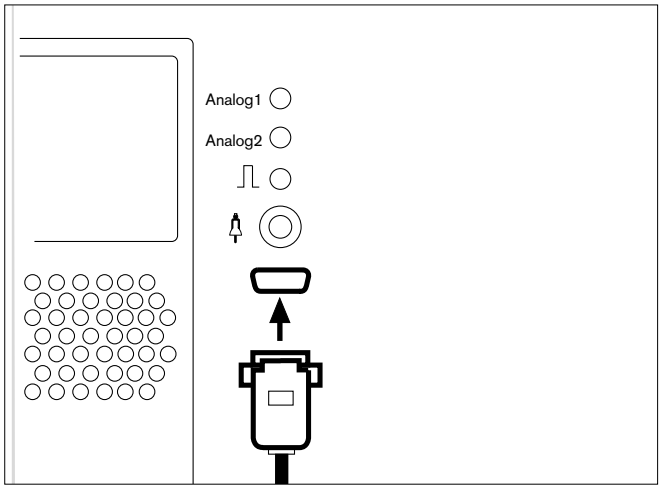
Use one of the following printers:

Epson LX 300,
Epson FX 870 with serial interface,
HP Laserjet with Epson emulation mode and serial interface.
Other printers should be used only after consultation with Dräger Medizintechnik GmbH.

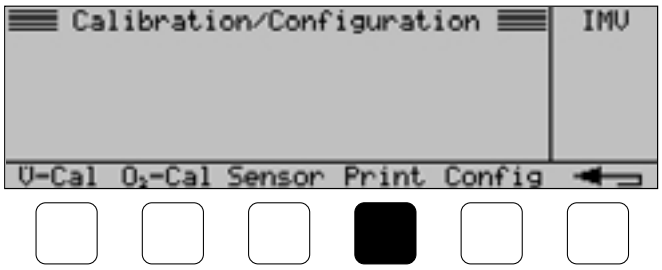
- Connect the printer via a cable 83 06 489.

  The RS232 interfaces of the printer and the Babylog 8000 plus must be configured identically.

- Configuring the RS232 interface: see page 73.



- Press the key »**Cal. Config.**«:



- Press the key »**Print**«.
- Display (example):

Printing reports

This function is used for documenting measured values, settings and the status of the ventilator.

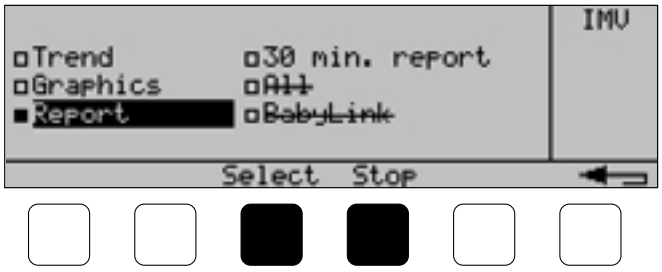
Example:

```
+-----------------------------------------------------------------+
|15:39          23.08.1997          IPPV            Babylog 8000plus|
|                                                                 |
|Einstellwerte:                    |Messwerte:                    |
|TI:    0,40s   Pinsp: 25,0 mbar   |FiO2:  21 %     Mean: 10,1 mbar |
|TE:    0,80s   PEEP:   4,0 mbar   |Leck:   0 %     Peak: 25,0 mabr |
|I:E:   1:2     FiO2:    21 %      |spont:  0 %     PEEP:  4,0 mbar |
|fset: 50 bpm                      |                f:      50 bpm  |
|               Flow in:9,6 L/min  |VT:    15 mL                    |
|               Flow ex:9,6 L/min  |MV:  0,75 L/min TIspont:-,--s    |
+-----------------------------------------------------------------+
|HFV:                              |HFV:                          |
|HfFrequ:10Hz   HfAmpl:  100 %     |VTim:   11 mL   MVim:0,75 L/min |
|                                  |VTHf:  --- mL   DCO2:---- mL^2/ |
+-----------------------------------------------------------------+
|VG:                               |LFT:                          |
|VTset: 10,0 mL                    |C: 0,75 mL/mbar R: 85 mbar/mL/s |
|                                  |C20/C:  1,67    TC: 64 s      |
+-----------------------------------------------------------------+
|VIVE:   aus     Trigger: 10,0     |Flow-Messung:                 |
|                                  |NTPD     ISO    FiO2-kompensiert|
+-----------------------------------------------------------------+
```

To print a report once:

- Press the key »**Select**« repeatedly until »**Report**« is highlighted.
- Start printing by pressing the key »**Start**«. The function of this key then changes to »**Stop**«.

  During printing of the report, the functions "All" and "BabyLink" are not available. One of the other functions may be started, but printing starts only after completion of the report output.

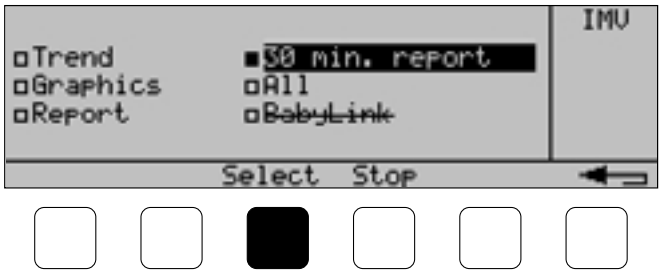


To cancel the printing operation:

- Press the key »**Stop**«.

To print a report automatically every 30 minutes:

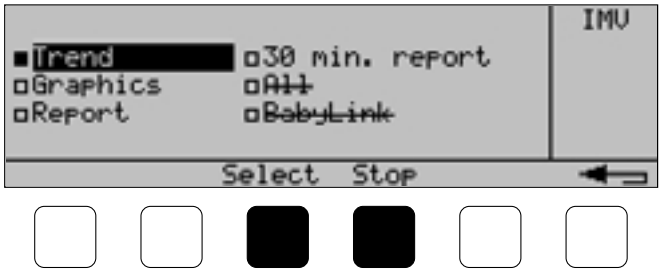
- Press the key »**Select**« repeatedly until »**30 Min. report**« is highlighted.
- Start printing by pressing the key »**Start**«. The function of this key then changes to »**Stop**«.



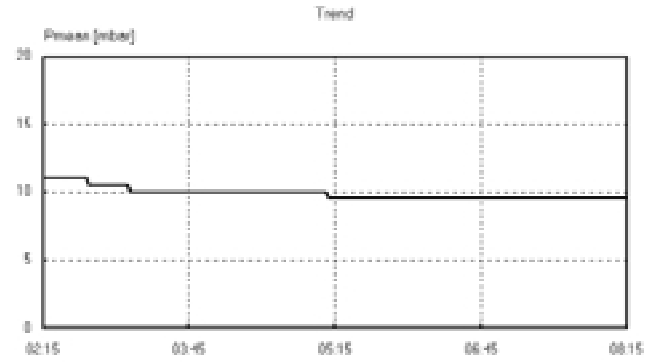
Printing a trend

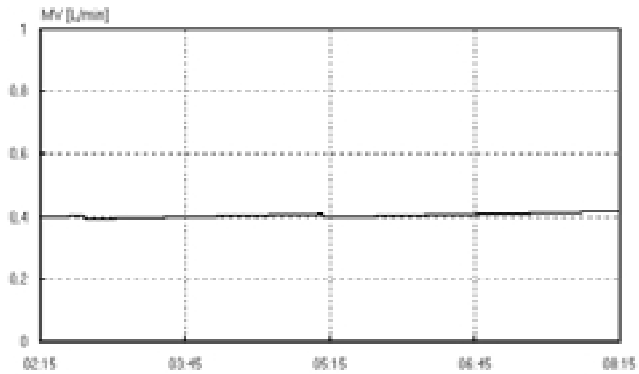
This function is used for graphical printing of the measured values for Mean, MV and FiO_2 stored in the trend memory. The contents of the last trend display window which was selected (width and position within the 24 hour period) are output.

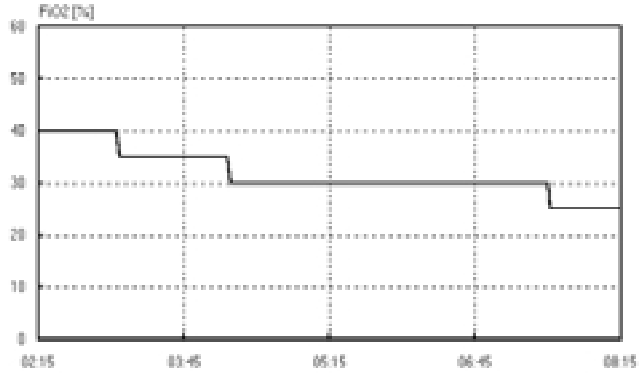
- Press the key »**Select**« repeatedly until »**Trend**« is highlighted.
- Start printing by pressing the key »**Start**«. The function of this key then changes to »**Stop**«.



Example:







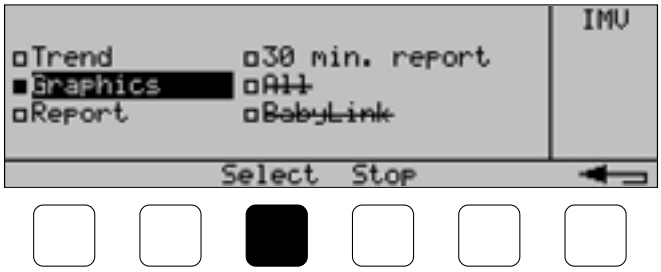
To cancel the printing operation:

- Press the key »**Stop**«.

Printing curves

This function is set for graphical printing of the curves:

airway pressure,
flow and
tidal volume.

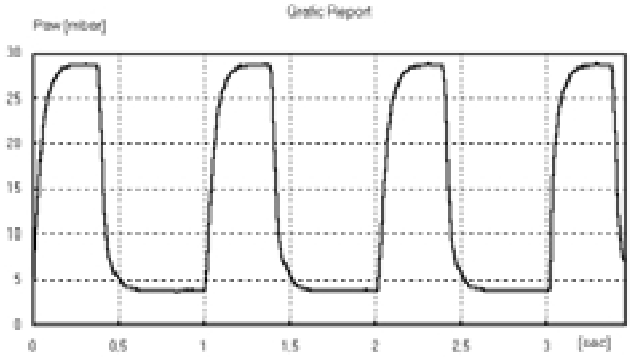


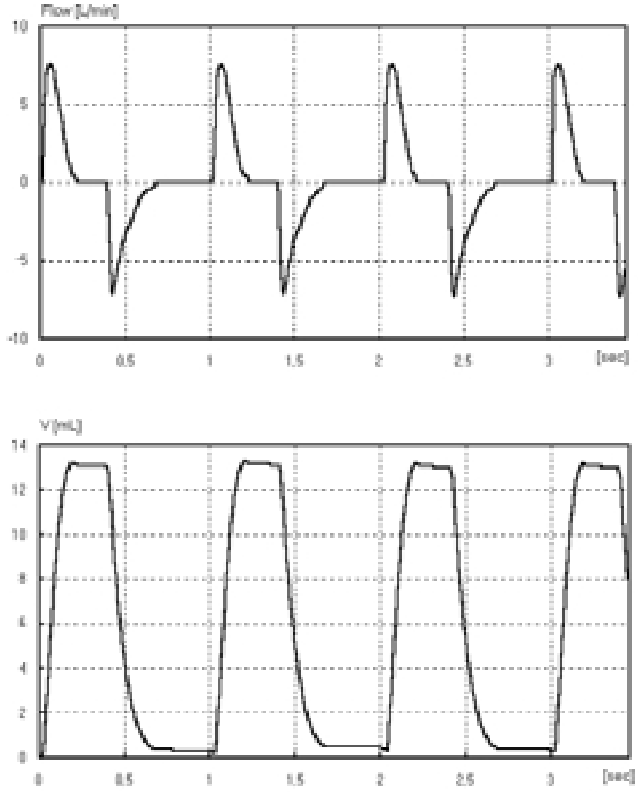
- Press the key »**Select**« repeatedly until »**Graph**« is highlighted.
- Start printing by pressing the key »**Start**«. The function of this key then changes to »**Stop**«.

To cancel the printing operation:

- Press the key »**Stop**«

Example:

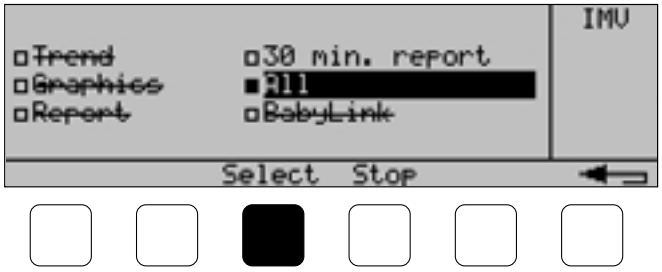




Printing everything

This function is used to print the report, the trends and the curves.

- Press the key »**Select**« repeatedly until »**All**« is highlighted.
- Start printing by pressing the key »**Start**«. The function of this key then changes to »**Stop**«.



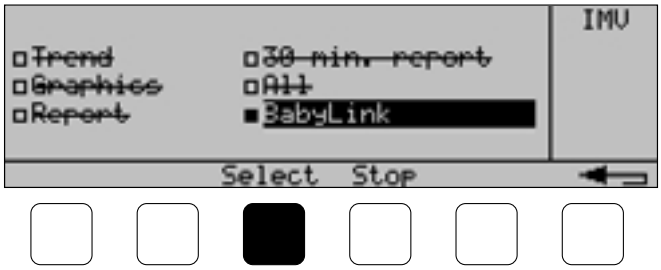
To cancel the printing operation:

- Press the key »**Stop**«.

Transmitting data to a patient monitor

This function is set for connection of a device (monitor, PC) which uses the BabyLink transmission protocol. For more details, see the "BabyLink" manual.

Connect the monitor via a cable 83 06 488.



- Press the key »**Select**« repeatedly until »**BabyLink**« is highlighted.
- Start transmission by pressing the key »**Start**«. The function of this key then changes to »**Stop**«.

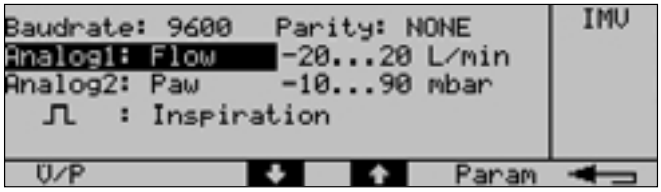
To cancel the transmission:

- Press the key »**Stop**« .

Configuring the interfaces

This function is used to programme the RS232 interface, the analogue interfaces and the pulse output.

- Press the key »**Cal. Config**«, »**Config**« and »**Com**«.
- Display (example):

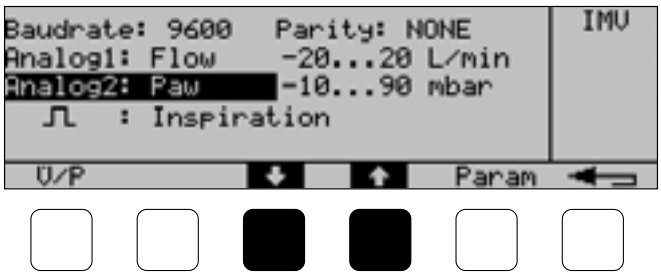


Selecting the signals and scales for Analog1 and Analog2

- Press the key »**Param**« repeatedly until »**Analog1**« is highlighted.
- Select the desired signal with the keys » ↓ « and » ↑ « .
- Press the key »**Param**« and then select the desired scale value with keys » ↓ « and » ↑ «.

  Repeat the above steps for output Analog2.

  The setting remains stored even if the ventilator is switched off.



The following signals and scales can be selected:

Airway pressure	–10 . . .90 mbar	–> 0 . . .10 V
Airway pressure	– 5 . . .45 mbar	–> 0 . . .10 V
Mean airway pressure	–10 . . .90 mbar	–> 0 . . .10 V
Mean airway pressure	– 5 . . .45 mbar	–> 0 . . .10 V
FiO_2	0 . .100 Vol.%	–> 0 . . .10 V
Flow	–40 . . .40 L/min	–> 0 . . .10 V
Flow	–20 . . .20 L/min	–> 0 . . .10 V
Flow	–10 . . .10 L/min	–> 0 . . .10 V
Flow	– 5 . . . .5 L/min	–> 0 . . .10 V
Volume	0 . . 500 mL	–> 0 . . .10 V
Volume	0 . . 100 mL	–> 0 . . .10 V
Volume	0 . . . 50 mL	–> 0 . . .10 V
Volume	0 . . . 25 mL	–> 0 . . .10 V
Tidal volume	0 . . 500 mL	–> 0 . . .10 V
Tidal volume	0 . . 100 mL	–> 0 . . .10 V
Tidal volume	0 . . . 50 mL	–> 0 . . .10 V
Tidal volume	0 . . . 25 mL	–> 0 . . .10 V
Minute volume MV	0 . . . 10 L/min	–> 0 . . .10 V
Minute volume MV	0 . . . . 5 L/min	–> 0 . . .10 V
Minute volume MV	0 . . . . 1 L/min	–> 0 . . .10 V
Minute volume MV	0 . . .0.5 L/min	–> 0 . . .10 V
MVim	0 . . . 10 L/min	–> 0 . . .10 V
MVim	0 . . . . 5 L/min	–> 0 . . .10 V
MVim	0 . . . . 1 L/min	–> 0 . . .10 V
MVim	0 . . .0.5 L/min	–> 0 . . .10 V
V_{Tim}	0 . . . 500 mL	–> 0 . . .10 V
V_{Tim}	0 . . . 100 mL	–> 0 . . .10 V
V_{Tim}	0 . . . . 50 mL	–> 0 . . .10 V
V_{Tim}	0 . . . . 25 mL	–> 0 . . .10 V
V_{THF}	0 . . . .25 mL	–> 0 . . .10 V
V_{THF}	0 . . . . . 5 mL	–> 0 . . .10 V
D_{CO2}	0 . . . 200 mL^2/s	–> 0 . . .10 V
D_{CO2}	0 . . . . 50 mL^2/s	–> 0 . . .10 V
Continuous Flow (setting)	0 . . . . 125 L/min	–> 0 . . .10 V
Leakage rate	0 . . . .100 %	–> 0 . . .10 V
Spontaneous component of MV	0 . . . .100 %	–> 0 . . .10 V

Default settings:

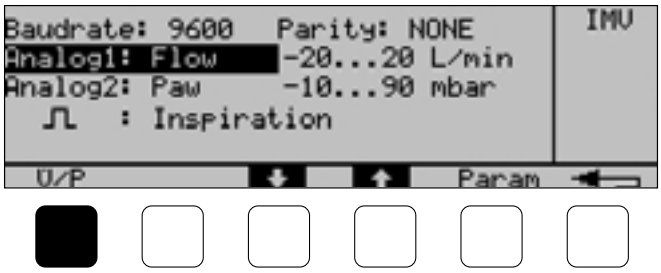
Analog1:	
Flow	–20 . . . 20 L/min
Analog2:	
Airway pressure	–10 . . . 90 mbar

To select the default settings during operation:

- Press the key »**V̇ /P**«.

  If a measured value exceeds the scale limits, the voltage is limited to the end-of-scale value.

  The setting remains stored even if the ventilator is switched off.



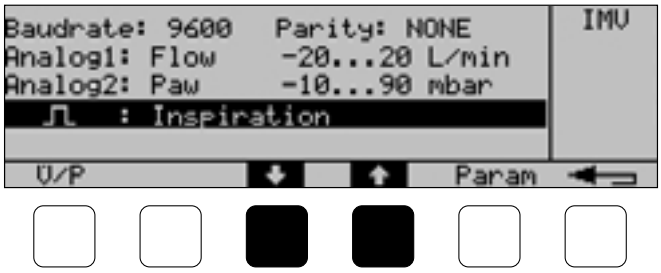
Configuring pulse output

- Press the key »**Param**« repeatedly until »⎍«is highlighted.
- Select the desired signal with the keys »↓« and »↑«:

  triggered mandatory stroke
  or
  mandatory stroke
  or
  alarm.

  The default factory setting is: mandatory stroke.

  The setting remains stored even if the ventilator is switched off.



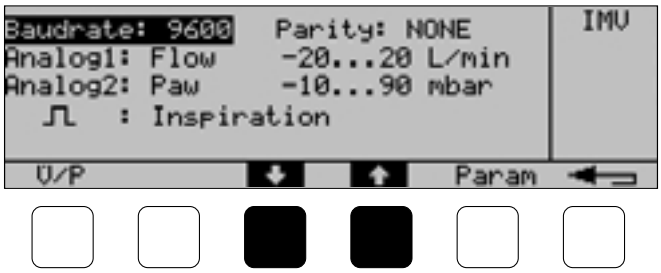
Configuring RS 232 interface

This function is used to select the transmission speed (baudrate) and the parity checking.

- Press the key »**Param**« repeatedly until »**Baudrate**« is highlighted.
- Select the desired baudrate with the keys »↓« and »↑« :

  9600, 2400 oder 1200

- Press the key »**Param**« to select »Parity«.



- Select the desired parity with the keys »↓« and »↑«:

  NONE
  or
  EVEN
  or
  ODD

- When using a printer, select »**NONE**«.

  The default factory settings are:

Baudrate:	9600
Parity:	NONE
Stop bits:	1 (fixed)
Data bits:	8 (fixed)

Exit from the menu:

- Press the key »⏎«.

  The settings remain stored even if the ventilator is switched off.

Setting the printer

The printer must be configured as follows:

Baudrate:	same as Babylog 8000 plus
Parity:	none
Data bits:	8
Handshake mode:	XON/XOFF Alternate control sequence mode

Shutting down

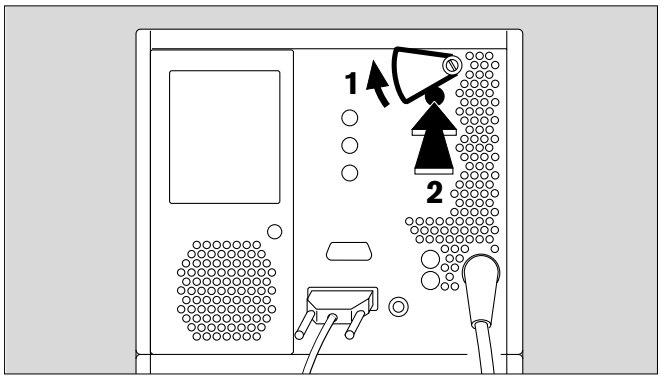
After disconnecting the patient.

On the rear of the ventilator:

1 Swing the protective cover over the main switch to one side and

2 press the button fully inwards and release it to switch the ventilator off.

- Set the main switch of the humidifier to 0.
- Disconnect the plugs of all electrical and gas supplies from their sockets.



Fault – Cause – Remedy

Contents

Fault – Cause – Remedy

The Babylog 8000 plus classifies the messages in three levels of urgency:

Alarm messages – Caution messages – Advisory messages

The messages are listed in alphabetical order in the following table.

The table is intended to help you to find the cause for an alarm message and to rectify the related condition.

Message	Cause	Remedy
Airway pressure high **Exp. valve opened**	Pressure increase in hose system; expiratory valve has been opened to relieve the system. Equipment malfunction (patient system)	Check the hose system. Replace the patient system. Call DrägerService.
Airway pressure high **Inspiration cancelled**	Pressure increase in hose system; mechanical inspiration has been shortened to relieve the system. Equipment malfunction (patient system)	Check the hose system. Replace the patient system. Call DrägerService.
Airway pressure low	Leak or disconnection Insp. or exp. flow set too low	Check that hose connections are tight. Increase the flow.
Apnoea	Patient's spontaneous breathing has ceased.	Ventilate with supervision.
Calibrate flow sensor !	Calibration of the flow sensor is requested each time the unit is switched on or after a power failure. Without calibration, no flow can be measured.	Press key »**OK**« and calibrate the flow sensor (page 26). To continue operation without flow measurement, simply press »**OK**«.
Check PEEP setting !	For high-frequency ventilation, the rotary knob »**PEEP/CPAP**« determines the mean value of the airway pressure.	After completion of high-frequency ventilation, set PEEP to the desired value with the rotary knob »**PEEP/CPAP**«**.**
Fault in rotary knob	Equipment fault	Call DrägerService.
FiO_2 high	Fault in FiO_2 measurement or fault in mixer function	Calibrate O_2 sensor manually (page 25). Call DrägerService.
FiO_2 low	Fault in FiO_2 measurement or fault in mixer function	Calibrate O_2 sensor manually (page 25). Call DrägerService.

Message	Cause	Remedy
Flow measurement disturbed VG uses Pinsp, Check set value !	Volume guarantee VG stops because the flow sensor is defective or disconnected; flow-measurement malfunction	Replace the flow sensor. Connect the cable. Set Pinsp to a suitable value.
Flow measurement disturbed Measurement switched off	Flow sensor faulty or disconnected. Malfunction. Cable faulty.	Connect the flow sensor or cable. Calibrate the flow sensor (page 26). Replace the flow sensor (page 22). Replace the cable.
Flow sensor dirty ? Please clean sensor!	Water or secretion in the flow sensor	Replace sensor insert.
Frequency high !	Hyperventilation Self-triggering	Adjust the frequency. Increase the trigger threshold.
Hose kinked ?	Ventilation hose kinked or blocked or condensate in the hose. Internal diameter of ventilation hoses too small.	Check and clear the hose system. Use a suitable hose system.
I : E maximum 3 : 1!	The rotary knobs for TI and TE have been set to a TI:TE ratio greater than 3:1. The setting is limited to 3:1.	Check the settings for TI and TE and correct if necessary.
IRV !	The rotary knobs for TI and TE have been set to a TI:TE ratio greater than 1:1 (Inversed Ratio Ventilation)	Press »**OK**« or check the settings for TI and TE and correct if necessary.
Leak in hose system ? Check setting !	Leakage or disconnection. P_{insp} set too high.	Check the hose system for leaks. Check the P_{insp} setting.
Loss of stored data	Equipment malfunction (e.g. after a power failure).	Enter the lost settings again or call DrägerService.
Machine fault xyz xyz = error code	Equipment malfunction.	Call DrägerService.
Medical air low	Air supply pressure too low	Ensure that the pressure is above 3 bar.
Medical air supply pressure measurement disturbed	Pressure sensor or pressure reduction valve faulty.	Call DrägerService.
MV high	Lung compliance has increased. Resistance has decreased. Hyperventilation. Equipment malfunction.	Check the ventilation settings and correct if necessary. Call DrägerService.
MV low	The lung compliance has decreased. Resistance has increased. Spontaneous breathing intermittent or weaker. Equipment malfunction. Tube leakage too high.	Check the ventilation settings and correct if necessary. Call DrägerService.

Message	Cause	Remedy
O_2 calibration disturbed	Fault occurred during calibration.	Re-calibrate manually (page 25). Call DrägerService.
O_2 calibration Meas switched off	Unit is calibrating the O_2 sensor.	Press »**OK**«,
O_2 measurement disturbed	FiO_2 measurement malfunction.	Replace the O_2 sensor (page 17) or call DrägerService.
O_2 measurement disturbed Change sensor !	O_2 sensor exhausted.	Fit a new O_2 sensor (page 17).
O_2 pressure low	Oxygen supply pressure too low.	Ensure that the pressure is above 3 bar.
O_2 supply pressure measurement disturbed	Pressure sensor or pressure reduction valve faulty.	Call DrägerService.
PEEP at least 3 mbar !	The rotary knob »PEEP/CPAP« has been set to a value lower than 3 mbar for high-frequency ventilation. PEEP/CPAP is limited to 3 mbar.	Set to at least 3 mbar!
PEEP greater than 8 mbar ? Press OK to confirm !	The rotary knob for PEEP has been set to a value higher than 8 mbar, but the setting is limited to 8 mbar.	Press »**OK**« to deactivate limiting to 8 mbar.
P_{insp} greater than 40 mbar ? Press OK to confirm !	The rotary knob for P_{insp} has been set to a value higher than 40 mbar, but the setting is limited to 40 mbar.	Press »**OK**« to deactivate limiting to 40 mbar.
P_{insp}/PEEP Check set values !	P_{insp} has been set to less than 5 mbar above PEEP. PEEP is limited by P_{insp}.	Increase P_{insp}, decrease PEEP.
Pressure measurement disturbed	Fluids in patient system Condensate in ventilation hoses. Pressure measurement malfunction. Internal diameter of ventilation hoses too small.	Replace the patient system. Remove the condensate. Call DrägerService. Use a suitable hose system.
Printer disturbed printing cancelled	Printer switched off. No paper in printer. Printer cable faulty. RS 232 interface or printer configured incorrectly.	Switch on the printer. Insert paper. replace the cable. Configure the RS 232 interface of the printer and the Babylog 8000 plus with identical settings.
Re-calibrate flow sensor if exchanged !	During operation: flow sensor has been replaced. Cable has been disconnected and re-connected.	Press »**OK**« and calibrate the sensor (page 26). Press »**OK**«.

Message	Cause	Remedy
Tube obstructed ?	Tube kinked or blocked.	Clear the tube.
VT low **Check settings !**	Tidal volume does not reach the set value.	Increase the flow V̇ insp. Increase the inspiration time, possibly increase Pinsp.

Care

Contents

Care

Stripping down

Ventilation hoses

- Empty the water traps.
- Disconnect the plugs of the flow-sensor cable from the insert and the socket on the rear of the ventilator.

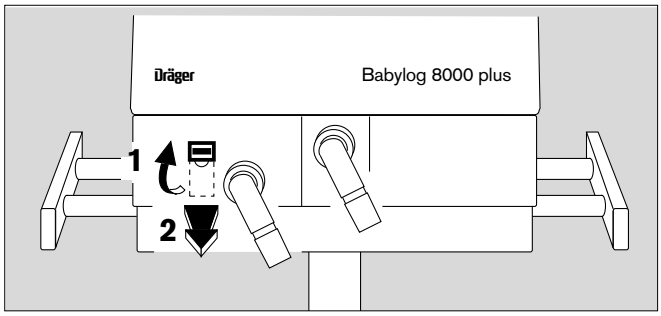
Pull the insert out of the flow sensor:

- Press the buttons on both sides and simultaneously pull the insert out of the Y-piece.
- Remove the hoses from the hose holder of the incubator.
- Remove the hoses from the sleeves on the ventilator and on the humidifier module.
- Remove the water trap and the Y-piece and pull the collecting jar from the water trap.

Removing the expiration valve

1 Lift the locking lever upwards.

2 Pull the expiration valve out forwards.



Disinfecting/cleaning/sterilising

Use surface disinfectants for disinfection. For reasons of material compatibility, suitable disinfectants are those on the based on:

– aldehydes,
– alcohols and
– quaternary ammonium compounds.

The following are not suitable:

– compounds containing phenol.
– compounds which release halogens,
– strong organic acids,
– compounds which release oxygen or
– sterilisation with ethylene oxide.

For users in the Federal Republic of Germany, we recommend the use of disinfectants shown in the current DGHM (Deutsche Gesellschaft für Hygiene und Mikrobiologie) list.
The DGHM list (available from mhp-Verlag, Wiesbaden) also shows the effective ingredients of each disinfectant.
In countries where the DGHM list is unknown, the above recommendations apply.

Basic Babylog 8000 plus unit, trolley, flow-sensor cable and gas connection hoses

- Disinfect by wiping with, for example, Buraton 10 F (Messrs. Schülke & Mayr, Norderstedt).
  Observe the manufacturer's instructions for use.

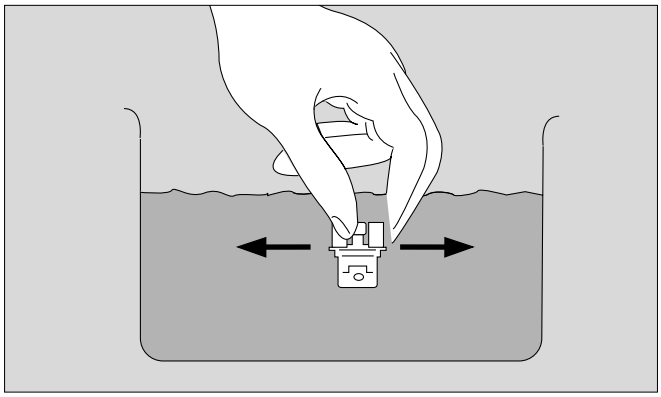
Flow-sensor insert

Do not use a cleaning/disinfecting machine. Do not clean with compressed air, water jet, brush, etc., since this will destroy the thin wires in the flow sensor.

Dried mucus will shorten the service life of the flow sensor; for this reason:

- disinfect the sensor immediately after use in a bath containing, for example, Gigasept FF (Messrs. Schülke & Mayr, Norderstedt).
  Observe the manufacturer's instructions for use.
- Then rinse the insert by carefully moving it to and fro in a bath of distilled water. Thoroughly shake out any remaining water.

  Then:
- sterilise in hot steam at 130 °C to 140 °C.



Expiration valve, ventilation hoses, Y-piece (without flow sensor), catheter cone

- Clean and disinfect with moist heat
  (for example: 93 °C/10 min) in a cleaning and disinfecting machine, using only a detergent.

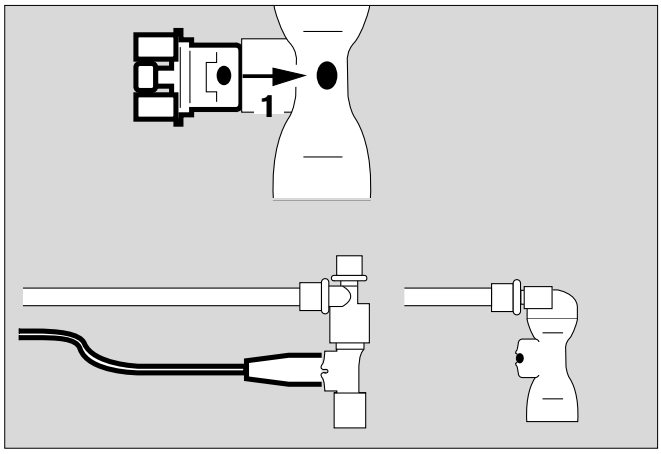
After cleaning

- Sterilise in hot steam at 130 °C to 140 °C.
- Always sterilise the expiration valve in order to remove any water remaining in the ducts and control lines.

Installing the flow-sensor insert

1 Align the two marks and slide the insert into the Y-piece until it locks into position.

- Insert the plug into the sensor.



- Assemble the equipment as described in "Preparation" (pages 20 to 22).

After switching on:

- Calibrate the flow sensor (page 25).
- Check readiness for use (page 87).

Checking readiness for use

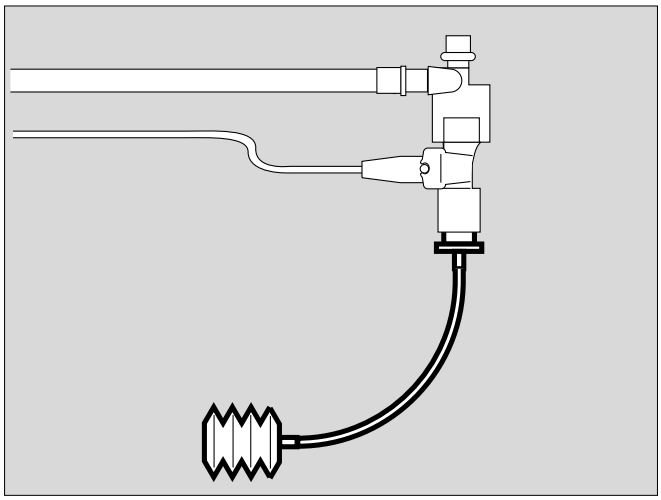
This must be done each time the unit is assembled.

Assemble the equipment completely (pages 20 to 22).

After switching on, calibrate the flow sensor (page 25).

Connecting the test lung

The test lung consists of a bellows simulating compliance (about 0.5 mL/mbar) and a CH 12 tracheal tube about 165 mm long, with connector, for simulation of airway resistance.

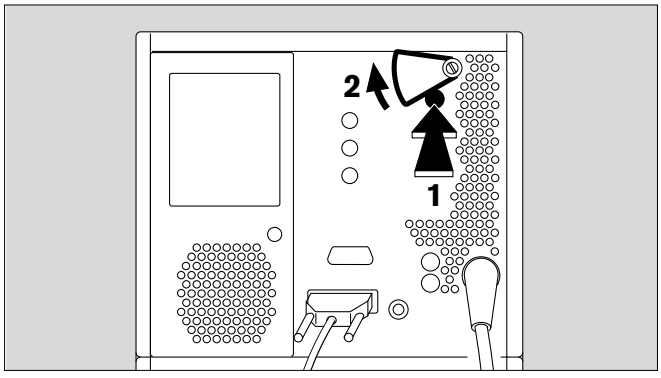


Testing the mains failure alarm

- Disconnect the mains plug from the from the mains supply socket.

1 Switch on the ventilator by pressing the main switch on the rear of the unit until it locks into position.
A continuous tone must sound at a constant level for about 20 seconds.
If this does not happen, charge the battery (see "Before using for the first time" on page 23).

On the rear of the unit:

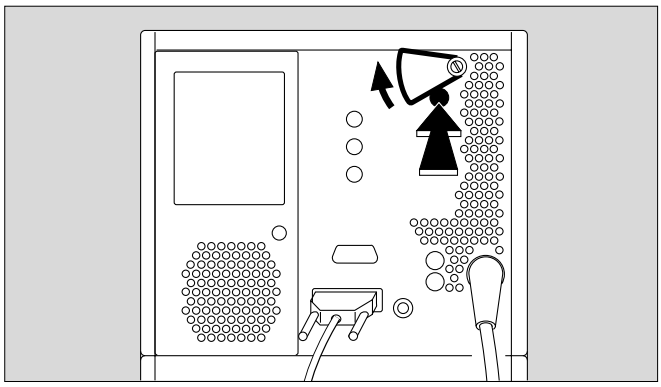


2 Swing the protective cover of the main switch to one side.

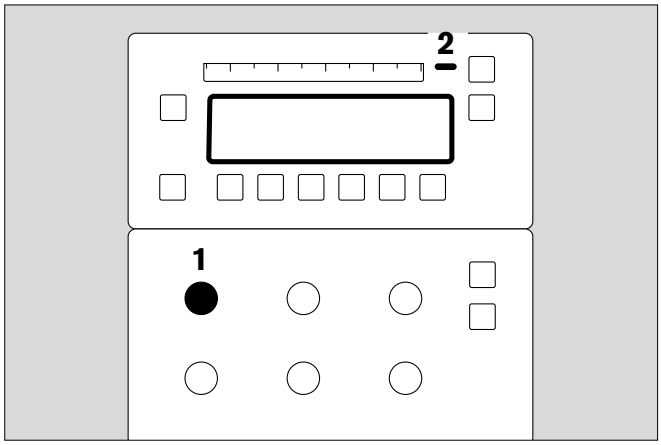
1 Fully depress the main switch and release it to switch the ventilator off. The continuous tone ceases.

- Re-insert the mains plug into the mains supply.

Testing gas failure alarm



- Switch on the ventilator by pressing the main switch on the rear of the unit until it locks into position.

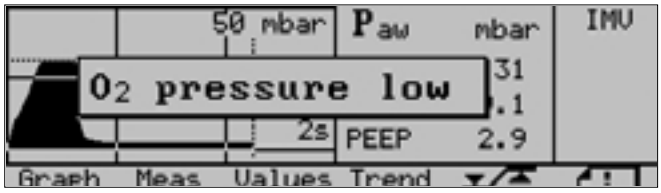


- Switch on IPPV/IMV (page 36).
- Set lower alarm limit MV ▼ to 0 and upper alarm limit MV ▲ to 15 l/min.

1 Turn the rotary knob »**O2-Vol%**« to 60 %.

- Remove the oxygen connection hose from the wall outlet socket.

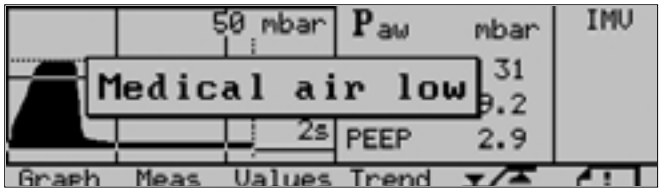
2 The red alarm lamp must blink and the alarm must sound.



- Display:

- Re-insert the oxygen connection hose into the wall outlet socket.

2 The red alarm lamp is extinguished, the alarm message disappears and the alarm tone is switched off.



- Remove the medical air connection hose from the wall outlet socket.
- Display:

2 The red alarm lamp must blink and the alarm must sound.

- Re-insert the medical air connection hose into the wall outlet socket.

2 The red alarm lamp is extinguished, the alarm message disappears and the alarm tone is switched off.

Testing IPPV

- Switch on IPPV/IMV (page 36).
- Set the following rotary knobs (where the green LEDs are lit) as follows:

1 »**O_2-Vol%**« to 21.

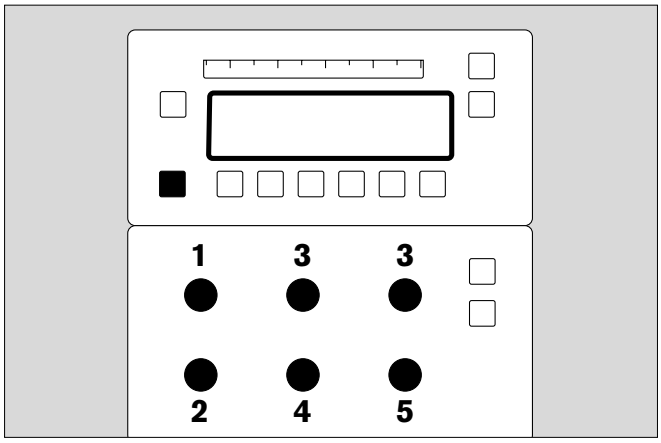
2 »**Insp. Flow $\dot{V}$**« to 10.

3 »**TI**« to 0.4.
»**TE**« to 0.6.

4 »**P_{insp}**« to 20.

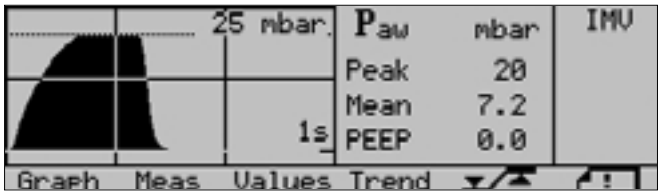
5 »**PEEP/CPAP**« to 0.

- In the monitoring menu, press the keys »**Meas**« and »**Paw**«.



- Display (example):
- The displayed values must lie within their permissible ranges, as follows:

Peak	18 to 22 mbar
Mean	6 to 10 mbar
PEEP	–1.5 to 1.5 mbar

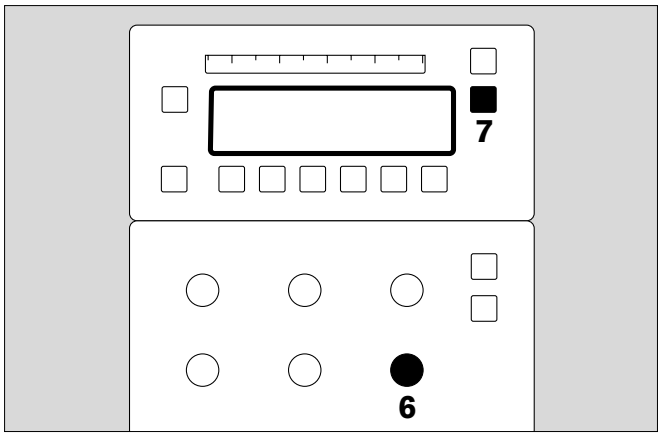


Testing PEEP

6 Set the rotary knob »**PEEP/CPAP**« to 10.

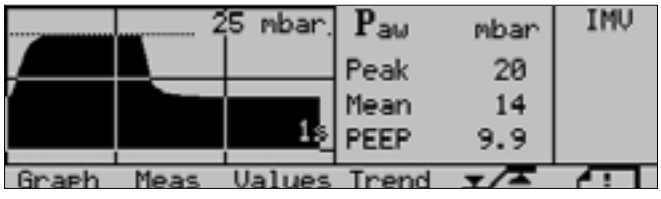
Confirm this setting:

7 Press the key »**OK**«.



- Display (example):
- The displayed values must lie within their permissible ranges, as follows:

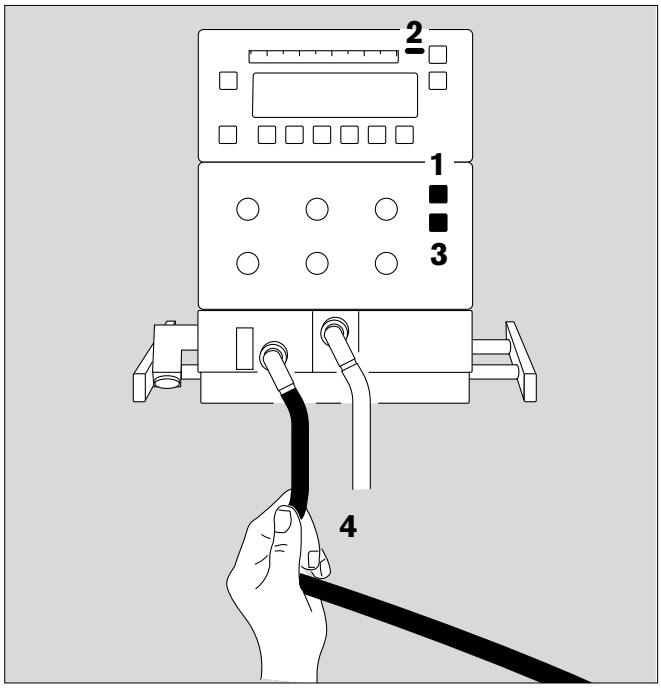
Peak	18 to 22 mbar
Mean	12 to 16 mbar
PEEP	8 to 12 mbar



Testing alarm limits

Alarm limits for apnoea:

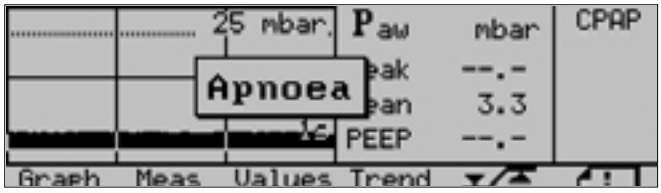
1 Switch on CPAP (page 42).



After not more than 30 seconds:

2 The red alarm lamp must blink and the alarm must sound.

- Display (example):
  Apnoea
  or
  MV low



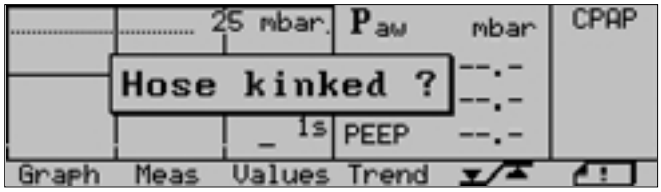
Alarm limits for airway pressure:

3 Switch on IPPV/IMV (page 42).

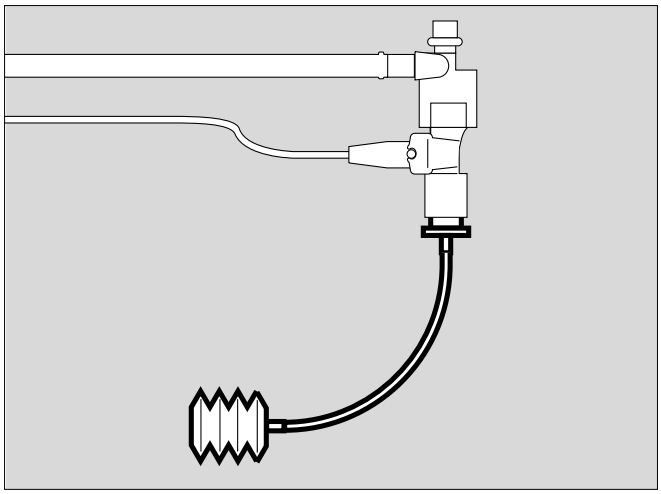
4 Kink the expiration hose:

2 The red alarm lamp must blink and the alarm must sound.

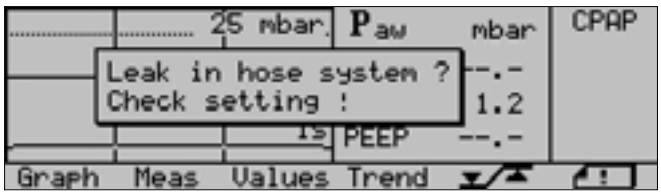
- Display (example):
  Hose kinked?
  or
  Airway pressure high



- Release the hose and then disconnect the connector from the Y-piece.



- The red alarm lamp must blink and the alarm must sound.
- Display (example):
  Airway pressure low
  or
  Leak in hose system?
  Check Pinsp setting



- Set the rotary knob »**PEEP/CPAP**« back to 0.
- Connect the test lung again.

If it passes all of the above tests the Babylog is ready for use!

- **Test the humidifier as described in the related Instructions for Use!**

Maintenance intervals

Always clean and disinfect the unit and/or its components before maintenance and before sending it/them in for repair!

O2 sensor	replace in the case of a fault message (page 17).
Cooling-air filter	clean or replace every 4 weeks (page 93); to be replaced at least once per year.
Lip seals of the connecting plate behind patient system	to be replaced at least every 2 years by trained service personnel
NiCd battery for mains failure alarm	to be replaced at least every 2 years by trained service personnel (see page 93 for disposal).
Time-keeper RAM	to be replaced at least every 4 years by trained service personnel (see page 93 for disposal).
Inspection and service*	to be carried out every 6 months by trained service personnel
General overhaul of pressure reduction valves	to be carried out every 6 months by trained service personnel

For units with LC displays:

If the glass of the LC display is broken, a chemical liquid can leak out. Avoid skin contact. If affected, wash skin areas immediately with soap and water!

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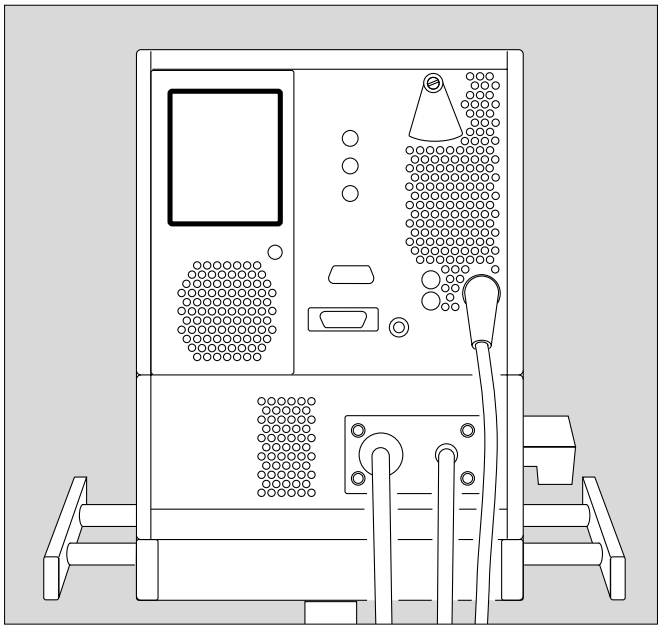
* Definitions:
Inspection = examination of the actual condition
Service = measures to maintain the specified condition
Repair = measures to restore the specified condition
Maintenance = inspection, service and repair

Replacing the cooling-air filter

- Pull the cooling-air filter out of its holder on the rear of the ventilator.
- Use a new filter or wash the old filter in warm water and detergent and dry thoroughly.
- Insert the filter in its holder without folding it.



Disposal of batteries and O_2 sensors

Batteries, and O_2 sensors:

- Do not incinerate batteries or O_2 sensors as they may explode.
- Do not open them as they contain corrosive substances!
- Do not attempt to charge dry batteries.

Batteries and O_2 sensors should be regarded as special waste:

- Dispose of them in accordance with the local regulations for waste disposal.

Exhausted O_2 sensors can be returned to Dräger Medizintechnik GmbH.

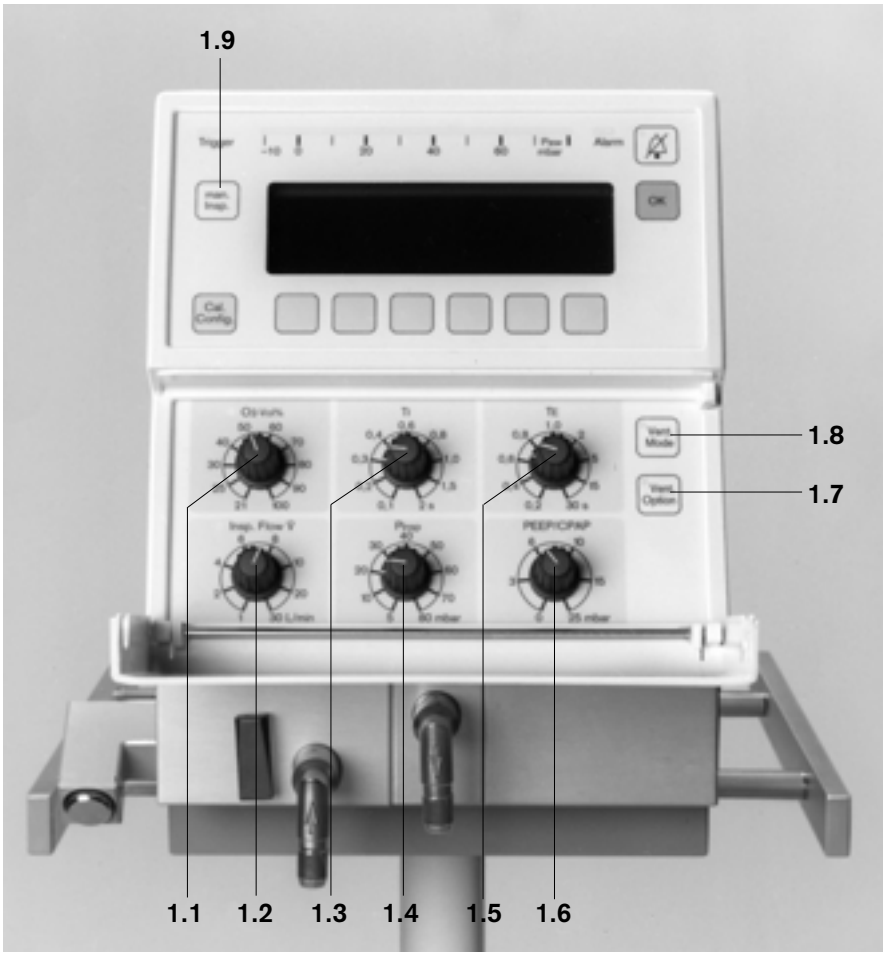
Disposal of the ventilator

– at the end of its service life

The Babylog 8000 plus 5.n may be returned to Dräger Medizintechnik GmbH for suitable disposal.

What's What

Contents



1 Front control panel

1.1 Rotary knob for inspiratory O_2 concentration »**O_2-Vol.%**«

1.2 Rotary knob »**Insp. Flow** $\dot{V}$ «

1.3 Rotary knob »**Inspiration time TI**«

1.4 Rotary knob for limiting inspiration pressure »**$P_{insp.}$**«

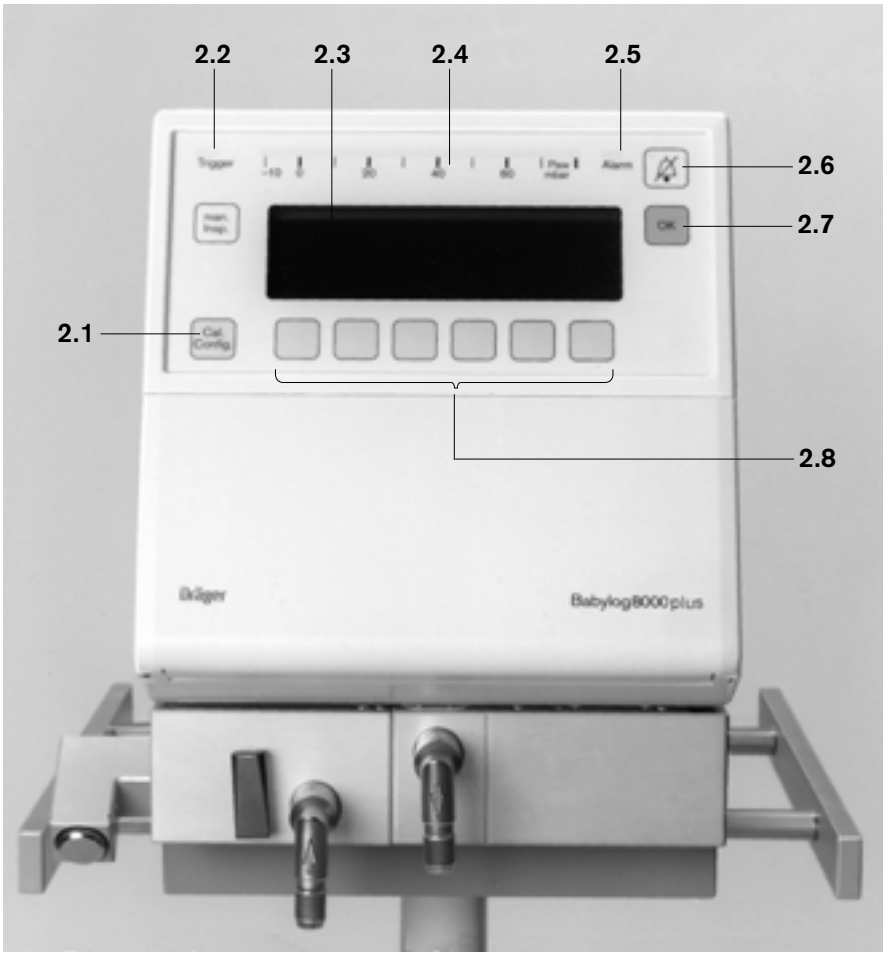
1.5 Rotary knob »**Expiration time TE**«

1.6 Rotary knob »**PEEP/CPAP**«

1.7 Key »**Vent. Option**« for additional functions in ventilation modes

1.8 Key »**Vent. Mode**« for selecting ventilation modes

1.9 Key »**man. Insp.**« for manual start or extension of an inspiration



2 Display panel

2.1 Key for selecting the calibration and configuration menus

2.2 Yellow LED »**Trigger**« lights when inspiration is started by the trigger

2.3 Screen for display of settings and measured values

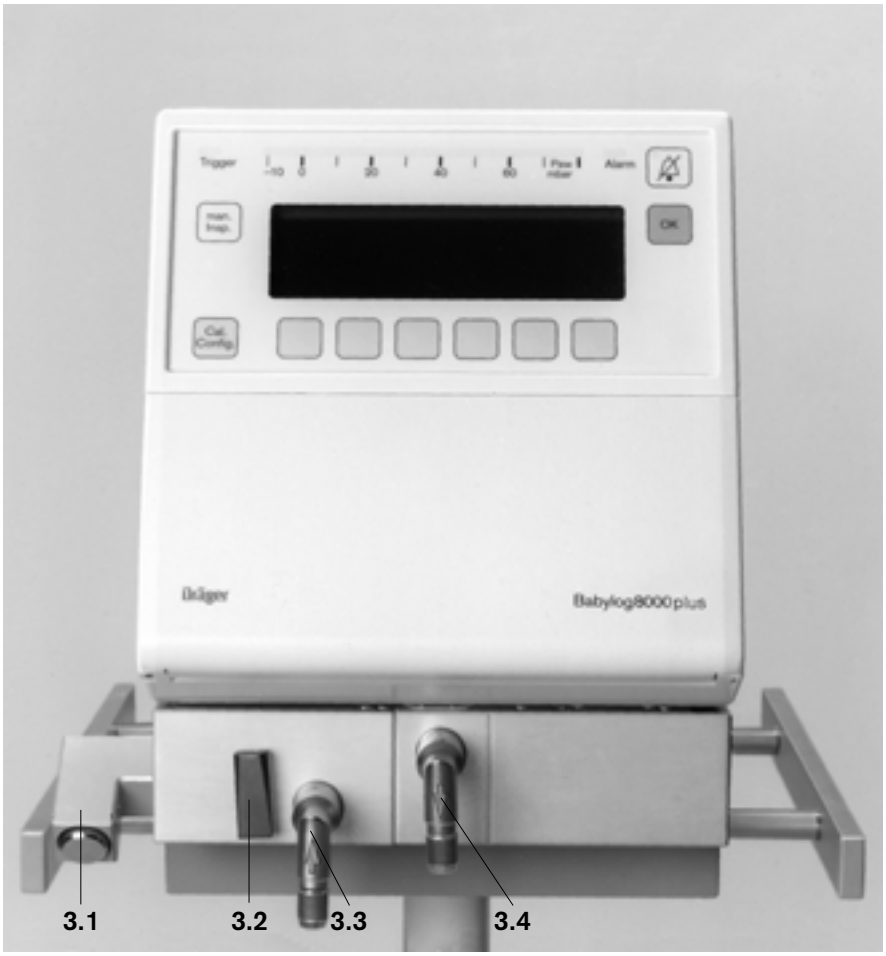
2.4 Bargraph display for the airway pressure Paw

2.5 Red alarm lamp; blinks to draw attention to an alarm or caution message displayed on the screen

2.6 Key » 🔔 « for suppressing the alarm tone for about 2 minutes

2.7 Key »**OK**« for acknowledging messages and for testing the LEDs and the alarm tone

2.8 Menu keys



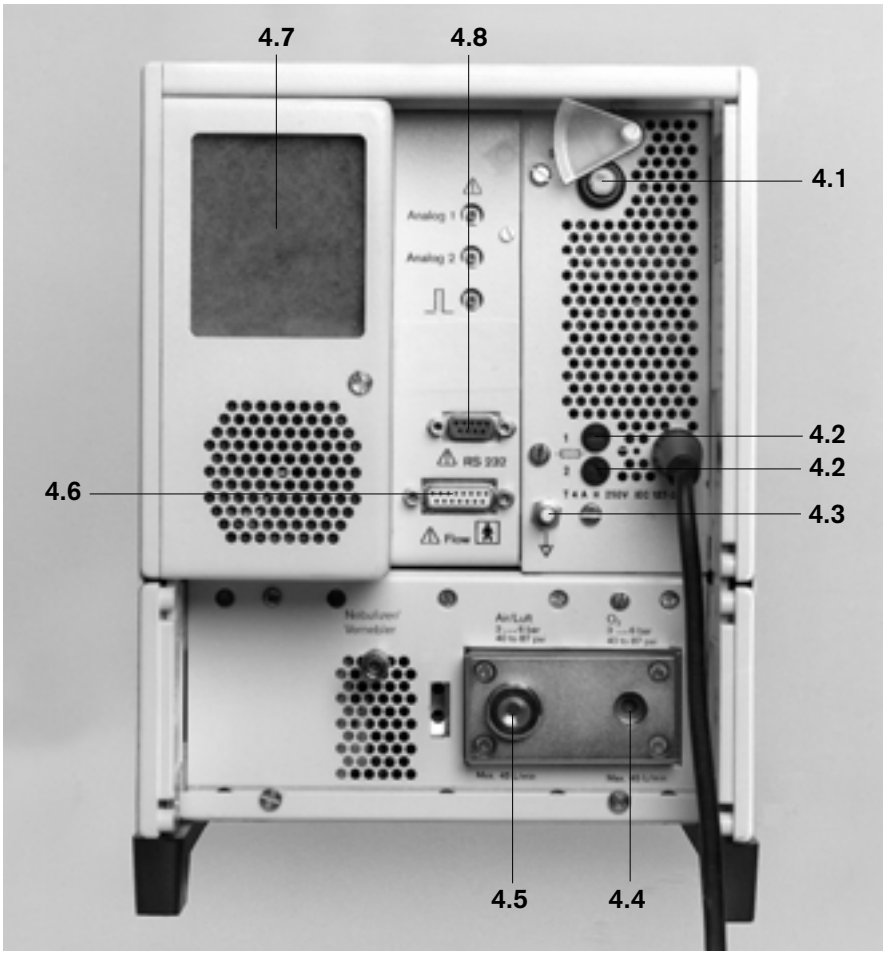
3 Connections

3.1 Silencer

3.2 Locking lever for expiration valve

3.3 Expiration nozzle

3.4 Inspiration nozzle



4 Back of unit

4.1 Main switch

4.2 Mains fuses (2x)

4.3 Potential equalisation stud

4.4 Oxygen connection

4.5 Medical-air connection

4.6 Socket for flow-sensor cable

4.7 Cooling-air filter for fan

4.8 Connectors for optional interfaces

Technical Data

Contents

Technical Data

Ambient conditions

During operation:

Temperature	10 to 40 °C
Atmospheric pressure	780 to 1060 hPa
Relative humidity	30 to 90 %, no condensation

For storage:

Temperature	–20 to 60 °C
Atmospheric pressure	500 to 1060 hPa
Relative humidity	10 to 95 %, no condensation

Parameters – ranges, resolution and accuracy

Parameter	Range	Resolution	Accuracy
Insp. time TI	0.1 to 2 s	0.1 s to 1 s: 0.01 s 1 s to 2 s: 0.1 s	±10 ms
Exsp. time TE	0.2 to 30 s	0.2 s to 1 s: 0.01 s 1 s to 10 s: 0.1 s 10 s to 30 s: 1 s	±10 ms
O_2 Vol.%	21 to 100 %	1 %	3 %
Insp.-Flow $\dot{V}_{insp.}$	1 to 30 L/min	1 to 10 L/min: 0.1 L/min 10 to 30 L/min: 1 L/min	10 %
Exsp.-Flow $\dot{V}_{exsp.}$	1 to 30 L/min	1 to 10 L/min: 0.1 L/min 10 to 30 L/min: 1 L/min	10 %
$P_{insp.}$	10 to 80 mbar*	1 mbar	1 mbar ±3 % (measurement function)
PEEP	0 to 25 mbar	to 10 mbar: 0.1 mbar >10 mbar: 1 mbar	1 mbar ±3 % (measurement function)
MV alarm limits	0 to 15 mbar	<1 L/min: 0.01 L/min 1 to 10 L/min: 0.1 L/min	±10 % (measurement function)
Delay time for lower MV alarm limit	0 to 30 s	1 s	±10 ms
Apnoea delay	5 to 20 s	1 s	±10 ms
Panting	20 to 200 bpm	5 bpm	1 bpm
Tidal volume V_{TSet}	2 to 100 mL	2 to 9.9 mL: 0,1 mL 10 to 19.5 mL: 0.5 mL 20 to 100 mL: 1 mL	to 5 mL ± 0,5 mL ab 5 mL ± 10 %

* 1 mbar = 1 hPa
1 bar = 100 kPa

Equipment parameters

Principle of operation	Babylog 8000 plus ventilates on the continuous-flow principle with time control and and is pressure limited. Oxygen is added to the air with an integrated air-oxygen mixer.
Control principle	Continuous flow, expiration valve, pressure-limited, time-controlled
Trigger sensitivity	1 to 10 corresponds to about 0.02 to 3 mL
Trigger delay time (time from the start of [see explanation on page 124] spontaneous inspiration to the start of a synchronised mandatory ventilation stroke)	Typically 40 to 60 ms
Pos. end exp. pressure (PEEP) or continuous pos. airway pressure (CPAP)	0 to 25 mbar
System compliance with hose system but without humidifier	<0.6 mL/mbar
System resistance at 30 L/min inspiratory resistance expiratory resistance	<20 mbar/L/s <12 mbar/L/s <8 mbar/L/s

Use other hose systems only if their resistance does not exceed the specified values since the measurement of the airway pressure may otherwise be affected!

Measurement functions – ranges and accuracy

Airway pressure

Sensor	Two differential pressure sensors within the ventilator measure the pressures, relative to the atmospheric pressure, at the inspiration and expiration connectors of the hose system. The pressure at the Y-piece is calculated from these two values (see the explanation on page 122).
Measuring range	–10 to 100 mbar
Zero-point error	±1.0 mbar
Amplification error	±3 % of measured value

Measurement conditions according to EN 794-1, para. 51.7

Display parameters
All parameters are displayed digitally or graphically on screen.

Parameter	Range	Resolution
Peak	0 to 99 mbar	0 to 9.9 mbar: 0.1 mbar 10 to 99 mbar: 1 mbar
PEEP	0 to 99 mbar	0 to 9.9 mbar: 0.1 mbar 10 to 99 mbar: 1 mbar
Pmean	0 to 99 mbar	0 to 9.9 mbar: 0.1 mbar 10 to 99 mbar: 1 mbar
Airway pressure (t), bargraph display	–10 to 80 mbar	2 mbar
Airway pressure (t), screen display	–10 to 100 mbar	–2.5 to 25 mbar: 0.5 mbar –5 to 50 mbar: 1 mbar –10 to 100 mbar: 2 mbar

Flow and volume

Sensor — Hot-wire anemometer between Y-piece and tube connector

Sensor type	Dead space volume (without tube)	Resistance at 30 L/min
Y-piece with flow sensor 84 10 185	1.7 mL	≤12 mbar
Flow sensor ISO 15 84 11 130	0.9 mL	≤11 mbar

Gas composition — Medical gas according to the selected oxygen air mix

Reference conditions — can be switched between
- NTPD (normal temperature 20 °C, atmospheric pressure 1013 hPa, dry gas) and
- BTPS (body temperature 37 °C, ambient pressure, gas saturated with moisture)

Flow measurement range — 0.2 L/min to 30 L/min
3 dB cut-off frequency — 28 Hz

Measuring accuracy for expiratory tidal volume
(without expiratory leakage)

Measuring conditions in accordance with EN 794-1, Section 51.106
Measuring range — 0 to 999 mL
Measuring error up to 5 mL — 0.5 mL
Measuring error above 5 mL — 10 % of measured value

Display parameters
All parameters are displayed numerically or graphically on the screen.

Parameter	Range	Resolution
V_T	0 to 999 mL	0 to 9.9 mL: 0.1 mL 10 to 99 mL: 1 mL
MV	0 to 30 L/min	0 to 0.99 L/min: 0.01 L/min 1 to 9.9 L/min: 0.1 L/min 10 to 30 L/min: 1 L/min
Leakage	0 to 100 %	0 to 10 %: 10 % 10 to 100 %: 1 %
Spontaneous component of MV	0 to 100 %	1 %
DCO_2	0 to 999 mL^2/s	1 mL^2/s
Flow curve	–20 to 20 L/min	–2.5 to 2.5 L/min: 0.1 L/min –5 to 5 L/min: 0.2 L/min –10 to 10 L/min: 0.4 L/min –20 to 20 L/min: 0.8 L/min
Frequency	0 to 9.9 bpm 10 to 999 bpm*	0.1 bpm 1 bpm
RVR	0 to 1000 bpm/mL	0.1 bpm/mL

* 1 bpm = 1 breath per minute

Inspiratory oxygen concentration

Sensor	Fuel cell in inspiratory flow, integrated in the unit
Measuring range	18 to 100 vol.%
Measuring accuracy	±3 vol.% referred to the medical gases oxygen and air. During calibration, Babylog 8000 plus expects these to contain 20.9 vol.% of oxygen and 100 vol.% of oxygen, respectively.

The measured value is displayed numerically on the screen.

Parameter	Range	Resolution
FiO_2	18 to 100 Vol.%	1 Vol.%

Measured lung values

Parameter	Range	Resolution
Compliance C of respiratory system	0.2 to 10 mL/mbar	0.1 mL/mbar
Resistance R	10 to 10000 mbar/L/s	1 mbar/L/s
Time constant TC of respiratory system	10 to 5000 ms	10 ms
Overdistension index C20/C	0 to 5	0.1

Alarm criteria

Insp. O_2 concentration
An alarm is generated if the measured inspiratory O_2 concentration FiO_2 is more than 4 vol.% above or below the set value for longer than 25 seconds.

Disconnection
A disconnection or a major leak in the hose system means that no (or an insufficient) ventilation pressure is generated. Detection is therefore achieved by checking whether a minimum pressure which depends on the operating mode and the PEEP and Pinsp settings is reached. An alarm is generated if, in ventilation modes IPPV/IMV, SIPPV and SIMV, the airway pressure does not lie above the minimum pressure PEEP + (Pinsp-PEEP)/4 for at least 0.025 seconds in each ventilation cycle.

Inspiratory pressure high
During mandatory inspiration, the airway pressure should not exceed the set pressure limits. An excess pressure of up to 5 mbar is tolerated so that coughing, for example, does not immediately generate an alarm. Above the alarm threshold Pinsp+5 mbar, the pressure-time integral of the excess value is calculated and an alarm is generated if this value exceeds 0.33 mbar. Mandatory inspiration is terminated at the same time.
Example: the airway pressure rises to 6 mbar above the pressure limit Pinsp and then remains constant. The alarm is generated after 0.33 s.
If, after the alarm, the pressure-time integral increases further and rises above 0.58 mbar·s, ventilation is terminated and the hose system is vented.

CPAP pressure high
An alarm is generated in ventilation mode CPAP and in the expiration phases of the mandatory ventilation modes if the airway pressure lies above the threshold PEEP/CPAP+4 mbar for more than 5 seconds. At the same time, the hose system is vented.
If the airway pressure rises above PEEP/CPAP+25 mbar, the alarm is generated after 0.3 seconds.

CPAP pressure low
An alarm is generated if the airway pressure drops below PEEP/CPAP–2 mbar and the pressure-time integral exceeds 6 mbar·s.

Tube blocked
A blocked or kinked endotracheal tube allows no breathing gas to flow, and this situation is detected by measuring the flow.
An alarm is generated if no flow is measured during a complete ventilation cycle in any mandatory ventilation mode.

Ventilation hose kinked
This situation is detected by measuring the airway pressure at the inspiration and expiration connectors of the ventilator. If a ventilation hose is blocked or kinked, the airway pressure at the inspiration connector rises and the pressure difference between the two connectors is considerably greater than in normal operation.
An alarm is generated if the pressure difference exceeds 8 mbar+0.6 Insp. Flow (in L/min). At the same time, the hose system is vented.

Tidal volume VT low
This is detected when the VG volume regulation function cannot apply the set tidal volume. An alarm is generated if VT is less than 90 % VTset or VTset-0.5 mL, whichever is lower. The reasons for this may be:
1. that PInsp is set too low and the ventilation pressure is insufficient to generated the desired VT or
2. that there is no plateau in the inspiration because the inspiratory flow is set too low or the inspiration time TI is set too short.

The alarm is delayed by the time "Alarm delay".

Minute volume MV
An alarm is generated if the measured minute volume lies outside the adjustable alarm limits. If, however, the volume drops below the lower alarm limit, the alarm is delayed by a time which can be adjusted between 0 and 30 seconds. Brief interruptions of the breathing can thus be tolerated without an immediate alarm. The alarm limits can be set between 0 and 15 L/min, but the upper limit must always be set higher than the lower limit.

Apnoea
An alarm is generated if the ventilator does not detect any ventilation for a period longer than the set apnoea time, where "ventilation" means a minimum tidal volume. This must be at least 0.6 mL for mandatory ventilation, at least 0.4 mL for spontaneous breathing and at least 0.2 mL for high-frequency ventilation. The apnoea time can be set in the range 5 s to 20 s.

Panting
An alarm is generated if the measured breathing frequency is greater than the current setting of the adjustable panting frequency limit.

Safety principle
The Babylog 8000 plus is a software-controlled ventilator. Its safety concept is based on the use of two microprocessor systems which operate independently of each other, each monitoring the functions of the other. The measuring and alarm functions required for this are duplicated.

Operating data

Mains supply voltage	Range: 100/110/127 V ±10 % 230/240 V ±10 % switchable 50/60 Hz
Current consumption	
at 230 V	0,6 A
at 110 V	1,3 A
Power consumption	approx. 140 W
Fuses	
Range 100 V to 127 V	T4A H 250V IEC 127-2/ $\overline{V}$
Range 230 V to 240 V	T4A H 250V IEC 127-2/ $\overline{V}$

Gas supply	
O_2 operating pressure	3 bar –10 % to 6 bar +10 %
O_2 connection thread	M12 x 1, female
Air operating pressure	3 bar –10 % to 6 bar +10 %
Air connection thread	M20 x 1.5, male The gases must be dry and free of oil and dust.
Gas consumption for control	approx. 3.0 mL/min air
Gas consumption for ejector	10 L/min
Total gas consumption	max. 43 L/min air or O_2
Sound pressure (free-field measurement over reflecting surface)	
Protection classification	 Type BF bodyfloating ≙ EN 60601-1, section 19, tab. 4: max. permissive earth leakage current 0.5 mA
Dimensions (W x H x D)	
Basic unit	212 x 280 x 390 mm
Unit with trolley	700 x 1335 x 700 mm
Weight	
Basic unit	approx. 14.5 kg
Electromagnetic compatibility EMC	Tested to EN 60601-1-2
Classification according to Directive 93/42/EC Appendix IX	Class II b
UMDNS-Code Universal Medical Device Nomenclature System	17 – 361

Analogue and digital interfaces (optional)

All inputs and outputs of the analogue and digital interfaces are electrically isolated from the electronics of the ventilator. The electric strength is 2.5 kV.

Analog1 and Analog2
The outputs are resistant to short circuits.
The output voltages are generated by one 12-bit D/A converter, followed by a low-pass filter, for each interface.

Connection plug	SMB-Subclic

Signal delay	Electronic filter circuits in the Babylog 8000 plus delay the signals for airway pressure and flow by about 15 ms with respect to the sensor signals. This delay must be taken into account when measuring with a separate measuring device and comparing its output with the analogue output of the Babylog 8000 plus.
Output resistance	≈ 10 kΩ

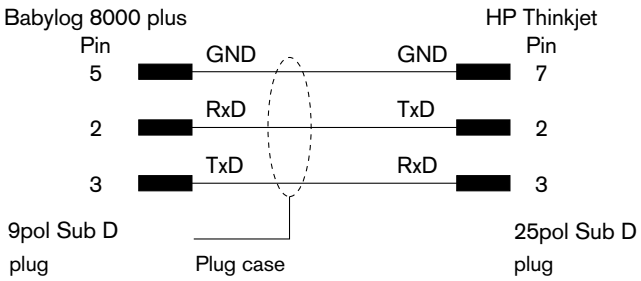
Pulse output

The output is resistant to short circuits.

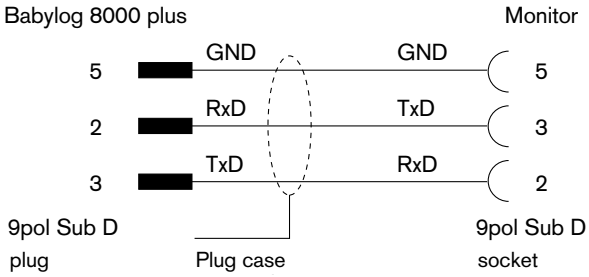
H-level voltage	5 V ±0.5 V unloaded
L-level voltage	0 V ±0.5 V unloaded
Output resistance	<5 kΩ
Connection plug	SMB-Subclic

RS 232 interface
Levels in accordance with DIN 66020

Pin assignments of printer cable 83 06 489



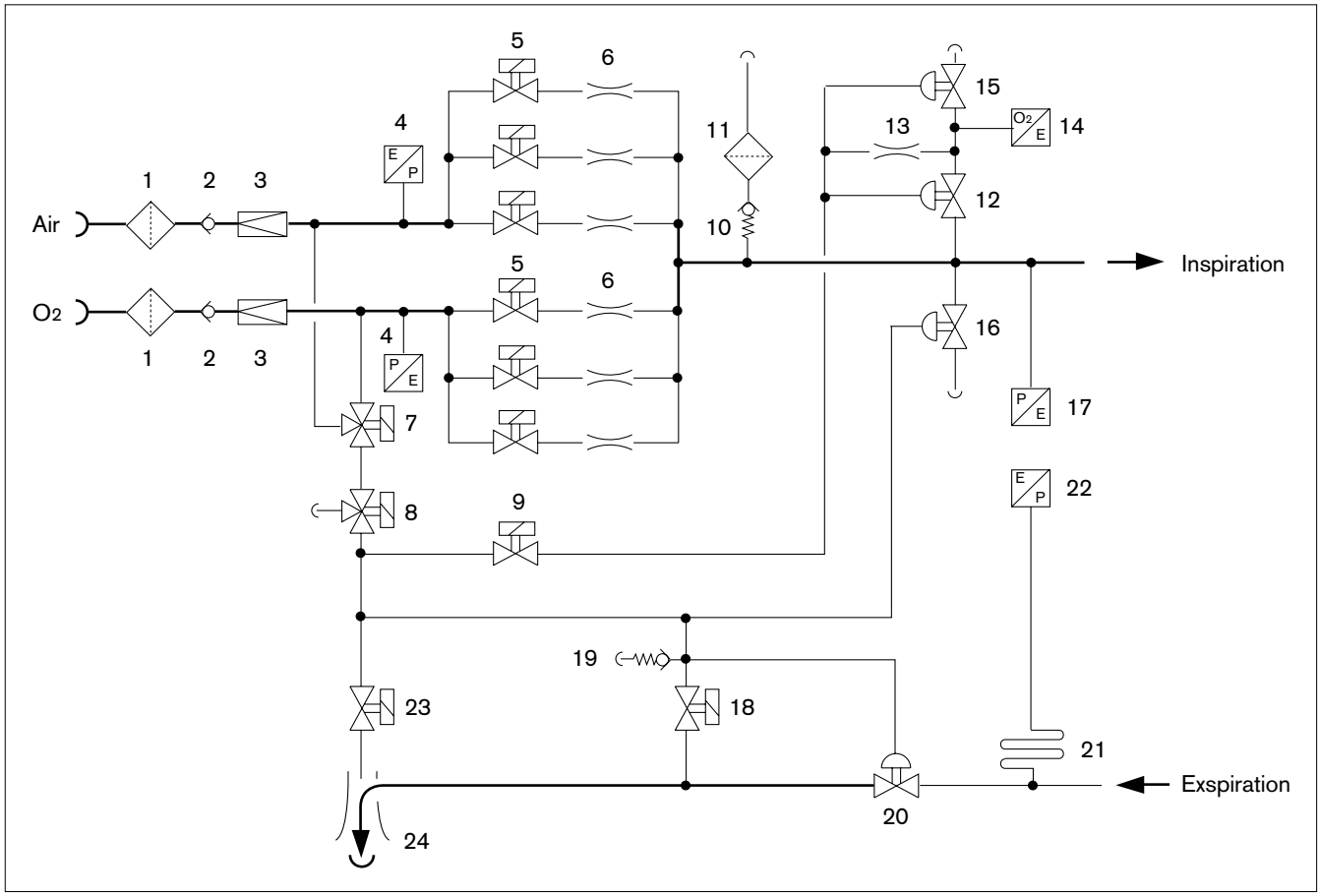
Pin assignments of monitor cable 83 06 488



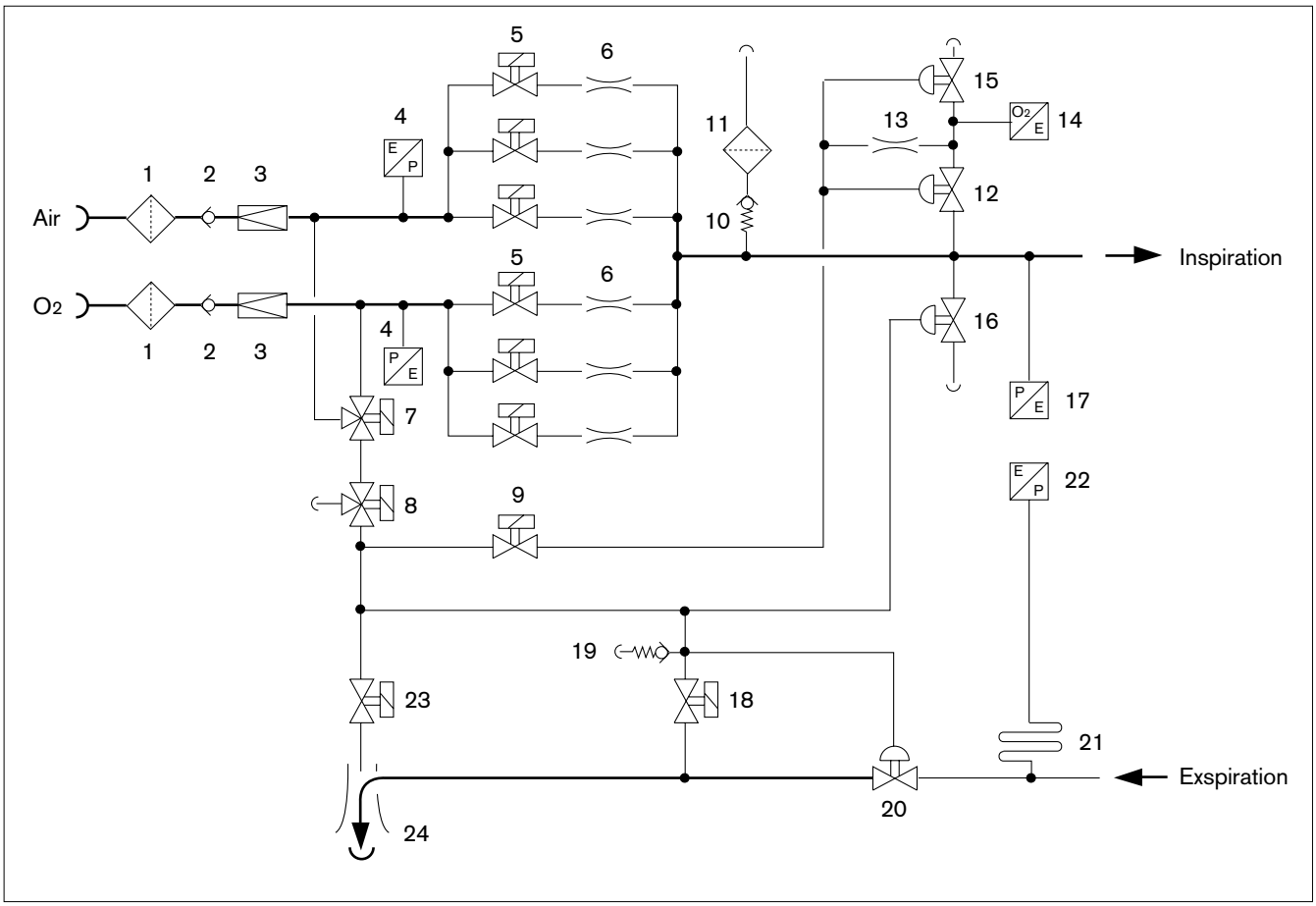
Description

Contents

Block diagram of the pneumatic circuit
(simplified)



1 Sintered filter
2 Non-return valve
3 Pressure regulator
4 Absolute-pressure sensor
5 Solenoid valve of mixer and dosing unit
6 Flow adjuster of mixer and dosing unit
7 Solenoid changeover valve
8 Solenoid valve
9 Solenoid valve
10 Non-return valve
11 Filter
12 Pneumatic control valve
13 Flow adjuster
14 O2 sensor
15 Pneumatic control valve
16 Pneumatic safety valve
17 Relative-pressure sensor
18 Electrical PEEP control valve
19 Safety valve
20 Expiration valve
21 Bactericidal labyrinth
22 Relative-pressure sensor
23 Solenoid valve
24 Ejector



Gas supply

The compressed gases air and oxygen are connected via the filters **1** and the non-return valves **2** to the pressure regulators **3**, which maintain a constant system pressure for each gas.

The non-return valves **2** prevent gas from flowing back into the central gas supply system.

The absolute-pressure sensors **4** measure and monitor the system pressures. After the pressure regulators **4**, gas and oxygen are tapped off and fed to the solenoid valve **7**. This connects either control air or calibration gas via solenoid valve **8** to the solenoid valve **9**, the solenoid valve **23**, the safety valve **16**, the PEEP control valve **18** and the expiration valve **20**.

From the pressure regulators **3**, both gases flow to the solenoid valves **5** and the flow adjusters **6**, which mix the gases and control their flow.
The gas mixture flows via the inspiration hose to the patient.

If the gas supply fails, room air can be drawn in via the filter **11** and the non-return valve **10**. The non-return valve **10** prevents breathing gas from escaping into the room.

Controlled ventilation

There is a continuous flow of gas through the inspiration hose to the Y-piece.

The oxygen sensor **14** measures the inspiratory oxygen concentration through the pneumatic valve **12**, which is open.

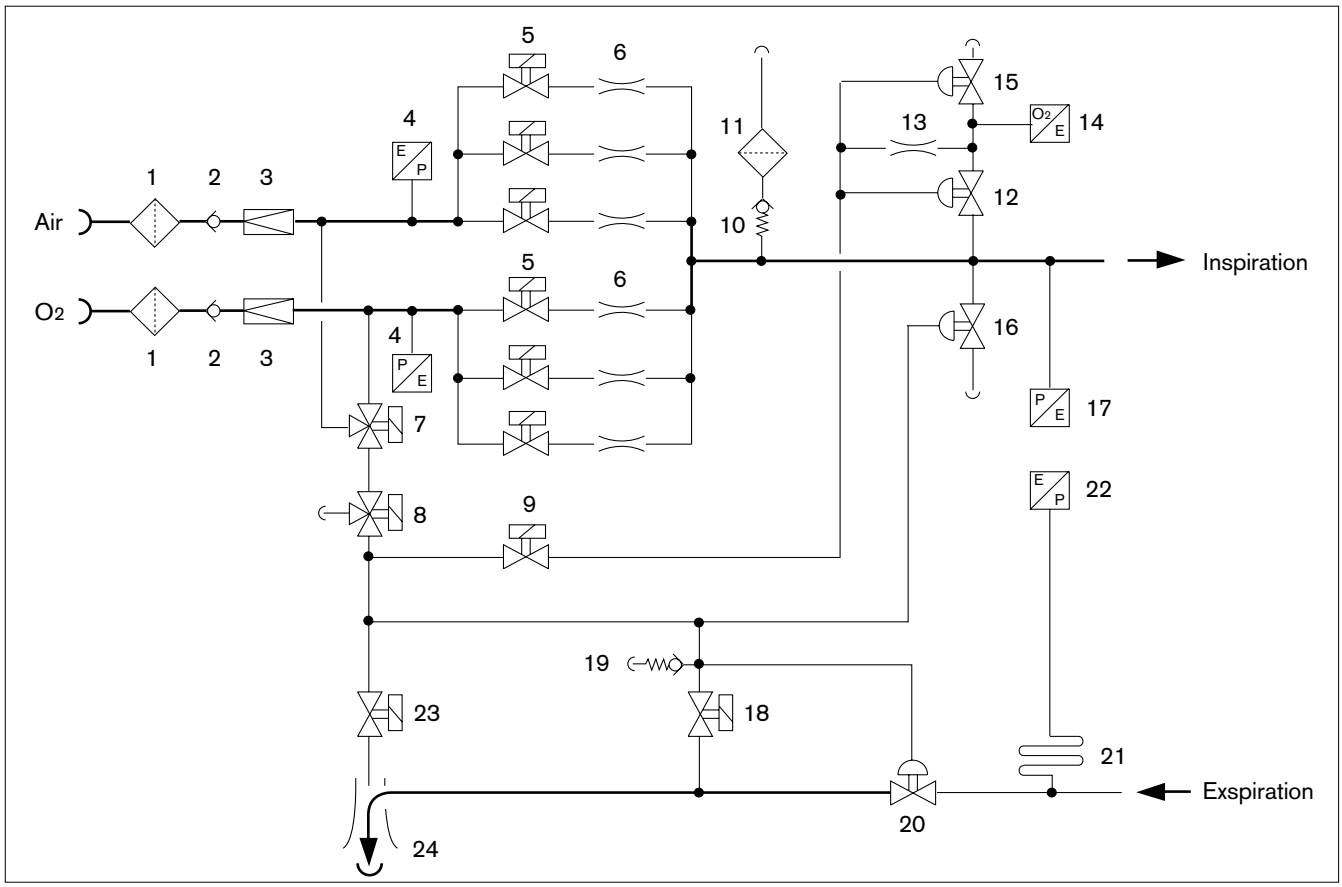
The safety valve **16** prevents overpressure in the hose system if, for example, the expiration hose becomes blocked.

Inspiration

The expiration valve **20** is activated by the PEEP control valve **18** and closes the expiration side. The continuous gas flow thus flows into the patient's lungs. The airway pressure is measured by the two relative-pressure sensors **17** and **22**. Limiting of the inspiratory pressure is controlled via the expiration valve **20**.

Expiration

The PEEP control valve **18** releases the system pressure on the expiration valve **20**, which opens the expiration side. The patient thus breathes out via the open expiration valve **20**. The ejector **24** is driven via the open solenoid valve **23** and supports the expiration.



PEEP

The PEEP control valve **18** generates a control pressure on the control side of the expiration valve **20**. This pressure regulates the PEEP in the ventilation system.

CPAP

The control pressure generated by the PEEP control valve **18** acts on the control side of the expiration valve **20** and generates a continuous positive airway pressure in the ventilation system.

There is a continuous flow of gas through the Y-piece and the expiration valve **20**.

Measurement of ventilation parameters

Oxygen measurement

The O2 sensor **14** continuously measures the inspiratory O2 concentration via the pneumatic valve **12**.

Automatic two-point calibration is carried out every 24 hours, as follows:

Air is first connected to the pneumatic valve **12** via the solenoid valve **7**, the solenoid valve **8** and the solenoid valve **9**. The pneumatic valve **12** closes the connection between the oxygen sensor **14** and the inspiration line.

The pneumatic valve **15** is opened and the oxygen sensor **14** is flushed with air for about 2.5 minutes via the flow adjuster **13**.

After this, the sensor is flushed with oxygen in the same manner. After calibration, the solenoid valve **7** switches back to air, solenoid valve **9** closes, pneumatic valve **15** closes and pneumatic valve **12** connects the oxygen sensor to the inspiration line again.

Measurement of airway pressure

The two relative-pressure sensors **17** and **22** determined the pressures at the inlet and outlet sides of the hose system. The unit determines the airway pressure at the Y-piece, taking into account the pressure drop caused by the continuous flow in the hose system.

The bactericidal labyrinth **21** prevents contamination of the pressure sensor **22** by the expired gas.

Continuous Positive Airway Pressure (CPAP)

The Babylog 8000 plus maintains the airway pressure at the PEEP/CPAP level. The patient can breathe spontaneously at any time. The continuous flow setting should be clearly higher than that required by the patient for spontaneous breathing in order to avoid variations of the airway pressure and the related increased breathing effort.

Intermittent Positive Pressure Ventilation / Intermittent Mandatory Ventilation (IPPV/IMV)

Mandatory ventilation with continuous flow, ignoring any spontaneous breathing. The ventilation strokes are executed in the rhythm set for TI and TE. No distinction is made between IPPV and IMV because the wide adjustment range for TE (up to 30 seconds) also covers the frequency range for IMV.

Between the ventilation strokes, the Babylog 8000 plus maintains the airway pressure at the PEEP/CPAP level, which means that the patient can always breathe spontaneously.

The settings V̇ insp, TI and Pinsp determine the shape of the ventilation stroke: the continuous flow determines the leading edge, TI determines the duration and the pressure is limited to Pinsp. If the pressure curve reaches Pinsp, a pressure plateau results; if not, the pressure curve has a sharp peak.

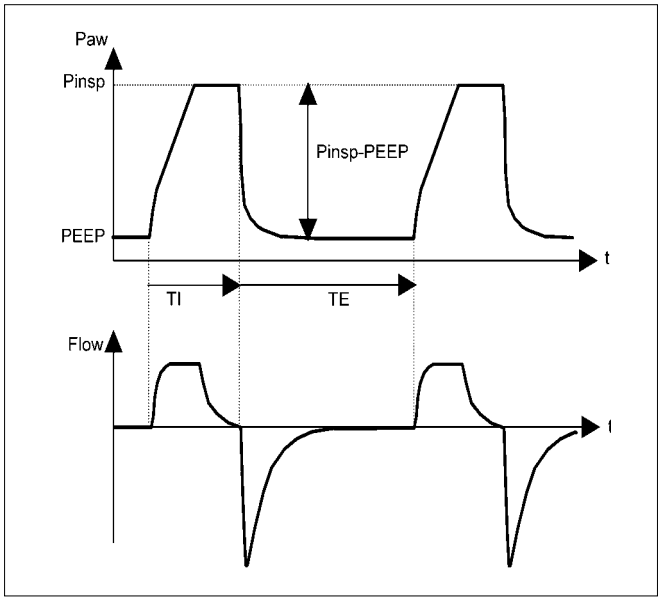
The tidal volume depends on the pressure pattern. The relationship is simple in two limit cases.

Case 1, long plateau:
If the plateau is so long that the inspiratory flow drops to zero by the end of TI, the lung pressure is the same as the airway pressure and the ventilation pressure - the difference between Pinsp and PEEP - controls the tidal volume.

$VT = (Pinsp – PEEP) \cdot Crs$

where Crs is the compliance of the respiratory system.

Case 2, no plateau:
If there is no inspiratory plateau, Pinsp has no effect. Part of the continuous flow V̇ insp fills the hose system in each ventilation stroke; only the remainder of the flow enters the lungs. The hose system is thus also ventilated.

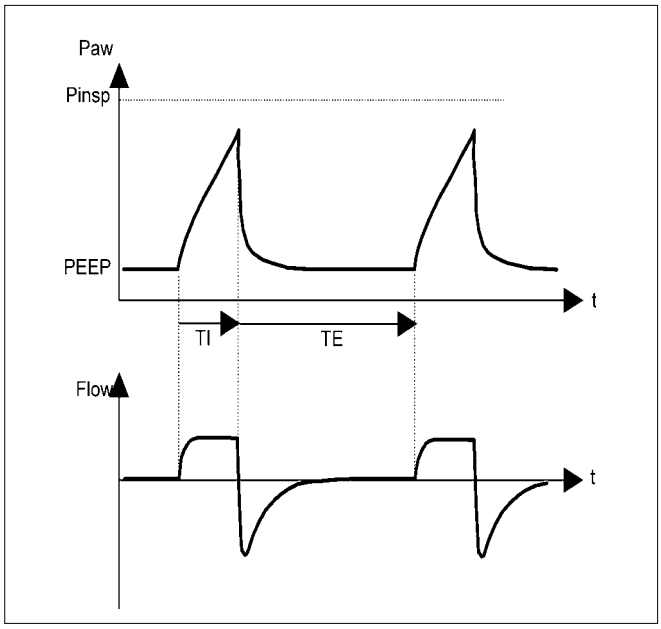


The tidal volume is approximately

$VT = TI \cdot \dot{V}\,insp \cdot Crs/(Crs + Cs)$

where Cs is the compliance of the hose system. The effects of the hose system can be considerable, particularly with small patients, because Crs and Cs are approximately equal.
If, for example, Crs = Cs = 0.5 mL/mbar, only half of the set continuous flow actually enters the patient's lungs.

This effect (the fact that the hose system is also ventilated) occurs on all ventilators. In order to measure the actual inspired and expired tidal volume, the flow sensor of the Babylog 8000 plus is located in the Y-piece.



Synchronized Intermittent Positive Pressure Ventilation (SIPPV)

The ventilation strokes are synchronised with spontaneous breathing. A stroke begins when a spontaneous inspiration is detected and ends after the inspiration time TI.

The shape of the ventilation stroke is set just as for IPPV/IMV. The Babylog 8000 plus detects the spontaneous inspiration by flow measurement. A ventilation stroke is triggered if

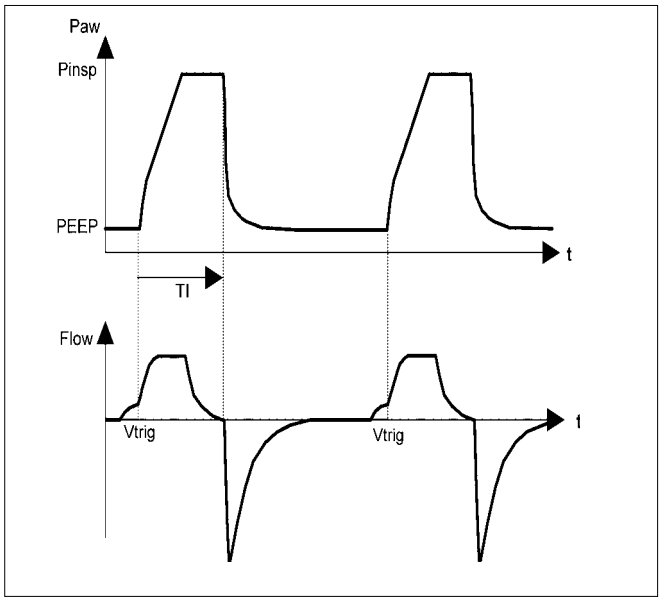
- inspiratory flow is detected after an expiration and
- the volume continuously inspired during the spontaneous inspiration (the trigger volume Vtrig) reaches the set trigger sensitivity and
- the volume Vtrig is inspired by the end of TE.

Furthermore, a ventilation stroke may not be triggered less than 0.2 seconds after the end of the preceding stroke, so that the patient has time to breathe out.

The patient controls the ventilation frequency, which may be up to

fmax= 1/(TI+0.2 s+RT)

where RT is the trigger response time, i.e. the time from the start of a spontaneous inspiration to the start of the triggered ventilation stroke.



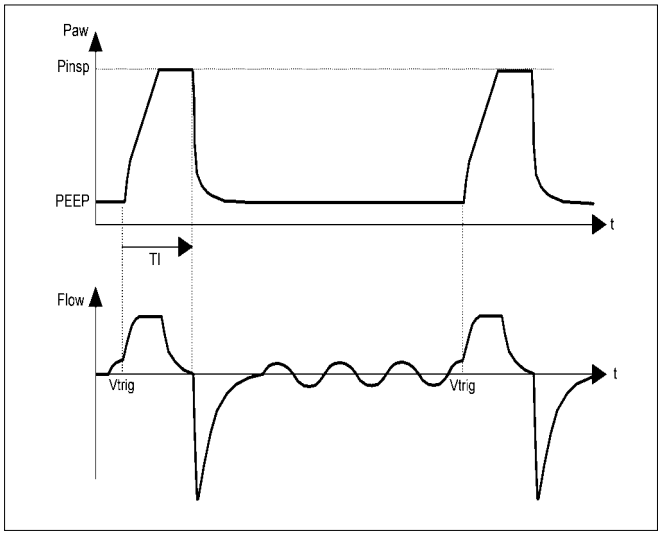
If the patient stops breathing, ventilation in IPPV/IMV mode is started.

SIPPV is suitable for patients with sufficient spontaneous breathing and regulation. The patient can be weaned from the ventilator by gradually reducing the inspiration pressure.

Synchronized Intermittent Mandatory Ventilation
(SIMV)

SIMV combines synchronised ventilation with spontaneous breathing. In contrast to SIPPV, support is not provided for each spontaneous inspiration, but only for a sufficient number to ensure that ventilation is executed with the set frequency. Between the ventilation strokes, the patient can breathe spontaneously, but receives no support from the ventilator.

In each time interval with the length TI+TE, the first spontaneous inspiration triggers a ventilation stroke with the length TI. Any further spontaneous inspiration during this period is ignored. The ventilation strokes thus have the irregular rhythm of spontaneous breathing, but their average frequency is the same as the set frequency value.



Triggering is carried out in the same way as for SIPPV.

The shape of the ventilation stroke is adjusted as for IPPV/IMV.

In SIMV mode, the ventilation frequency can be adjusted just as in IPPV/IMV mode. Triggered mandatory ventilation strokes alternate with spontaneous-breathing phases without support, during which the patient must do all the breathing work.
By extending TE, it is thus possible to transfer an increasing proportion of the total breathing work from the ventilator to the patient.

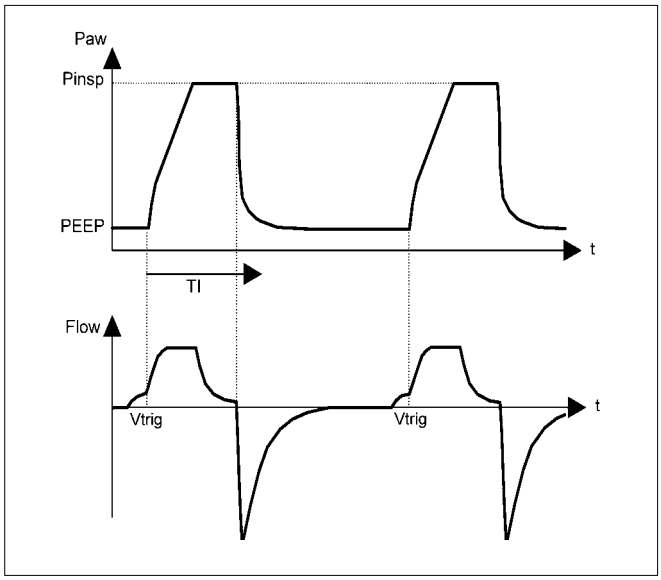
If the patient stops breathing, ventilation in IPPV/IMV mode is started.

SIMV is suitable for patients with sufficient spontaneous breathing. Weaning can be carried out by gradually increasing TE and lowering the inspiratory pressure.

Pressure Support Ventilation (PSV)

The PSV mode operates in a manner which is basically similar to SIPPV. In addition to the breathing frequency, however, the patient also controls the duration of the ventilation stroke via the flow in this mode. The mandatory inspiration is terminated when the flow drops to 15 % of the maximum inspiratory flow, or after the time TI, whichever occurs first.

In order for the inspiratory flow to drop during the ventilation stroke, the pressure pattern must have a plateau (see the description of IPPV/IMV). If this is the case, the lung pressure rises as the lungs fill, approaching the airway pressure, and the flow decreases.
The rate at which the lung pressure approaches the airway pressure depends on the time constant Trs of the respiratory system. The shorter the Trs, the faster the lungs fill with air. The ventilation stroke in PSV mode thus ends when the lungs are almost full, and the effective inspiration time is optimally matched to the requirements of the patient.



Triggering is carried out in the same manner as in SIPPV mode.

Apart from the inspiration time, the shape of the ventilation stroke is set in the same manner as for IPPV/IMV mode. If the plateau is too short, the ventilation stroke is terminated after time TI, as in SIPPV mode.

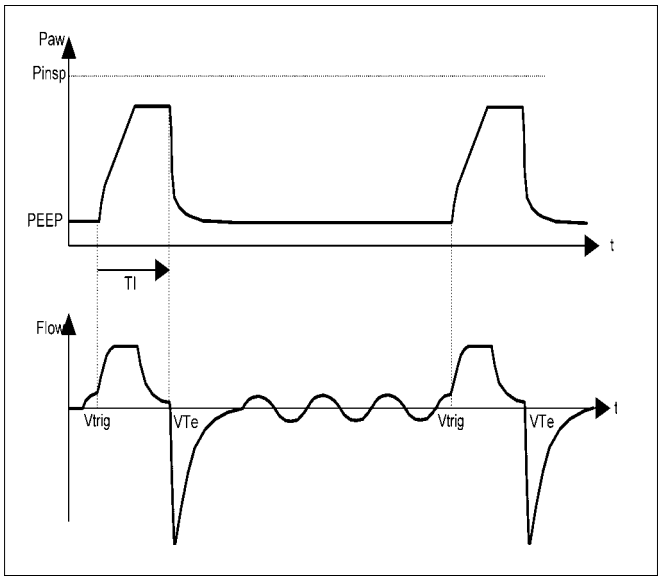
If the patient stops breathing, ventilation in IPPV/IMV mode is started.

PSV is suitable for patients with sufficient spontaneous breathing and regulation. The patient can be weaned from the ventilator by gradually reducing the support pressure.

Volume Guarantee
(VG)

The additional function VG provides volume control of the mandatory ventilation strokes. For this, the Babylog 8000 plus automatically regulates the inspiratory plateau in order to apply the set tidal volume.
This function compensates for changes in the mechanical characteristics of the respiratory system and keeps the tidal volumes of the mandatory ventilation strokes constant.

VG can be used in the ventilation modes SIPPV, SIMV and PSV. The diagram on the right shows its use with SIMV as an example.



The advantage over time-controlled, pressure-limited ventilation is that changes in the resistance or compliance of the respiratory system have no effects on the tidal volume. If, for example, the compliance rises, the inspiration pressure is reduced automatically. Inversely, if the compliance drops, the pressure rises; however, it never exceeds the set pressure limit Pinsp. The function also compensates for variations in spontaneous breathing: the better the patient breathes, the less pressure is applied by the ventilator. With VG, therefore, the Babylog 8000 plus always operates with the pressure which is just needed for the desired tidal volume, reducing the pressure stresses on the lungs to the absolute minimum necessary.

Without VG, the user must adjust the inspiratory pressure manually to obtain the desired tidal volume. The VG function thus also relieves the user of tedious routine work.

The regulation functions within the range between PEEP and Pinsp. By setting Pinsp, the user determines the maximum pressure the ventilator may use.

There are two situations in which the regulator cannot achieve the desired volume, namely if:

1. Pinsp is too low or
2. the inspiratory pressure pattern does not have a plateau because the flow is too low or TI is too short.

In both cases, the Babylog 8000 plus displays a warning message if the actual VT lies below 90 % of the desired volume.

Regulation is carried out incrementally from one breath to the next. The expiratory VT is measured and compared with the desired volume and a new plateau pressure is calculated for the next breath. If the desired volume is changed, it takes about seven ventilation strokes for the system to reach the necessary inspiration pressure for this volume.

In the case of a serious leak in the tube, the expired VT may (just as in other ventilation modes) be greater than that measured at the expiration connector. The inspiratory tidal volume will then differ from the expiratory tidal volume. If, in the course of a ventilation stroke, the actual inspiratory VT exceeds the VTe of the previous stroke by an amount which depends on the actual leakage, the Babylog 8000 plus terminates the inspiration stroke.

If the flow sensor fails, or if the patient stops breathing spontaneously, mandatory ventilation is started as in IPPV/IMV mode.

High-Frequency Ventilation

(HFV)

Ventilation with high-frequency pressure oscillations permits gas exchange in the lungs in spite of the very small tidal volumes - often in the same order of magnitude as the dead space volume. While the pressure variations in the hose system can be fairly large, the lungs are subjected only to small variations around the mean pressure. The mechanical stresses resulting from distension and relief of the lungs are small.

Principle of operation

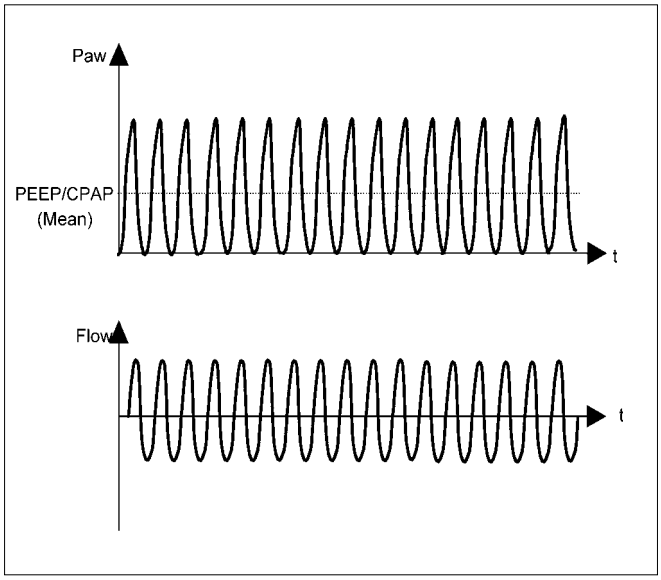
The high-frequency pulses, just like the breathing cycles in conventional mandatory ventilation, are controlled with the aid of the diaphragm of the expiration valve. During the inspiration phases of the HF oscillations, the pressure is above the mean airway pressure; during the expiration phases, it is below this value. The mean pressure is automatically regulated to the value set with the PEEP/CPAP rotary knob.

For this regulation, the ventilator must automatically set the continuous flow and the I:E ratio of the HF cycles. With HFV active, the rotary knob for the continuous flow is disabled. Furthermore, the VIVE option cannot be used together with HFV.

The pressure amplitudes at the Y-piece depend on the amplitude setting and also on the hose system and the respiratory system of the patient. It is thus necessary to adjust the amplitude on the relative scale from 0 to 100 % until the desired pressure or the desired tidal volume is achieved.

HFV with CPAP

The high-frequency oscillations are continuously superimposed on the mean pressure (PEEP/CPAP).



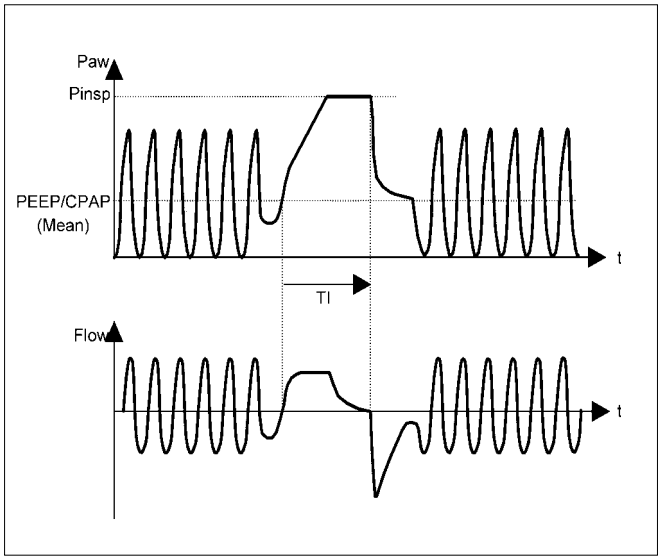
HFV with IMV

The high-frequency oscillations are superimposed on the PEEP/CPAP pressure during the expiration time TE between the IMV strokes. They stop 100 milliseconds before an IMV stroke and start again 250 milliseconds after the stroke. The delay after the stroke is intended to ensure sufficient time for expiration and to avoid air-trapping.

The IMV strokes are controlled by the settings V̇ insp, Pinsp, PEEP/CPAP and TI.

Due to the IMV strokes, the mean airway pressure is slightly higher than for HFV with CPAP.

During the HF phases, the pressure again oscillates around the PEEP/CPAP level.



Monitoring with HFV

As for conventional ventilation, the ventilation curves for pressure and flow are measured and optionally displayed. As a special feature for HFV, the following are measured:

$DCO_2 = VTHF^2 \cdot f$

This is the transport coefficient for CO_2, which is an indication of the amount of volume ventilation during HFV, rather like the minute volume for conventional ventilation.

VTHF

This is the tidal volume of the HF pulses, averaged over several HF cycles.

MVim

This is the minute volume taken up by IMV strokes, measured on the inspiration side.

VTim

This is the minute volume taken up by IMV strokes, measured on the expiration side.

Measurement of airway pressure

The Babylog 8000 plus measures the airway pressure indirectly in order to avoid the need for a separate pressure-measurement hose to the Y-piece. Two piezo-resistive pressure sensors measure the pressures at the inspiration connector (PI) and at the expiration connector (PE) within the ventilator. The airway pressure PY is calculated from these two values.

Due to the fact that the ventilator operates with a continuous flow, the inspiratory pressure PI is the starting point for this. The continuous flow V insp generates a pressure drop in the inspiratory leg of the Y-piece which depends on the resistance RI of the inspiration hose and the value of $\dot{V}$ insp, as follows:

$P = \dot{V}\,\text{insp} \cdot RI$

P depends only slightly on the ventilation pattern. The desired pressure at the Y-piece is thus approximately equal to the pressure PI reduced by the pressure P:

$PY = PI - P = PI - \dot{V}\,\text{insp} \cdot RI$

The airway pressure at the Y-piece can thus be calculated if the resistance RI is known.

The total resistance of the hose system can be measured during ventilation with the aid of the sensors for PI and PE. It is not, however, possible to determine the inspiratory component of this total value.
Comprehensive laboratory tests have shown that the inspiratory leg of all commonly used hose systems accounts for about 70 % of the total resistance. The Babylog 8000 plus therefore uses this estimate for calculations:

$PY = PI - 0.7 \cdot \langle PI - PE \rangle$

where <PI – PE> represents the average over time of the pressure drop in the entire hose system. If a hose system with a resistance distribution other than 30 % to 70 % is used, there will be an error in the measured airway pressure. With the hose systems in general use, this error is less than 1 mbar, but it may be greater in very resistive systems, particularly if high continuous flow rates are used. For this reason, only hoses with an internal diameter of at least 10 mm should be used.

Measurement of flow and volume

The flow is measured with a hot-wire anemometer in the Y-piece or with a sensor fitted between the Y-piece and the tube. The direction of flow is detected by using two hot wires, one of which is shielded by a baffle on one side.

The lowest flow rate which can be detected reliably is 0.2 L/min. Flow rates below this are suppressed and displayed as zero.

There are two different types of flow sensors available:

- the Y-sensor, integrated into the Y-piece and
- the ISO sensor, inserted between the Y-piece and the tube connector.

Both types use the same sensor insert, but their characteristics are nevertheless not identical. The type of flow sensor being used is selected in the menu in order to optimise the measurement function.

Reference condition

Primarily, hot-wire anemometers measure quantities of gas, rather than volumes or flow rates. As defined in the state equation for gases, the volume of a specific amount of gas depends on the ambient conditions, namely atmospheric pressure, temperature and relative humidity.

The Babylog 8000 plus displays the measured volume and flow values for one of two different reference conditions:

- NTPD (temperature 20 °C, atmospheric pressure 1013 mbar, dry air) or
- BTPS (body temperature 37 °C, actual atmospheric pressure, air saturated with moisture).

The desired reference condition is selected in the menu.

Leakage rate

If the tube is not a tight fit, some air will often escape between the wall of the trachea and the tube. Since the flow sensor of the Babylog 8000 plus is located in the Y-piece, i.e. upstream of the leak, breathing gas is lost after measurement during inspiration and before measurement during expiration. The tidal volume measured on the inspiration side is thus larger than the actual tidal volume, while that measured on the expiration side is smaller. Averaged over time, the difference between the inspiratory and expiratory flow is equal to the leakage flow, since the amount of gas which does not flow back through the sensor during expiration must have escaped through the leak.

The Babylog 8000 plus determines the leakage flow from the difference between the inspiratory minute volume MVi and the expiratory minute volume MVe (which is displayed as MV). Normalised for MVi, the leakage rate in percent displayed on the screen is:

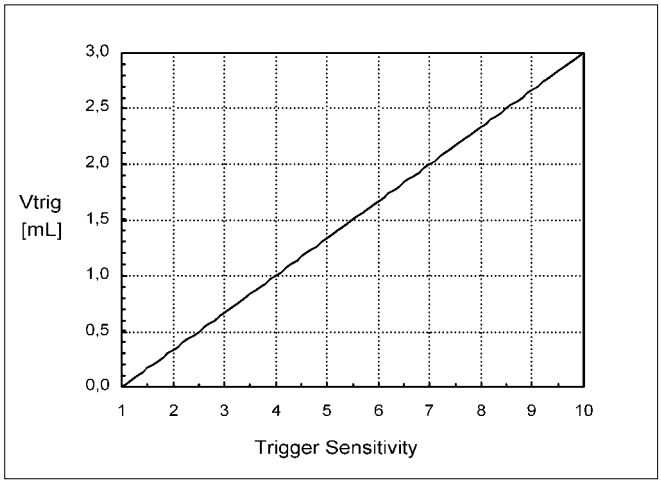
Leakage rate = 100 % · (MVi - MVe) / MVi

Trigger function

The Babylog 8000 plus detects spontaneous breathing by measuring the flow. When the patient attempts to breath in, the flow signal, which was until then zero or negative (= expiration), starts to rise. In order to reliably detect inspiration, and to avoid triggering a ventilation stroke as the result of interference signals, the patient must first breathe in a certain volume Vtrig. This volume is set as the trigger sensitivity on a scale from 1 to 10 in the menu, where 1 is the highest and 10 is the lowest sensitivity. The diagram on the right shows the relationship between the sensitivity and the trigger volume Vtrig.

At the maximum sensitivity, Vtrig = 0 and the inspiratory flow needs to reach only the minimum value of 0.2 L/min in order to trigger a stroke. However, it is possible for strokes to be triggered by artefacts at this setting. If self-triggering occurs, the sensitivity should be reduced.

With decreasing sensitivity, the delay between the spontaneous inspiration and the ventilation stroke increases. This delay may not be so long that the inspiration stroke hinders the spontaneous expiration, since the patient would then have to "fight" the ventilator. The best sensitivity is thus always a compromise between the shortest possible trigger delay and the reliable protection against self-triggering.



Measuring lung parameters

The Babylog 8000 plus calculates the following parameters from the pressure, flow and volume ventilation curves for a ventilation cycle:

- C
  The dynamic compliance of the respiratory system, calculated by linear regression.
- R
  The resistance of the airways and the ET tube, calculated by linear regression.
- r
  The correlation coefficient.
- TC
  The time constant of the respiratory system (TC = R · C).
- C20/C
  The overdistension index, calculated in accordance with [1]

The Babylog 8000 plus 5.n first stores all measured values Paw(t), flow(t) and V(t) for one ventilation stroke with a maximum duration of 5 seconds. 120 measured values are taken per second. These data are then evaluated and the results are displayed. A further ventilation cycle is then stored and evaluated, and so on. The displayed results do not, therefore, belong to the current ventilation cycle; in general, they are several seconds old.

The calculation is based on the equation

$$Paw = R \cdot Flow + V/C$$

which is valid for a single-compartment model of the respiratory system at any point in time during a ventilation stroke. The resistance and compliance are assumed to be constant. The linear regression method finds the values for R and C which best match the measured values pressure, flow and volume. The correlation coefficient, which is a number between 0 and 1, is an indication for the quality of the match. The closer this coefficient is to 1, the better the agreement.

Since the Babylog 8000 plus knows only the airway pressure, but not the pleura or oesophageal pressure, spontaneous breathing cannot be taken into account. If strong spontaneous breathing is superimposed on the ventilation, the results of the evaluation will be falsified.

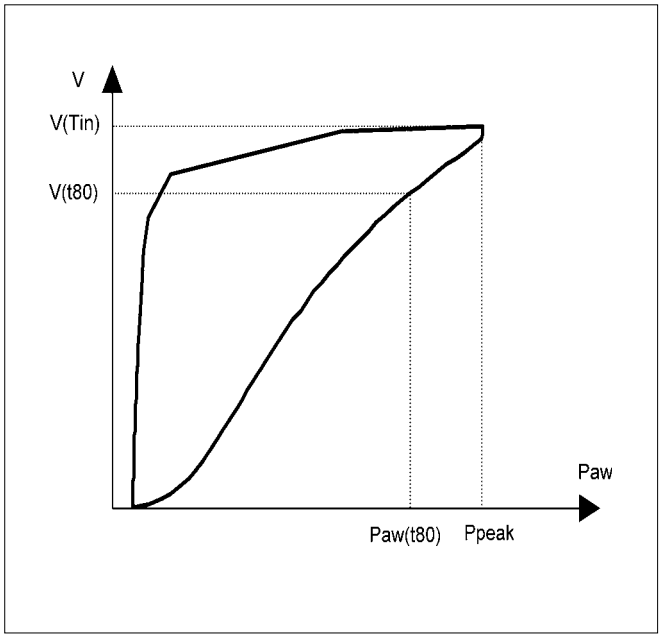
The same applies if there is a major leak: the displayed value for resistance and compliance will be too high.

Possible falsification of the results by the above-mentioned conditions is indicated by a warning symbol on the screen. This is displayed if r is less than 0.95, if the leakage in the displayed curve is greater than 20% or if there is strong spontaneous breathing.

For the overdistension index, the ratio C20 is calculated from the volume increase from the last 20% of the inspiration pressure and is referred to the dynamic compliance [1]:

$$C20 = (V(TI) - V(t80)) / (0.2 \cdot Ppeak)$$

The results remain displayed until the next evaluation cycle has been completed. If, however, no new measured values are available within one minute, the display is cleared.



[1]
Identifying lung overdistention during mechanical ventilation by using volume-pressure loops by Joel B. Fisher, Mark C. Mammel, Michael C. Coleman, Dennis R. Bing, Stephen J. Boros Pediatric Pulmonology 5:10-14 (1988)

Rate-Volume Ratio
(RVR)

The ratio of the breathing rate to the tidal volume can help to assess the chances of successfully weaning the patient from the ventilator [1]. The Babylog 8000 plus calculates and displays the RVR. In order to avoid fluctuations of the measured value due to switching between spontaneous and mandatory breathing cycles, the ratio between the rate and the volume is not formed directly. Instead, the RVR is calculated with the formula

$$RVR = f / VT = f^2 / MV$$

which is equivalent to averaging the RVR over a period of 10 to 15 seconds.

[1]
A prospective study of indexes predicting the outcome of trials of weaning from mechanical ventilation;
by Karl L. Yang, Martin J. Tobin
The New England Journal of Medicine, Vol 324, 21, 1991

Explanation of abbreviations

Abbreviation	Meaning
C	Compliance
CPAP	**C**ontinuous **P**ositive **A**irway **P**ressure Breathing
DCO_2	Transport coefficient which describes the transport of CO_2 out of the lungs
f	Frequency
FiO_2	Inspiratory O_2 concentration
Fpat	Spontaneous breathing frequency
HFV	**H**igh **F**requency-**V**entilation
IMV	**I**ntermittent **M**andatory **V**entilation
IPPV	**I**ntermittent **P**ositive **P**ressure **V**entilation
IRV	**I**nversed **R**atio **V**entilation
ISO 5369	International standard for medical ventilation equipment – lung ventilators
KG	Body weight [kg]
MV	Minute volume
MVim	Minute volume applied by mandatory ventilation strokes during high-frequency ventilation, measured on the inspiration side
Paw	Airway pressure
Peak	peak pressure
PEEP	Positive end-expiratory pressure
Mean	Mean pressure
Pinsp.	Maximum inspiration pressure
R	Resistance
RT	Trigger Response Time
RVR	**R**ate-**V**olume **R**atio
SIPPV	**S**ynchronized **I**ntermittent **P**ositive **P**ressure **V**entilation
TI:TE	Ratio inspiration time : expiration time
TI	Inspiration time
TE	Expiration time
$\dot{V}$	Inspiratory and expiratory flow
$\dot{V}_{insp.}$	Inspiratory flow
$\dot{V}_{exsp.}$	Expiratory flow
VIVE	**V**ariable **I**nspiratory flow, **V**ariable **E**xpiratory flow
V_T	Tidal volume
V_{THF}	Tidal volume generated by high-frequency pulses, averaged over several high-frequency pulses
V_{Tim}	Tidal volume applied by mandatory ventilation strokes during high-frequency ventilation, measured on the inspiration side
V_{trig}	Trigger volume

Explanation of symbols on the screen and keys

 Menu for setting the minute-volume alarm limits

 Upper alarm limit

 Lower alarm limit

 Menu for the log

 Reduce or scroll backwards

 Increase or scroll forwards

 Reduce time window

 Increase time window

 Move time window or select parameter

 Move time window or select parameter

 Disable alarm tone for 2 minutes

 Horn/alarm tone

 Pulse signal for display of events during ventilation

 Return to main menu

 Increase

 Decrease

 Select parameter

Call the calibration/configuration menu

Call the ventilation menu

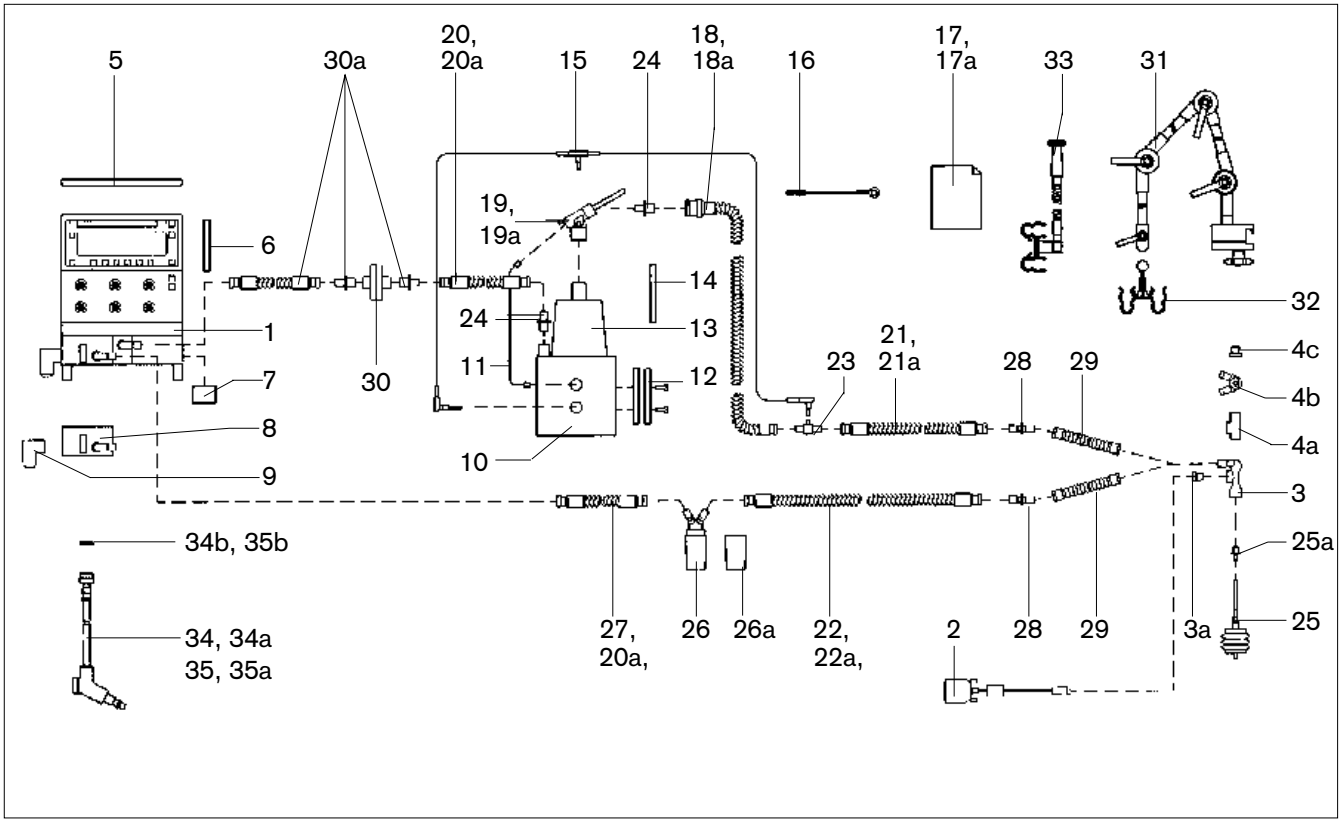
Call the ventilation options menu
(optional functions)

 Flow measurement is switched off

 FiO_2 measurement is switched off

 Apnoea monitoring is switched off

Parts List



Item No.	Designation/description	Order No.
1 – 9	Babylog 8000 plus 5.n, basic unit (see Order List for other versions)	84 09 200
2	Connection cable (flow sensor)	84 09 626
3	Y-piece with flow sensor	84 10 185
3a	Flow sensor (pack of 5)	84 10 179
4a	Flow sensor ISO 15	84 11 130
4b	Adapter K	84 03 075
4c	Cap	84 01 645
5	Instrument tray	84 09 455
6	Room-air filter	83 05 367
7	O_2 sensor capsule	68 50 645
8,9	Expiration valve with silencer	84 08 950
9	Silencer	84 09 990
10	Humidifier, basic unit 220 V to 240 V	84 11 046
11	Adaptor, hose heater	84 11 097
12	Mounting kit for rail	84 11 074
13	Humidifier chamber MR 340 including 100 sheets filter paper	84 11 047
14	Filter paper (100 sheets)	84 11 073

Item No.	Designation/description	Order No.
15	Double temperature sensor for hose 1.1 m	84 11 048
16	Drawing wire 1.5 m	84 11 050
17-22 23-29 17a-22a 23 - 26	Hose set, Fisher & Paykel	84 11 041
	Hose set HFV, Fisher & Paykel	84 11 153
17	Reversible sheet, Fisher & Paykel	84 11 042
17a	Reversible sheet HFV, Fisher & Paykel	84 11 155
18	Ventilation hose K ISO, 110 cm	21 65 651
18a	Hose, light, 0.75 m	84 11 156
19	Hose heater 1.10 m	84 11 045
19a	Hose heater 0.70 m	84 11 154
20	Silicone hose K. 0.25 m	84 09 636
20a	Hose, light, 0.25 m	84 10 817
21	Silicone hose K. 0.60 m	84 03 073
21a	Hose, light, 0.40 m	84 10 816
22	Silicone hose K. 1.00 m	84 03 080
22a	Hose, light, 0.65 m	84 10 814
23	Temperature sensor mounting	84 11 044

Item No.	Designation/description	Order No.
24	Catheter connector, size 11	M 19 351
25	Bellows K, complete	84 09 742
25a	Catheter connector	M 19 334
26	Water trap, Ex	84 09 627
26a	Container	84 03 976
27	Silicone hose K. 0.35 m	84 03 070
28	Double cone, 11a	84 09 897
29	Corrugated hose, flexible	84 10 709
30	Bacterial filter	84 09 716
30a	Connection set, bacterial filter	84 10 230
31,32	Hinged arm	84 09 609
32	Hose clip	84 09 841
33	Hinged arm for incubator 8000	84 11 075
34	O_2 connection hose, 3 m	M 29 231
34a	O_2 connection hose, 5 m	M 29 251
34b	Set of sealing rings for O_2 connection hose (pack of 3)	M 17 719
35	Air connection hose, 3m	M 29 239
35a	Air connection hose, 5m	M 29 259
35b	Set of sealing rings for air connection hose (pack of 3)	M 17 721
36	PEEP valve (not shown)	84 07 475
37	Resu-bag, baby (not shown)	21 11381
38	Hose, 1.8 m (not shown)	21 05438
39	Trolley 0,5 B (not shown)	84 09 280
40	Short rail (not shown)	2M 85 337
41	Wall-hung shelf Type 1, 0,5 B (not shown)	84 08 601
42	Mounting plate (not shown)	2M 19 460

Order List

Designation/description	Order No.
Babylog 8000 plus 5.n, basic unit Optional voltages: 100 V – 127 V / 220 V – 240 V	84 11 163
Babylog 8000 plus 5.n, basic unit Optional voltages: 100 V – 127 V / 220 V – 240 V with BabyLink option	84 11 162
Babylog 8000 plus 5.n, basic unit Optional voltages: 100 V – 127 V / 220 V – 240 V with HFV option	84 11 161
Babylog 8000 plus 5.n, basic unit Optional voltages: 100 V – 127 V / 220 V – 240 V with BabyLink and HFV options	84 11 160
O_2 sensor capsule	68 50 645
Babylog 8000 plus 5.n with options "Pressure Support Ventilation PSV" and "Volume Guarantee VG"	84 18 003
Babylog 8000 plus 5.n with options "High-Frequency Ventilation HFV", "Pressure Support Ventilation PSV" and "Volume Guarantee VG"	84 18 001
Babylog 8000 plus 5.n with options "BabyLink", "Pressure Support Ventilation PSV" and "Volume Guarantee VG"	84 18 002
Babylog 8000 plus 5.n with options "High-Frequency Ventilation HFV", "Pressure Support Ventilation PSV", "Volume Guarantee VG" and "BabyLink"	84 18 000
Accessories designed for use with the basic unit	
Hose set, Fisher & Paykel	84 11 041
Hose set HFV, Fisher & Paykel	84 11 153
optionally	
Trolley 0,5 B for mounting the Babylog	84 09 280 2M 85 337
Wall-hung shelf 0,5 B for mounting the Babylog	84 10 718
Mounting plate for use on an incubator	2M 19 460

Designation/description	Order No.
Hinged arm for use outside an incubator, with mounting for hinged arm	84 09 609
Hose clips for incubator 8000	84 11 075
Basic humidifier unit MR 340, 220 V – 240 V	84 11 046
Humidifier chamber MR 340, including 100 sheets of filter paper	84 11 047
Gas connection hoses	
O_2 connection hose, 3 m or O_2 connection hose, 5 m	M 29 231 M 29 251
Air connection hose, 3 m or Air connection hose, 5 m	M 29 239 M 29 259
Special accessories	
Conversion kit "High-Frequency Ventilation HFV" (for units up to Serial No. ARHC) (for units with Serial No. ARHD onwards)	84 11 134 84 11 208
Conversion kit "BabyLink"	84 11 108
Resu-bag »Baby« for manual ventilation	21 11 381
plus PEEP valve	84 07 475
Hose, 1.8 m, for O_2 supply to Resu-bag »Baby«	21 05 438
Water traps IN / EX	84 09 738
High-pressure water trap	84 12 628
Safety valve	84 12 448
Conversion kit "Pressure Support Ventilation PSV" and "Volume Guarantee VG"	84 11 473
Conversion kit "Medicament nebulizer"	84 11 025
consisting of: Coupling Connector Catheter connector 11mm Sealing plug for Y-piece Medicament nebulizer	 84 11 023 84 05 752 M 19 351 84 11 024 84 05 000

Designation/description	Order No.
Replacement sets for sterilisation	
Hose set, Fisher & Paykel	84 11 041
Hose set HFV, Fisher & Paykel	84 11 153
Expiration valve, Babylog 8000 plus	84 08 950
Y-piece with flow sensor	84 10 185
Flow sensor ISO 15	84 11 130
Adapter K	84 03 075
Cap	84 01 645
Spare and replacement parts	
Hose set, Fisher & Paykel	84 11 041
Hose set HFV, Fisher & Paykel	84 11 153
Expiration valve, Babylog 8000 plus	84 08 950
Y-piece with flow sensor	84 10 185
Flow sensors (pack of 5)	84 10 179
Flow sensor ISO 15	84 11 130
Adapter K	84 03 075
Cap	84 01 645
O_2 sensor capsule	68 05 645
Cable for double temperature sensor for hose, 1.1 m	84 11 048
Drawing wire, 1.5 m	84 11 050
Hose heater, 1.1 m	84 11 045
Hose heater, 0.7 m	84 11 154
Room-air filter	83 05 367
Set of sealing rings for medical-air connection hose (pack of 3)	M 17 721
Set of sealing rings for O_2 connection hose (pack of 3)	M 17 719
Flow-sensor cable	84 09 626
Silicone hose K 0.12 m	84 09 680
Silicone hose K 0.25 m	84 09 636
Silicone hose K 0.40 m	84 03 070
Silicone hose K 0.60 m	84 03 073
Silicone hose K 1.00 m	84 03 080
Silicone hose K 1.20 m	84 10 189
Hose (light) 0.12 m	84 10 819
Hose (light) 0.25 m	84 10 817
Hose (light) 0.40 m	84 10 816
Hose (light) 0.65 m	84 10 814
Hose (light) 1.00 m	84 10 815
Hose (light) 1.20 m	84 10 818

Designation/description	Order No.
Double cone 11a	84 09 897
Technical documents available on request	

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These Instructions for Use apply only to
Babylog 8000 plus 5.n
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.

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Directive 93/42/EEC
concerning Medical Devices

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