RespiCare S, CV

Ventilation Therapy Unit

Technical
Documentation

Contents

General

Function Description

Contents

Test List

Replacing Non-Repairable Items

Contents

Changes

Appendix

General

1 About This Service Manual

This Service Manual conforms to the International Standard IEC 60601-1.

Read each step in every procedure thoroughly before beginning any test. Always use the proper tools and specified test equipment. If you deviate from the instructions and/or recommendations in this Service Manual, the equipment may operate improperly or unsafely, or the equipment could be damaged.

Only authentic Dräger spare parts may be used for maintenance.

The Test List in this Service Manual does not replace inspections and servicing by Dräger Medizintechnik GmbH.

> ⚠ **Strictly follow the Instructions for Use!**
>
> **This Service Manual does not replace the Instructions for Use. Any use of the apparatus requires full understanding and strict observation of the Instructions for Use.**

1.1   Definitions

This symbol is used to provide important information that, if ignored, could lead directly to a patient's or operator's injury. It is also used to provide important information that, if ignored, could lead directly to equipment damage and, indirectly, to a patient's injury.

This symbol is used to provide additional information, operating tips, or maintenance suggestions.

Inspection	=	examination of actual condition
Servicing	=	measures to maintain specified condition
Repair	=	measures to restore specified condition
Maintenance	=	inspection, service, and repair, where necessary

Function Description

The following function description covers the two currently available variants: RespiCare S, and RespiCare CV.

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2 RespiCare S

The RespiCare S is a nasal respiration therapy unit. The RespiCare S is for patients with spontaneous breathing capability requiring temporary assistance in breathing.

The RespiCare S allows spontaneous breathing with a continuous positive airway pressure (CPAP) and a spontaneous breathing with a continuous positive airway pressure with synchronized assistance (CPAP/ASB).
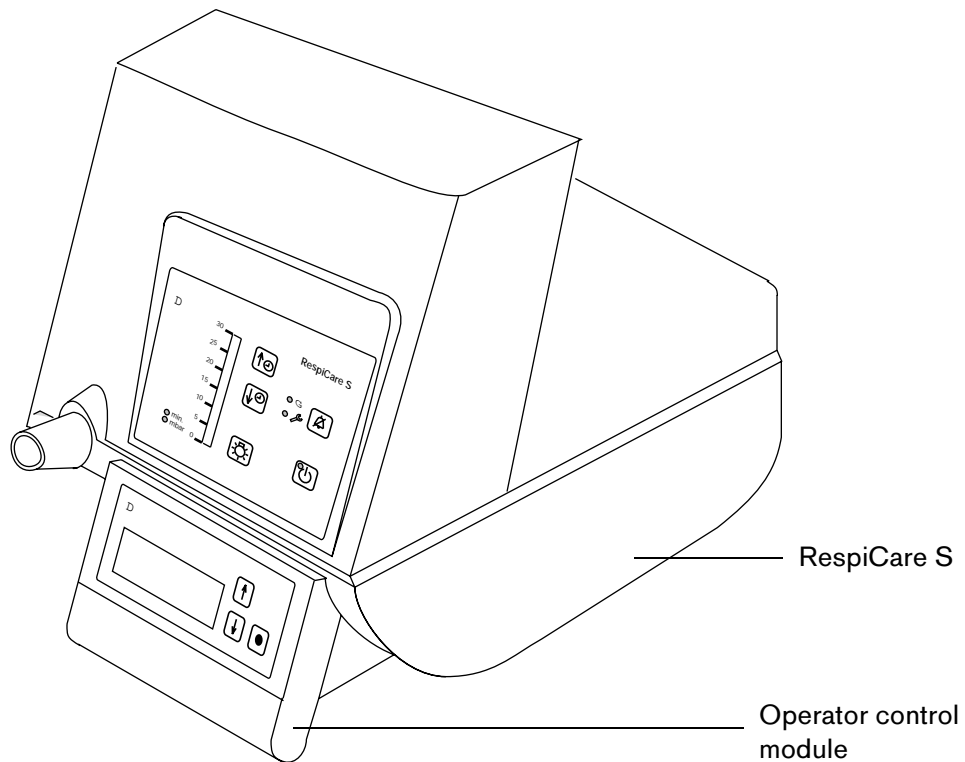
Fig. **1:** View of the RespiCare S
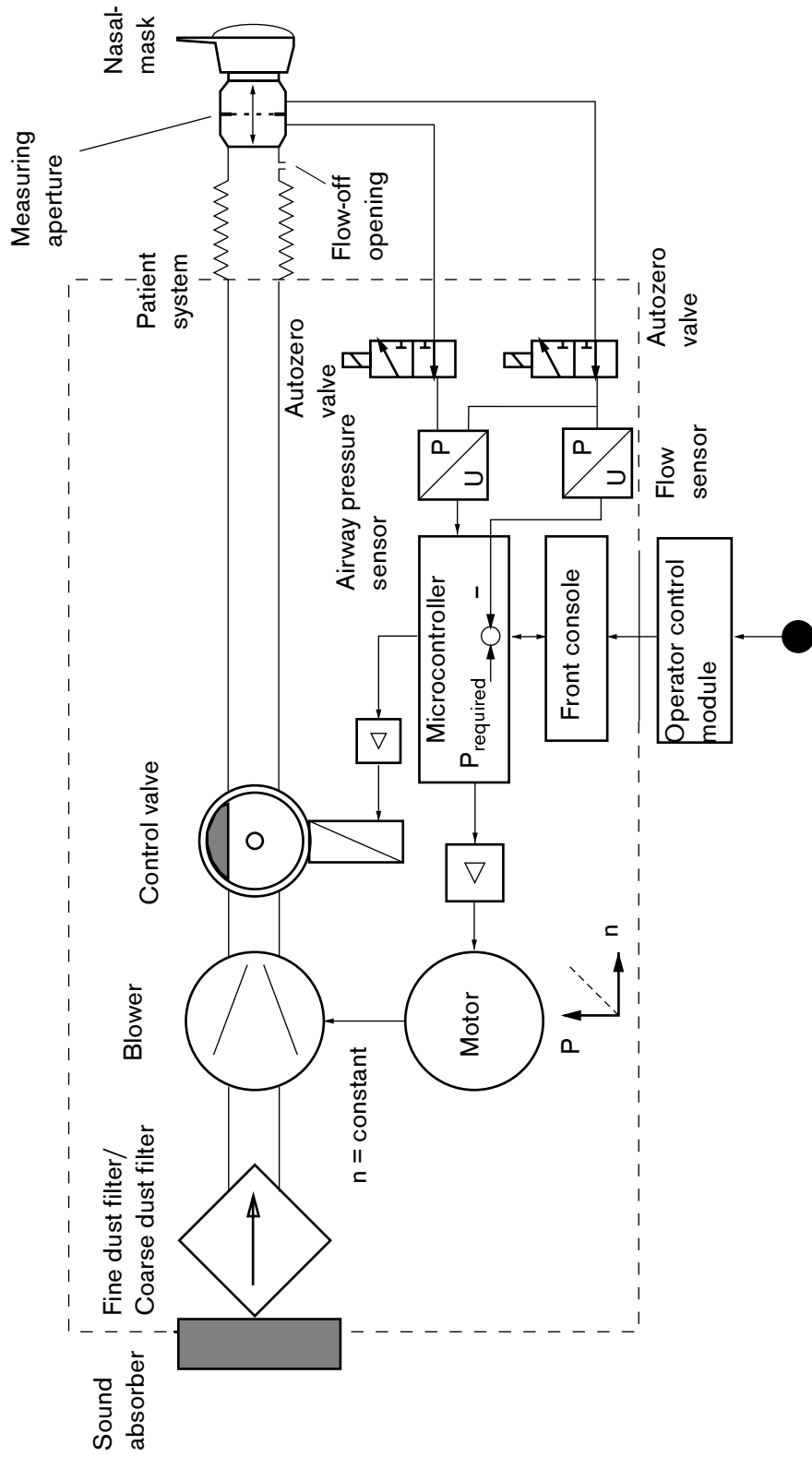
Fig. 2: Function diagram, RespiCare S

2.1   Mode of functioning of the RespiCare S

The inducted ambient air is passed through a fine dust filter/coarse dust filter and is compressed according to the pre-set ventilation pressure.

The blower motor delivers a patient flow of approx. 60 l/min up to an airway pressure of 30 mbar.

The upper pressure level set for the patient limits the rotational speed of the blower.

A control valve controls the pressure levels. The microcontroller controls the opening and closing of the control valve dependent on the airway pressure (Paw). The steepness of the pressure rise can be varied with the actuation speed of the control valve.

A bidirectional flow detector measures the patient flow and detects triggering of patient respiration.

The airway pressure sensor measures the airway pressure (Paw). The airway pressure is visually displayed on the strip display.

A flow-off opening in the measuring aperture permits gas exchange from the patient system.

i   In the event of blower motor failure, continued spontaneous breathing of the patient is possible.

2.2 Operating modes of the RespiCare S

The operating modes of the RespiCare S are CPAP and CPAP/ASB.

2.2.1 CPAP

CPAP is a spontaneous breathing with a positive airway pressure.
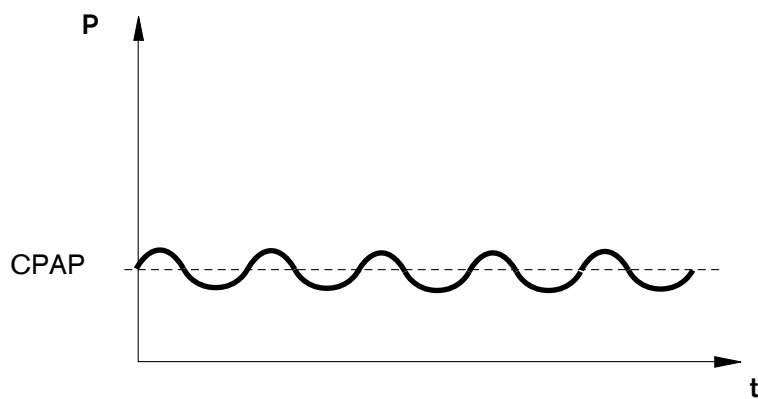
Fig. 3: CPAP curve diagram

2.2.2   CPAP/ASB

CPAP/ASB is an assisted spontaneous breathing with adjustable pressure support.

The inspiratory or expiratory flow is triggered by the pre-set inspiration or expiration pressure, as appropriate.

If the expiratory flow is not triggered, the RespiCare S switches to the expiratory pressure level four seconds after the start of inspiration.

After activation of the flow trigger the RespiCare S remains insensitive for the following times: minimum time for inspiration 300 ms and minimum time for expiration 500 ms, to prevent autonomous triggering of the RespiCare S.

The time of the pressure rise from the expiratory to the inspiratory level is adjustable.
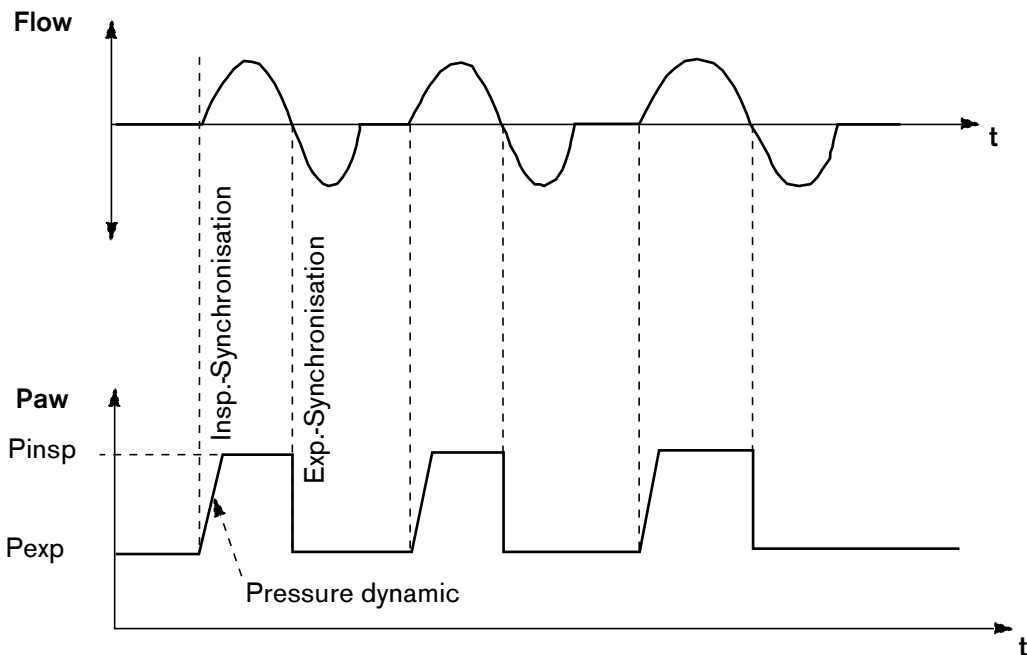
Fig.   4: CPAP/ASB curve diagram

Triggering window, inspiration

The triggering window is produced from 50% of T-low (required) – ΔT-low of the last breath.

ΔT-low = T-low (required) – T-low (actual)

2.2.3 Leakage flow detection

A leakage flow occurs when respiratory gas escapes by an undetected leak between the patient and the patientís nasal mask.

The flowmeter totalizes the patient flow and the leakage flow. For the inspiration trigger and the expiration trigger always to be activated at the same patient flow, the leakage flow must be known, so that the trigger can compensate for it. The flow signal (ΔP) is translated into l/min and linearized. A filter averages the leakage flow (mean flow).

In standby mode, in the event of a disconnection or a stenosis alarm the mean flow must be reset to zero.
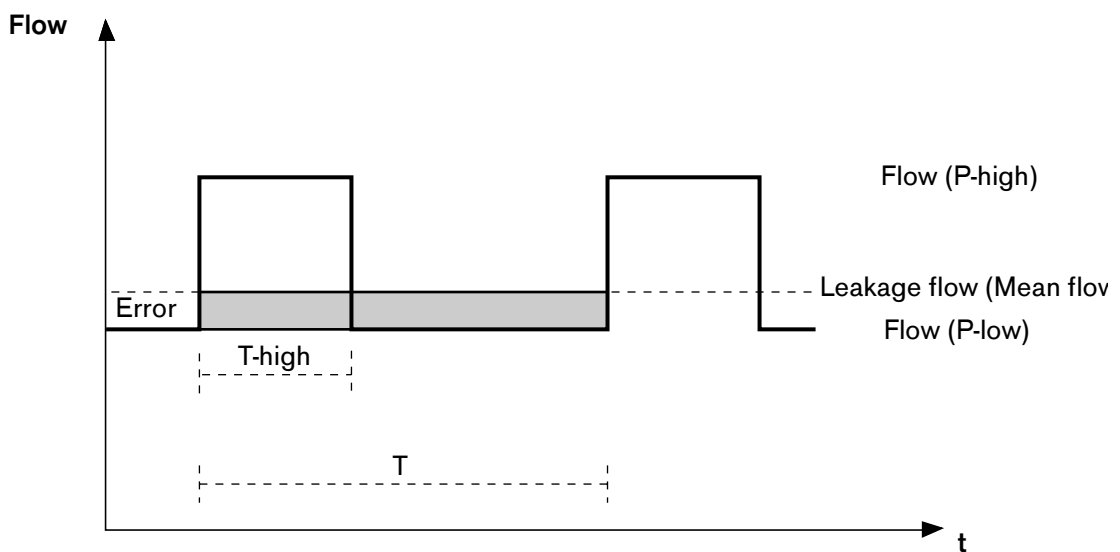
Fig. 5: Leakage flow compensation

The error increases the greater the time T-high is, and the greater the inspiratory leakage flow is. The inspiratory leakage flow is dependent on the mask characteristic and on the inspiratory pressure.

> **i**
>
> **Self-triggering.** If the patient flow is too high and an excessive leakage flow is occurring, the RespiCare S may trigger autonomously.

2.2.4 Triggering

The RespiCare S has five trigger thresholds. The trigger thresholds permit triggering of flow and detection of apnea.

Fig. 6: Trigger thresholds for flow triggering/apnea detection

Trigger thresholds

Trigger threshold	Inspiration trigger (l/min) above leakage (mean flow)	Expiration trigger (l/min) below peak flow
1	13	15
2	20	30
3	30	45
4	40	60
5	50	75

Inspiration/expiration switchover

Switchover	Conditions	Min. duration	Max. duration
Exp. -> Insp.	Above inspiration trigger level	300 ms	4 s insp.
Insp. -> Exp.	Below expiration trigger level	500 ms	–

2.3   RespiCare S
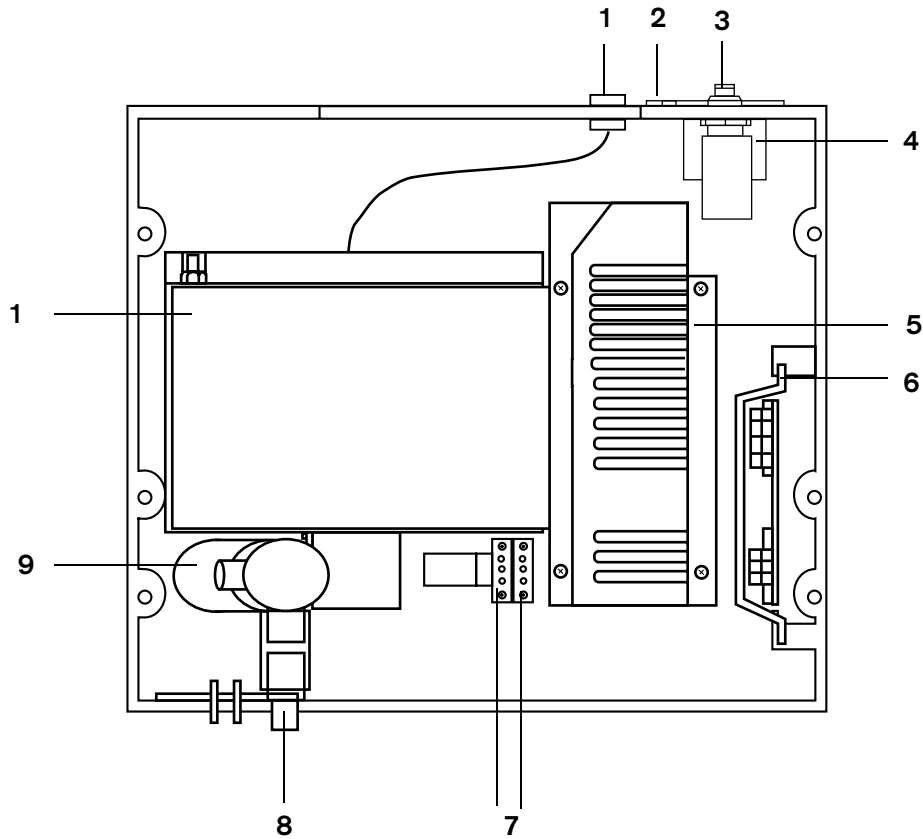
Fig.   7: Component layout on floor of RespiCare S

Legend

1	Operator control module connecting port
2	Analog port (Paw)
3	Mains switch
4	Mains fuse
5	Power pack
6	Motor actuator
7	Autozero valves
8	Patient connecting port
9	Control valve
10	Blower motor
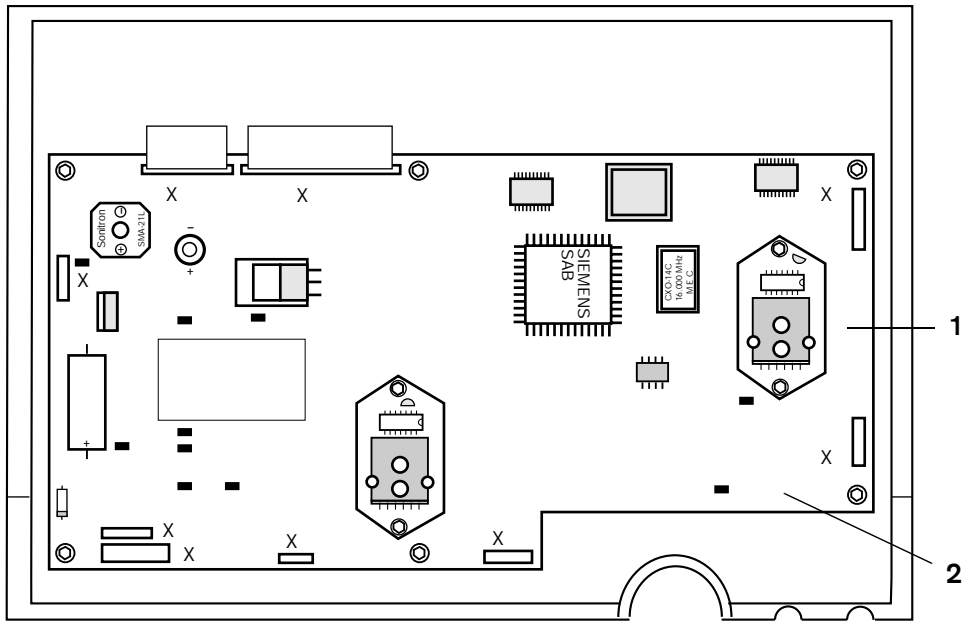
Fig. 8: Component layout in lid of RespiCare S

Legend

1 Control PCB

2 Front console (in the front)

2.4 Components of the RespiCare S

The RespiCare S comprises the following components:

- On/off switch
- Mains fuse
- Power pack
- Control PCB
- E-vent measuring aperture
- Motor actuator
- Blower motor
- Front console
- Control valve
- Autozero valves
- Operator control module.

2.4.1 On/off switch

The on/off switch switches the mains power on and off respectively at two poles.

2.4.2 Mains fuse

The mains fuse protects against excessive currents in case of fault.

2.4.3 Power pack

The power pack is a switched-mode power supply unit. The mains input voltage is approx. 100 VAC to 240 VAC. The mains output voltages are approx. 13.5 VDC and approx. 24 VDC.

2.4.4 Control PCB

The control PCB controls and monitors the functions in the RespiCare S. The airway pressure sensor (Paw) and the flow sensor (ΔP) are installed on the control PCB.

The control PCB contains the following components:

- +5 VLOG generator
- Microcontroller
- Quartz
- EPROM
- Latch
- EEPROM
- Driver blocks
- D/A converters
- Airway Pressure sensor (Paw)
- Flow sensor
- Horn actuator
- Horn
- Autozero valve actuator
- Inside temperature gauge
- Reset generator
- Serial port
- Analog output (Paw).
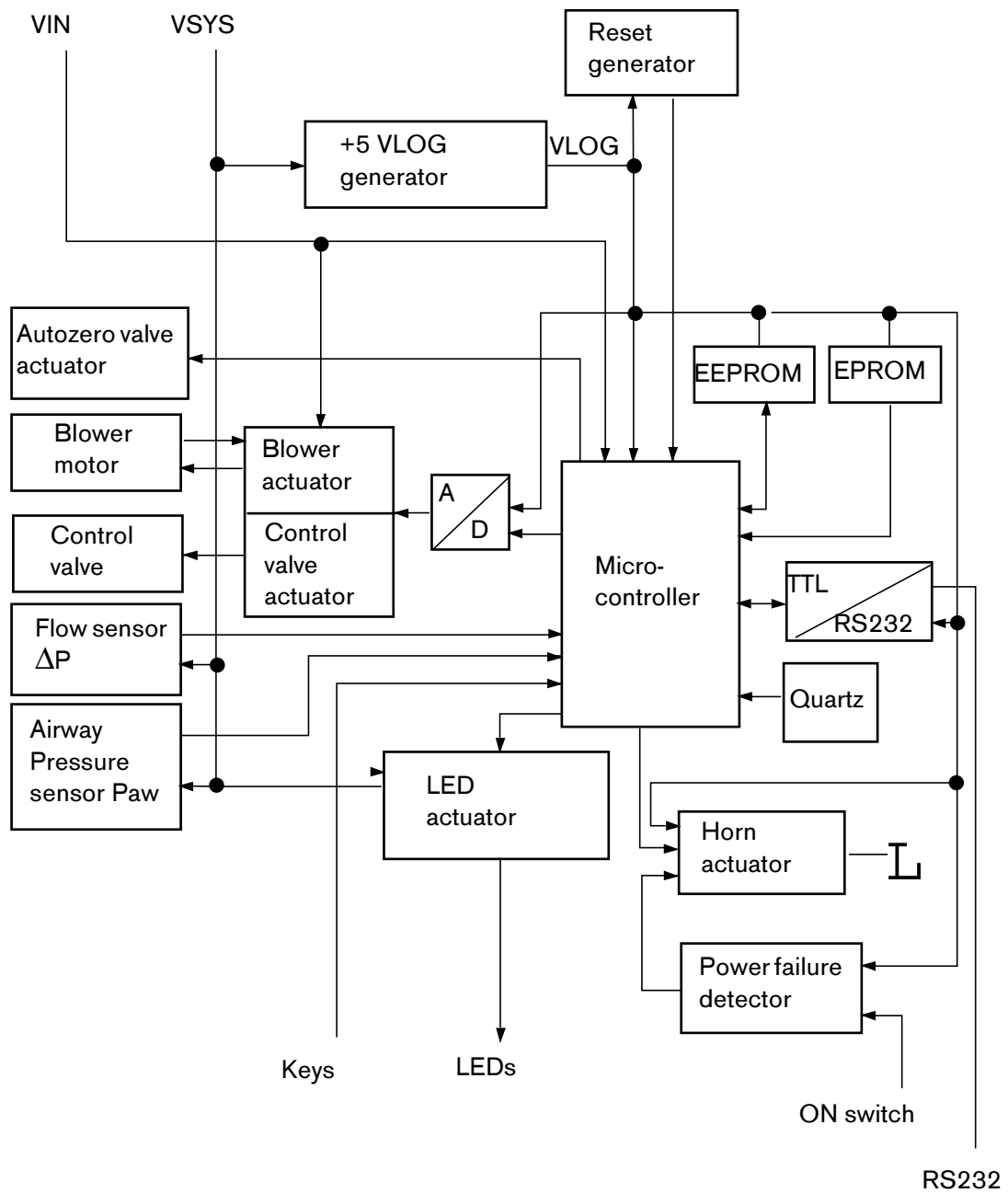
Fig. 9: Block diagram of the control PCB

+5 VLOG generator

A linear regulator generates the stabilized operating voltage of approx. 5 VDC (VLOG) from the power pack voltage of approx. 13 VDC (VSYS).

Microcontroller

The microcontroller controls and monitors the functions of the RespiCare S.

Quartz

A quartz clocks the microcontroller at a 16 MHz clock frequency.

EPROM

The EPROM contains the software program.

Latch

The data bus data (address for the EPROM) are buffered in the latch.

EEPROM

The EEPROM stores the user settings, calibration data and data of the operating time counter. The EEPROM is serially connected to the microcontroller.

Driver blocks

The actuation signals of the microcontroller are amplified with driver blocks.

D/A converters

D/A converters convert the microcontroller data into analog voltage values.

Airway pressure sensor (Paw)

The airway pressure sensor (Paw) measures the patientís airway pressure. The airway pressure sensor converts the airway pressure into an analog voltage. The microcontroller evaluates the voltage.

Horn actuator

The microcontroller generates an actuation signal for the horn in case of fault.

When the RespiCare S is on and the VLOG operating voltage falls, the RespiCare S generates a continuous alarm tone.

Horn

The horn is mounted on the control PCB. The horn operating voltage is 5 VLOG.

Autozero valve actuator

The microcontroller generates an actuation signal for the autozero valves every five minutes. The pulse duration is approx. 100 milliseconds.

Inside temperature gauge

A temperature sensor measures the temperature inside the RespiCare S.

If the inside temperature is higher than 80 °C the microcontroller generates an alarm and a technical fault (TF) is displayed on the operator panel.

If the RespiCare inside temperature is higher than 65 °C, the coolin fan is switched on.

Reset generator

The reset generator monitors the 5 VLOG operating voltage. It includes two comparators which monitor the upper and lower tolerance bands of the 5 VLOG operating voltage.

If the voltage moves outside the tolerance, the reset generator generates a reset signal on the microcontroller.

2.4.5 Serial port

2.4.6 The serial port connects the microcontroller to the RS 232 socket.

Analog output (Paw)

A separate pressure curve monitor can be connected to the analog output.

2.4.7 E-vent measuring aperture

The patientís exhalation flow is measured by reducing the diameter of the E-vent measuring aperture. A flow-dependent differential pressure is produced at measuring points 1 and 2 (see diagram below). This differential pressure is applied to the E-vent measuring aperture. The flow sensor (ΔP) converts the differential pressure into an electronic value and passes the value to the microcontroller for evaluation.

ΔP

E-vent measuring aperture

$\overset{o}{V}$

P

1

2

ΔP is produced from the differential pressure from measuring leads 1 and 2
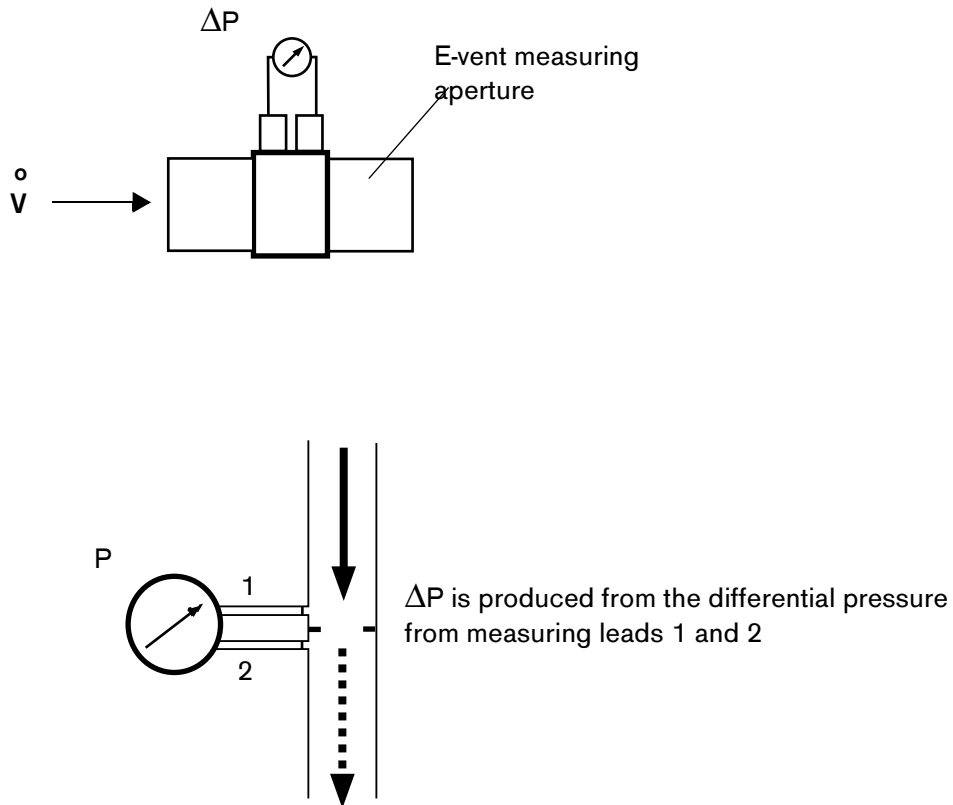
Fig. 10: Flow sensor of the RespiCare S

2.4.8   Motor actuator

The motor is actuated by a four-quadrant drive. The pre-set value determines the rotational speed of the motor.

2.4.9   Blower motor

The operating voltage of the blower motor is 14 to 28 V.

2.4.10   Front console

The keys and LEDs are mounted on the front console. The pressed keys are read by the microcontroller.

2.4.11   Control valve

The operating voltage of the control valve is 24 V.

2.4.12   Autozero valves

The autozero valves vent the measuring inputs of the airway pressure sensor (Paw) and the flow sensor (ΔP) every five minutes into the atmosphere.

2.4.13 Operator control module

The operator control module is adaptable for the RespiCare S by means of a magnetic fixture. The operator control module includes the input unit and the LC display. The mode and patient setting parameters are set with the operator control module in the RespiCare S. The display represents the patient settings with 4x20 characters.

The backlighting is activated when one of the three keys on the operator control module is pressed, and goes out automatically two minutes after the last press.
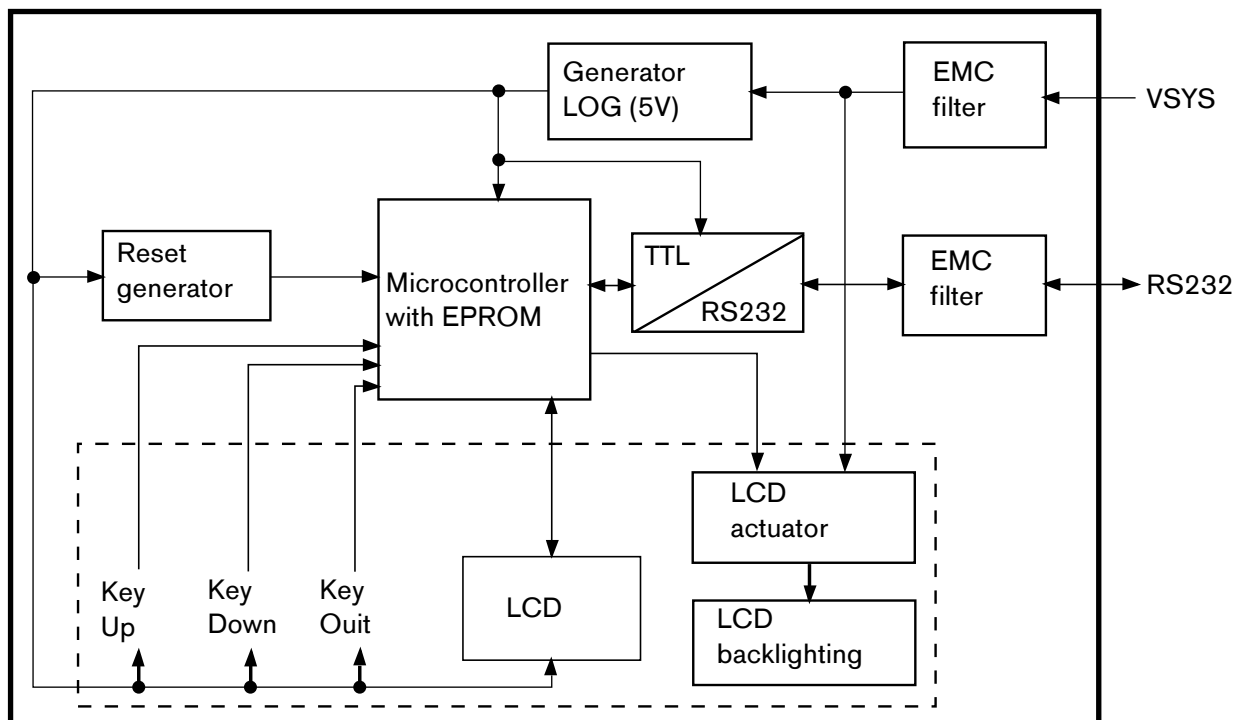
Fig. 11: Block diagram of the operator control module

2.5 Ports

The RespiCare S has two ports.

2.5.1 Bidirectional port

A bidirectional RS 232 port permits operation of the operator control module.

2.5.2 External power connection

An external power connection allows the RespiCare S to be operated with an external voltage of 100 VAC to 240 VAC, or with a DC/AC converter (accessory).

2.6 Self-test

After power-up the RespiCare S carries out a self-test lasting approximately 5 seconds.

The following functions are tested in the self-test:

- All LEDs and displays
- Display of software version when operator control module in use
- RAM/ROM
- EPROM checksum
- Horn activation
- Voltage monitoring.

2.7 Alarms

2.7.1 Power failure

In the event of power failure the acoustic alarm sounds. An internal power source supplies the horn with operating voltage. The acoustic alarm sounds for 120 seconds.

2.7.2 Disconnection alarm / Stenosis alarm

The disconnection alarm or stenosis alarm can be deactivated with the operator control module.

The disconnection alarm/stenosis alarm is conditioned by a pressure comparison between the pressure Paw (required) and the pressure Paw (actual). If the pressure Paw does not reach the required value, a counter is incremented. If the counter reading exceeded, an alarm is triggered.

Criterion

a) Paw (required) > 10 mbar: Paw (actual) < Paw (required) – 5 mbar

b) Paw (required) $\leq$ 10 mbar: Paw (actual) < 50% Paw (required)

2.7.3 Device fault

In the event of a device fault the RespiCare S switches off the blower motor. The acoustic alarm sounds.

> **i** In the event of blower motor failure, continued spontaneous breathing of the patient is possible.

2.7.4 Inside temperature

If the inside temperature within the RespiCare S is higher than 80 °C the micro-controller generates an alarm and a technical fault (TF) is displayed on the operator panel.

2.8　Counters

2.8.1　Total operating time

The total counter (Tot) is displayed on the operator control module. The total counter (Tot) is an absolute time counter which represents the total operating time.

2.8.2　Patient usage

The patient usage counter (Pat) is displayed on the operator control module. The blower motor running time is registered.

2.8.3　Service interval

The service interval counter (Service) is displayed on the operator control module. The Service LED (screwdriver) on the RespiCare S lights up when a service is due.

3   RespiCare CV

The RespiCare CV is a nasal respiration therapy unit. The RespiCare CV is for patients with spontaneous breathing capability requiring temporary assistance in breathing.

The RespiCare CV allows spontaneous breathing with a continuous positive airway pressure (CPAP), spontaneous breathing with a continuous positive airway pressure and synchronized assistance (CPAP/ASB), pressure controlled ventilation (PCV), and a pressure controlled ventilation with synchronized inspiratory phase (PCV S).
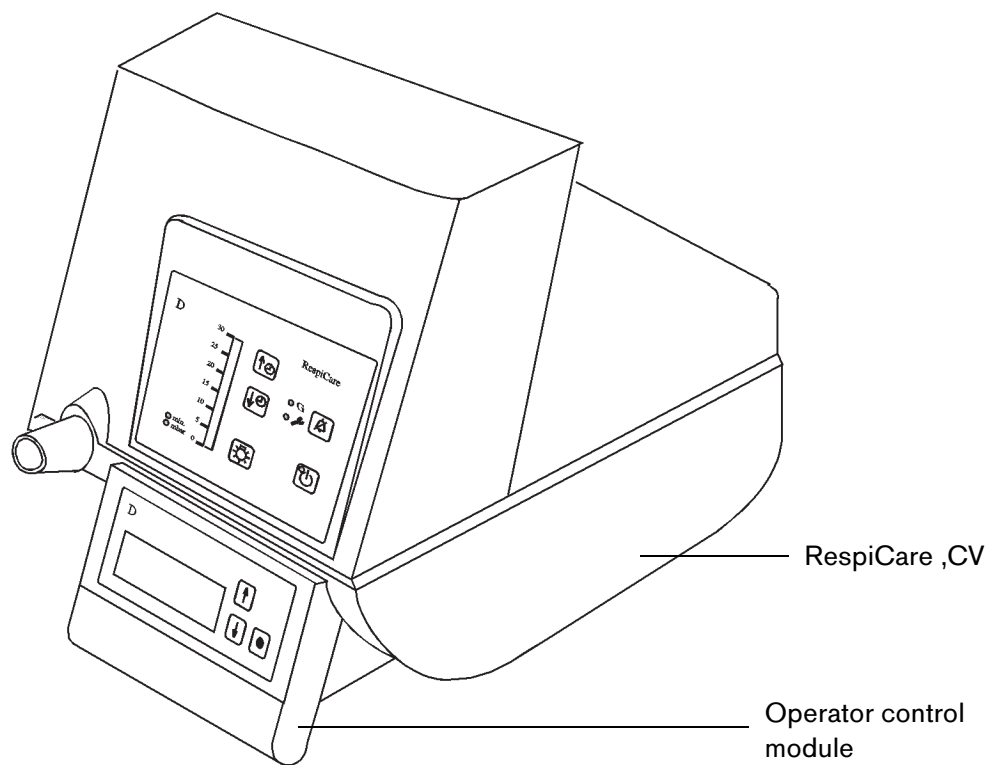

RespiCare ,CV

Operator control module

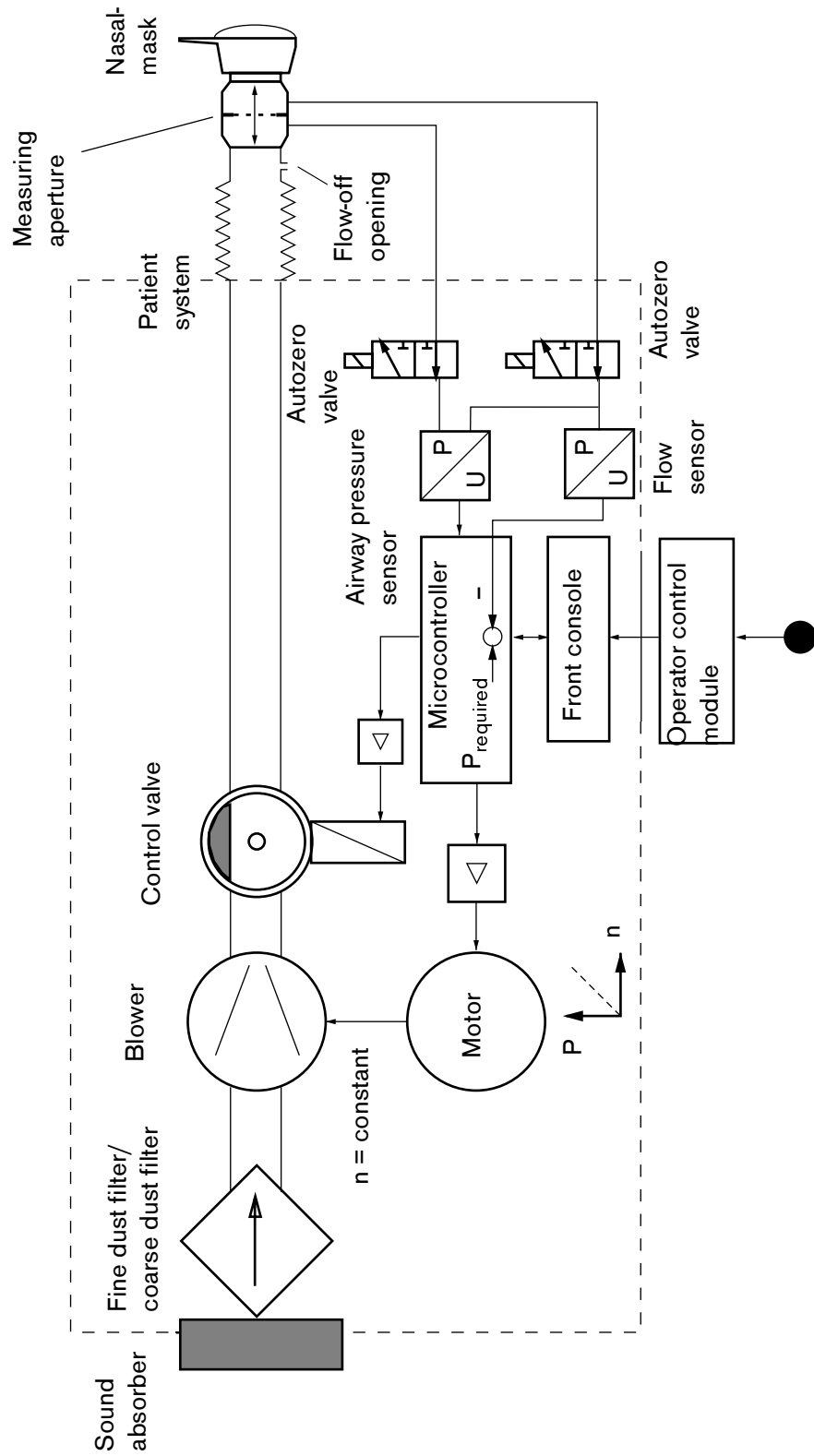**Fig. 12:** View of the RespiCare CV

Fig. 13: Function diagram, RespiCare CV

3.1   RespiCare CV Function Description

The inducted ambient air is passed through a fine dust filter/coarse dust filter and is compressed according to the pre-set ventilation pressure.

The blower delivers a patient flow of approx. 60 l/min up to an airway pressure of 30 mbar.

The upper pressure level set for the patient limits the rotational speed of the blower.

A control valve controls the pressure levels. The microcontroller controls the opening and closing of the control valve dependent on the airway pressure (Paw). The steepness of the pressure rise can be varied with the actuation speed of the control valve.

A bidirectional flow detector measures the patient flow and detects triggering of patient respiration.

The airway pressure sensor measures the airway pressure (Paw). The airway pressure is visually displayed on a strip display.

A flow-off opening in the measuring aperture permits gas exchange from the patient system.

i   In the event of blower motor failure, continued spontaneous breathing of the patient is possible.

3.2 Operating modes of the RespiCare CV

The operating modes of the RespiCare CV are CPAP, CPAP/ASB, PCV and PCV (S).

3.2.1 CPAP

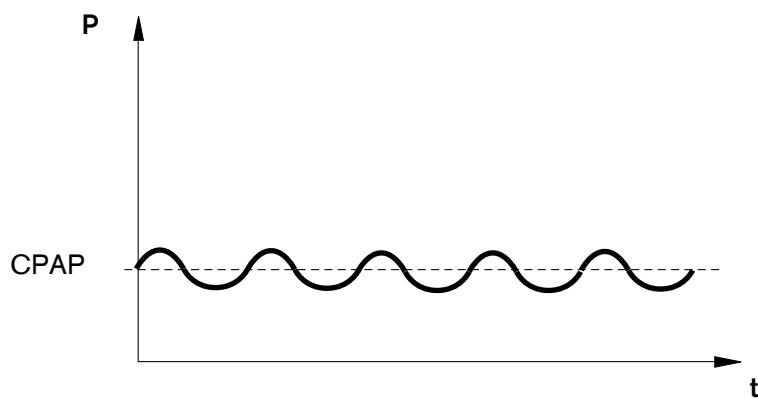CPAP is a spontaneous breathing with a positive airway pressure.

Fig. 14: CPAP curve diagram

3.2.2 CPAP/ASB

CPAP/ASB is an assisted spontaneous breathing with adjustable pressure support and add-on apnea ventilation.

The inspiratory or expiratory flow is triggered by the pre-set inspiration or expiration pressure, as appropriate.

If the expiratory flow is not triggered, the RespiCare CV switches to the expiratory pressure level four seconds after the start of inspiration.

After activation of the flow trigger the RespiCare CV remains insensitive for the following times: minimum time for inspiration 300 ms and minimum time for expiration 500 ms, to prevent autonomous triggering of the RespiCare CV.

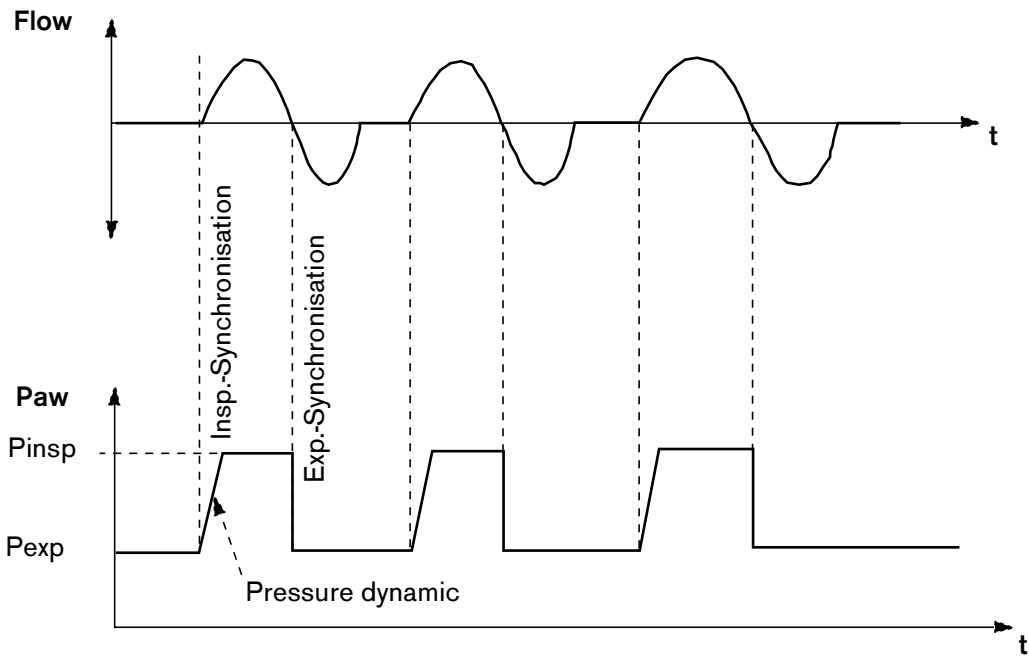The time of the pressure rise from the expiratory to the inspiratory level is adjustable.

Fig. 15: CPAP/ASB curve diagram

3.2.3 PCV (S)

PCV is a controlled breathing at constant rate and constant I/E ratio at two different pressure levels. The PCV (S) differs from PCV in that ventilation is synchronised to the patients inspiration.
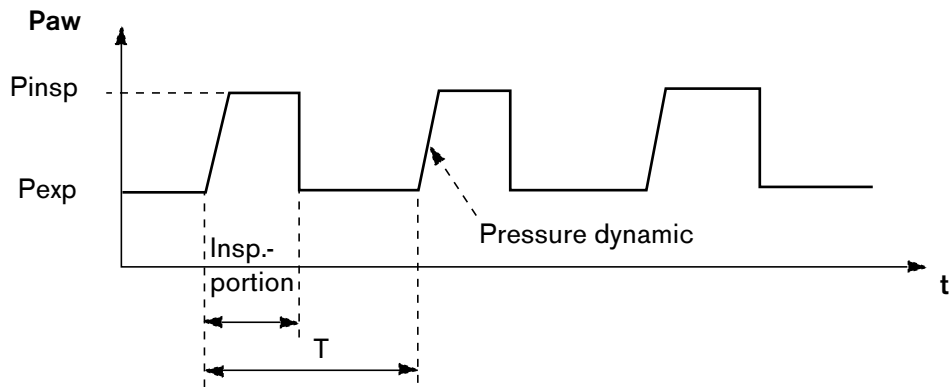

Fig. 16: PCV curve diagram

3.2.4 Leakage flow detection

A leakage flow occurs when respiratory gas escapes by an undetected leak between the patient and the patientís nasal mask.

The flowmeter totalizes the patient flow and the leakage flow. For the inspiration trigger and the expiration trigger always to be activated at the same patient flow, the leakage flow must be known, so that the trigger can compensate for it. The flow signal (ΔP) is translated into l/min and linearized. A filter averages the leakage flow (mean flow).

In standby mode, in the event of a disconnection or a stenosis alarm the mean flow must be reset to zero.
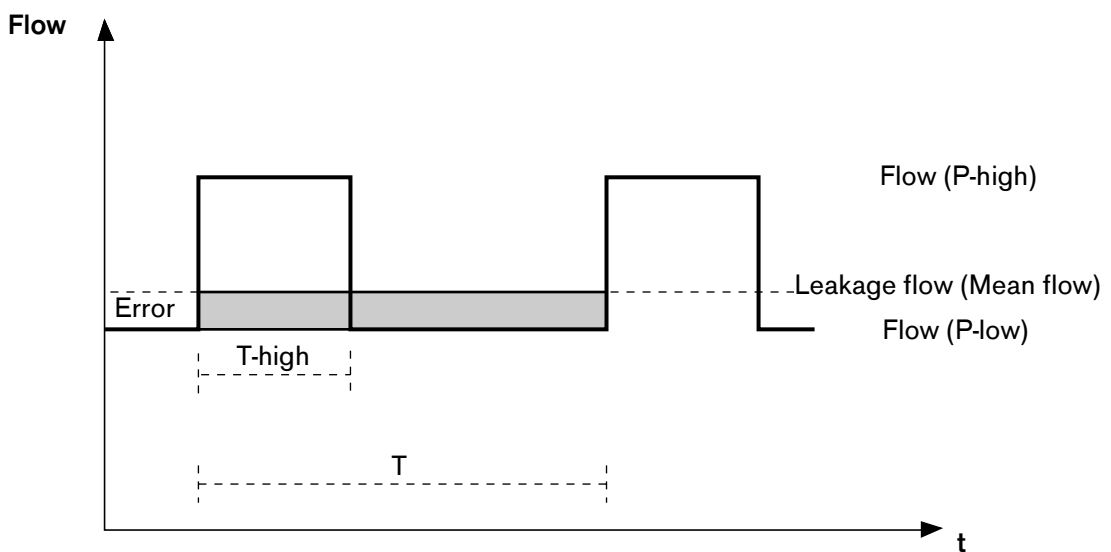
Fig. 17: Leakage flow compensation

The error increases the greater the time T-high is, and the greater the inspiratory leakage flow is. The inspiratory leakage flow is dependent on the mask characteristic and on the inspiratory pressure.

Self-triggering. If the patient flow is too high and an excessive leakage flow is occurring, the RespiCare CV may trigger autonomously.

3.2.5 Triggering

The RespiCare CV has five trigger thresholds. The trigger thresholds permit triggering of flow and detection of apnea.

Fig. 18: Trigger thresholds for flow triggering/apnea detection

Trigger thresholds

Trigger threshold	Inspiration trigger (l/min) above leakage (mean flow)	Expiration trigger (l/min) below peak flow
1	13	15
2	20	30
3	30	45
4	40	60
5	50	75

Inspiration/expiration switchover

Switchover	Conditions	Min. duration	Max. duration
Exp. -> Insp.	Above inspiration trigger level	300 ms	4 s insp.
Insp. -> Exp.	Below expiration trigger level	500 ms	–

3.3 RespiCare CV

Fig. 19: Component layout on floor of RespiCare CV

Legend

1   Operator control module connecting port

2   Analog port (Paw)

3   Mains switch

4   Mains fuse

5   Power pack

6   Motor actuator

7   Autozero valves
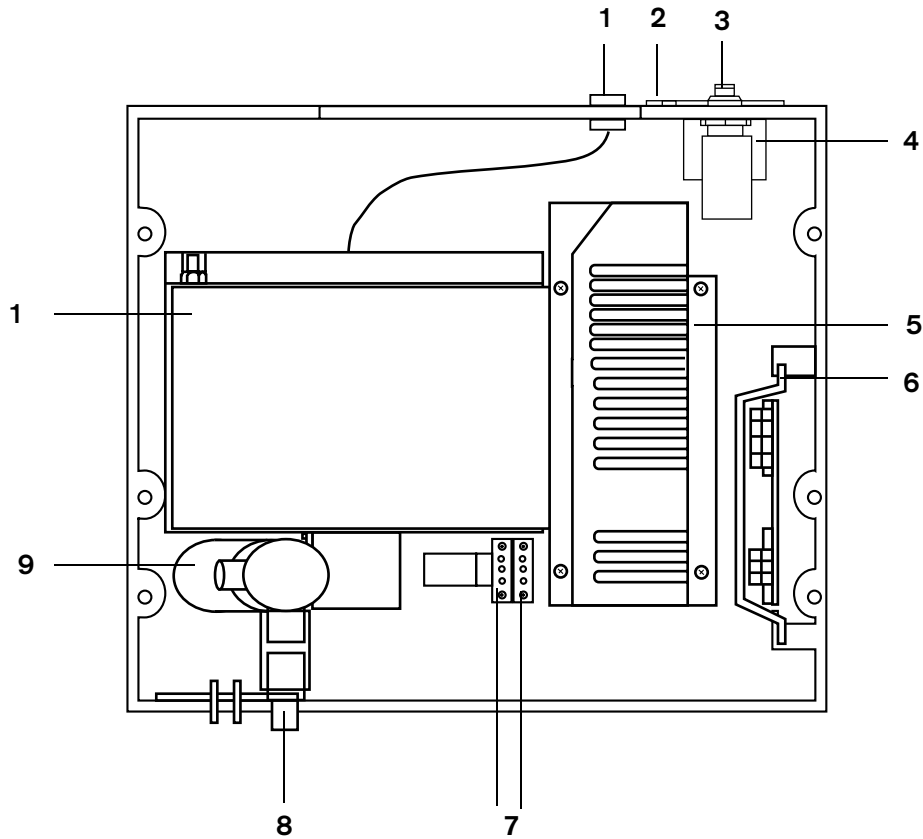
8   Patient connecting port

9   Control valve

10   Blower motor
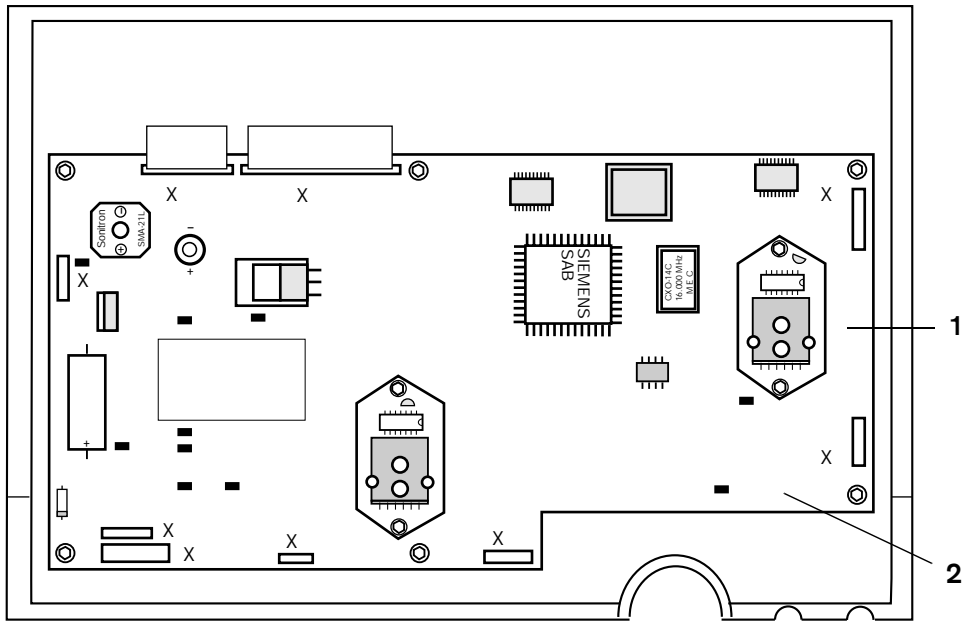
Fig. 20: Component layout in lid of RespiCare CV

Legend

1 Control PCB

2 Front console (in the front)

3.4 Components of the RespiCare CV

The RespiCare CV comprises the following components:

- On/off switch
- Mains fuse
- Power pack
- Control PCB
- E-vent measuring aperture
- Motor actuator
- Blower motor
- Front console
- Control valve
- Autozero valves
- Operator control module.

3.4.1 On/off switch

The on/off switch switches the mains power on and off respectively at two poles.

3.4.2 Mains fuse

The mains fuse protects against excessive currents in case of fault.

3.4.3 Power pack

The power pack is a switched-mode power supply unit. The mains input voltage is approx. 100 VAC to 240 VAC. The mains output voltages are approx. 13.5 VDC and approx. 24 VDC.

3.4.4   Control PCB

The control PCB controls and monitors the functions in the RespiCare CV. The airway pressure sensor (Paw) and the flow sensor (ΔP) are installed on the control PCB.

The control PCB contains the following components:

– +5 VLOG generator

– Microcontroller

– Quartz

– EPROM

– Latch

– EEPROM

– Driver blocks

– D/A converters

– Airway pressure sensor (Paw)

– Flow sensor

– Horn actuator

– Horn

– Autozero valve actuator

– Inside temperature gauge

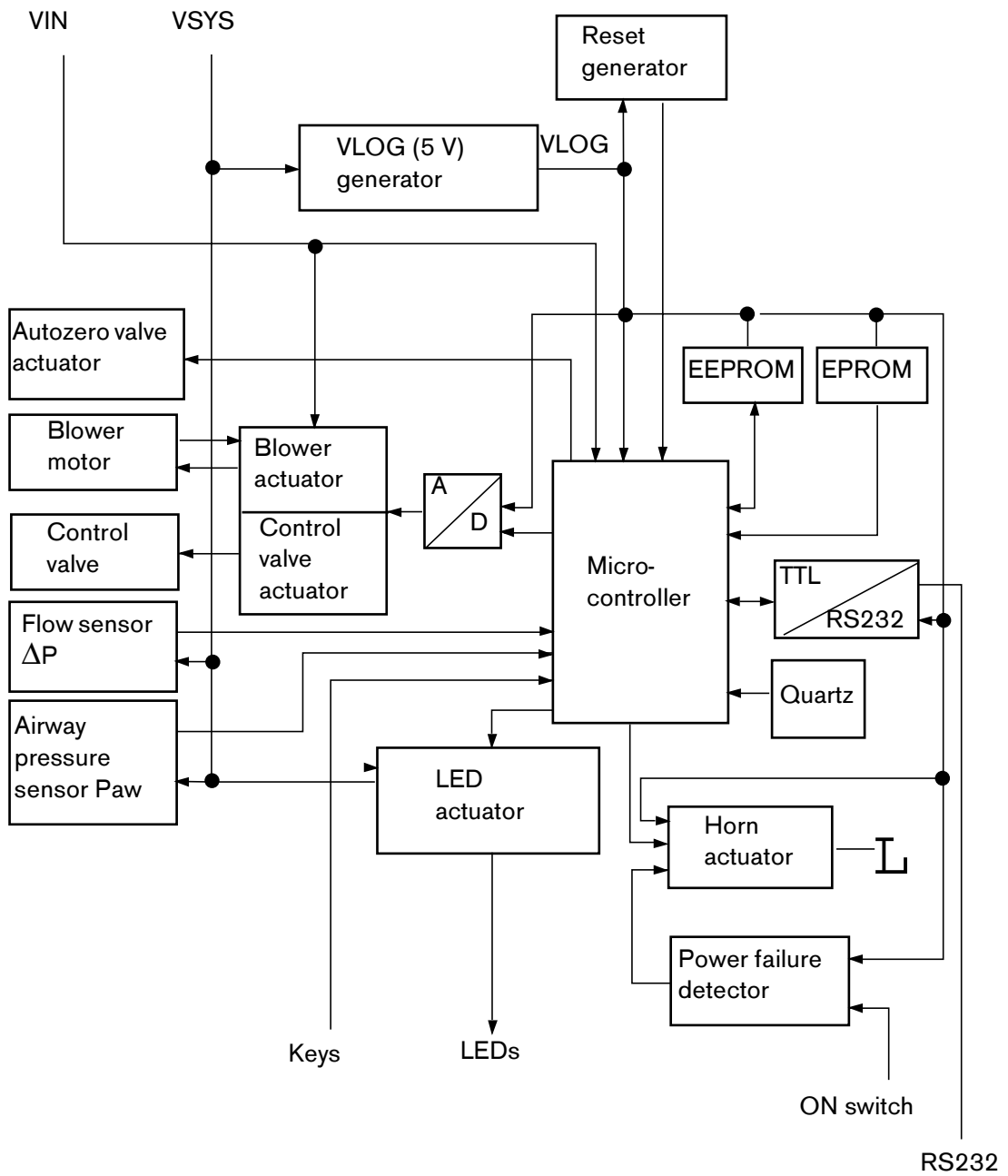– Reset generator

– Serial port

– Analog output (Paw).

Fig. 21: Block diagram of the control PCB

5 VLOG generator

A linear regulator generates the stabilized operating voltage of approx. 5 VDC (VLOG) from the power pack voltage of approx. 13 VDC (VSYS).

Microcontroller

The microcontroller controls and monitors the functions of the RespiCare SC.

Quartz

A quartz clocks the microcontroller at a 16 MHz clock frequency.

EPROM

The EPROM contains the software program.

Latch

The data bus data (address for the EPROM) are buffered in the latch.

EEPROM

The EEPROM stores the user settings, calibration data and data of the operating time counter. The EEPROM is serially connected to the microcontroller.

Driver blocks

The actuation signals of the microcontroller are amplified with driver blocks.

D/A converters

D/A converters convert the microcontroller data into analog voltage values.

Airway pressure sensor (Paw)

The airway pressure sensor (Paw) measures the patientís airway pressure. The airway pressure sensor (Paw) converts the airway pressure into an analog voltage. The microcontroller evaluates the voltage.

Horn actuator

The microcontroller generates an actuation signal for the horn in case of fault.

When the RespiCare SC is on and the VLOG operating voltage falls, the RespiCare SC generates a continuous alarm tone.

Horn

The horn is mounted on the control PCB. The horn operating voltage is 5 VLOG.

Autozero valve actuator

The microcontroller generates an actuation signal for the autozero valves every five minutes. The pulse duration is approx. 100 milliseconds.

Inside temperature gauge

A temperature sensor measures the temperature inside the RespiCare CV.

If the inside temperature of RespiCare is higher than 80 °C, the microcontroller generates an alarm and a technical fault (TF) is displayed on the operator panel.

If the inside temperature of RespiCare is higher than 65 °C, the cooling fan is switched on.

Reset generator

The reset generator monitors the 5 VLOG operating voltage. It includes two comparators which monitor the upper and lower tolerance bands of the 5 VLOG operating voltage.

If the voltage moves outside the tolerance, the reset generator generates a reset signal on the microcontroller.

3.4.5 Serial port

The serial port connects the microcontroller to the RS 232 socket.

3.4.6 Analog output (Paw)

A separate pressure curve monitor can be connected to the analog output.

3.4.7 E-vent measuring aperture

The patientis exhalation flow is measured by reducing the diameter of the E-vent measuring aperture. A flow-dependent differential pressure is produced at measuring points 1 and 2 (see diagram below). This differential pressure is applied to the E-vent measuring aperture. The flow sensor (ΔP) converts the differential pressure into an electronic value and passes the value to the microcontroller for evaluation.
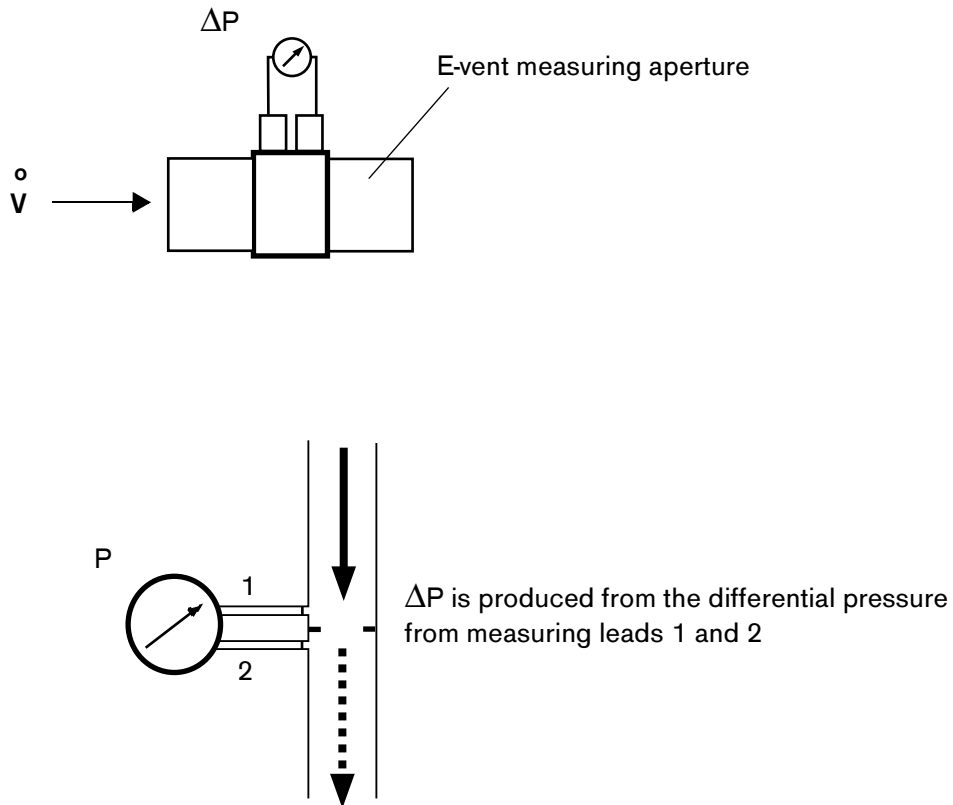

Fig. 22: Flow sensor of the RespiCare CV

3.4.8   Motor actuator

The motor is actuated by a four-quadrant drive. The pre-set value determines the rotational speed of the motor.

3.4.9   Blower motor

The operating voltage of the blower motor is 14 to 28 V.

3.4.10   Front console

The keys and LEDs are mounted on the front console. The pressed keys are read by the microcontroller.

3.4.11   Control valve

The operating voltage of the control valve is 24 V.

3.4.12   Autozero valves

The autozero valves vent the measuring inputs of the airway pressure sensor (Paw) and the flow sensor (ΔP) every five minutes into the atmosphere.

3.5   Operator control module

The operator control module is adaptable for the RespiCare CV by means of a magnetic fixture. The operator control module includes the input unit and the LC display. The mode and patient setting parameters are set with the operator control module in the RespiCare SC. The display represents the patient settings with 4x20 characters.

The backlighting is activated when one of the three keys on the operator control module is pressed, and goes out automatically two minutes after the last press.
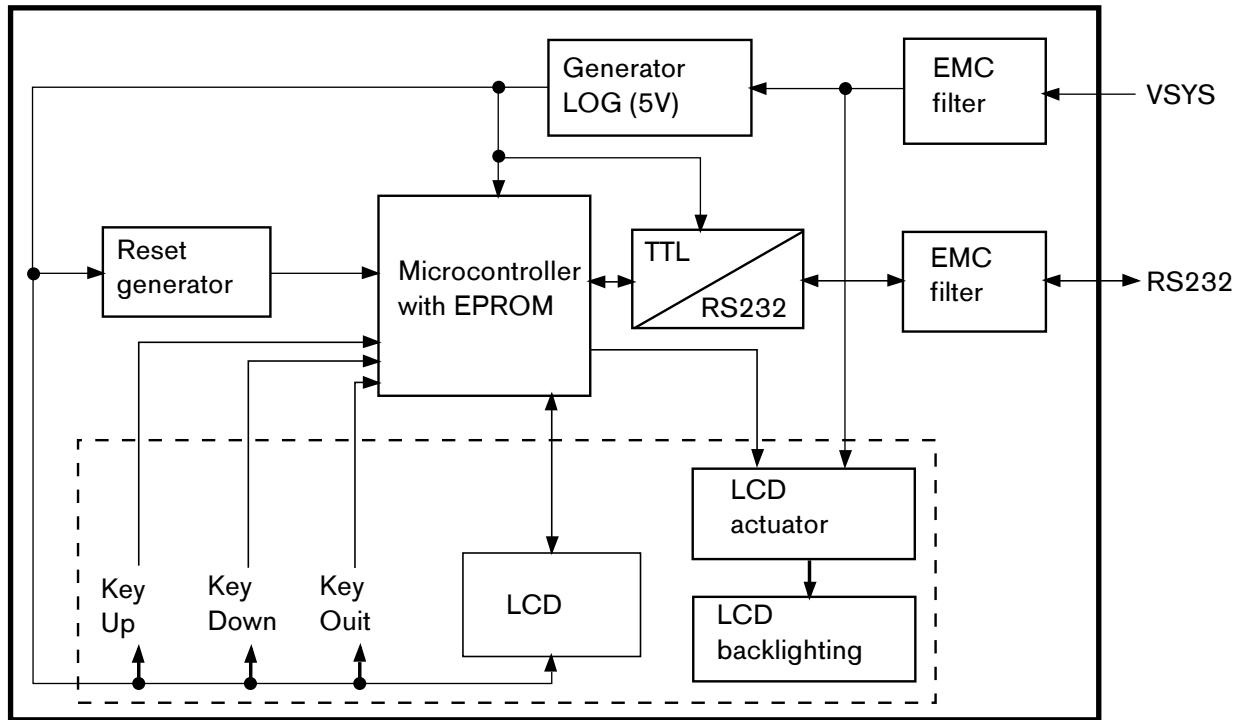
Fig. 23: Block diagram of the operator control module

3.6 Ports

The RespiCare CV has two ports.

3.6.1 Bidirectional port

A bidirectional RS 232 port permits operation of the operator control module.

3.6.2 External power connection

An external power connection allows the RespiCare CV to be operated with an external voltage of 100 VAC to 240 VAC, or with a DC/AC converter (accessory).

3.7 Self-test

After power-up the RespiCare CV carries out a self-test lasting approximately 5 seconds.

The following functions are tested in the self-test:

- All LEDs and displays
- Display of software version when operator control module in use
- RAM/ROM
- EPROM checksum
- Horn activation
- Voltage monitoring.

3.8 Alarms

3.8.1 Power failure

In the event of power failure the acoustic alarm sounds. An internal power source supplies the horn with operating voltage. The acoustic alarm sounds for 120 seconds.

3.8.2 Disconnection alarm / Stenosis alarm

The disconnection alarm or stenosis alarm can be deactivated with the operator control module.

The disconnection alarm/stenosis alarm is conditioned by a pressure comparison between the pressure Paw (required) and the pressure Paw (actual). If the pressure Paw does not reach the required value, a counter is incremented. If the counter reading exceeded, an alarm is triggered.

Criterion

a) Paw (required) > 10 mbar: Paw (actual) < Paw (required) – 5 mbar

b) Paw (required) $\leq$ 10 mbar: Paw (actual) < 50% Paw (required)

3.8.3 Device fault

In the event of a device fault the RespiCare CV switches off the blower motor. The acoustic alarm sounds.

> **i** In the event of blower motor failure, continued spontaneous breathing of the patient is possible.

3.8.4 Inside temperature

If the inside temperature of the RespiCare CV is higher than 80 °C the microcontroller generates an alarm and a technical fault (TF) is displayed on the operator panel.

3.9 Counters

3.9.1 Total operating time

The total counter (Tot) is displayed on the operator control module. The total counter (Tot) is an absolute time counter which represents the total operating time.

3.9.2 Patient usage

The patient usage counter (Pat) is displayed on the operator control module. The motor blower running time is registered.

3.9.3 Service interval

The service interval counter (Service) is displayed on the operator control module. The Service LED (screwdriver) on the RespiCare CV lights up when a service is due.
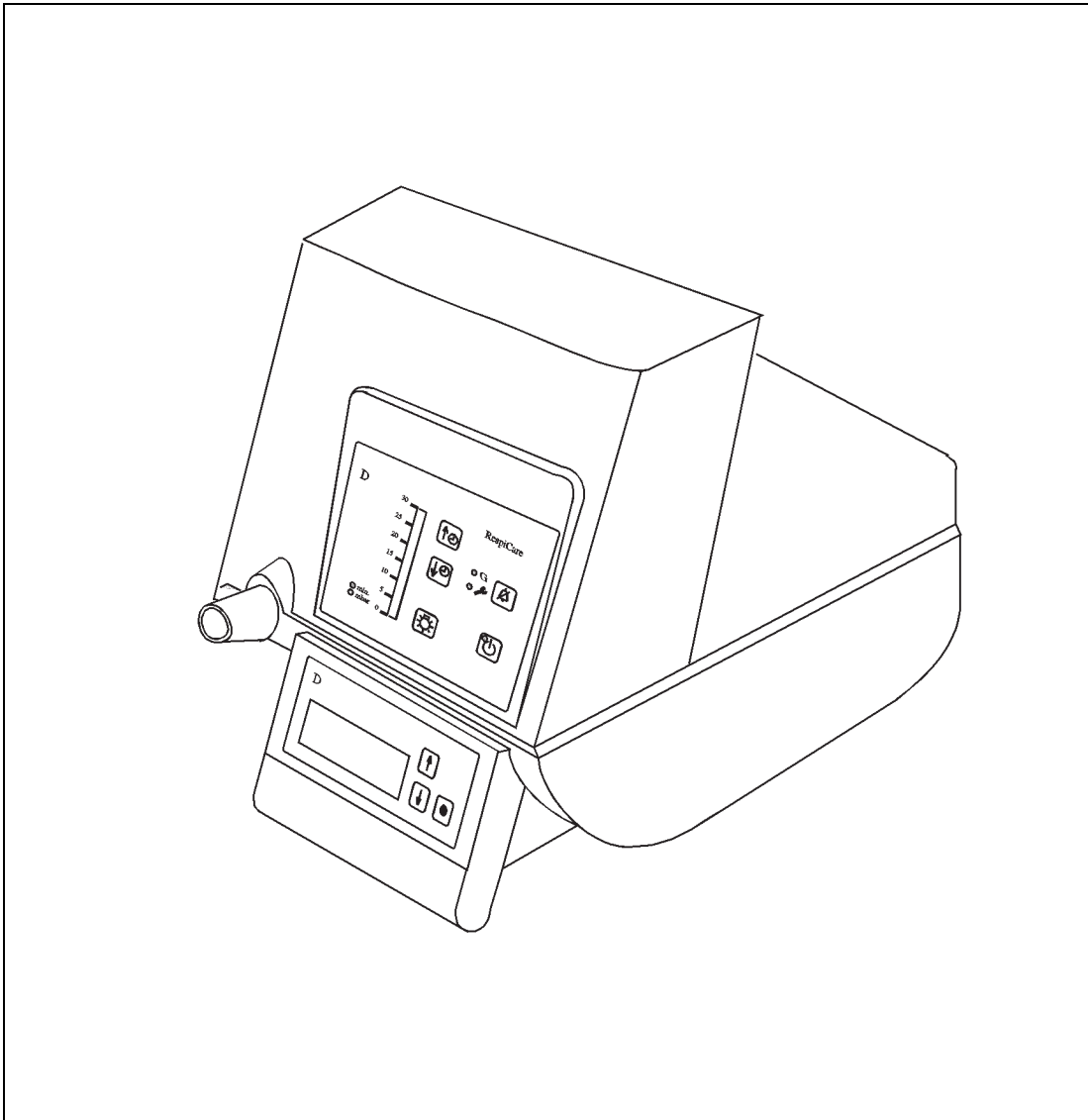
Test List

RespiCare 3.n

Serial no.: _____

Installation site: _____

4   Test Equipment

Test hoses

E-Vent test outlet

Ventilation hose

Breathing bag

This Test List does not replace inspections and servicing by Dräger Medizintechnik GmbH

5   Accompanying Documents

Instructions for Use ☐

6   General Appearance

Basic unit

Operator control module

Test hoses including E-Vent test outlet

Patient hose system

Oxygen adapter

Nasal mask

DC/AC converter (accessory)

Cable for analog output (Paw). ☐

7 Functions Tests

7.1 Power Failure Alarm Test

- Assemble the RespiCare ready for operation (operator control module, test hoses incl. E-Vent test outlet, ventilation hose, and breathing bag).

- Disconnect the mains plug of the RespiCare from the mains socket-outlet.

- Switch on the RespiCare using the ON/OFF switch **1** (located on the rear panel).
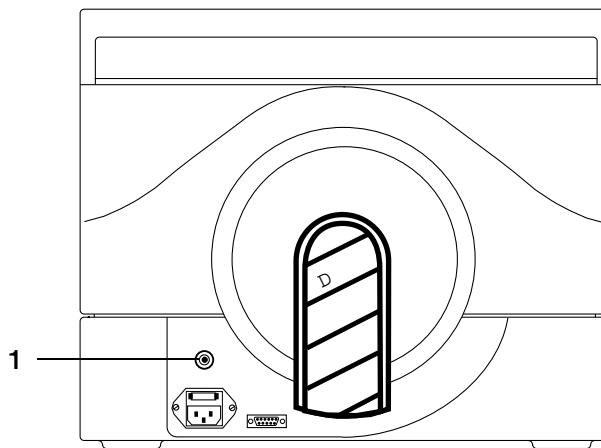
.

Fig. 24: Rear view of the RespiCare

The continuous alarm tone sounds.

- Switch off the RespiCare using the ON/OFF switch.

The continuous alarm tone stops.

- Connect the mains plug of the RespiCare to the mains socket-outlet.

7.2 Power-On Test

- Switch on the RespiCare.

The RespiCare runs a self-test. The pixels on the display of the operator control module and all LEDs of the RespiCare basic unit light up. A short alarm tone sounds.

This Test List does not replace inspections and servicing by Dräger Medizintechnik GmbH

7.3   RespiCare S Function Test

- Switch on the RespiCare S.

- Select the CPAP mode.

- Adjust a CPAP pressure of 5 mbar.

- Select the CPAP/ASB mode.

- Adjust an inspiratory pressure (Pinsp) of 15 mbar.

- Adjust an ASB ramp (Ramp) of 0.5 s.

- Trigger the RespiCare S by slightly compressing the breathing bag.

The RespiCare S builds up the ASB pressure and the breathing bag inflates.

7.4   RespiCare CV Function Test

- Switch on the RespiCare SC.

- Select the PCV(S) mode.

- Adjust the following values:

– upper pressure level (P-insp) to 20 mbar

– lower pressure level (P-exp) to 10 mbar

– Frequency (Freq.) to 10 1/min

– (%insp) to 66%

– trigger.l to 2 of 5

– ramp to 0.1 s

- Trigger the RespiCare CV by slightly compressing the breathing bag.

The breathing bag inflates. The time-controlled change between pressure leves is synchronized with the patient's spontaneous breathing.

7.5   Displaying/Recording the Operating Hours

- Switch off the RespiCare.

- Switch on the RespiCare and press and hold the standby key for about 4 seconds until the operator control module displays the following message:

```
┌─────────────────────────┐
│ CSM - Customer           │
│ Service Mode             │
│                          │
│                          │
└─────────────────────────┘
```

- Stop pressing the standby key.

The operator control module displays the following message:

```
┌─────────────────────────┐
│ Adjust language          │
│ <-  -  001   +  ->       │
│                          │
│                          │
└─────────────────────────┘
```

- Select the operating hours meters (Test 003) by pressing the arrow-up key twice.

The operator control module displays the following message:

```
┌─────────────────────────┐
│ Operation hours          │
│ <-  -  003   +  ->       │
│                          │
│                          │
└─────────────────────────┘
```

- Press the confirm-key (dot key).

- Record the operating hours of the RespiCare in the following fields.

Total (Tot)

```
┌─────────────────────────┐
│                          │
│                          │
└─────────────────────────┘
```

Patient (Pat)

```
┌─────────────────────────┐
│                          │
│                          │
└─────────────────────────┘
```

Service

```
┌─────────────────────────┐
│                          │
│                          │
└─────────────────────────┘
```

- Switch off the RespiCare.

This Test List does not replace inspections and servicing by Dräger Medizintechnik GmbH

8   Assemble the RespiCare ready for operation.

Date: _____   Name: _____

Replacing Non-Repairable Items

9 Replacing the Fine Dust Filter/Coarse Dust Filter

9.1 General Information about the Fine Dust Filter/ Coarse Dust Filter

9.1.1 Fine Dust Filter

The fine dust filter must be replaced with a new one at the following intervals:

- every six months

- after 500 hours of application
  (use the Instructions for Use to find out about the hours of application)

Risk of malfunction. Damaged fine dust filter may impair the function of the RespiCare. **Always replace a damaged fine dust filter with a new one.**

9.1.2 Coarse Dust Filter

The coarse dust filter must be cleaned every three weeks.

The coarse dust filter must be replaced with a new one after six months.

Risk of malfunction. Damaged fine dust filter may impair the function of the RespiCare. **Always replace a damaged fine dust filter with a new one.**

9.2 Removing/Replacing the Fine Dust Filter/Coarse Dust Filter

- Disconnect the mains plug (1) from the socket of the RespiCare.

- Remove the silencer (2) (located on the rear panel of the RespiCare) by pulling it out.
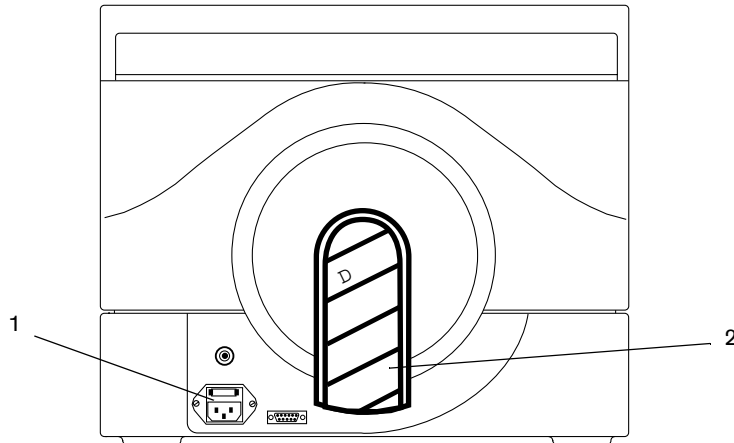
Fig. 25: Rear view of the RespiCare, removing the silencer

- Turn the mount (3) of the fine dust filter/coarse dust filter anti-clockwise and place the mount aside.
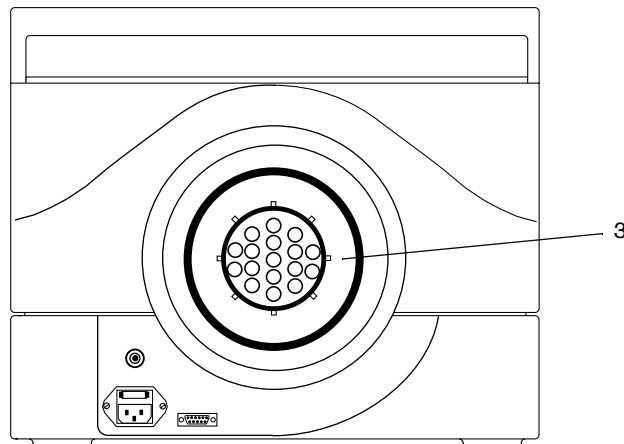
Fig. 26: Rear view of the RespiCare, removing the mount

GBK566550V01fm 23.10.00

- Remove the fine dust filter/coarse dust filter (1) from its mount (2) and dispose of it as household waste.

- Place the new fine dust filter/coarse dust filter (1) in the mount (2).
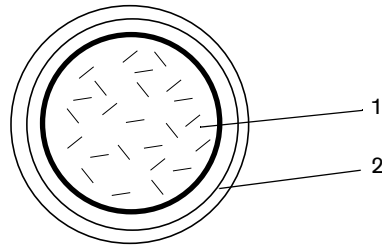
Fig. 27: View in the mount

- Secure the mount (3) by turning it clockwise into the RespiCare as far as it will go.
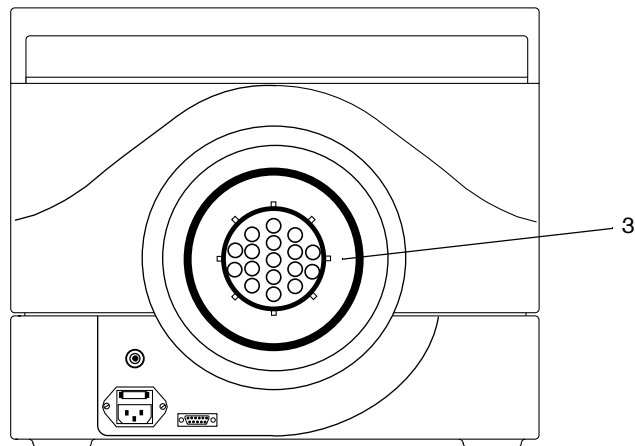
Fig. 28: Rear view of the RespiCare, securing the mount

- Push the silencer (1) into the RespiCare.
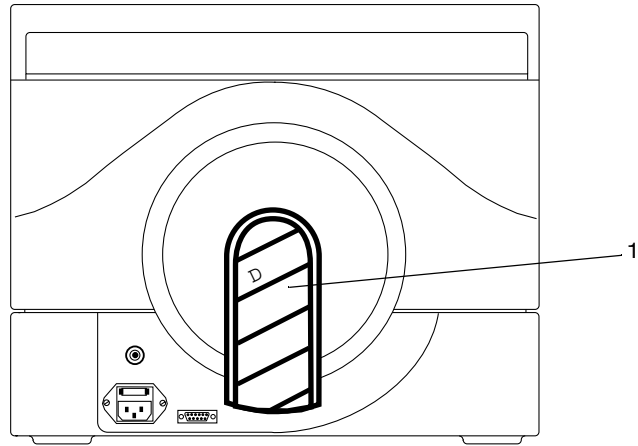
Fig. 29: Rear view of the RespiCare, mounting the silencer

- Enter the replacement date in the respective report.

Changes

10 List of changes

Important:

This technical documentation is valid for the technical equipment status October 2000.

Type of Change	Date

GBK566500AE1.fm 23.10.00

Appendix

11   Abbreviations

Abbreviations/Symbol	Meaning
ASB	**A**ssisted **S**pontaneous **B**reathing
CPAP	**C**ontinuous **P**ositive **A**irway **P**ressure
Freq	Ventilation frequency
Insp%	Percentage inspiration in the respiratory phase
mbar	Bar graph indication of the airway pressure (mbar)
min.	Bar graph indication of the time (minutes) for the Softstart function
Paw	Airway Pressure
Pexsp.	Expiration Pressure
Pinsp.	Inspiration Pressure
P-high	Upper pressure level
P-low	Lower pressure level
Patient	Patient usage counter
PCV	**P**ressure **C**ontrolled **V**entilation
PCV (S)	**P**ressure **C**ontrolled **V**entilation **S**ynchronized
Trigg. E	Expiratory flow trigger
Trigg. I	Inspiratory flow trigger
⏻	Standby button for switching the fan on and off
☼	Switches the bar graph illumination on and off
🔔	Suppresses the alarm tone for approx. 2 minutes
↑🕐	Setting the time for the softstart
↓🕐	Setting the time for the softstart
●	Activating and confirming settings

Abbreviations/Symbol	Meaning
↑	Making selections and settings
↓	Making selections and settings
🔔	Red alarm LED
🔧	Yellow LED for Service