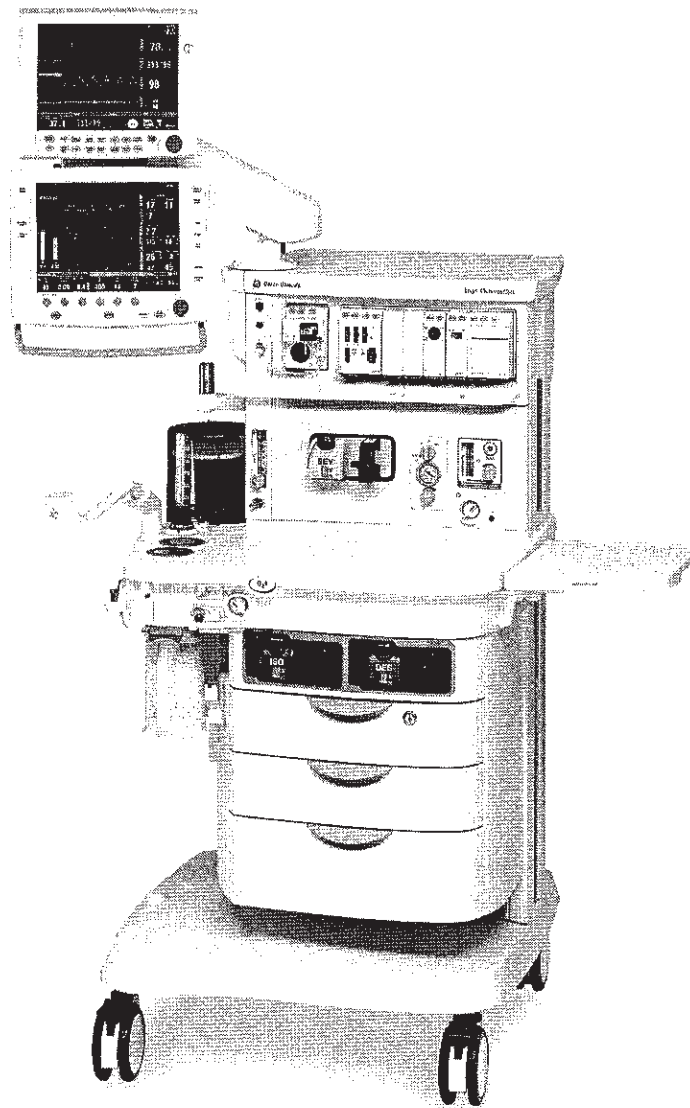


GE Healthcare

# Aisys

## User's Reference Manual

*Software Revision 7.X*



## User Responsibility

This Product will perform in conformity with the description thereof contained in this User's Reference manual and accompanying labels and/or inserts, when assembled, operated, maintained, and repaired in accordance with the instructions provided. This Product must be checked periodically. A defective Product should not be used. Parts that are broken, missing, plainly worn, distorted, or contaminated should be replaced immediately. Should repair or replacement become necessary, Datex-Ohmeda recommends that a telephonic or written request for service advice be made to the nearest Datex-Ohmeda Customer Service Center. This Product or any of its parts should not be repaired other than in accordance with written instructions provided by Datex-Ohmeda and by Datex-Ohmeda trained personnel. The Product must not be altered without the prior written approval of Datex-Ohmeda. The user of this Product shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, improper repair, damage, or alteration by anyone other than Datex-Ohmeda.

**CAUTION** U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner. Outside the U.S.A., check local laws for any restriction that may apply.

Datex-Ohmeda products have unit serial numbers with coded logic which indicates a product group code, the year of manufacture, and a sequential unit number for identification. The serial number can be in one of two formats.

AAAX11111	AAAXX11111AA
The <b>X</b> represents an alpha character indicating the year the product was manufactured; <b>H</b> = 2004, <b>J</b> = 2005, etc. <b>I</b> and <b>O</b> are not used.	The <b>XX</b> represents a number indicating the year the product was manufactured; <b>04</b> = 2004, <b>05</b> = 2005, etc.

*Aisys, Carestation, Easy-Fil, Advanced Breathing System, ComWheel, D-fend, EZchange, Disposable Multi Absorber, Reusable Multi Absorber, PSVPro, SmartVent, Aladin, and Aladin<sub>2</sub>* are registered trademarks of Datex-Ohmeda, Inc.

Other brand names or product names used in this manual are trademarks or registered trademarks of their respective holders.

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**Warranty**

# 1 Introduction

**WARNING** Read each component's User's Reference manual and understand the following before using this system:

- All system connections.
- All warnings and cautions.
- How to use each system component.
- How to test each system component.

△ Before using the system:

- Complete all of the tests in the "*Preoperative Tests*" section.
- Test all other system components.

△ If a test fails, do not use the equipment. Have a Datex-Ohmeda trained service representative repair the equipment.

<b>In this section</b>	Intended use . . . . .	1-2
	Symbols used in the manual or on the equipment . . . . .	1-4
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## Intended use

Aisys means Anesthesia Integrated System.

The Aisys Carestation is scalable, flexible, and functionally integrated, featuring the most advanced design, ventilation, respiratory monitoring, and breathing system. In addition, module bays allow for the physical integration of legacy Datex-Ohmeda patient monitors and supports mounting of other GE Healthcare monitors. Optionally, the open architecture design supports mounting of non-Datex-Ohmeda patient monitors, record keeping, and connections to the hospital information system. The INview movable display arm helps keep the anesthetist's focus on the patient by offering control of all hemodynamic, gas delivery, anesthetic agent, and ventilation parameters.

This anesthesia system is designed for mixing and delivering inhalation anesthetics, Air, O<sub>2</sub>, and N<sub>2</sub>O. The anesthesia system's small breathing system volume allows an anesthetic agent delivery response time of less than 7 seconds. (Agent response time defined as achieving 90% of the setting change measured while in non-circle circuit with a 2 l/min fresh gas flow.)

This anesthesia system uses SmartVent ventilation technology offering Volume Control Ventilation with tidal volume compensation and electronic PEEP. The proven SmartVent technology also features optional Pressure Control Ventilation, Pressure Support Ventilation with an Apnea Backup (PSVPro) that is used for spontaneously breathing patients, Synchronized Intermittent Mandatory Ventilation (SIMV) modes, Pressure Control Ventilation-Volume Guarantee (PCV-VG), and VCV cardiac bypass. In Volume Control Ventilation, a patient can be ventilated using a minimal tidal volume of 20 ml. In Pressure Control Ventilation, volumes as low as 5 ml can be measured. These advanced features allow for the ventilation of a broad patient range.

This anesthesia system uses the Advanced Breathing System (ABS). This integrated breathing system is easy to remove and disassemble and is fully autoclavable. Its fully integrated design enhances the system's elegance while minimizing tube connections, minimizing circuit volume, and increasing the work surface area.

This anesthesia system is designed for expansion and upgrades, so it is easy to add new technologies and ventilation capabilities without investing in a new system.

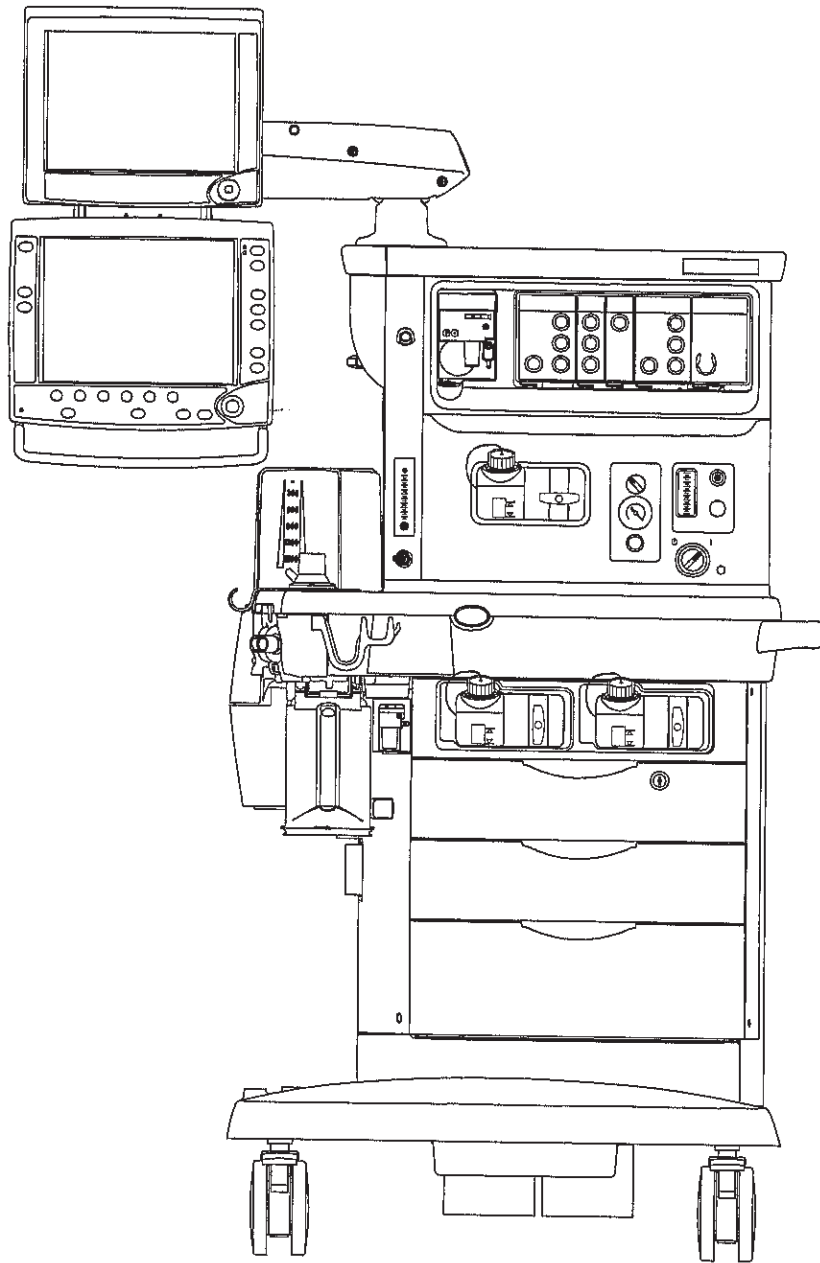
This anesthesia system is not suitable for use in an MRI environment.

This system must only be operated by authorized medical personnel well trained in the use of this product. It must be operated according to the instructions in this User's Reference manual.

**WARNING** Explosion Hazard. Do not use this system with flammable anesthetic agents.



**Note** Configurations available for this product depend on local market and standards requirements. Illustrations in this manual may not represent all configurations of the product. This manual does not cover the operation of every accessory. Refer to the accessory documentation for further information.



AB.75.100

Figure 1-1 • Front view























## Symbols used in the manual or on the equipment

Symbols replace words on the equipment, on the display, or in Datex-Ohmeda manuals.





















Warnings and Cautions tell you about dangerous conditions that can occur if you do not follow all instructions in this manual.

Warnings tell about a condition that can cause injury to the operator or the patient.

Cautions tell about a condition that can cause damage to the equipment. Read and follow all warnings and cautions.

	On (power)		Off (power)
	Standby		O2 Flush button
	Type BF equipment		Type B equipment
	Airway module indicator		ACGO active
	Dangerous voltage		Frame or chassis ground
	Protective earth ground		Earth ground
	Direct current		Alternating current
	Caution/Warning		Attention, refer to product instructions
	Refer to product instructions		Pinch hazard
	Electrical input		Electrical output
	Electrical input/output		Sample gas inlet to scavenging

# 1 Introduction

	Pneumatic inlet		Pneumatic outlet
SN	Serial number	REF	Stock number
	Equipotential		Lamp, lighting, illumination
	Variability		Variability in steps
	Suction bottle outlet		Vacuum inlet
<b>MAX</b>	Maximum	<b>VACUUM</b>	Vacuum
<b>EXHAUST</b>	Exhaust	$\approx V_T$ (mL)	Bellows volumes are approximate
+	Plus, positive polarity	-	Minus, negative polarity
	Bag position/manual ventilation		Mechanical ventilation
	Inspiratory flow		Expiratory flow
	Movement in one direction		Movement in two directions
	Lock		Unlock
	Isolation transformer		Low pressure leak test
134°C	Autoclavable		Not autoclavable
	This way up	O <sub>2</sub> %	O <sub>2</sub> cell connection
$\approx$ cmH <sub>2</sub> O	APL settings are approximate	<b>AGSS</b>	Anesthetic Gas Scavenging System

# Aisys



O2% indicator on left and balance gas indicator on right. Colors associated with gas settings.



Gas indicator. Color associated with gas settings.



Alarm silence



Submenu



No battery/battery failure



Battery in use. Bar indicates amount of battery power remaining.



Read to center of float



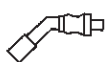
EZchange canister (CO2 bypass)



Open drain (remove liquid)



Close drain



Pipeline



Cylinder



Systems with this mark agree with the European Council Directive (93/42/EEC) for Medical Devices when they are used as specified in their User's Reference manuals. The xxxx is the certification number of the Notified Body used by Datex-Ohmeda's Quality Systems.



Authorized representative in the European Community



Date of manufacture



Manufacturer



Indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of equipment.



GOST R Russian certification



This product consists of devices that may contain mercury, which must be recycled or disposed of in accordance with local, state, or country laws. (Within this system, the backlight lamps in the monitor display contain mercury.)



Caution: federal law prohibits dispensing without prescription.



Enhanced temperature sensing



Agent level unknown



Agent level sensing supported. Bar indicates amount of agent remaining.



When moving or transporting anesthesia machine, place the display arm in the transport position as shown.

## Typeface conventions used

Names of hard keys on the display and modules are written in bold typeface; for example, **Normal Screen**.

Menu items are written in bold italic typeface; for example, ***Vent Setup***.

Messages that are displayed on the screen are enclosed in single quotes; for example, 'Check sample gas out.'

When referring to different sections and other documents, the names are written in italic typeface and enclosed in double quotes; for example, "*System Controls and Menus*."

## Abbreviations


Abbreviation	Definition
<b>A</b>	
AA	Anesthetic agent
ABS	Advanced breathing system
ACGO	Auxiliary Common Gas Outlet
AGSS	Anesthesia Gas Scavenging System
Alt O <sub>2</sub>	Alternate O <sub>2</sub>
APL	Adjustable pressure-limiting
APN	Apnea
<b>C</b>	
CGO	Common Gas Outlet
CO <sub>2</sub>	Carbon dioxide
Compl	Compliance
<b>E</b>	
ET	End-tidal concentration
EtCO <sub>2</sub>	End-tidal carbon dioxide
EtO <sub>2</sub>	End-tidal oxygen
Exp	Expiratory
<b>F</b>	
FI	Fraction of inspired gas
FICO <sub>2</sub>	Fraction of inspired carbon dioxide

<b>Abbreviation</b>	<b>Definition</b>
FI-ET	Difference between inspiratory and expiratory concentrations
FiO <sub>2</sub>	Fraction of inspired oxygen
F-V	Flow-volume loop
<b>I</b>	
I:E	Inspiratory-expiratory ratio
Insp	Inspiratory
Insp Pause	Inspiratory pause time
<b>M</b>	
MAC	Minimum Alveolar Concentration
MV	Minute volume
MV <sub>exp</sub>	Expired minute volume
MV <sub>insp</sub>	Inspired minute volume
<b>N</b>	
N <sub>2</sub> O	Nitrous oxide
<b>O</b>	
O <sub>2</sub>	Oxygen
<b>P</b>	
Pair	Air supply pressure
Paux	Auxiliary pressure
Paw	Airway pressure
PCV	Pressure controlled ventilation
PCV-VG	Pressure controlled ventilation - volume guaranteed
PEEP	Positive end expiratory pressure
PEEP <sub>e</sub>	Extrinsic positive end expiratory pressure
P <sub>exp</sub>	Expiratory pressure
P-F	Pressure-flow loop
P <sub>insp</sub>	Inspiratory pressure
P <sub>limit</sub>	High pressure limit
P <sub>max</sub>	Maximum pressure
P <sub>mean</sub>	Mean pressure
PO <sub>2</sub>	Oxygen supply pressure
P <sub>peak</sub>	Peak pressure
P <sub>plat</sub>	Plateau pressure
P <sub>supp</sub>	Support pressure
PSV	Pressure supported ventilation
PSVPro	Pressure supported ventilation with apnea backup
P-V	Pressure-volume loop

<b>Abbreviation</b>	<b>Definition</b>
<b>R</b>	
Rate	Respiratory rate
Raw	Airway resistance
RR	Respiratory rate
<b>S</b>	
SIMV/PSV	Synchronized intermittent mandatory ventilation with pressure supported ventilation
SIMV-PC	Synchronized Intermittent mandatory ventilation - pressure controlled
<b>T</b>	
TV	Tidal volume
TVexp	Expired tidal volume
TVinsp	Inspired tidal volume
<b>V</b>	
VCO2	Carbon dioxide production
VCV	Volume controlled ventilation
Vol	Volume

## 2 System Controls and Menus

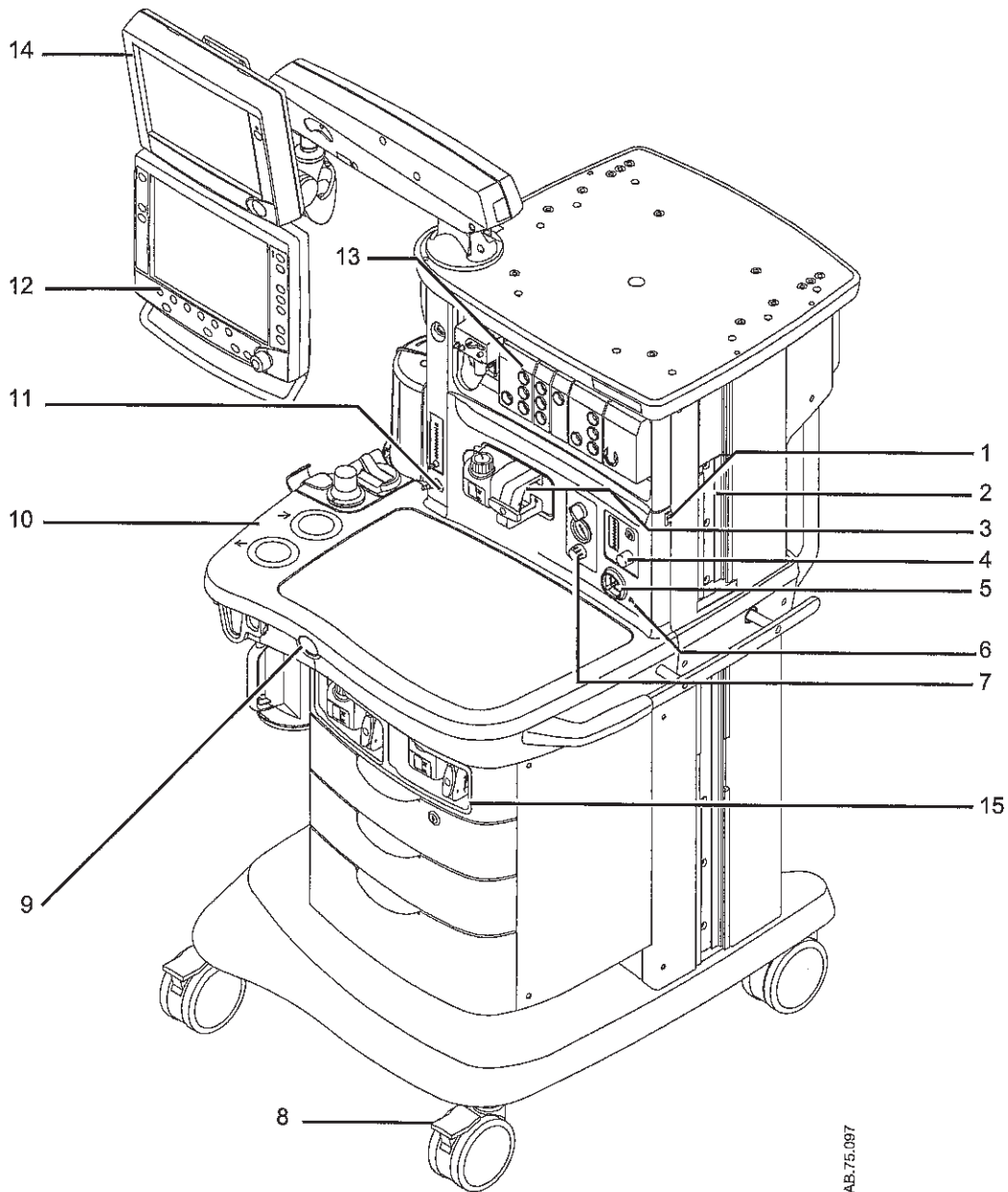
**WARNING** Do not use antistatic or electrically-conductive breathing tubes or masks. They can cause burns if used near high-frequency surgical equipment.

 Explosion Hazard. Do not use this system with flammable anesthetic agents.

<b>In this section</b>	System overview . . . . .	2-2
	Advanced breathing system (ABS) components . . . . .	2-5
	Display controls . . . . .	2-12
	Anesthesia system display . . . . .	2-13
	Using menus . . . . .	2-16



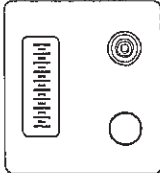



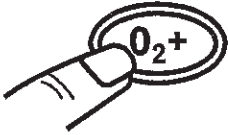

## System overview

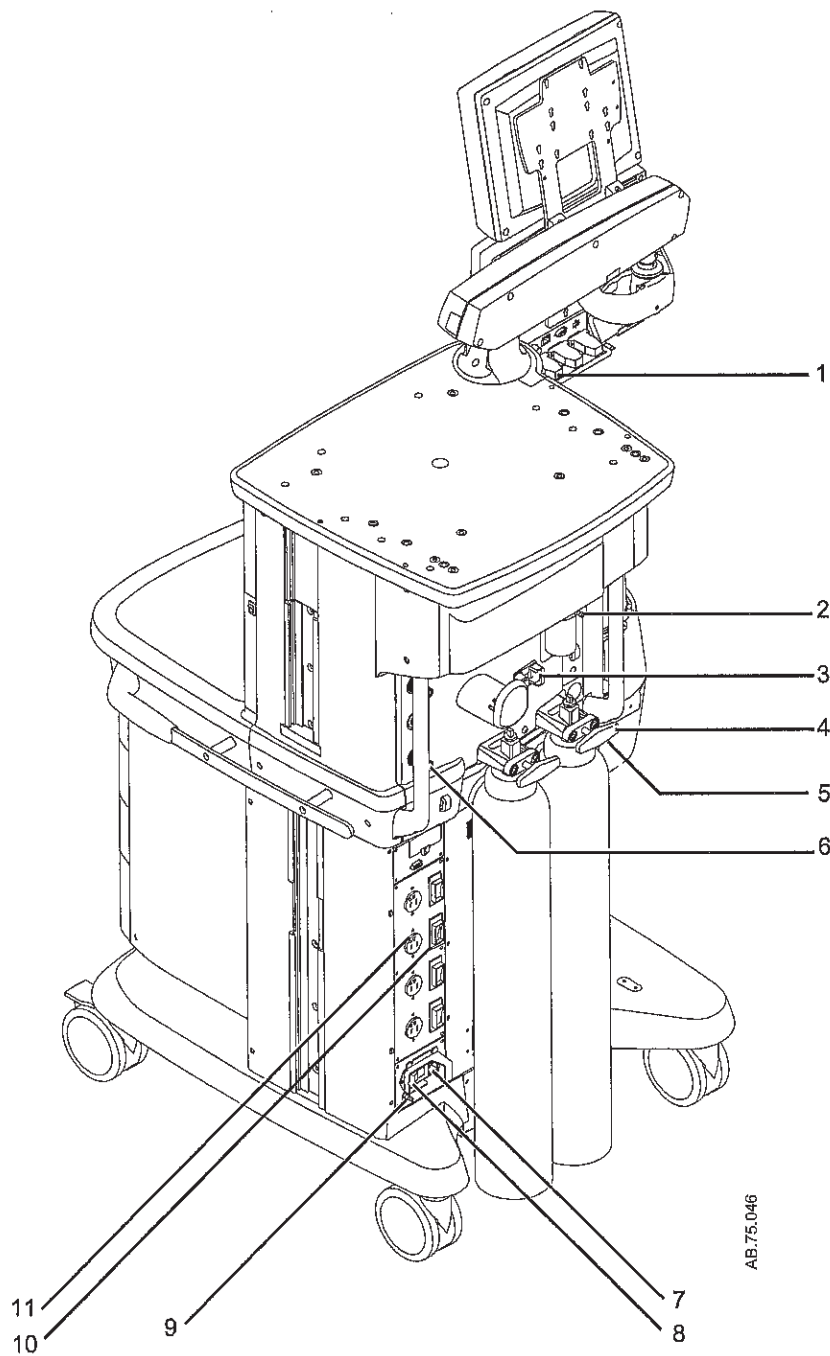


- |                                   |   |
|-----------------------------------|---|
| 1. Light switch                   | 9. O2 flush button                        |
| 2. Dovetail                       | 10. Advanced breathing system             |
| 3. Aladin cassette and active bay | 11. Auxiliary O2 flow control (optional)  |
| 4. Alternate O2 control           | 12. Anesthesia display                    |
| 5. System switch                  | 13. Patient monitoring modules (optional) |
| 6. Mains indicator                | 14. Patient monitoring display (optional) |
| 7. Integrated suction (optional)  | 15. Aladin cassette storage bay           |
| 8. Brake                          |   |

Figure 2-1 • Front view

## 2 System Controls and Menus

Item, Figure 2-1	Description
4 Alternate O2 control	<p>Alternate O2 control activates automatically in the case of certain failures or errors. It can also be activated manually by pushing the Alternate O2 control button if the display fails. Turn the knob counterclockwise to increase the flow. Turn the knob clockwise to decrease the flow. See "Alternate O2 control" in the Operation section.</p> 
5 System switch	<p>Set the switch to the On (I) position to permit gas flow and to turn on the system.</p> 
6 Mains indicator	<p>The mains indicator will come on when AC power is connected.</p>
7 Integrated suction (optional)	<p>Turn the switch to MAX for full vacuum. Turn the switch to Off (0) for no vacuum. Turn the switch to On (I) for adjustable vacuum. When in adjustable vacuum, turn the knob clockwise to increase the vacuum and counterclockwise to decrease the vacuum.</p> 
8 Brake	<p>Push down to lock. Lift to release.</p> 
9 O2 flush button	<p>Push the O2 flush button to supply high flows of O2 to the breathing system.</p> 
11 Auxiliary O2 flow control (optional)	<p>Turn the knob counterclockwise to increase the flow. Turn the knob clockwise to decrease the flow.</p> 

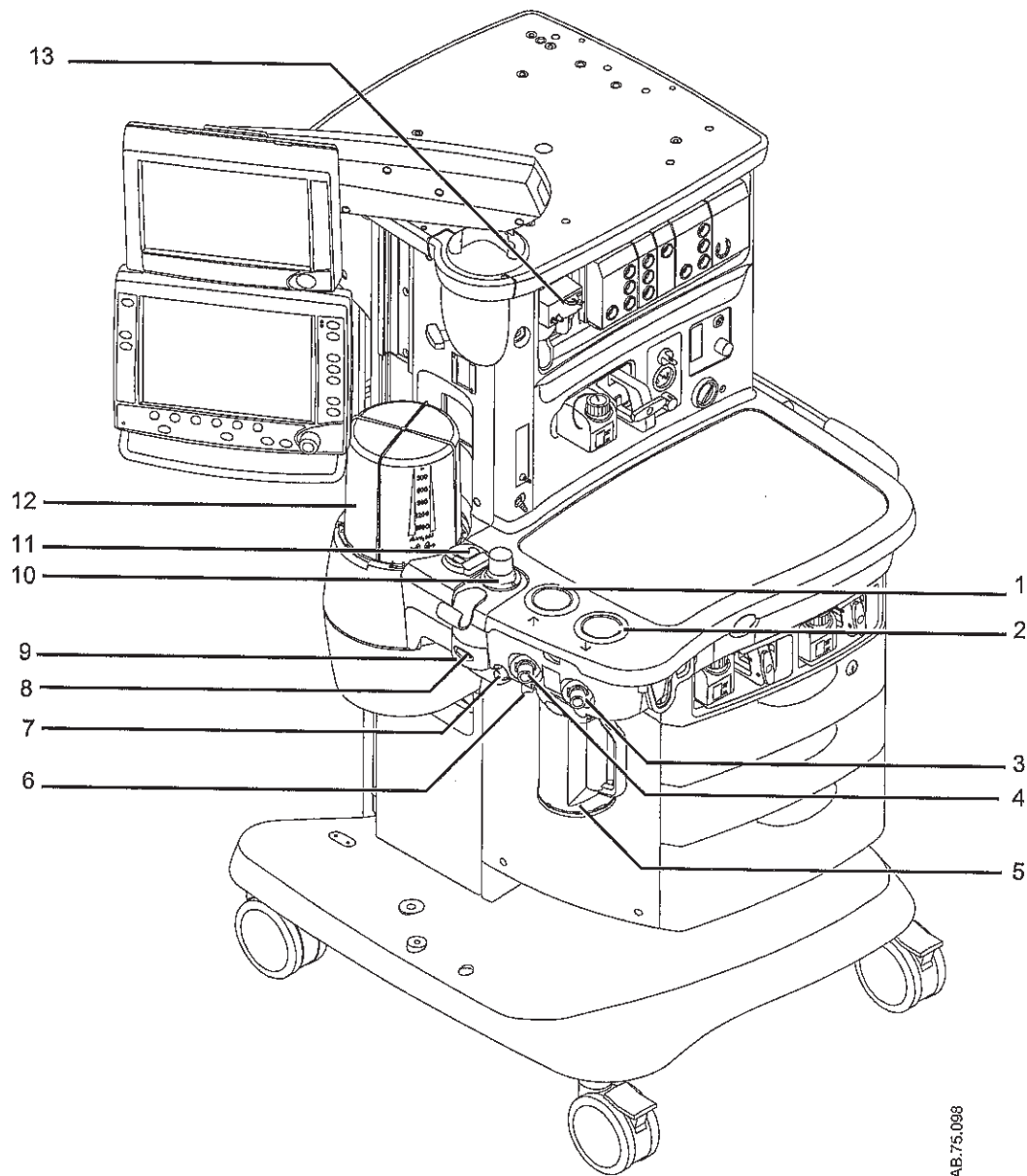


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- |  |                                |
|--|--------------------------------|
| 1. Serial port                             | 7. Mains inlet                 |
| 2. Collection bottle connection            | 8. System circuit breaker      |
| 3. Cylinder wrench (key) storage           | 9. Equipotential stud          |
| 4. Cylinder yoke                           | 10. Outlet circuit breaker     |
| 5. AGSS (Anesthesia Gas Scavenging System) | 11. Isolated electrical outlet |
| 6. Pipeline connections                    |                                |

Figure 2-2 • Rear view

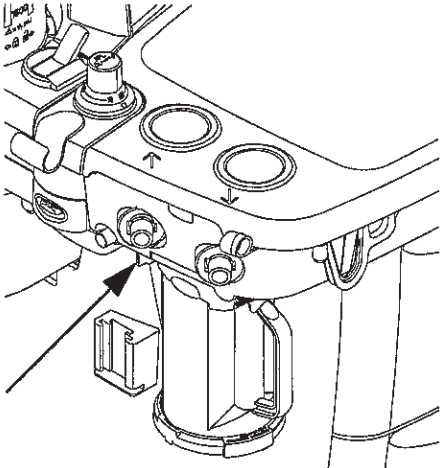
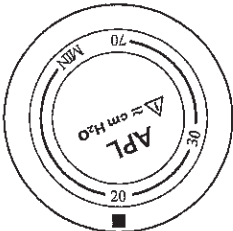
## Advanced breathing system (ABS) components



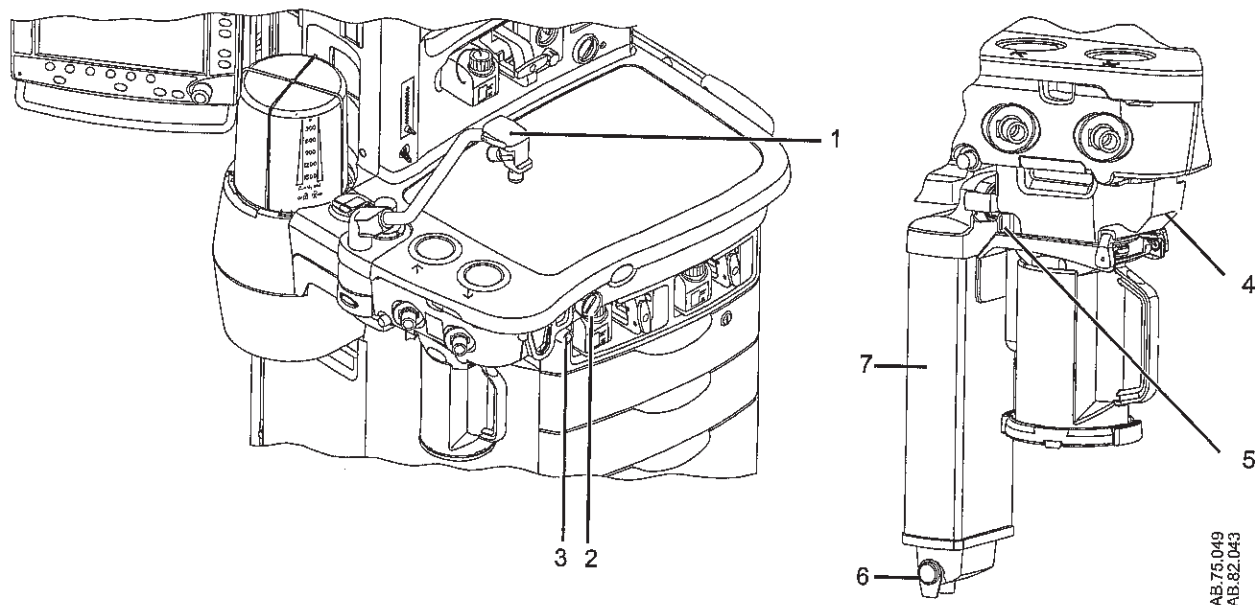
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- |                              |  |
|------------------------------|--|
| 1. Expiratory check valve    | 8. Breathing system release                  |
| 2. Inspiratory check valve   | 9. Manual bag port                           |
| 3. Inspiratory flow sensor   | 10. Adjustable pressure-limiting (APL) valve |
| 4. Expiratory flow sensor    | 11. Bag/Vent switch                          |
| 5. Absorber canister         | 12. Bellows assembly                         |
| 6. Absorber canister release | 13. Airway module (optional)                 |
| 7. Leak test plug            |  |

Figure 2-3 • Advanced breathing system

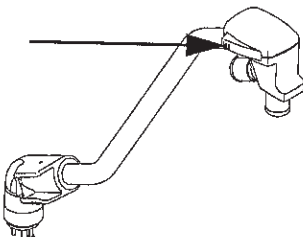
Item, Figure 2-3		Description
3, 4	Inspiratory flow sensor Expiratory flow sensor	Flow sensors provide volume measurements for some monitoring functions and tidal volume delivery.
6	Absorber canister release	<p>Push to remove the canister. This causes the breathing system to vent to the room (unless the EZchange canister option is installed). Be sure to hold the canister by the handle before releasing the canister.</p> 
10	Adjustable pressure-limiting (APL) valve	<p>Adjusts breathing system pressure limit during manual ventilation. The scale shows approximate pressures. Above 30 cmH<sub>2</sub>O, the knob will click as it turns.</p> 
11	Bag/Vent switch	Selects between manual ventilation (bag) or mechanical ventilation (ventilator).

### Optional ABS components



- 1. Bag support arm
- 2. Auxiliary Common Gas Outlet (ACGO) switch
- 3. ACGO port
- 4. EZchange canister module (CO2 bypass)
- 5. EZchange canister release
- 6. Condenser drain button
- 7. Condenser

Figure 2-4 • Breathing system options

Item, Figure 2-4		Description
1	Bag support arm	Squeeze the button to raise or lower the arm. 
2	Auxiliary Common Gas Outlet (ACGO) switch	Set switch to ACGO position for fresh gas to flow through the ACGO port. The ACGO may be used to provide fresh gas to an auxiliary manual breathing circuit.
5	EZchange canister release	Push to drop the canister to EZchange position. This seals the breathing circuit, permitting continued ventilation and rebreathing of exhaled gases. Be sure to hold the canister by the handle before releasing the canister.
6	Condenser drain button	Push to drain water out of the condenser.

## Non-circle circuit

Fresh gas flow is diverted around the inspiratory check valve and out through the inspiratory port when non-circle ventilation is selected. This fresh gas source may be used with circuits without CO<sub>2</sub> absorbent capability (for example, Mapleson variants). Mechanical ventilation is not available when using the non-circle circuit. Tidal volume monitoring is not available.

O<sub>2</sub> monitoring of fresh gas is available automatically when using the non-circle circuit if the system has the airway module option or the O<sub>2</sub> cell monitoring option.

Fresh gas oxygen concentration is displayed on the screen. Set the alarm limits appropriately. Note that fresh gas oxygen concentration may not reflect FIO<sub>2</sub> when using these types of circuits. Use an external O<sub>2</sub> monitor when using a rebreathing circuit with the non-circle circuit.

Systems with both an airway module and an O<sub>2</sub> cell will display the circuit O<sub>2</sub> value obtained from the airway module.

Do not use an external ventilator when using the non-circle circuit. Do not use the non-circle circuit to drive external ventilators or for jet ventilation.

### WARNING

The maximum pressure at the non-circle circuit can be up to 27 kPa (4 psi). Use a breathing circuit with pressure relief.

### ACGO (optional)

Fresh gas flow is directed through the Auxiliary Common Gas Outlet (ACGO) on the front of the machine when the ACGO switch is in the ACGO position. Mechanical ventilation is not available when operating an auxiliary manual breathing circuit with fresh gas from the ACGO. The Bag/Vent switch, APL valve, and bag arm are not part of the external circuit. Volume and pressure monitoring are not available.

### WARNING

The Bag/Vent switch and the APL valve do not control the ACGO or any breathing circuit connected to the ACGO. Do not use these controls when using a breathing circuit with fresh gas from the ACGO. Patient injury may occur.



Volume and pressure monitoring are not available through the system when using the ACGO port. Monitor the patient using other methods.

O<sub>2</sub> monitoring of fresh gas is available automatically when the ACGO is selected if the system has the airway module option or the O<sub>2</sub> cell monitoring option. A sample of the fresh gas is diverted to the O<sub>2</sub> cell in the breathing system. The sample flow to the O<sub>2</sub> cell is dependent on the pressure in the external circuit. The sample flow reduces the fresh gas flow rate to the auxiliary breathing circuit equal to the amount diverted to the O<sub>2</sub> cell.

Fresh gas oxygen concentration is displayed on the screen. Set the alarm limits appropriately. Note that fresh gas oxygen concentration may not reflect FIO<sub>2</sub> during spontaneous breathing or in rebreathing circuits. Use an external O<sub>2</sub> monitor if using a rebreathing circuit on ACGO.

Systems with both an airway module and an O<sub>2</sub> cell will display the circuit O<sub>2</sub> value obtained from the airway module.

Do not use an external ventilator on the ACGO. Do not use the ACGO to drive external ventilators or for jet ventilation.

### WARNING

The maximum pressure at the ACGO can be up to 55 kPa (8 psi). Use a breathing circuit with pressure relief.

### Scavenging the ACGO sample flow

A sample of the fresh gas is diverted to the airway module or the O<sub>2</sub> cell in the breathing system to show the O<sub>2</sub> numerics on the screen. This sample flow should be scavenged when an auxiliary manual breathing circuit is used with N<sub>2</sub>O or volatile anesthetics. If scavenging is not connected, the sample flow is emptied into the room. To connect the scavenging:

1. Attach a circle breathing circuit to the inspiratory and expiratory ports.
2. Occlude the breathing circuit by connecting the Y-piece to the leak test plug located behind the expiratory port.
3. Check for clinically correct settings.



4. Check the position of the Bag/Vent switch.
  - If the Bag/Vent switch is set to mechanical ventilation mode, the bellows fills slowly with the sample flow. When the bellows is full, the sample flow goes to the AGSS. (Mechanical ventilation does not start when the ACGO switch is set to ACGO.)
  - If the Bag/Vent switch is set to the bag mode, set the APL valve to MIN, and attach a bag. The bag fills slowly with the sample flow. When the bag is full, the sample flow goes to the AGSS.

### **Scavenging from an auxiliary manual breathing circuit**

Scavenge the exhaust if an auxiliary manual breathing circuit is used with N<sub>2</sub>O or volatile anesthetics.

An auxiliary inlet is available for active and passive AGSS units. It provides a female connection with 30 mm - 30 mm male connector (or a 30 mm -19 mm male connector) into the auxiliary port under the breathing system. Do not use these connectors as an outlet for exhaust flow.

The auxiliary inlet is a convenience inlet to the air brake of active AGSS units. There is a reservoir to capture exhaust flows higher than the extract flow.

A separate exhaust hose is needed from the auxiliary manual breathing circuit to the disposal point for all AGSS units.

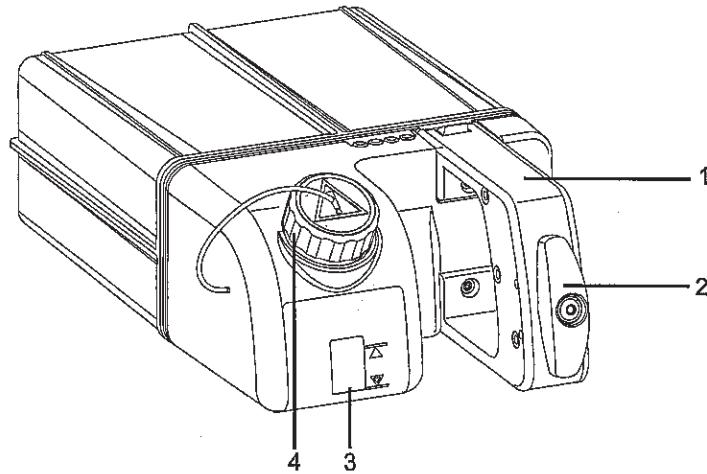
### **Scavenging a gas monitor sample flow**

Sample gas from a gas monitor can be scavenged using the sample gas return port or the AGSS.

- To scavenge from a gas monitor using the sample gas return port, connect the tubing from the monitor to the sample gas return port.
- To scavenge from a gas monitor using the AGSS, connect tubing from the monitor to the male luer inlet on the bottom of the AGSS underneath the breathing system.

### Aladin cassette controls

The electronically controlled vaporizer consists of the internal electronic control unit and the Aladin agent cassette. See the "Vaporizer" section for more information.

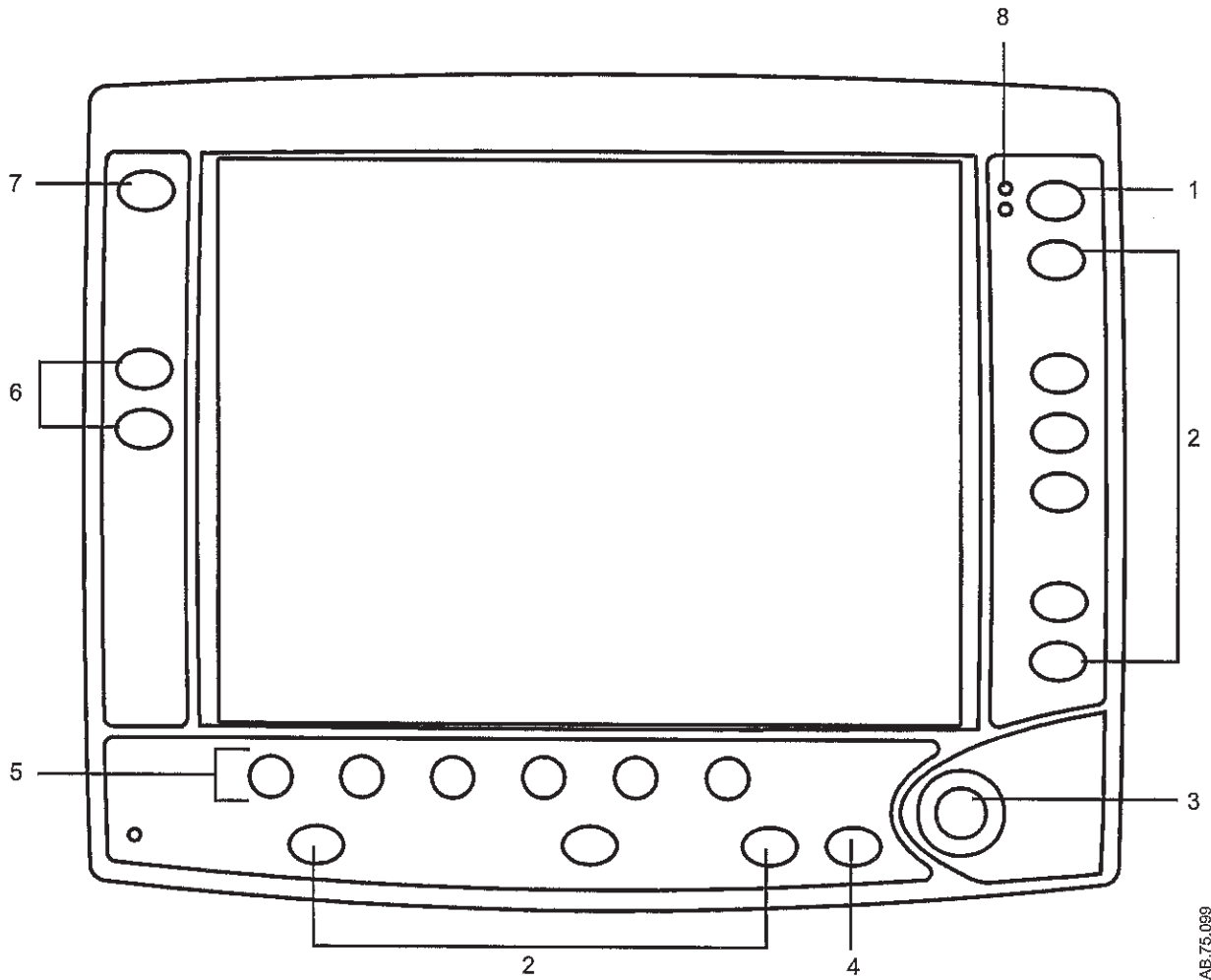


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1. Handle with release trigger
2. Lock
3. Liquid level indicator
4. Agent filling port

Figure 2-5 • Aladin<sub>2</sub> cassette

## Display controls

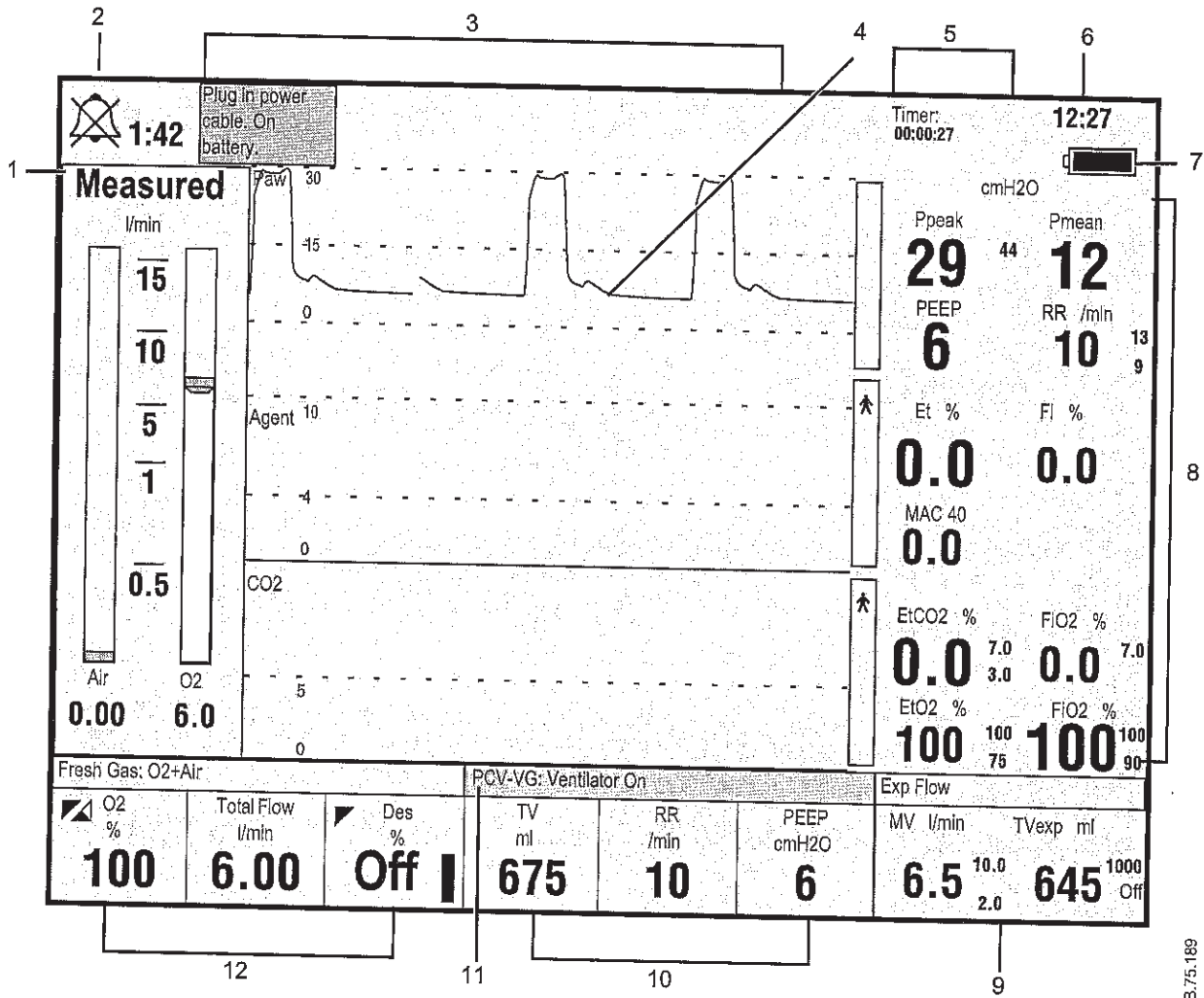


AB.75.089

- |    |                    |  |
|----|--------------------|--|
| 1. | Silence Alarms key | Push to silence any active, silenceable high and medium priority alarms or to suspend/acknowledge any non-active medium or high priority alarms. Alarm is silenced for 120 seconds or alarm is suspended for 90 seconds. |
| 2. | Menu keys          | Push to show corresponding menu.   |
| 3. | ComWheel           | Push to select a menu item or confirm a setting. Turn clockwise or counterclockwise to scroll menu items or change settings.   |
| 4. | Normal Screen key  | Push to remove all menus from the screen.  |
| 5. | Quick keys         | Push to change corresponding gas setting or ventilator setting. Turn the ComWheel to make a change. Push the ComWheel to activate the change.  |
| 6. | Timer keys         | Push to start or stop the timer. Push to reset the timer back to zero.   |
| 7. | MV/TV Alarms key   | Push to turn off the MV and TV alarms. Push again to turn the MV and TV alarms on.   |
| 8. | Alarm LEDs         | Turn on solid or flash to indicate alarm priority.   |

Figure 2-6 • Display controls

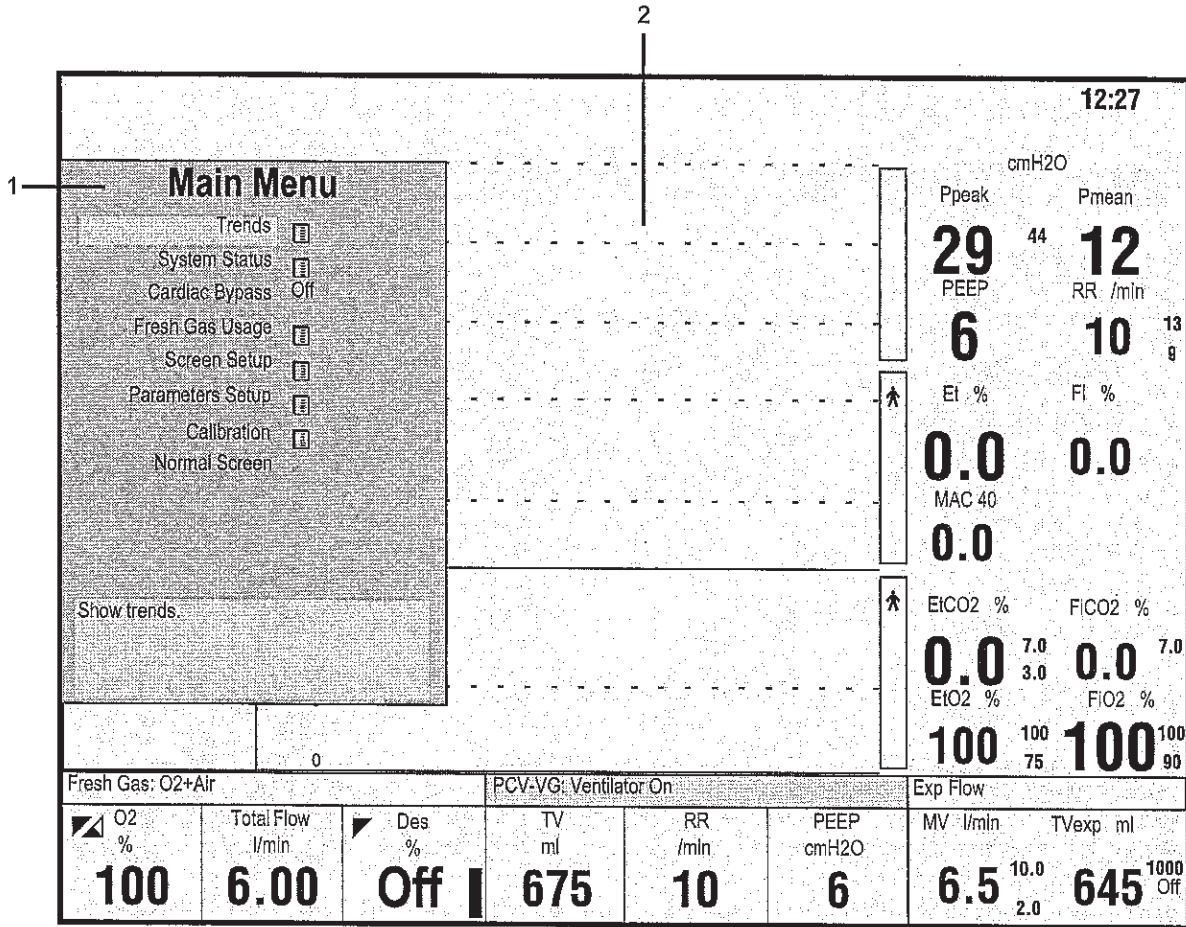
# Anesthesia system display



1. Split screen area showing electronic gas flow indicators
2. Alarm silence symbol and countdown
3. Alarm message fields
4. Waveform fields
5. General message field or timer field
6. Clock
7. Battery indicator field
8. Measured values field
9. Pipeline and cylinder supply or respiratory data or digit field
10. Ventilator settings
11. Ventilation mode
12. Gas settings

Figure 2-7 • Normal view

When a menu key is selected, the menu field overlays the gas flow indicators and the waveform fields start at the right edge of the menu.



- 1. Menu
- 2. Waveform fields

Figure 2-8 • Menu view

### Waveform fields

Up to three waveforms can be shown on the normal screen view. Each waveform can be set to show specific information such as Paw, agent, flow, or CO2 data. The corresponding numeric information shows in the measured values field to the right of the waveform. If the waveform is set to show the agent and no airway module is inserted, that waveform and numeric areas are blank.

When one waveform is turned off, that waveform and the corresponding numerics information are removed from the normal screen view. The remaining waveforms and numerics increase in size to fill the waveform area. When two waveforms are turned off, those waveforms and the corresponding numerics information are removed from the normal screen view. The remaining waveform increases in size and is centered in the waveform area.

See *"Screen configuration"* in the *"Operation"* section for more information.

### Digit field

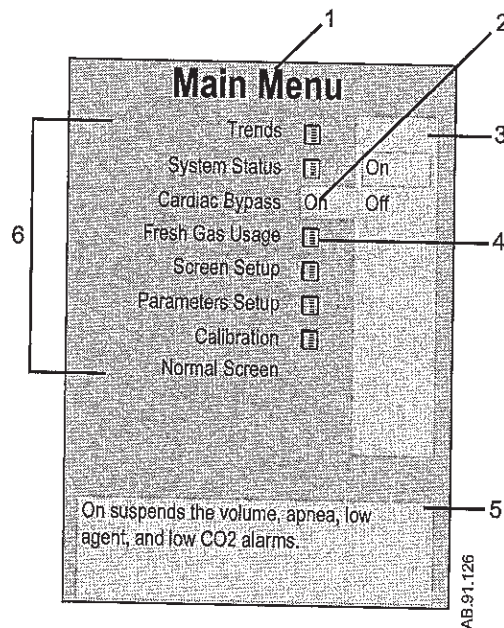
The digit field can be set to show specific information such as gas supply, flow, or agent. If the digit field is set to show agent and no airway module is inserted, the area is blank.

Paw, O2, and either TVexp or CO2 must show on the display during a case. If any of these parameters is not selected to show on the display, the digit field information is replaced with the missing parameter.

See *"Screen configuration"* in the *"Operation"* section for more information.

## Using menus

Push a menu key to display the corresponding menu. Use the ComWheel to navigate the menu.



1. Menu title
2. Current selection
3. Adjustment window
4. Submenu
5. Instructions or help information
6. Menu items

Figure 2-9 • Menu example

1. Push the menu key to display the corresponding menu.
2. Turn the ComWheel counterclockwise to highlight the next menu item. Turn the ComWheel clockwise to highlight the previous menu item.
3. Push the ComWheel to enter the adjustment window or a submenu.
4. Turn the ComWheel clockwise or counterclockwise to highlight the desired selection.
5. Push the ComWheel to confirm the selection.
6. Select **Normal Screen** or push the **Normal Screen** key to exit the menu and return to the normal monitoring display. (Select **Previous Menu** to return to the last displayed menu, if available.)



# 3 Operation

**WARNING** Ventilator alarms indicate potential hazard conditions. All alarms that occur should be investigated to help ensure adequate patient safety.

⚠ Maintain sufficient fresh gas flow when using sevoflurane.

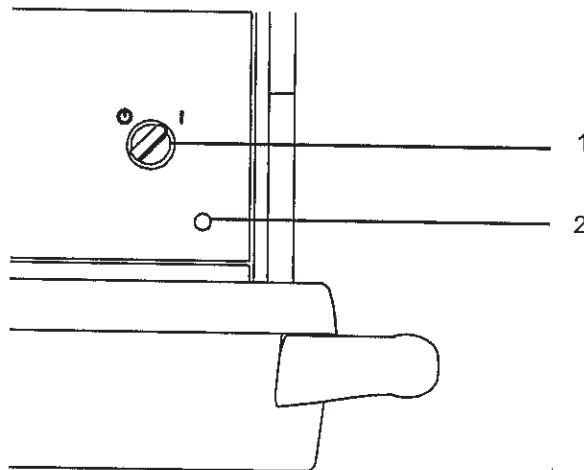
⚠ Desiccated (dehydrated) absorbent material may produce dangerous chemical reactions when exposed to inhalation anesthetics. Adequate precautions should be taken to ensure that absorbent does not dry out. Turn off all gases when finished using the system.

<b>In this section</b>	Turning on the system . . . . .	3-2
	Start case (start gas flow) . . . . .	3-3
	End case . . . . .	3-6
	Ventilator setup . . . . .	3-7
	Gas setup . . . . .	3-9
	Spirometry . . . . .	3-11
	Spirometry setup . . . . .	3-14
	Main Menu . . . . .	3-16
	Screen configuration . . . . .	3-20
	Alarm setup . . . . .	3-23
	Alternate O2 control . . . . .	3-26
	EZchange canister (optional) . . . . .	3-27
	Condenser (optional) . . . . .	3-28
	Passive AGSS (optional) . . . . .	3-29
	Active AGSS (optional) . . . . .	3-30



## Turning on the system

1. Plug the power cord into an electrical outlet. Make sure the system circuit breaker is on.
  - The mains indicator is lit when AC power is connected.
  - Battery is charging if it is not already fully charged.



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1. System switch
2. Mains indicator

Figure 3-1 • Mains indicator and system switch

2. Check that the breathing system is properly connected.

**CAUTION** Do not turn on the system with the right-hand (inspiratory) port plugged.

3. Turn the System switch to On.
  - The display shows the power-up screen.
  - The system does a series of automated self tests.
4. Perform a **Machine Check** before the first case of the day.
5. Perform a preoperative checkout before each case. See the "Preoperative Checkout" section.

**Note** The system must perform a power-up self test after 12 hours of remaining on. If the system has been on longer than 12 hours without a power-up self test, the 'Turn power Off and On for self tests' alarm occurs. Turn the power off and then back on between cases to resolve the alarm.

## Start case (start gas flow)

Access the **Start Case** menu by pushing the **Start/End Case** key or by selecting **Start Case** from the **Checkout** menu. Use the **Start Case** menu to set the case data and to start the gas flow.

<p><b>Start Case</b></p> <p>Default Settings</p> <p>Patient Weight</p> <p>Set Vent By Weight</p> <p>Patient Age</p> <p>Other Gas</p> <p>CO2 Alarms</p> <p>Volume Apnea</p> <p>Start Case Now</p>
--

The **Default Settings** has five selections. The first four selections are case types. The fifth selection is **Last Case**. The case type in the first slot shows as the default when the **Start Case** menu is opened.

Case types are configured in the **Install/Service - Case Defaults** menu. The **Install/Service** menu is only accessible by a Super User or a service person. See the "Super User Mode" section for more information on the **Start Case** menu defaults.

The values of **Patient Weight**, **Patient Age**, **Other Gas**, and **Volume Apnea** are configured to the default case type by the Super User. **CO2 Alarms** setting is set to 'On' when the **Start Case** menu is opened.

**Note** **Volume Apnea** is not shown on the **Start Case** menu when the **Volume Apnea Selection** is set to **Disable** in the **Install/Service** menu.

The **Set Vent By Weight** menu item is accessible when the ventilation mode is set to VCV or PCV-VG. Use this setting for breath rate and tidal volume calculations based on the set patient weight. The **Default Settings** selection shows 'Weight' when **Set Vent By Weight** is selected.

**WARNING** Make sure that the patient breathing circuit is correctly assembled and that the ventilator settings are clinically appropriate before starting ventilation. Incorrect breathing circuit assembly and incorrect ventilator settings can injure the patient.

## Using default settings

1. Set the Bag/Vent switch to Bag.
2. Push the **Start/End Case** key.
  - The case defaults are shown on the menu.
  - The **Default Settings** selection shows the preset case type.
3. Verify or change the settings on the **Start Case** menu.
4. Select **Start Case Now**. Gas flow starts.

## Using customized settings

The case type, ventilator settings, ventilation mode, alarm settings, and gas settings can be changed before starting a case. Use the **Vent Setup** menu, **Alarm Setup** menu, or **Gas Setup** menu to change settings not shown on the **Start Case** menu before starting a case. Return to the **Start Case** menu from these menus to make additional adjustments or to start a case.

1. Set the Bag/Vent switch to Bag.
2. Push the **Start/End Case** key.
3. Verify or change the settings on the **Start Case** menu.
  - Select a case type or **Last Case** from the **Default Settings**.
  - Make adjustments to the other settings as appropriate for the case.
  - The **Default Settings** selection changes to show 'Preset' if any changes to the settings are made.
4. To change the alarm settings:
  - Push the **Alarm Setup** key.
  - Select **Adjust Settings**.
  - Change the settings.
  - Select **Back**.
  - Make any other changes to the alarm setup.
  - Select **Previous Menu** to return to the **Start Case** menu to make additional adjustments.
5. To change ventilator settings:
  - Push the **Vent Setup** key.
  - Select **Adjust Settings**.
  - Change the settings.
  - Select **Exit** to return to the **Start Case** menu.
6. To change the ventilation mode:
  - Push the **Vent Setup** key.
  - Select the desired mode.
  - Select **Confirm** or adjust the settings and select **Confirm** to return to the **Start Case** menu.

7. To change the gas settings:
  - Push the **Gas Setup** key.
  - Select **Adjust Settings**.
  - Change the settings.
  - Select **Exit** to return to the **Start Case** menu.
8. To change the balance gas:
  - Push the **Gas Setup** key.
  - Select the balance gas to use with O2.
  - Select **Exit** or adjust the settings and select **Exit** to return to the **Start Case** menu.
9. To change the circuit type:
  - Push the **Gas Setup** key.
  - Select the circuit type.
  - Select **Confirm** or adjust the settings and select **Confirm** to return to the **Start Case** menu.
10. From the **Start Case** menu, select **Start Case Now**. Gas flow starts.

## Minimum Alveolar Concentration (MAC)

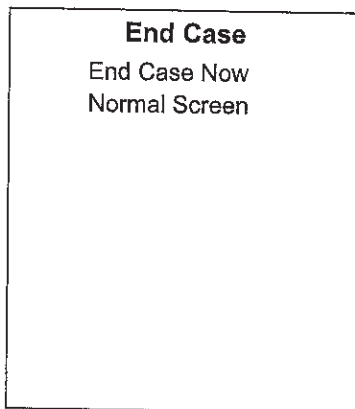
The adjusted Minimum Alveolar Concentration (MAC) is calculated based on the patient age entered in the **Start Case** menu. The default patient age of selected case type is used if no patient age is entered.

The MAC value is calculated from the exhaled gas concentration and the related affects based on the age of the patient. Typically, younger patients have better liver function and can clear a drug faster, resulting in a higher MAC value. The MAC calculation used is based on the Eger formula. When two agents are detected, the MAC values of each agent are added together. The MAC value range is 0.0 to 9.9.

The adjusted MAC value shows on several areas of the screen including in the mini-trend, agent waveform numeric information, gases digit field, and graphical trends page. MAC data shows as dashes if there is not an airway module installed in the module bay.

## End case

Use the **End Case** menu to stop gas flow and end the patient alarms.

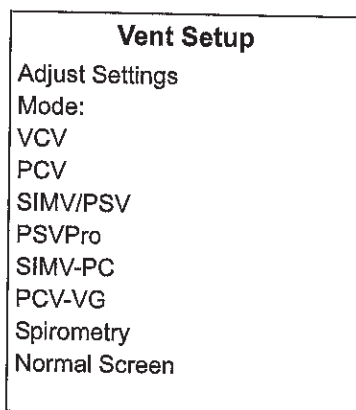


1. Set the Bag/Vent switch to Bag.
2. Push the **Start/End Case** key.
3. Select **End Case Now** to put the system in standby (stops gas flow and patient alarms).


## Ventilator setup

Access the **Vent Setup** menu by pushing the **Vent Setup** key. The system has up to six modes of mechanical ventilation:

- Volume Control Ventilation (VCV).
- Pressure Control Ventilation (PCV) (optional).
- Synchronized Intermittent Mandatory Ventilation/Pressure Support (SIMV/PSV) (optional).
- Pressure Support Ventilation (PSVPro) (optional).
- Synchronized Intermittent Mandatory Ventilation-Pressure Control (SIMV-PC) (optional).
- Pressure Control Ventilation-Volume Guaranteed (PCV-VG) (optional).



**WARNING** Most anesthetic agents will cause patients to have reduced ventilatory responses to carbon dioxide and to hypoxemia. Therefore, triggered modes of ventilation may not produce adequate ventilation.

 The use of neuromuscular blocking agents will reduce the patient's breathing response, which will interfere with triggering.

**Important** Refer to the "*Specifications and Theory of Operation*" section for more information on ventilation modes.

### Using quick keys

The main ventilator settings for each mode can easily be changed using the ventilator quick keys.

1. Push a ventilator quick key to select the corresponding ventilator setting.
2. Turn the ComWheel to make a change.
3. Push the ComWheel to activate (confirm) the change.

## Using Vent Setup menu

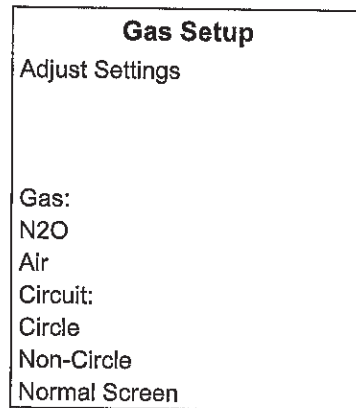
1. Push the **Vent Setup** key.
  - **Adjust Settings** is selected by default.
  - An arrow to the right of the mode indicates the current mode.
2. Push the ComWheel to enter the adjustment window for the selected mode.
3. Use the ComWheel to navigate the adjustment window and to change a value.
4. Push the ComWheel to activate the change.
5. Push the **Normal Screen** key or select **Exit**.

## Changing ventilator modes and settings

1. Push the **Vent Setup** key.
2. Select the mode and push the ComWheel to enter the adjustment window.
3. Use the ComWheel to navigate the adjustment window and to change a value.
4. Select **Confirm** to activate the mode.

## Gas setup

Access the **Gas Setup** menu by pushing the **Gas Setup** key. Use the **Gas Setup** menu to adjust the O<sub>2</sub>% and total flow, to change the balance gas, and to change the circuit type.



### Using quick keys

The O<sub>2</sub>% and total flow can easily be changed using the gas quick keys.

1. Push a gas quick key to select the corresponding gas setting.
2. Turn the ComWheel to make a change.
3. Push the ComWheel to activate (confirm) the change.

### Using Gas Setup menu

1. Push the **Gas Setup** key.
  - An arrow to the right of the balance gas indicates the gas currently being used with O<sub>2</sub>.
  - **Adjust Settings** is selected by default.
2. Push the ComWheel to enter the adjustment window.
3. Use the ComWheel to navigate the adjustment window and change a value.
4. Push the ComWheel to activate the change.
5. Push the **Normal Screen** key or select **Exit**.

### Changing gas and settings

1. Push the **Gas Setup** key.
2. Select the balance gas to use with O<sub>2</sub> and push the ComWheel to enter the adjustment window.
3. Use the ComWheel to navigate the adjustment window and change a value.
4. Push the ComWheel to activate the change.
5. Push the **Normal Screen** key or select **Exit**.



## Changing circuit type

1. Push the **Gas Setup** key.
  - **Adjust Settings** is selected by default.
  - An arrow to the right of the circuit type indicates the circuit currently in use.
2. Use the ComWheel to select **Circle** or **Non-Circle** and enter the adjustment window.
3. Confirm or change and confirm the settings.
4. Push the **Normal Screen** key or select **Exit**.

## Spirometry

There are three types of spirometry loops: Pressure-Volume (P-V), Flow-Volume (F-V) and Pressure-Flow (P-F). View, save, and erase spirometry loops and set the loop scaling in the **Spirometry** menu. Access the **Spirometry** menu by pushing the **Spirometry** key.

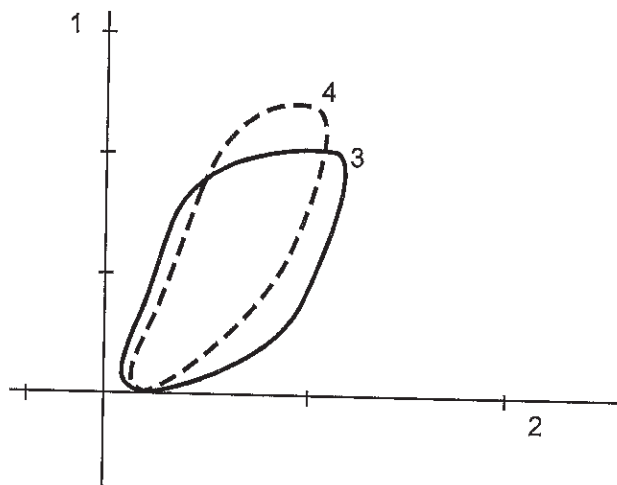
Use the **Spirometry** menu to:

- View a specific loop type; select **Loop Type** and set the loop type.
- Adjust the loop scaling; select **Scaling** and set the scale type.
- Access the **Spirometry Setup** menu; select **Spiro Setup**.
- Store a loop to memory; select **Save Loop**. Up to six loops can be saved.
- View a saved loop; select **Reference Loop** and the time at which the loop was saved.
- Erase a saved loop; select **Erase Loop** and the time at which the loop was saved.

Spirometry	
Loop Type	P-V
Scaling	
Spiro Setup	
Save Loop	
Reference Loop	None
Erase Loop	None
Previous Menu	

## Setting loop type

The spirometry loops show in the spirometry window and can be set to show alongside the waveforms as the split screen.



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1. Volume axis
2. Pressure axis
3. Real-time loop
4. Reference loop (appears on display in white)

Figure 3-2 • Example of a P-V loop

To set the loop type:

1. Push the **Spirometry** key.
2. Select **Loop Type** and set the loop type.
  - Set to **P-F** for Paw-Flow.
  - Set to **F-V** for Flow-Volume.
  - Set to **P-V** for Paw-Volume.

**Note** The loop type can also be set in the **Spirometry Setup** menu. Push the **Main Menu** key, and select **Parameters Setup - Spirometry Setup - Loop Type**.

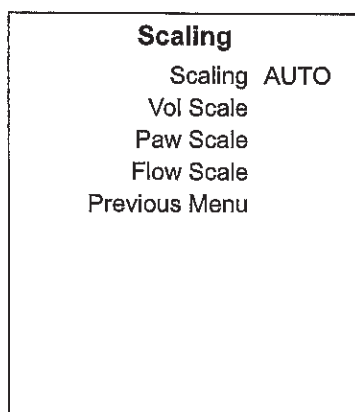
## Scaling

The scales shown in the spirometry loop graph are set in the **Scaling** menu. The available settings for the volume, Paw, and flow graph axes are dependent on the set patient type of adult or pediatric.

The **AUTO** selection automatically adjusts the volume, Paw, and flow axes of the loop graph based on the minimum and maximum breath reading shown in the waveform.

The **Linked** selection links the adjustment of the volume, Paw, and flow axes of the loop graph together. Change one of the scales and the remaining two scales automatically change based on the one set scale.

The **Indep** selection allows the axes of the loop graph to be changed separately for the volume, Paw, and flow axes.



1. Push the **Spirometry** key.
2. Select **Scaling**.
3. Set the scale type to **AUTO**, **Linked**, or **Indep**.
  - If **AUTO** is selected, the scales are automatically set.
  - If **Linked** is selected, set one of the scales volume, Paw, or flow. The other two scales adjust based on the set scale.
  - If **Indep** is selected, set the volume scale, set the Paw scale, and set the flow scale.

## Spirometry setup

Push the **Spirometry** key and select **Spiro Setup** to access the **Spirometry Setup** menu. Use the **Spirometry Setup** menu to:

- Set the patient and sensor type.
- Select a data source.
- Set the loop type.
- Change the volume shown on the spirometry split screen to MVexp or TVexp.
- Set split-screen view.
- Access the Paw and MVexp alarm limits.

**Note** The **Spirometry Setup** menu is also accessible through **Main Menu - Parameters Setup - Spirometry Setup**.

<b>Spirometry Setup</b>	
Patient and Sensor Type	Adult
Data Source	Vent
Loop Type	P-V
TV or MV	TV
Split Screen	None
Paw Alarm	
MVexp Alarm	
Previous Menu	

### Setting patient and sensor type

Patient and sensor type refer to the style of airway adapter used with the airway module. If spirometry data is obtained from the airway module, ensure that the sensor type matches the airway adapter used.

If the sensor type is not set correctly, the information displayed may not be accurate.

1. Push the **Spirometry** key.
2. Select **Spiro Setup - Patient and Sensor Type**.
3. Select **Adult** or **Pedi** depending on the sensor used.
  - Adult refers to the D-lite sensor.
  - Pedi refers to the Pedi-lite sensor.

## Selecting a data source

Several monitoring parameters can be obtained from the ventilator or the airway module.

When setting the airway module as the data source, make sure that a D-lite or Pedi-lite sensor is properly connected on the airway module. If the sensor is not properly connected, but the airway module is installed, the waveform shows no flow. The gas monitor samples and displays room air.

If information is not available through the airway module, information comes from the internal ventilator sensors. If the internal ventilator sensor readings disagree with the airway module sensor readings, the associated alarm occurs.

Information that is retrieved from the airway module is identified with the module data indicator. See the "Airway Modules" section for more information.



Figure 3-3 • Airway module data indicator

1. Push the **Spirometry** key.
2. Select **Spiro Setup - Data Source**.
3. Select **Patient** or **Vent** as the primary source for information.
  - If **Patient** is selected, the airway module will be the first source for information.
  - If **Vent** is selected, the internal sensors of the ventilator will be the first source for information.
4. Push the **Normal Screen** key or select **Previous Menu**.

## Setting spirometry split screen

Spirometry loops can be viewed alongside the waveforms on the normal screen. To set up the spirometry split screen:

1. Push the **Spirometry** key.
2. Select **Spiro Setup**.
3. Select **Split Screen - Spiro**.
4. Push the **Normal Screen** key.

## Main Menu

Menus and settings available through the **Main Menu** include **Trends, System Status, Cardiac Bypass, Fresh Gas Usage, Screen Setup, Parameters Setup,** and **Calibration.**

**System Status** shows the status of gas supplies, electrical supplies, and software settings.

See "Screen configuration" for information on the **Screen Setup** menu item.

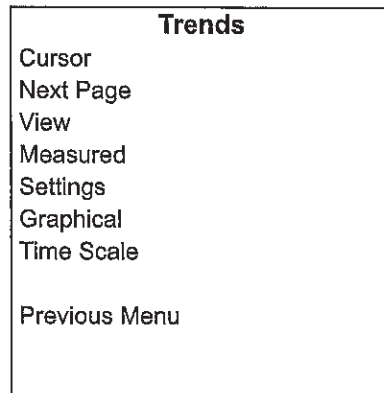
See "Parameters setup" in the "Airway Modules" section for more information on the **Parameters Setup** menu item.

See the "User Maintenance" section for more information on calibrations.

<p><b>Main Menu</b> Trends System Status Cardiac Bypass Off Fresh Gas Usage Screen Setup Parameters Setup Calibration Normal Screen</p>
---

## Trends

There are three views for patient trends: measured (numerical), settings, and graphical. Trend information is saved every 1 minute for the most recent 24 hours.



1. Push the **Trends** key.
2. Select the desired view.
  - An arrow indicates the current trend view.
3. Select **Cursor** to scroll through the current trend view.
4. Push the ComWheel to return the highlight to **Cursor**.
5. Select **Next Page** to view additional parameters.
6. Push the **Normal Screen** key or select **Previous Menu**.



## Cardiac bypass

There are two types of cardiac bypass. Manual ventilation cardiac bypass is standard. VCV cardiac bypass is optional.

## Manual ventilation cardiac bypass

Manual ventilation cardiac bypass suspends alarms for patients on cardiac bypass when the ventilator is not mechanically ventilating. The volume, apnea, low agent, CO<sub>2</sub>, and respiratory rate alarms are suspended. The alarms are enabled when cardiac bypass is turned off or mechanical ventilation is started.

### WARNING

Manual ventilation cardiac bypass and VCV cardiac bypass modes should only be used when the patient is receiving extra-corporeal oxygenation by means of a heart-lung machine. These modes of ventilation are not intended to provide metabolic levels of ventilation to the patient.

1. Set the Bag/Vent switch to Bag.
2. Push the **Main Menu** key.
3. Set **Cardiac Bypass** to **On**.
  - The general message 'Cardiac Bypass' shows in the waveforms and in the general message field when manual ventilation cardiac bypass is active.

## VCV cardiac bypass (optional)

Systems with VCV cardiac bypass enabled can mechanically ventilate while in VCV mode. The VCV mode is the only ventilation mode available while using VCV cardiac bypass. The volume, apnea, low agent, CO<sub>2</sub>, low Paw, and respiratory rate alarms are suspended. The alarms are enabled when VCV cardiac bypass is turned off or mechanical ventilation is stopped.

### WARNING

Manual ventilation cardiac bypass and VCV cardiac bypass modes should only be used when the patient is receiving extra-corporeal oxygenation by means of a heart-lung machine. These modes of ventilation are not intended to provide metabolic levels of ventilation to the patient.

1. Start mechanical ventilation in VCV mode.
2. Push the **Main Menu** key.
3. Set **Cardiac Bypass** to **On**.
  - The PEEP is set to 5 cmH<sub>2</sub>O.
  - TV settings of less than 170 ml prior to starting cardiac bypass remain at the set TV.
  - TV settings of more than 170 ml prior to starting cardiac bypass change to 170 ml.
  - PEEP and TV settings can be changed after entering cardiac bypass mode.
4. The general message 'VCV Cardiac Bypass' shows in the waveforms and in the general message field when VCV cardiac bypass is active.

## **Fresh gas usage**

Use the *Fresh Gas Usage* selection to view the volume of O<sub>2</sub>, Air, N<sub>2</sub>O, and agents used for the three most recent cases. Data only shows for gases available on the system. Agent data shows the three most recently used agents.

1. Push the **Main Menu** key.
2. Select *Fresh Gas Usage*.
3. Select the patient case to view.
4. Push the **Normal Screen** key or select *Previous Menu*.

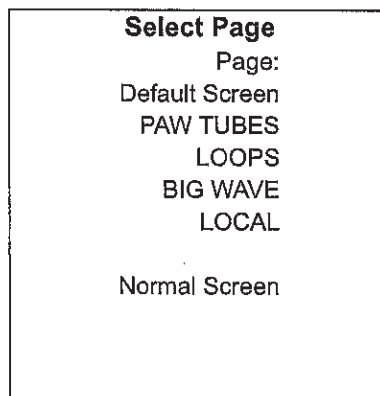
## Screen configuration

Each case type selected on the **Start Case** menu has a corresponding screen configuration for the normal screen. Four additional normal screen views are available through the **Select Page** menu. The case type screen configurations and the normal screen views are set by the Super User in the **Install/Service** menu.

Areas of the normal screen can be customized to show specific information. Use the **Screen Setup** menu to customize the normal screen view.

### Select page

Use the **Select Page** menu to quickly change or return the normal screen view to a case type view.



1. From the normal screen with no menus showing, push the ComWheel.
  - An arrow to the right of the menu item indicates the page view that is in use.
  - A corresponding message shows in the general message area.
  - If no arrow shows on the **Select Page** menu, a customized normal screen view is in use.
2. Select a view or select **Normal Screen** to leave the selections unchanged.

## Screen setup

Waveform, digit field, fresh gas control style, split screen, sweep speed, and brightness are adjusted in the **Screen Setup** menu. Changes made to all settings (except **Brightness**) during a case are not saved when the case is ended. The set **Brightness** remains until it is changed again or until the system power is turned off.

Screen Setup	
Waveform Field 1	Paw
Waveform Field 2	Flow
Waveform Field 3	CO2
Digit Field	AA
Fresh Gas Controls	O2%
Split Screen	None
Sweep Speed	Fast
Brightness	4
Install/Service	
Previous Menu	

## Waveform fields

The waveforms can be set to show agent, CO2, flow, Paw, or can be set to off. Waveforms cannot be set to the same value (except for off). If waveform is set to the same value as another waveform, the previously set waveform changes to off and is removed from the normal screen

1. Push the **Main Menu** key.
2. Select **Screen Setup**.
3. Select the waveform field and make the change.
4. Push the **Normal Screen** key or select **Previous Menu**.

## Digit field

The digit field can be set to show gas supply, flow, or agent.

1. Push the **Main Menu** key.
2. Select **Screen Setup - Digit Field**.
3. Select the **Supply, Flow, or AA**.
  - If **AA** is selected, an airway module must be inserted or the digit field will be blank.
4. Push the **Normal Screen** key or select **Previous Menu**.

### **Setting gas controls and screen configuration**

There are two ways to configure gas controls: O2% with total flow or individual gas flow. The Super User can set the gas control for the facility. Or the Super User can set the gas control to allow the user to select the setting.

Selecting **O2%** shows O2% as the first quick key and total flow l/min as the second quick key. This gas control configuration adjusts the balance automatically when either the O2% or the total flow is changed.

Selecting **Flow** shows balance gas l/min as the one quick key and O2 l/min as the other quick key. This gas control/screen configuration allows individual control of the gasses.

1. Push the **Main Menu** key.
2. Select **Screen Setup - Fresh Gas Controls**.
3. Select the desired view.
4. Push the **Normal Screen** key or select **Previous Menu**.

### **Split screen**

Gas and agent delivery, trends, spirometry loops, or a Paw gauge can be shown as a split screen alongside the waveforms on the normal screen. To change the normal screen to show a split screen:

1. Push the **Main Menu** key.
2. Select **Screen Setup - Split Screen**.
3. Select the desired view.
4. Push the **Normal Screen** key or select **Previous Menu**.

### **Sweep speed**

The waveform draw rate can be set to fast (6.25 mm/s) or slow (0.625 mm/s). When the sweep speed is changed, the waveforms are redrawn at the new rate.

1. Push the **Main Menu** key.
2. Select **Screen Setup - Sweep Speed**.
3. Set the speed.
4. Push the **Normal Screen** key or select **Previous Menu**.

## Alarm setup

Alarm limits, alarm volume, and other alarm settings are adjusted in the **Alarm Setup** menu. Alarm history is also accessed through this menu. Selecting **Default Limits** loads the default settings as set by the Super User or the factory defaults if no Super User settings have been entered.

Setting **Leak Audio** to **Off** silences audio alarms for small leaks. Leak Audio is automatically set to On and cannot be changed when either the Low MV alarm limits are off or the **MV/TV Alarms** is set to **Off**.

The apnea time delay is the amount of time that can pass without the system detecting a measured breath before the apnea alarm occurs. The apnea time delay range is 10 to 30 seconds. Set the **Apnea Time** in 1 second increments.

Alarm Setup	
Adjust Settings	
Volume Apnea	Off
MV/TV Alarms	On
Leak Audio	On
CO2 Alarms	On
Auto MV Limit	Off
Default Limits	
Alarm Volume	3
Apnea Time	30
Alarm History	
Previous Menu	

### Setting alarm limits

1. Push the **Alarms Setup** key.
2. Select **Adjust Settings**.
3. Scroll to the desired alarm.
4. Select alarm limit and set the limit.
5. Push the **Normal Screen** key or select **Back**.

## Volume apnea

**Volume Apnea** is not shown on the **Alarm Setup** menu when the **Volume Apnea Selection** is set to **Disable** in the **Install/Service** menu.

Set **Volume Apnea** to **Off** to disable the volume apnea alarm during manual ventilation. 'Volume Apnea Off' shows in the general message field. The volume apnea alarm remains disabled until the Bag/Vent switch is set to ventilator or **Volume Apnea** is set to **On**.

1. Push the **Alarm Setup** key.
2. Select **Volume Apnea** and set to **On** or **Off**.
3. Push the **Normal Screen** key or select **Previous Menu**.

### Note

When **Volume Apnea** is set to **Off** during manual ventilation and then mechanical ventilation is started, the volume apnea alarms are active. **Volume Apnea - Off** requires confirmation through a pop-up window when manual ventilation is resumed.

## MV/TV alarms

The MV and TV alarms can be turned off. When the volume alarms are disabled, 'MV/TV Alarms Off' appears in the general message field. The volume alarm limits waveform numerics show as dashes during a case.

If the MV and TV alarms are set to **Off** during manual ventilation, the alarms remain off until the Bag/Vent switch is set to ventilator or the **MV/TV Alarms** is set to **On**.

The MV and TV alarms retain the last value set during mechanical ventilation. If **MV/TV Alarms** is set to **On** during mechanical ventilation, it remains on when manual ventilation starts. If **MV/TV Alarms** is set to **Off** during mechanical ventilation it remains off when manual ventilation starts.

1. Push the **Alarm Setup** key.
2. Select **MV/TV Alarms** and set to **On** or **Off**.
3. Push the **Normal Screen** key or select **Previous Menu**.

## CO2 alarms

CO2 information is obtained from the airway module installed in the anesthesia system module bay. The CO2 alarms setting has no affect if there is no airway module in the anesthesia system.

Set **CO2 Alarms** to **Off** during manual ventilation to disable the CO2 'Apnea' alarm, 'EtCO2 low,' 'EtCO2 high,' and 'FiCO2 high. Absorbent OK?' alarms. The 'CO2 Alarms Off' message shows in the general message field. The CO2 alarm limit waveform numerics show as dashes during a case.

If **CO2 Alarms** is set to **Off**, the alarms remain disabled until the Bag/Vent switch is set to ventilator, the case is ended, or the **CO2 Alarms** is set to **On**.

1. Push the **Alarm Setup** key.
2. Select **CO2 Alarms** and set to **On** or **Off**.
3. Push the **Normal Screen** key or select **Previous Menu**.

**Auto MV limit**

MV alarm limits can be calculated automatically for mechanical ventilation when in VCV or PCV-VG modes and volume compensation is enabled. Set **Auto MV Limit** to **On** for automatic calculations of the MV alarm limits. The MV alarm limits continue to be automatically calculated until **Auto MV Limit** is set to **Off** or until an MV alarm limit is manually adjusted during mechanical ventilation.

If the automatic calculation of the low or high minute volume alarm limit exceeds the allowable limit, the minimum or maximum alarm limit is used.

1. Push the **Alarm Setup** key.
2. Select **Auto MV Limit** and set to **On**.
3. Push the **Normal Screen** key or select **Previous Menu**.



## Alternate O2 control

**WARNING** The Alternate O2 control is not an auxiliary source of O2.

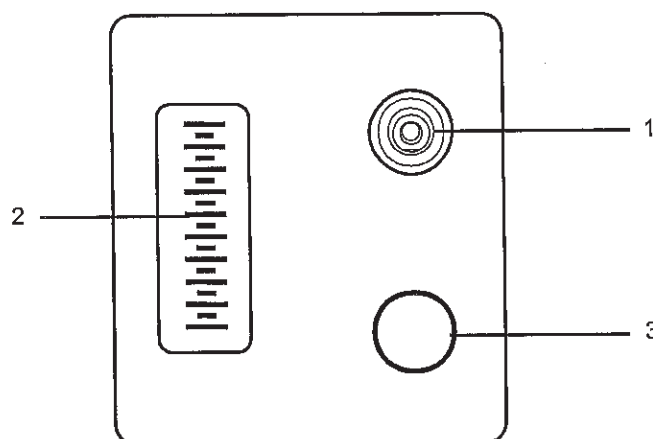
Alternate O2 control delivers agent and O2 through an independent pneumatic path to the selected patient circuit and is connected to the system O2 supply. Alternate O2 control activates automatically in the case of certain failures or errors. It can also be activated manually.

**WARNING** When Alternate O2 control is enabled, flow from the electronic mixer is stopped and the agent concentration is set to off. O2 is flowing through the Alternate O2 control to the breathing system. To activate anesthetic agent flow to the breathing system, set the agent to the desired concentration.

Agent delivery cannot be activated in the case of certain electronic mixer or agent delivery failures. The Agent quick key will be blank if agent delivery is unavailable.

The Alternate O2 control is available approximately 20 seconds after the system is turned on. The Alternate O2 flow is adjustable to approximately 0.5 l/min to 10 l/min as indicated on the flow tube.

1. Push the Alternate O2 ON/OFF button.
2. The O2 flow is indicated on the flow tube.
3. Use the flow control to adjust the O2 flow.
4. Set the agent to the desired concentration.
5. To end Alternate O2 control, push the Alternate O2 ON/OFF button.



1. ON/OFF button
2. Flow tube
3. Flow control

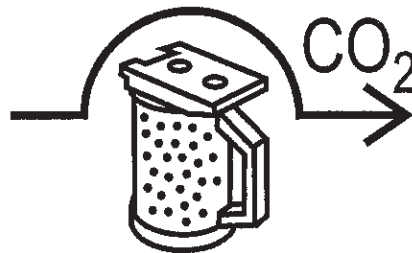
Figure 3-4 • Alternate O2 control

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## EZchange canister (optional)

Push the absorber canister release to activate the EZchange canister mode. The canister will swing down to the EZchange position. The EZchange canister mode seals the breathing circuit when the canister holder is down. This permits continued ventilation and rebreathing of exhaled gases while easily replacing the absorber canister.

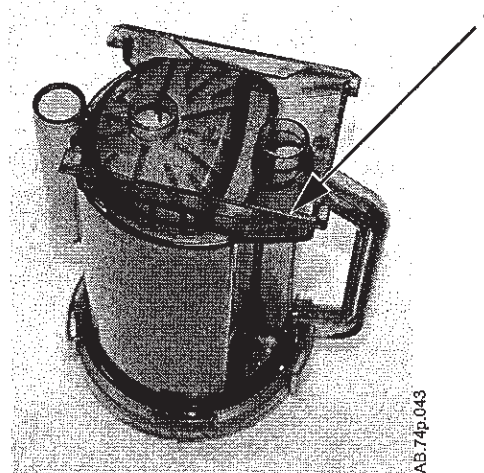
Systems with EZchange canister have the following label on the canister holder. When the system is in EZchange position, the message 'CO<sub>2</sub> Absorber Out of Circuit' shows in the waveform area on the anesthesia display.



AB.82.042

To return to absorber mode, reinsert the canister into the holder and push the canister back up and snap it into absorber position. When the canister is in the absorber position, the exhaled gas flows through the absorber, removing CO<sub>2</sub>.

**Note** Check the absorber canister to ensure it has side rails. If the canister does not have side rails, it will not work in the EZchange canister holder.



AB.74p.043

1. Side rails

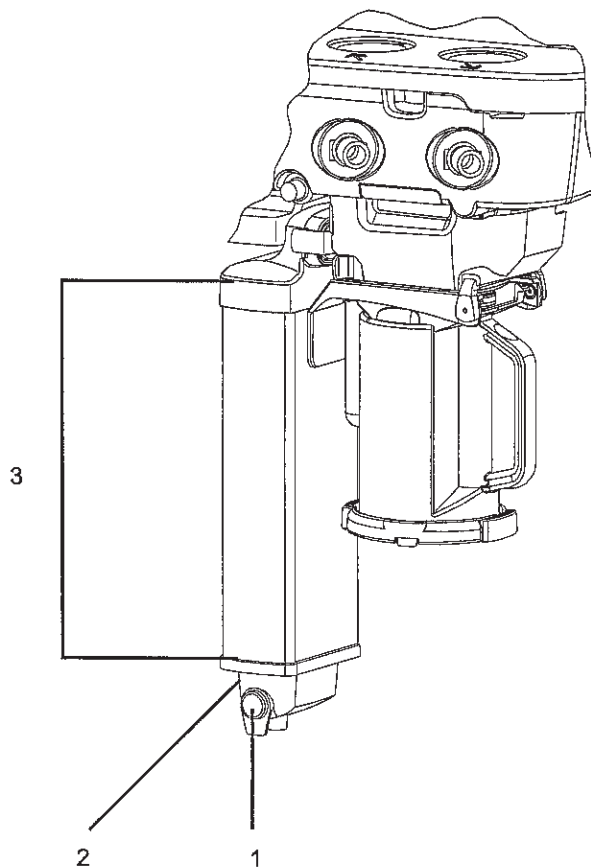
## Condenser (optional)

The condenser removes water in the system that is produced from the reaction of CO<sub>2</sub> gas with the absorbent. When fresh gas flow settings of less than the patient minute volume are used during ventilation, the amount of re-breathed gas increases. More CO<sub>2</sub> flows through the breathing system increasing the absorbent consumption. The moisture buildup in the breathing system is also increased.

The condenser is connected between the outlet of the absorber canister and the inlet of the circuit module. Moisture in the gas is condensed into water droplets, which run into the condenser's reservoir.

Visually check the condenser reservoir daily. Drain the reservoir daily.

1. Place a container under the reservoir.
2. Push the drain button to empty any water in the condenser.



AB.82.043

1. Drain button
2. Reservoir
3. Condenser

Figure 3-5 • Condenser

## Passive AGSS (optional)

**WARNING** Always verify the proper operation of any gas scavenging system; ensure the scavenging system is not occluded.

The passive AGSS (Anesthesia Gas Scavenging System) contains both positive and negative pressure relief valves to protect the breathing system and the patient. The outlet is a 30-mm tapered connector on the bottom of the receiver.

There is also a connector that may be used for scavenging the sample from a gas monitor. The male luer inlet connection is located near the 30 mm connector.

Passive AGSS is intended primarily for use in operating room environments which have no active gas extraction system for waste gas disposal. The disposal system generally consists of large diameter tubing directly linking the passive AGSS with the building exterior. The tubing should be as large in diameter and as short as possible for the particular application.

Passive AGSS may also be used with a non-recirculating ventilation system for waste gas disposal. The tubing connection from passive AGSS to the non-recirculating ventilation system should be an open connection, essentially at atmospheric pressure. For example, to an exhaust grill.

## Active AGSS (optional)

**WARNING** Always verify the proper operation of any gas scavenging system; ensure the scavenging system is not occluded.

There are several versions of the optional active AGSS (Anesthesia Gas Scavenging System) available depending on the hospital's type of waste gas disposal system.

Each version has a two-liter reservoir to capture peak exhaust flows that briefly exceed the extract flow. The disposal system normally entrains room air through an air brake (located in a receiver underneath the breathing system), but will spill from this port during extended periods of high exhaust flow. Its effectiveness is limited by the extract flow of the particular active AGSS device.

- The active low flow system is for use with high vacuum disposal systems. It requires a vacuum system capable of a continuous nominal flow of 36 l/min and 300 mmHg (12 inHg) or greater vacuum pressure. A flow indicator on the system indicates when the unit is in operation.
- The active high flow system is for use with low vacuum (blower type) disposal systems. This requires a system capable of providing a continuous nominal flow of 50 l/min. A flow indicator on the system indicates when the unit is in operation.
- Another version is the active adjustable flow. It provides the capability to adjust the flow with a needle valve (located in a receiver underneath the breathing system) and a visual indicator bag which should be properly inflated. It requires a vacuum system capable of a continuous nominal flow of 36 l/min and 300 mmHg (12 inHg) or greater vacuum pressure.
- The active low flow system with a 12.7 mm hose barb connector is for use with low vacuum disposal system. It requires an external venturi system with flowmeter and 36 l/min extract flow.
- The active low flow system with a 25 mm barb connector is for use with low vacuum disposal systems. It requires an external venturi/ejector system with 36 l/min extract flow. A flow indicator on the system indicates when the unit is in operation.
- The active low flow system with 30 mm ISO taper is for use with low vacuum disposal systems. It requires an external venturi/ejector system with 36 l/min extract flow. A flow indicator on the system indicates when the unit is in operation.

### Connecting active AGSS with a flow indicator

To use the optional active AGSS on a system that has a flow indicator, connect it as follows.

1. Connect the proper hose to the AGSS outlet connector on the bottom of the AGSS underneath the breathing system. Attach the other end to the hospital disposal system.
2. With the AGSS operating, verify that the flow indicator ball on the flow indicator rises to the green zone, indicating adequate flow.

**Note**

The ball in the upper red zone indicates excessively high extraction flow. The ball in the lower red zone indicates extraction flow rate is too low or a blocked filter.

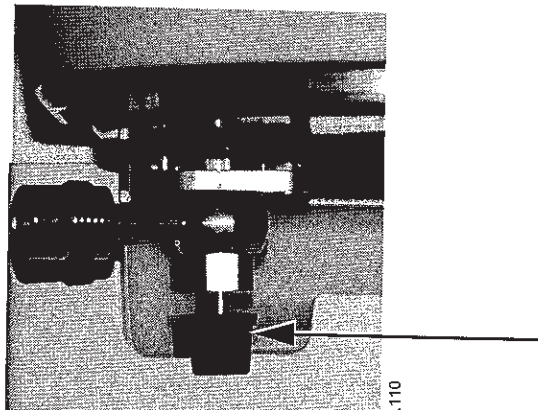
3. Complete the tests in the "Preoperative Tests" section of this manual.

### Connecting active adjustable AGSS

The active adjustable AGSS option flow rate is limited to 30 l/min with this option.

To use the optional active AGSS installed on the system which uses the three-liter bag as a visual indicator, connect it as follows:

1. Connect a disposal hose to the DISS connector on the needle valve on the bottom of the AGSS (underneath). The hose should be flexible and reinforced to help prevent kinking and crushing.
2. Attach the other end of the hose to the hospital disposal system.
3. Attach the three-liter bag to the 30 mm auxiliary 1 port on the bottom of the AGSS.
4. Use the needle valve to adjust the flow rate to match the amount of gas being scavenged. Use the visual indicator bag when adjusting the flow rate. The bag should remain partially inflated when the flow rate is adequate.



5. Complete the tests in the "Preoperative Tests" section of this manual.

# 4 Preoperative Checkout

**WARNING** Read each component's User's Reference manual and understand the following before using this system:

- All system connections.
- All warnings and cautions.
- How to use each system component.
- How to test each system component.

⚠ Before using the system:

- Complete all of the tests in the *"Preoperative Tests"* section.
- Test all other system components.

⚠ If a test fails, do not use the equipment. Have a Datex-Ohmeda trained service representative repair the equipment.

<b>In this section</b>	Every day before your first patient . . . . .	4-2
	Before every patient . . . . .	4-3

## Every day before your first patient

- Check that necessary emergency equipment is available and in good condition.
- Check that the equipment is not damaged and that components are correctly attached.
- Check that pipeline gas supplies are connected and cylinders are installed.
- Check that the amount of liquid agent in the cassette is adequate. Install the agent cassette into the active bay. The cassette is properly inserted when the agent is identified on the display.
- Check that the breathing circuit is correctly connected, not damaged, and the breathing system contains sufficient absorbent.
- Turn the System switch to On.
- Connect scavenging and verify operation.
- Calibrate the flow sensors. Do a **Flow and Pressure** calibration in the **Calibration** menu.
- Do a **Machine Check** in the **Checkout** menu.
- Do an Agent Delivery check in the Checkout menu for each agent cassette that will be used during the day.
- Check that an adequate reserve O<sub>2</sub> supply is available.
- Check that the ventilator functions correctly:
  - Connect a test lung to the patient Y.
  - Set the ventilator to VCV mode and the settings to TV at 400 ml, RR at 12, I:E at 1:2, Tpause at Off, PEEP at Off, and Pmax at 40.
  - Set the gas flow to the minimum settings.
  - Start a case.
  - Set the Bag/Vent switch to ventilator.
  - Fill the bellows using O<sub>2</sub> flush.
  - Check that mechanical ventilation starts. Check that the bellows inflate and deflate. Check that the display shows the correct ventilator data. Check that there are no inappropriate alarms.
- Set the appropriate controls and alarm limits for the case.



**Before every patient**

**Note** This check does not need to be done before the first case of the day if the *"Every day before your first patient"* checklist was done.

- Check that necessary emergency equipment is available and in good condition.
- If the cassette was changed since the last case:
  - Check that the amount of liquid agent in the cassette is adequate.
  - Check that the cassette is properly inserted. The cassette is properly inserted when the agent is identified on the display.
- Check that the breathing circuit is correctly connected, not damaged, and the breathing system contains sufficient absorbent.
- Leak check the breathing system:
  - Set the Bag/Vent switch to Bag, close the APL valve (set to 70), and occlude the patient Y.
  - Pressurize the breathing system to approximately 30 cmH<sub>2</sub>O using the O<sub>2</sub> flush button.
  - Ensure that the pressure remains fixed for at least 10 seconds.
- Check that the ventilator functions correctly:
  - Connect a test lung to the patient Y.
  - Set the ventilator to VCV mode and the settings to TV at 400 ml, RR at 12, I:E at 1:2, Tpause at Off, PEEP at Off, and Pmax at 40.
  - Set the gas flow to the minimum settings.
  - Start a case.
  - Set the Bag/Vent switch to ventilator.
  - Fill the bellows using O<sub>2</sub> flush.
  - Check that mechanical ventilation starts. Check that the bellows inflate and deflate. Check that the display shows the correct ventilator data. Check that there are no inappropriate alarms. Make sure that the alarms function. See the *"Alarm tests."*
- Set the appropriate controls and alarm limits for the case.

# 5 Preoperative Tests

<b>In this section</b>	Inspect the system . . . . .	5-2
	Aladin cassette installation . . . . .	5-3
	Flow and pressure calibration . . . . .	5-4
	Circuit compliance compensation . . . . .	5-4
	Checkout menu . . . . .	5-5
	Leak < 250 ml . . . . .	5-5
	Machine check . . . . .	5-6
	Individual checks . . . . .	5-8
	Positive low pressure leak test (ACGO systems only) . . . . .	5-11

## Inspect the system

**WARNING** The top shelf weight limit is 45 kg (100 lb).

- ⚠ Make sure that the breathing circuit is correctly connected and not damaged. Replace the breathing circuit if it is damaged.
  
- ⚠ Do not leave gas cylinder valves open if the pipeline supply is in use. Cylinder supplies could be depleted, leaving an insufficient reserve supply in case of pipeline failure.

Before using the system, ensure that:

- The equipment is not damaged.
- Components are correctly attached.
- The breathing circuit is correctly connected, not damaged, and the breathing system contains sufficient absorbent.
- The Aladin cassette is locked in position and contains sufficient agent.
- Pipeline gas supplies are connected and the pressures are correct.
- Cylinder valves are closed.
- Models with cylinder supplies have a cylinder wrench attached to the system.
- Models with cylinder supplies have a reserve supply of O<sub>2</sub> connected to the machine during system checkout.
- The necessary emergency equipment is available and in good condition.
- Equipment for airway maintenance, manual ventilation, tracheal intubation, and IV administration is available and in good condition.
- Applicable anesthetic and emergency drugs are available.
- If an optional O<sub>2</sub> flowmeter is present, ensure there is adequate flow.
- If an optional suction regulator is present, ensure there is adequate suction.
- The casters are not loose and the brakes are set and prevent movement.
- The power cord is connected to an electrical outlet. The mains indicator comes on when AC Power is connected. If the indicator is not on, the system does not have mains (electrical) power. Use a different outlet, close the circuit breaker, or replace or connect the power cable.

## Aladin cassette installation

1. Using the liquid level indicator, check that the cassette is filled to the appropriate level.
2. If using Aladin<sub>2</sub>, unlock the cassette handle before installing it into the active bay.
3. Insert the cassette into the active bay until a click is heard. An audible click indicates that the cassette is in position.
4. Turn the lock on the handle to the horizontal position (Aladin<sub>2</sub> cassettes only).
5. The cassette is properly inserted when the agent is identified on the display. Make sure that the displayed agent matches the cassette.

**Note** Store the cassettes in the cassette bay when they are not in use. See the "*Vaporizer cassettes*" section for additional cassette information.

## Flow and pressure calibration

Calibrate the flow sensors by removing them from the system. On-screen instructions are available through **Main Menu - Calibration - Flow and Pressure**.

### Important

Room temperature fluctuations of more than 5°C may affect sensor measurements. Recalibrate the flow sensors if the room temperature changes by more than 5°C.

1. Set the Bag/Vent switch to Bag.
2. Remove the flow sensor module.
3. Wait for 'No insp flow sensor' and 'No exp flow sensor' alarms to occur.
4. Reinsert the flow sensor module. Wait for alarms to clear.
5. Start mechanical ventilation when ready.

## Circuit compliance compensation

Circuit compliance is determined during the **Machine Check-System** check or when the **System** check is done as an individual check.

The ventilator adjusts gas delivery and monitoring to compensate for the compliance of the patient circuit if:

- The system has a gas analyzer installed.
- The **Machine Check** is completed after the system is turned on.

In volume modes, circuit compliance compensation increases the volume delivered at the inspiratory port by taking into consideration the circuit compliance value. In all modes, circuit compliance compensation adjusts the exhaled volume measurements. Circuit compliance compensation provides consistent ventilator accuracy at the patient circuit.

### WARNING

Perform a Machine Check after changing the patient tube type. Changing the patient breathing circuit after completing a Machine Check affects the volume delivery in volume ventilation modes and affects the exhaled volume measurements in all modes.



Breathing circuits and breathing circuit components are available in many different configurations from multiple suppliers. Attributes of the breathing circuits such as materials, tube length, tube diameter, and configuration of components within the breathing circuit, may result in hazards to the patient from increased leakage, added resistance, or changed circuit compliance. It is recommended that a Machine Check be conducted prior to use with each patient.

## Checkout menu

The **Checkout** menu shows on the display after turning on the system. To access the **Checkout** menu between cases, push the **Checkout** key. Step-by-step instructions show in the right window next to the **Checkout** menu during the checks. Use the **Checkout** menu to:

- Perform a **Machine Check**.
- Perform any of the individual checks.
- Set the **Leak < 250 ml** setting.
- View the **Check Log**.
- Start a case.

Checkout	
Machine Check	
Leak < 250 ml	No
Individual Checks	
System	
Circuit	
Circuit O2 Cell	
Low P Leak	
Agent Delivery	
Check Log	
Start Case	

## Leak < 250 ml

The **Leak < 250 ml** setting is used during the circuit leak check portion of the checkout procedures. This check tests for leaks in the machine, breathing circuit, patient circuit, and manual bag. The default setting is **No**.

**Note** Extraction of gas by external gas monitors may cause failure of the leak checks during tests.

**No** When **No** is selected, the leak test will pass for leaks below 250 ml at 3 kPa (30 cmH<sub>2</sub>O) pressure with no user interaction required. For leaks between 250 ml and 750 ml, the user can fix the leak and rerun the test or accept the leak and continue. For leaks above 750 ml, the test will fail and the user must fix the leak and rerun the test.

**Yes** Set to **Yes** to measure small leaks above 100 ml during the checkout procedures. Selecting **Yes** will display the measured leak at 3 kPa (30 cmH<sub>2</sub>O) pressure and result in the test taking somewhat longer.

## Machine check

The **Machine Check** or the individual checks must be performed at least once within every 24-hour period.

Perform the **Machine Check** at the start of each day. The machine check runs automatically and beeps to indicate when it is finished or if interaction is required.

The **Machine Check** does a **Machine Check-System** check, **Machine Check-Circuit** check, and a **Machine Check-Circuit O2** cell check (if circuit O2 cell is present). When one of the checks is completed, the next check begins.

**Note** Any cassette may be used during the check. Use a non-desflurane cassette during the check to test the full functionality of the internal electronic control unit.

1. Turn the System switch to On.
2. Select **Machine Check** and follow the instructions.
3. If a check fails, follow the instructions to perform a recheck or accept the results.
4. When the **Machine Check** is completed, start a case.

**Note** In case of a patient emergency, the **Machine Check** may be bypassed by selecting **Start Case** from the **Checkout** menu. The general message 'Please Do Checkout' is displayed if a **Machine Check** is not completed with passing results within 24 hours.

### Machine check - system

The **Machine Check-System** checks the Bag/Vent switch, proper gas supply pressures, ventilator operation and leak, battery and electrical power, circuit compliance, and flow control operation. This is a two-step check.

1. Set the Bag/Vent switch to Vent.
2. Open the patient Y.
3. (ACGO option only.) Set the ACGO switch to Circle.
4. Calibrate the flow sensors. Make sure the flow sensors are securely latched when they are reinserted.
5. Select **Start**. The display shows the checks being run.
  - The system beeps when this portion of the check is done.
  - The results are shown on the display.
6. Make sure the bellows is fully collapsed.
7. Occlude the patient Y.
8. Select **Continue**. The display shows the checks being run.
9. When the check passes, the next check starts.

### Machine check - circuit

The **Machine Check-Circuit** checks the Bag/Vent switch, proper gas supply pressures, airway pressure measurement transducer, APL valve, and manual circuit leak.

1. Occlude the patient Y.
2. Set Bag/Vent switch to Bag.
3. Set the APL valve halfway between 30 and 70.
4. (ACGO option only.) Set the ACGO switch to Circle.
5. Select **Start**. The display shows the checks being run.
  - The system beeps when the check is done.
  - The results are shown on the display.
6. When the check passes, the next check starts.

### Machine check - circuit O2

The **Machine Check-Circuit O2** check measures the O2%.

1. Open the patient Y.
2. Set the Bag/Vent switch to Vent.
3. (ACGO option only.) Set the ACGO switch to Circle.
4. The display will show the O2%. Do not select **Done** when 21 is first displayed. Allow the reading to stabilize, then select Done. Calibrate the O2 cell if necessary.

### Machine check - monitor

When **External Gas Monitor** is set to **Yes** by the Super User, the **Machine Check-Monitor** check occurs. This check is not a test. This check is a reminder to connect a respiratory gas monitor.



## Individual checks

The **Machine Check** or the individual checks must be performed at least once within every 24-hour period.

Individual checks allow the user to perform any combination of single checks. These checks are helpful if there is a specific problem/alarm and the user wishes to test only that portion of the system.

The checks do not automatically move on to the next check. After completing a check, do another check or start a case. If a check fails, follow the instructions to perform a recheck or accept the results.

### System

The **System** check checks the Bag/Vent switch, proper gas supply pressures, ventilator operation and leak, battery and electrical power, circuit compliance, and flow control operation. This is a two-step check.

#### Note

Any cassette may be used during the check. Use a non-desflurane cassette during the check to test the full functionality of the internal electronic control unit.

1. Set the Bag/Vent switch to Vent.
2. Open the patient Y.
3. (ACGO option only.) Set the ACGO switch to Circle.
4. Calibrate the flow sensors. Make sure the flow sensors are securely latched when they are reinserted.
5. Select **Start**. The display shows the checks being run.
  - The system beeps when this portion of the check is done.
  - The results are shown on the display.
6. Make sure the bellows is fully collapsed.
7. Occlude the patient Y.
8. Select **Continue**. The display shows the checks being run.
9. When the check passes, select **Back**.
10. Select another check or select **Start Case** to go to the **Start Case** menu.

### Circuit

The **Circuit** check checks the Bag/Vent switch, proper gas supply pressures, airway pressure measurement transducer, APL valve, and manual circuit leak.

1. Occlude the patient Y.
2. Set Bag/Vent switch to Bag.
3. Set the APL valve halfway between 30 and 70.
4. (ACGO option only.) Set the ACGO switch to Circle.
5. Select **Start**. The display shows the checks being run.
6. When the check passes, select **Back**.
7. Select another check or select **Start Case** to go to the **Start Case** menu.

### Circuit O2 cell

The **Circuit O2 Cell** check measures the O2%.

1. Open the patient Y.
2. Set the Bag/Vent switch to Vent.
3. (ACGO option only.) Set the ACGO switch to Circle.
4. The display will show the O2%. Do not select **Done** when 21 is first displayed. Allow the reading to stabilize, then select **Done**. Calibrate the O2 cell if necessary.
5. Select another check or select **Start Case** to go to the **Start Case** menu.

### Low P leak

The positive pressure **Low P Leak** check measures machine leaks before the breathing system, between the common gas outlet and the high pressure pneumatics and includes the gas mixer and vaporizer. It measures low pressure pneumatic leaks with a pass or fail limit of 50 ml.

1. Occlude the inspiratory (right-hand) port.
2. Select **Start**.
3. The display shows the checks being run. The system beeps when the check is done.
4. Open the inspiratory port and reconnect the breathing circuit.
5. Select another check or select **Start Case** to go to the **Start Case** menu.

### Low P leak (machines with ACGO)

The negative **Low P Leak** check measures machine leaks before the breathing system, between the common gas outlet and the high pressure pneumatics and includes the gas mixer and vaporizer. It measures low pressure pneumatic leaks with a pass/fail limit of 50 ml.

1. Make sure the ACGO switch is set to ACGO.
2. Insert a non-desflurane cassette.
3. Attach the squeeze bulb to the ACGO outlet.
4. Squeeze (collapse) the bulb.
5. If the bulb inflates in less than 30 seconds, select **Fail**.
6. If the bulb remains collapsed, select **Pass**.
7. Remove the squeeze bulb from the ACGO outlet.

#### Note

Any cassette may be used during the check. Using a desflurane cassette only checks for leaks between the vaporizer and common gas outlet.

## Agent delivery

The agent delivery check checks the agent delivery system and the cassette. This check will release agent to the circuit.

1. Insert a cassette, connect a patient circuit, and connect scavenging.
2. Set the Bag/Vent switch to Vent.
3. Occlude the patient Y.
4. (ACGO option only.) Set the ACGO switch to Circle.
5. Select **Start**.
6. The display shows the checks being run. The system beeps when the check is done.
7. Repeat the check once for each cassette.
8. When the check passes, select **Back**.
9. Select another check or select **Start Case** to go to the **Start Case** menu.

**Note** Any cassette may be used during the check. Use a non-desflurane cassette during the check to test the full functionality of the internal electronic control unit.

# 6 Airway Modules

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	Parameters setup .....	6-5
	Automatic agent identification.....	6-6
	Calibration.....	6-6

## Airway modules

The optional compact airway modules measure and monitor gases delivered to the patient and exhaled through the breathing circuit. The modules consist of an infrared sensor for measuring CO<sub>2</sub>, N<sub>2</sub>O, and anesthetic agents; a paramagnetic O<sub>2</sub> sensor; and a gas sampling system with the D-fend water separation system.

Systems with both an airway module and an O<sub>2</sub> cell will display the patient inspired O<sub>2</sub> value obtained from the airway module.

Respiratory rate is the frequency of peak (end tidal) CO<sub>2</sub> measurements per minute. A breath is defined as a change in the CO<sub>2</sub> signal that exceeds 1% (8 mmHg). All concentrations are measured and displayed breath by breath.

**WARNING** Remove the airway sampling line from the patient's airway and seal the sample port while nebulized medications are being delivered. Nebulized medications interfere with accurate gas reading.

⚠ If the **Data Source** is set to **Patient** in the **Spirometry Setup** menu, no Paw, Flow, Agent, or CO<sub>2</sub> waveforms or numeric information is displayed during the airway gas module warm-up period (approximately 2 minutes). Set the **Data Source** to **Vent** to display the waveforms and numeric information during the airway gas module warm-up period.

**CAUTION** Use only cables and accessories approved by GE Healthcare Finland Oy. Other cables and accessories may damage the system or interfere with measurement. Single-use accessories are not designed to be reused.

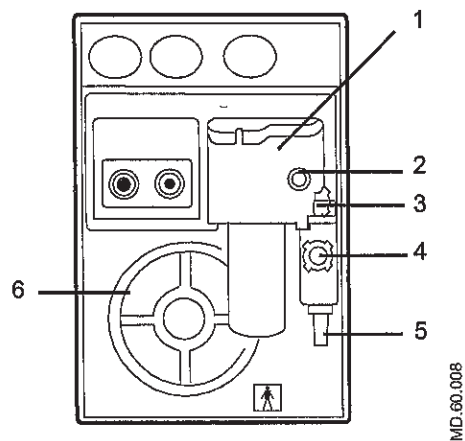
⚠ Strong scavenging suction on the monitor exhaust port may change the operating pressure of the monitor and cause inaccurate readings or internal damage.

## 6 Airway Modules

Use only airway modules that have anesthetic agent monitoring and O<sub>2</sub> monitoring on this system. The following modules can be used on this system: E-CAiO, E-CAiOV, E-CAiOVX, M-CAiO, M-CAiOV, and M-CAiOVX. (E series modules must be software version 4.5 and above. M series modules must be software version 3.2 and above.)

Letters in the name of the airway modules stand for:

- E = plug-in gas module
- M = plug-in gas module
- C = CO<sub>2</sub> and N<sub>2</sub>O
- A = anesthetic agents
- i = agent identification
- O = patient O<sub>2</sub>
- V = patient spirometry
- X = Gas exchange



1. D-fend water trap
2. Sampling line connector
3. Water trap latch
4. Reference gas inlet
5. Sample gas outlet
6. Cooling fan

Figure 6-1 • Compact airway module

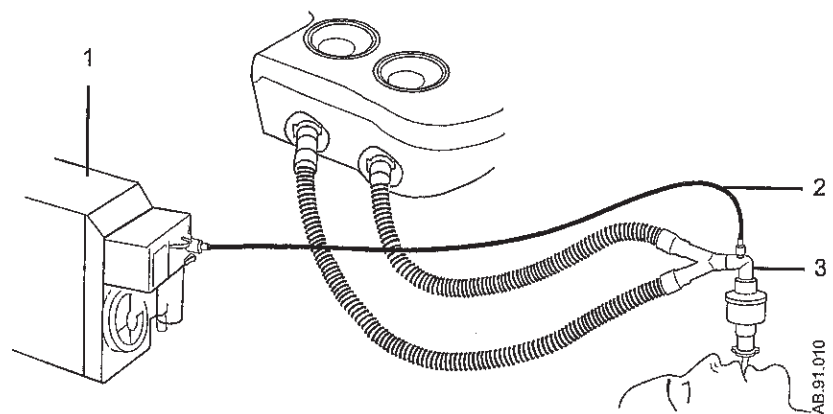
### Connection to a patient

1. Check that the airway gas module is installed.
2. Check that the airway adapter connections are tight and that the adapter is correctly installed.
3. Check that the water trap container is empty and properly attached.

### WARNING

Before connecting the exhaust line to the sample gas outlet on the compact airway module, ensure the other end is connected to the sample gas return port on the anesthesia machine. Incorrect connections may cause patient injury.

4. Connect the exhaust line from the sample gas return port to the sample gas outlet if N<sub>2</sub>O or volatile agents are used. (See the "Parts" section.)
5. Attach the gas sampling line to the sampling line connector on the water trap.
6. Turn the system on. The system does a series of automated self tests. The automatic agent identification is activated.
7. Connect the sampling line to the airway adapter. Take the gas sample as close to the patient's airway as possible. Position the adapter's sampling port upwards to prevent condensed water from entering the sampling line.



1. Airway module
2. Gas sampling line
3. Airway adapter with sampling line connector

Figure 6-2 • Airway gases setup with compact airway module

## Parameters setup

Use the **Parameters Setup** menu to change the monitoring settings of the data source, CO<sub>2</sub>, O<sub>2</sub>, agent, and spirometry. Push the **Main Menu** key. Select **Parameters Setup**.

### Data source

Several monitoring parameters can be obtained from the ventilator or the airway module. Information that is retrieved from the airway module is identified with the module data indicator.



Figure 6-3 • Airway module data indicator

Set the **Data Source** to **Patient** or **Vent** to select the primary source for information. If **Patient** is selected, the airway module will be the first source for information. If **Vent** is selected, the internal sensors of the ventilator will be the first source for information.

When setting the airway module as the data source, make sure that a D-lite or Pedi-lite sensor is properly connected on the airway module. If the sensor is not properly connected, but the airway module is installed, the waveform shows no flow. The gas monitor samples and displays room air.

If information is not available through the airway module, information comes from the internal ventilator sensors. If the internal ventilator sensor readings disagree with the airway module sensor readings, the associated alarm occurs.

### CO<sub>2</sub> setup

Change the size of the CO<sub>2</sub> waveform by changing the scale height. The scale units (% , kPa, and mmHg) are set by the Super User. Select **CO<sub>2</sub> Alarm** or **Resp Rate Alarm** to access and change the alarm limits for the corresponding alarm.

### O<sub>2</sub> setup

Select **O<sub>2</sub> Alarm** to access and change the O<sub>2</sub> alarm limits.

### Agent setup

Change the size of the agent waveform by changing the scale height. Select **Agent Alarm** to access and change the agent alarm limits.

### Spirometry setup

Change the size of the Paw and Flow waveforms by changing the corresponding scale heights. Select **Paw Alarm** or **MVexp Alarm** to access and change the alarm limits for the corresponding alarm.



## Automatic agent identification

Airway modules with agent identification will automatically identify and select Halothane, Enflurane, Isoflurane, Sevoflurane, and Desflurane. The inspiratory and expiratory concentrations of the agent appear in the number field or the agent waveform field if selected.

Minimum concentration for the identification is 0.15% volume. The agent selection remains active even if the concentration decreases below 0.15% volume during the case.

Automatic agent identification operates after the normal warm up of the gas module (approximately five minutes).

## Calibration

Calibrate airway modules once every six months or whenever there are indications of errors in the gas readings. Use a Datex-Ohmeda calibration gas and regulator to calibrate the modules. See the "Parts" section for the stock numbers of the calibration gas and regulator.

### WARNING

Only use Datex-Ohmeda calibration gas. Do not use any other calibration gases or the calibration will not succeed.

During gas calibration, % units are used for CO<sub>2</sub> regardless of selected measuring units.

1. Turn on the power. Let the module warm up for 30 minutes before starting calibration.
2. Attach the regulator to the calibration gas cylinder.
3. Attach a new sampling line to the water trap. Connect the loose end of the sampling line to the regulator on the calibration gas cylinder.
4. Push the **Main Menu** key.
5. Select **Calibration**.
6. Select **Airway Gas**.
7. Wait until Feed Gas appears after each gas name:
  - 'CO<sub>2</sub> Feed Gas.'
  - 'O<sub>2</sub> Feed Gas.'
  - 'N<sub>2</sub>O Feed Gas.'
  - 'Agent Feed Gas.'
8. Open the regulator until the gauge reads between 5 to 7 psi. Feed the calibration gas until the message 'OK' or 'Adjust' appears.
  - If an error occurs during calibration or if no gas is fed, **Calibr Error** appears after the gas name. Push the ComWheel to perform a new calibration.

## 6 Airway Modules

9. If adjustments are needed:
  - Do not close the regulator until all the adjustments have been made.
  - Select the gas to be adjusted and press the ComWheel.
  - Use the ComWheel to change the value until it matches the calibration gas cylinder value. Push the ComWheel to confirm the change.
  - Repeat for each gas requiring adjustment.

# 7 Alarms and Troubleshooting

**CAUTION** No repair should ever be attempted by anyone not having experience in the repair of devices of this nature. See the *“Repair policy”* in the *“User Maintenance”* section.

**WARNING** If an alarm occurs, safeguard the patient first before performing troubleshooting or doing repair procedures.

<b>In this section</b>	Alarms . . . . .	7-2
	List of alarms . . . . .	7-4
	Alarm ranges . . . . .	7-13
	Alarm tests . . . . .	7-15
	Breathing system problems . . . . .	7-17
	Electrical problems . . . . .	7-18
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## Alarms

Alarms are divided into technical alarms and parameter alarms. These alarms may be high priority, medium priority, or informational. When an alarm occurs during a case, an alarm tone sounds and the alarm message is displayed in the alarm message field.

Technical alarms result from a technical problem and occur whether or not a patient is connected to the system. Parameter alarms are calculated limits and limits that are set by the user on the **Alarm Setup** menu. Parameter alarms occur only during a case.

### Alarm priorities

Alarm priority is indicated by the color of the alarm message and the alarm LED located next to the alarm silence button.

High-priority alarm messages appear in white text on a red background. During a high-priority alarm, the red LED flashes.

Medium-priority alarm messages appear in yellow text on a gray background. During a medium-priority alarm, the yellow LED flashes.

Informational alarms appear in white text on a gray background. During an informational alarm, the yellow LED is on solid.

When a high-priority alarm is active at the same time as a medium-priority alarm or an informational alarm, the red and yellow LEDs flash. When a high-priority alarm is active at the same time as an informational alarm, the red LED flashes and the yellow LED is on solid. When a medium-priority alarm is active at the same time as an informational alarm, the yellow LED flashes. Pushing the **Silence Alarms** key changes the LED from flashing to on solid until the end of the alarm silence.

### Silencing alarms

Silencing an alarm stops the audible tone for 120 seconds. The alarm message shows in the alarm message field. Pushing the **Silence Alarms** key when no medium or high priority alarms are active suspends audible alarm tones for 90 seconds.

Alarms in the apnea alarm family have special silence behavior to reduce apnea nuisance alarms. Apnea family alarms include 'Apnea,' 'TVexp low,' 'EtCO2 low,' 'MVexp low,' and 'RR low.'

When silencing an apnea family alarm, the audio tone for the active alarm is silenced for 120 seconds. The audible tone for any additional apnea family alarm that occurs during the silence period is silenced for the remain time shown on the alarm silence countdown. Only the audible alarm tone is silenced. The alarm messages still show in the alarm message fields. 'APN' shows above the alarm silence countdown when the audible tone silence is in affect for the apnea family alarms.

### Display changes during alarms

Messages may appear in the waveform field during some alarms. If more than one alarm has a message, the message for the highest priority alarm is displayed. The message is removed when the alarm is resolved.

## 7 Alarms and Troubleshooting

The color of the alarm text shown in the alarm message fields is dependent on the alarm priority. Messages for high-priority alarms use red text. Messages for medium-priority alarms use yellow text. Informational messages use white text.

When the O<sub>2</sub> pipeline supply pressure drops to less than 252 kPa (36 psi), the lower-right corner of the display toggles between the O<sub>2</sub> supply information and the set digit field.

Some patient parameter alarms, such as 'Ppeak high' and 'FiO<sub>2</sub> low,' will latch when the alarm condition is corrected. When an alarm is latched, it is displayed in white text on a black background. The parameter box will stop flashing. All the associated waveform, numeric, and digit field messages are removed from the display. The flashing LED associated with that alarm changes from flashing to on solid. The alarm will remain in this condition until it is acknowledged by pushing the **Silence Alarms** key or until the alarm re-occurs. When the alarm is acknowledged, it is removed from the screen. If an alarm has latched and the alarm re-occurs before it is acknowledged, the alarm will revert to an active state.

### De-escalating alarms

Some device related alarms, such as 'Reverse Flow' and 'No insp flow sensor,' will de-escalate priority when the alarm is acknowledged by pushing the **Silence Alarms** key. The audible alarm tone is stopped for that active alarm until the alarm condition is resolved. The alarm message shows at the informational alarm level until the alarm condition is resolved and the alarm is cleared. If that alarm reoccurs after it has been resolved, the alarm occurs at its standard priority level.

### Battery indicator

The color and fill amount of the battery in use symbol indicates the amount of battery power remaining. Green indicates greater than 10 minutes of battery power remaining. Yellow indicates between 10 and 5 minutes of battery power remaining. Red indicates less than 5 minutes battery power remaining.

### Internal failure

'Internal problem prevents normal operation.' shows on the display during a software or hardware failure that requires service. If this message occurs, contact a Datex-Ohmeda trained service representative.

## List of alarms

If the corrective action does not resolve the alarm message, contact a Datex-Ohmeda trained service representative

Circuit pressures and volumetric flows are measured by the ventilator and airway gas module. If the **Data Source** is set to **Patient**, the displayed waveforms and numeric information are measured by the airway gas module. Although not displayed, the ventilator measurements continue and if a measured value violates an alarm setting, the appropriate alarm occurs. The value highlighted in the parameter numeric box may not appear to have violated the alarm setting. Changing the **Data Source** to **Vent** will display the circuit pressures and volumetric flows measured by the ventilator.

Message	Priority	Cause	Action
AA, CO2 monitoring not connected	Medium	External Gas Monitor setting is set to No on the <i>Install/Service</i> menu. External Gas Monitor setting is Yes on the <i>Install/Service</i> menu and the monitor condition changes to disconnected.	Set External gas monitor setting to Yes if the system uses a stand-alone monitor for O2, AA, and CO2.
Agent output not accurate. Schedule service.	Medium	Vaporizer detected a flow meter temperature sensor failure and is using a default temperature value.	Contact a Datex-Ohmeda trained service representative.
Air pressure low. Increase O2 %.	High	O2% is set to Air at 21%. Air pipeline pressure is less than 252 kPa (36 psi) and the air cylinder pressure dropped below 2633 kPa (381 psi) for one second.	Ensure the air pipeline and cylinder are properly connected. Increase the O2% flow.
Air supply pressure low	Medium	Air pipeline pressure is less than 252 kPa (36 psi) and the air cylinder pressure dropped below 2633 kPa (381 psi) for one second.	Ensure the air pipeline and cylinder are properly connected. Contact a Datex-Ohmeda trained service representative.
Apnea	Medium	Apnea time delay (10-30 seconds) has passed without a measured breath. Apnea time delay (20 - 30 seconds) has passed without a change in the measured CO2 by at least 1%.	Check for leaks in the patient circuit. Check for patient disconnection.
Apnea >120 s	High	Apnea time exceeds 120 seconds.	Check for leaks or blockages in the breathing circuit. Ensure the Bag/Vent switch is in the Vent position. Check the patient.

## 7 Alarms and Troubleshooting

Message	Priority	Cause	Action
Backup Mode active	Informational	No spontaneous breaths in set period of time (Backup Time) and 30 seconds have passed since starting PSVPro mode.	Select a new ventilation mode. The number of consecutive patient triggered breaths reaches the Exit Backup setting.
Breathing system loose	Informational	The breathing system is not latched.	Push the breathing system onto the frame and ensure it latches.
Calibrate (remove) flow sensors	Informational	Flow calibration failure or more than 24 hours have passed since the last flow sensor calibration.	Calibrate the flow sensors.
Calibrate O2 sensor	Informational	Calibration failure or measured O2 is greater than 110%.	Calibrate the O2 cell. Replace the O2 cell if necessary.
Calibrate, dry, or replace flow sensors	Informational	Patient volume mismatch occurred during the last case.	Calibrate, dry or replace the flow sensors. Start a new case.
Cannot deliver agent setting at set flow	Informational	Cassette output flow is 6 l/min or at maximum for more than 10 seconds.	Reduce the flow.
Cannot identify cassette	Medium	The identification coding of the cassette cannot be interpreted.	Try another cassette. Contact a Datex-Ohmeda trained service representative.
Cannot monitor Air pipeline	Medium	Air pipeline pressure is invalid.	Check pipeline supply pressure. Contact a Datex-Ohmeda trained service representative.
Cannot monitor gas supplies	Informational	Hardware failure.	Contact a Datex-Ohmeda trained service representative.
Cannot monitor O2 pipeline	Medium	O <sub>2</sub> pipeline pressure is invalid.	Check pipeline supply pressure.
Cannot read gas supply pressures	Medium	Transducer failure.	Contact a Datex-Ohmeda trained service representative.
Cassette overfilled, replace cassette	Medium	Agent level sensor indicates the cassette is overfilled.	Try another cassette. Contact a Datex-Ohmeda trained service representative to drain the cassette.
Check agent level. Do not fill vap while in use.	Informational	Cassette reporting a value of empty.	Fill the cassette.
Check agent level	Informational	Cassette reporting a value of empty. Agent level reporting is no longer available.	Use liquid level indicator on the cassette to determine the amount of agent remaining. Contact a Datex-Ohmeda trained service representative.
Check cassette. Set agent.	Medium	Cassette pressure is out of range. Agent flow interrupted or control failure.	Try another cassette. Remove and reinsert the cassette. Set the agent to the desired concentration.



## Aisys

Message	Priority	Cause	Action
Check circuit connections	Medium	Breaths detected in circle circuit while non-circle circuit is selected.	Check circle circuit connections and settings.
Check D-Fend	Medium	Water trap not attached.	Check that the water trap is properly attached to the airway module.
Check flow sensors	Medium	System has detected an improper flow pattern in the breathing circuit.	Ensure the internal flow sensors are connected correctly.
Check sample gas out	Medium	Possible blockage in airway module sample gas outlet.	Check for blockage in the airway module sample gas outlet. Remove blockage.
Circuit leak	Medium	Vent TVexp is less than half of vent TVinsp for at least 30 seconds.	Check for leaks in the patient circuit. Calibrate flow sensors. If problem persists, replace flow sensors.
Circuit leak silenced	Informational	Setting on Alarm Setup menu.	Vent TVexp is less than 50% of vent TVinsp for at least 30 seconds. Message indicates that the Leak Audio alarm is turned off.
Circuitry >75C shutdown possible	Medium	Power supply temperature exceeds 75°C.	Shut down system as soon as possible. Then, check cooling fans and filters.
Cooling fan needs service. System OK.	Medium	Fan reporting error.	Shut down system as soon as possible. Then, check cooling fans and filters.
Cooling fans failed. May overheat.	Medium	Fan reporting error.	Shut down system as soon as possible. Contact a Datex-Ohmeda trained service representative.
Display panel controls failure	Medium	Communication lost between panel and key pad.	Turn the system off and back on.
EtCO2 high	High	EtCO2 is greater than high alarm limit.	Check the patient and EtCO2 settings. Check if absorbent needs to be changed.
EtCO2 low	Informational Medium after 1 minute	EtCO2 is less than alarm limit. Priority escalates to Medium if alarm is not resolved after 1 minute.	Ensure the patient is properly intubated. Check for leaks or blockages in the patient circuit.
EtDES high	Medium <sup>1</sup>	EtDES is greater than alarm limit.	Set the alarm limits appropriately. Decrease the agent concentration.
EtDES low	Informational	EtDES is less than alarm limit.	Check the fill level on the vaporizers. Set alarm limit appropriately. Increase the agent concentration.
EtENF high	Medium <sup>1</sup>	EtENF is greater than alarm limit.	Set the alarm limits appropriately. Decrease the agent concentration.
EtENF low	Informational	EtENF is less than alarm limit.	Check the fill level on the vaporizers. Set alarm limit appropriately. Increase the agent concentration.



## 7 Alarms and Troubleshooting

Message	Priority	Cause	Action
EtHAL high	Medium <sup>1</sup>	EtHAL is greater than alarm limit.	Set the alarm limits appropriately. Decrease the agent concentration.
EtHAL low	Informational	EtHAL is less than alarm limit.	Check the fill level on the vaporizers. Set alarm limit appropriately. Increase the agent concentration.
EtISO high	Medium <sup>1</sup>	EtISO is greater than alarm limit.	Set the alarm limits appropriately. Decrease the agent concentration.
EtISO low	Informational	EtISO is less than alarm limit.	Check the fill level on the vaporizers. Set alarm limit appropriately. Increase the agent concentration.
EtO <sub>2</sub> high	Medium	EtO <sub>2</sub> is greater than high alarm limit.	Set the alarm limits appropriately. Decrease the O <sub>2</sub> concentration.
EtO <sub>2</sub> low	Medium	EtO <sub>2</sub> is less than low alarm limit.	Set the alarm limits appropriately. Increase the O <sub>2</sub> concentration.
EtSEV high	Medium	EtSEV is greater than alarm limit.	Set the alarm limits appropriately. Decrease the agent concentration.
EtSEV low	Informational	EtSEV is less than alarm limit.	Check the fill level on the vaporizers. Set alarm limit appropriately. Increase the agent concentration.
FiCO <sub>2</sub> high. Absorbent OK?	High	FiCO <sub>2</sub> is greater than alarm limit.	Check if absorbent needs to be changed. Check the patient.
FiDES high	Medium <sup>1</sup>	FiDES is greater than alarm limit.	Set the alarm limits appropriately. Decrease the agent concentration.
FiDES low	Informational	FiDES is less than alarm limit.	Check the fill level on the vaporizers. Set alarm limit appropriately. Increase the agent concentration.
FiENF high	Medium <sup>1</sup>	FiENF is greater than alarm limit.	Set the alarm limits appropriately. Decrease the agent concentration.
FiENF low	Informational	FiENF is less than alarm limit.	Check the fill level on the vaporizers. Set alarm limit appropriately. Increase the agent concentration.
FiHAL high	Medium <sup>1</sup>	FiHAL is greater than alarm limit.	Set the alarm limits appropriately. Decrease the agent concentration.
FiHAL low	Informational	FiHAL is less than alarm limit.	Check the fill level on the vaporizers. Set alarm limit appropriately. Increase the agent concentration.
FiISO high	Medium <sup>1</sup>	FiISO is greater than alarm limit.	Set the alarm limits appropriately. Decrease the agent concentration.
FiISO low	Informational	FiISO is less than alarm limit.	Check the fill level on the vaporizers. Set alarm limit appropriately. Increase the agent concentration.
FiO <sub>2</sub> high	Medium	FiO <sub>2</sub> is greater than high alarm limit.	Check the O <sub>2</sub> setting. Recalibrate the O <sub>2</sub> cell and the airway module.

# Aisys

Message	Priority	Cause	Action
FiO2 low	High	FiO2 is less than low alarm limit.	Check O <sub>2</sub> setting. Check for leaks or blockages in the patient circuit.
FiSEV high	Medium	FiSEV is greater than alarm limit.	Set the alarm limits appropriately. Decrease the agent concentration.
FiSEV low	Informational	FiSEV is less than alarm limit.	Check the fill level on the vaporizers. Set alarm limit appropriately. Increase the agent concentration.
For mech vent, set Bag/Vent switch	Informational	Bag/Vent switch is set to Bag and the ACGO switch is set to Circle.	Move switch to the Vent position to start mechanical ventilation.
Gas monitoring not available	Medium	Airway module hardware failure.	Replace airway module. Then, turn power off and back on between cases to clear the alarm and receive module data.
Increase low MV limit	Medium	Low MV limit is off in SIMV/PSV, SIMV-PC, or PSVPro modes.	Increase Low MV alarm limit to improve patient disconnection detection.
Insert cassette	Informational	Cassette removal detected during active delivery.	Reinsert the cassette.
Inspiration stopped	Medium	High airway pressure.	Check system for blockages.
Internal failure. System may shut down.	High	Power controller software failure.	Contact a Datex-Ohmeda trained service representative.
Internal failure. System may shut down.	Medium	Power controller software failure.	Contact a Datex-Ohmeda trained service representative.
Memory (EEPROM) failure	Informational	Software error.	Contact a Datex-Ohmeda trained service representative.
Module fail. No CO2, AA, O2 data.	Medium	Airway module hardware failure.	Replace module.
Module not compatible	Informational	The monitoring module detected is not compatible with system software.	Remove the incompatible module. Use a compatible module.
Move Bag/Vent Switch to Bag	Medium	Bag/Vent switch is in the wrong position.	Move switch to the Bag position.
MVexp high	Medium	MVexp is greater than MVexp high alarm limit (for nine breaths or one minute).	Change TV, RR, I:E, PEEP, or Tinsp to reset the minute volume to below the MVexp high alarm limit.
MVexp low	Medium	MVexp is less than MVexp low alarm limit (for nine breaths or one minute).	Change TV, RR, I:E, PEEP, or Tinsp to reset the minute volume to above the MVexp low alarm limit.

## 7 Alarms and Troubleshooting

Message	Priority	Cause	Action
N <sub>2</sub> O supply pressure low	Medium	N <sub>2</sub> O pipeline pressure is less than 252 kPa (36 psi) and the N <sub>2</sub> O cylinder pressure is less than 2633 kPa (381 psi).	Ensure the N <sub>2</sub> O pipeline and cylinder are properly connected.
Negative airway pressure	High	Paw is less than -10 cm H <sub>2</sub> O.	Check for blockages in the patient circuit.
No battery backup	Medium	Battery or charging failure.	Between cases turn the system circuit breaker off, then back on after 15 seconds to reset the system.
No battery backup for monitor	Informational	Monitor power cable is unplugged.	Make sure the monitor power cable is plugged in.
No exp flow sensor	Medium	Electrical signals show the flow sensor is not connected.	Connect the flow sensor. Replace the flow sensor if necessary.
No fresh gas flow!	High	Possible patient detected while system is in checkout state.	Disconnect the patient or start a case.
No fresh gas flow?	High	Possible fresh gas flow occlusion or loss of gas pressure.	Switch to circle circuit or bag the patient. Check pipeline supply connection.
No insp flow sensor	Medium	Electrical signals show the flow sensor is not connected.	Connect the flow sensor. Replace the flow sensor if necessary.
O <sub>2</sub> flush stuck on?	Informational	Switch is detected "on" continuously for more than 30 seconds.	Check flush valve. Ensure flush valve is not sticking.
O <sub>2</sub> monitoring not connected	Medium	O <sub>2</sub> cell not connected.	Install airway gas module or connect the O <sub>2</sub> cell.
O <sub>2</sub> supply pressure low	High	O <sub>2</sub> pipeline pressure is less than 252 kPa (36 psi) and the O <sub>2</sub> cylinder pressure dropped below 2633 kPa (381 psi) for one second.	Ensure the O <sub>2</sub> pipeline and cylinder are properly connected.
PEEP high. Blockage?	High	Paw greater than or equal to sustained limit for 15 seconds. <sup>2</sup>	Check for blockages in the patient circuit.
Plug in power cable. On battery.	Medium	The mains supply is not connected or has failed and the system is using battery power.	Ventilate manually to save power. Make sure the power cable is plugged in and system circuit breaker is on.
Ppeak high	High	Paw is greater than Pmax alarm limit.	Check for blockages in the patient circuit.
Ppeak low. Leak?	Medium	Peak airway pressure is less than low Pmin + 4 cmH <sub>2</sub> O for 20 consecutive seconds if the set respiratory rate is four or higher and 35 seconds if the set respiratory rate is less than four breaths/min.	Check for leaks in the patient circuit.

# Aisys

Message	Priority	Cause	Action
Replace D-Fend	Medium	Buildup in airway module sample line.	Replace D-Fend.
Replace exp flow sensor	Informational	EEPROM calibration data read failure.	Replace the expiratory flow sensor.
Replace insp flow sensor	Informational	EEPROM calibration data read failure.	Replace the inspiratory flow sensor.
Replace O <sub>2</sub> sensor	Informational	Measured O <sub>2</sub> is less than 5%.	Calibrate the O <sub>2</sub> cell. Replace the O <sub>2</sub> cell if necessary.
Reverse exp flow. Check valves OK?	Medium	Flow toward the patient seen in the expiratory flow sensor during inspiration for six breaths in a row.	Check the flow sensor condition. Replace the expiratory check valve between cases. Zero flow transducers between cases.
Reverse insp flow. Check valves OK?	Medium	Flow away from the patient seen in the inspiratory sensor during expiration for six breaths in a row.	Check the flow sensor condition. Replace the inspiratory check valve between cases. Zero flow transducers between cases.
RR high	Medium	RR is greater than high alarm limit.	Set the alarm limits appropriately or adjust the RR setting.
RR low	Medium	RR is less than low alarm limit.	Set the alarm limits appropriately or adjust the RR setting.
Sample line blocked	Medium	Airway module sample line is blocked.	Replace airway module sample line.
Service calibration advised	Informational	Calibration data is corrupt.	Contact a Datex-Ohmeda trained service representative.
Set Alt O <sub>2</sub> flow! Agent delivery off!	Medium	Multiple possible causes for the failure.	Contact a Datex-Ohmeda trained service representative.
Set Alt O <sub>2</sub> flow! Check agent setting!	Medium	Software or hardware failure prevents mixed gas delivery.	Contact a Datex-Ohmeda trained service representative.
System leak?	Informational	Leak detected between ventilator and patient circuit.	Check for leaks in the breathing system.
System shutdown in <5 min	<b>High</b>	Remaining battery power is between zero and five minutes.	Plug in the power cable. Check that the system circuit breaker is on.
Try another cassette. Schedule service.	Medium	Vaporizer detected a cassette temperature failure.	Insert a different cassette. Contact a Datex-Ohmeda trained service representative.
Turn power Off and On for self tests	Informational	System has been operating for longer than 12 hours without a power-up self test.	Turn power off and back on between cases to perform a self test.

## 7 Alarms and Troubleshooting

Message	Priority	Cause	Action
Turn switch on to continue use	High	System is in therapy when System switch is turned to Standby.	Turn the System switch to On to continue therapy. The system will return to normal function. If System switch is not turned to On within 8 seconds, the system will shut down.
TV not achieved	Informational	Measured tidal volume is less than set tidal volume.	Check for leaks in the patient circuit. Check for leaks in the breathing system.
TVexp high	Medium	TVexp is greater than TVexp high alarm limit (for nine breaths).	Change TV, RR, I:E, PEEP, or Tinsp or change the tidal volume to reset TVexp high alarm limit.
TVexp low	Medium	TVexp is less than TVexp low alarm limit (for nine breaths).	Change TV, RR, I:E, PEEP, or Tinsp or change the tidal volume to reset TVexp low alarm limit.
Unable to drive bellows	Informational	Bellows is collapsed.	Check the drive gas. Increase fresh gas flow (or push the O <sub>2</sub> flush button) to fill the bellows.
Using battery. Power Controller fail.	Medium	Mains supply is OK, but the system is running on the battery.	Shut down the system as soon as possible. Contact a Datex-Ohmeda trained service representative.
Vap leak? Try another cassette.	Medium	Cassette leak. Agent filling attempted during delivery. Internal issue with agent delivery hardware.	Try another cassette. Do not attempt to fill agent cassette while delivering agent. Contact Datex-Ohmeda trained service representative.
Vaporizer failure	Medium	Internal issue with agent delivery hardware.	Change anesthesia method or use an alternate machine. Shutdown the system as soon as possible and contact a Datex-Ohmeda trained service representative.
Ventilate manually!	High	Software or hardware failure prevents mechanical ventilation. No pressure, no flow, and no volume monitoring from ventilator.	Use a manual bag to ventilate the patient or use an alternate machine. Shutdown the system as soon as possible and contact a Datex-Ohmeda trained service representative.
Ventilate manually!	Medium	Software or hardware failure prevents mechanical ventilation. Pressure, flow, and volume monitoring from ventilator still available.	Use a manual bag to ventilate the patient or use an alternate machine. Shutdown the system as soon as possible and contact a Datex-Ohmeda trained service representative.
Ventilator has no drive gas	High	Drive gas supply is not sufficient to mechanically ventilate.	Check drive gas supply. Use a manual bag to ventilate the patient until the drive gas supply is restored.
Vol and Apnea monitoring off	Informational	Non circle circuit is selected.	Message will clear when circle circuit is selected.
Vol vent only. No PEEP or PSV.	Medium	Manifold pressure error. Pressure control unavailable. Medium priority alarm when Bag/Vent switch is in Vent and running PCV, PSVPro, SIMV-PC, PCV-VG mode.	Use volume control ventilation mode. Shut down system as soon as possible. Contact a Datex-Ohmeda trained service representative.

# Aisys

Message	Priority	Cause	Action
Vol vent only. No PEEP or PSV.	Informational	Manifold pressure error. Pressure control unavailable. Informational priority alarm when Bag/Vent switch is in Vent and not running PCV, PSVPro, SIMV- PC, PCV-VG mode; Bag/Vent switch is in Bag; or Non-circle circuit or ACGO is selected.	Continue to use volume control ventilation mode or ventilate manually. Shut down system as soon as possible. Contact a Datex-Ohmeda trained service representative.
Volume sensors disagree	Informational	TVexp is greater than TVinsp for six breaths.	Calibrate the flow sensors. Replace the flow sensors if the message does not clear.
Vaporizer internal temperature out-of-range	Medium	Manifold temperature reading or cassette temperature reading is outside of the limit.	Change the agent setting.

<sup>1</sup> The alarm priority escalates to High if the alarm is not resolved after 2 minutes.

<sup>2</sup>The sustained pressure threshold is calculated from the pressure limit setting. The sustained limit is calculated as follows:

Mechanical  
Ventilation with  
PEEP Off:

For Pmax less than 30 cmH<sub>2</sub>O, the sustained pressure limit is 6 cmH<sub>2</sub>O.  
For Pmax between 30 and 60 cmH<sub>2</sub>O, the sustained pressure limit is 20% of Pmax.  
For Pmax greater than to 60 cmH<sub>2</sub>O, the sustained pressure limit is 12 cmH<sub>2</sub>O.

Mechanical  
Ventilation with  
PEEP On:

For Pmax less than 30 cmH<sub>2</sub>O, the sustained pressure limit is 6 cmH<sub>2</sub>O plus "set PEEP"  
minus 2 cmH<sub>2</sub>O.  
For Pmax between 30 and 60 cmH<sub>2</sub>O, the sustained pressure limit is 20% of Pmax plus "set  
PEEP" minus 2 cmH<sub>2</sub>O.  
For Pmax greater than 60 cmH<sub>2</sub>O, the sustained pressure limit is 12 cmH<sub>2</sub>O plus "set PEEP"  
minus 2 cmH<sub>2</sub>O.

Mechanical  
Ventilation Off:

For Pmax between 12 and 60 cmH<sub>2</sub>O, the sustained pressure limit is 50% of Pmax.  
For Pmax greater than 60 cmH<sub>2</sub>O, the sustained pressure limit is 30 cmH<sub>2</sub>O.



## Alarm ranges

The alarms names are listed in order they appear on the **Alarm Limits** page accessible from the **Alarm Setup** menu. The alarms setting ranges show in the order they appear in the setting selections in the Alarm Settings menu. See the "Super User Mode" section for more information on the alarm default settings.

Alarm	Range	Increment
Pmax (only high)	12 -100 cmH2O 1.2 - 9.8 kPa 12 - 98 mbar, hPa 9 - 73 mmHg	1 cmH2O 0.1 kPa 1 mbar, 1hPa 1 mmHg
MV High	0.5 - 30.0, Off l/min	0.5 l/min
MV Low	Off, 0.1 - 10.0 l/min	0.1 l/min
TV High	20 - 1600, Off ml	20 ml
TV Low	Off, 5 - 20 ml 20 - 1500 ml	5 ml 20 ml
RR High	2 - 100, Off bpm	1 bpm
RR Low	Off, 1 - 99 bpm	1 bpm
EtCO2 High	0.1 -15%, Off 0.1 - 15, Off kPa 1 -115, Off mmHg	0.1% 0.1 kPa 1 mmHg
EtCO2 Low	Off, 0.1 - 14.9% Off, 0.1 - 14.9 kPa Off, 1 - 114 mmHg	0.1% 0.1 kPa 1 mmHg
FiCO2 High	0.1 - 15%, Off 0.1 - 15, Off kPa 1 - 115, Off mmHg	0.1% 0.1 kPa 1 mmHg
FiO2 High	19 - 100%, Off	1%
FiO2 Low	18 - 99%	1%
EtO2 High	19 - 100%, Off	1%
EtO2 Low	Off, 1 - 99%	1%
FIISO High	0.1 - 7.0%	0.1%
FIISO Low	Off, 0.1 - 6.9%	0.1%
FISEV High	0.1 - 10.0%	0.1%
FISEV Low	Off, 0.1 - 9.9%	0.1%
FIDES High	0.1 - 20.0%	0.1%
FIDES Low	Off, 0.1 - 19.9%	0.1%
FIENF High	0.1 - 7.0%	0.1%
FIENF Low	Off, 0.1 - 6.9%	0.1%
FIHAL High	0.1 - 7.0%	0.1%
FIHAL Low	Off, 0.1 - 6.9%	0.1%
EIISO High	0.1 - 7.0%, Off	0.1%
EIISO Low	Off, 0.1 - 6.9%	0.1%

Alarm	Range	Increment
EtSEV High	0.1 - 10.0%, Off	0.1%
EtSEV Low	Off, 0.1 - 9.9%	0.1%
EtDES High	0.1 - 20%, Off	0.1%
EtDES Low	Off, 0.1 - 19.9%	0.1%
EtENF High	0.1 - 7.0%, Off	0.1%
EtENF Low	Off, 0.1 - 6.9%	0.1%
EtHAL High	0.1 - 7.0%, Off	0.1%
EtHAL Low	Off, 0.1 - 6.9%	0.1%



## Alarm tests

Test the system to verify that alarms are functioning.

**Note** If an airway module is installed, the  $FiO_2$  readings are taken from the module instead of from the  $O_2$  cell. A sample line must be connected from the airway module to the breathing circuit in order to test the  $O_2$  alarms.

1. Connect a test lung to the patient connection.
2. Start a case.
3. Set the Bag/Vent switch to Vent.
4. Set the  $O_2$  concentration to 30%, and allow the  $O_2$  reading to stabilize.
  - For machines configured to individual gas control, set the  $O_2$  flow to approximately 500 ml/min and Air flow to approximately 5 l/min.
5. Test the  $O_2$  alarms:
  - Set the ***FiO<sub>2</sub> Low*** alarm limit to 50%. Make sure an ***FiO<sub>2</sub> low*** alarm occurs.
  - Set the ***FiO<sub>2</sub> Low*** alarm limit back to 21% and make sure that the ***FiO<sub>2</sub> low*** alarm cancels.
  - Set the ***FiO<sub>2</sub> High*** alarm limit to 50%.
  - Push the  $O_2$  flush button.
  - Make sure the ***FiO<sub>2</sub> high*** alarm occurs.
  - Set the ***FiO<sub>2</sub> High*** alarm limit back to 100%. Make sure that the ***FiO<sub>2</sub> high*** alarm cancels.
6. Test the ***MVexp low*** alarm:
  - Go to the ***Alarm Setup*** menu.
  - Set the ***MV Low*** alarm limit to greater than the measured minute volume.
  - Make sure that a ***MVexp low*** alarm occurs.
  - Set the ***MV Low*** alarm limit to off.
7. Test the ***Ppeak high*** alarm:
  - Set the ***Pmax*** to less than the peak airway pressure.
  - Make sure that the ***Ppeak high*** alarm occurs.
  - Set the ***Pmax*** to the desired level.
8. Test the ***PEEP high. Blockage?*** alarm:
  - Close the APL valve.
  - Set the Bag/Vent switch to Bag. Mechanical ventilation stops.
  - Block the patient connection and push the  $O_2$  flush button.
  - Make sure that the ***PEEP high. Blockage?*** alarm occurs after approximately 15 seconds.

9. Test the ***Ppeak low. Leak?*** alarm:
  - Unblock the patient connection.
  - Set the Bag/Vent switch to Vent.
  - Set the tidal volume and total flow to minimum.
  - Other alarms such as ***MVexp low*** can occur.
  - Make sure that the ***Ppeak low. Leak?*** alarm occurs.
10. Set all alarm limits to approved clinical values.

## Breathing system problems

Symptom	Problem	Solution
Gas scavenging flow is too low or too high.	Scavenging extract flow problem.	Use a different scavenging extraction system. Verify flow is within specification.
	Filter blockage. Active systems have a flow indicator.	Replace the filter. Refer to "Remove the AGSS receiver filter" in the "Advanced Breathing System Cleaning and Sterilization" User's Reference manual.
The bellows fills when the Bag/Vent switch is set to Bag or the bag fills when the switch is set to Vent.	Leak through Bag/Vent switch.	Contact a Datex-Ohmeda trained service representative to repair the system.
The ventilator does not read the position of the Bag/Vent switch.	Ventilator or absorber malfunction.	Ventilate manually. Contact a Datex-Ohmeda trained service representative to repair the system.
APL valve does not operate correctly.	APL valve problem.	Replace APL valve seal and diaphragm.
Large breathing system leak not quickly located (in bag mode).	Bag hose not connected properly.	Ensure that the bag hose is connected to the bag port (below the APL valve).
	Absorber canister not installed correctly.	Reinstall the absorber canister, ensure both pins are engaged.
Bellows falls below top of indicator during "Bellows assembly test."	Leak in the breathing system.	Check, clean, or reposition the pressure relief valve. If the problem persists, replace the pressure relief valve, bellows base, or bellows assembly.

## Electrical problems

**WARNING** If a circuit breaker opens frequently, do not use the system. Have a Datex-Ohmeda trained service representative repair the system.

Symptom	Problem	Solution
Mains indicator is not on.	The electrical power cable is not connected.	Connect the power cable.
	The system circuit breaker (switch) is off.	Turn the circuit breaker on.
	The power cable is damaged.	Replace the power cable.
	The electrical socket the power cable connects to has no power.	Use a different electrical socket.
	An internal fuse is open.	Contact a Datex-Ohmeda trained service representative to repair the system.
One electrical outlet does not have power.	The outlet circuit breaker is off.	Turn the circuit breaker on.
A circuit breaker opens frequently.	Equipment connected to the outlet(s) uses more current than the circuit breaker rating.	Use a different power supply for some of the equipment.
	The equipment connected to the outlet has a short.	Contact a Datex-Ohmeda trained service representative to repair the system.
The real time clock on the anesthesia display does not maintain accurate time and date.	The battery in the anesthesia display needs to be replaced.	Contact a Datex-Ohmeda trained service representative to repair the system.
Audible alarm. System function stops. Screen is blank.	Internal power converter failure.	Turn the system off. Contact a Datex-Ohmeda trained service representative to repair the system.

## Pneumatic problems

Symptom	Problem	Solution
High-pressure leak test fails.	Controls are not set correctly.	Ensure no gas is flowing, turn off the auxiliary flowmeter, and repeat the test.
	Incorrect cylinder connection.	Make sure that there is only one cylinder gasket, the gasket is in good condition, and the connection is tight.
Low-pressure leak.	Anesthesia machine problem.	Contact a Datex-Ohmeda trained service representative.

# 8 Setup and Connections

**In this section**

- Setup warnings . . . . . 8-2
- Canister setup . . . . . 8-4
- Electrical connections . . . . . 8-9
- Pneumatic connections . . . . . 8-11
- How to install gas cylinders . . . . . 8-15
- How to attach equipment to the top of the machine . . . . . 8-17

## Setup warnings

See "Standards" and "System components" in the "Specifications and Theory of Operation" section for information on specific monitoring requirements.

### WARNING

Datex-Ohmeda strongly recommends the use of O<sub>2</sub> monitoring and anesthetic agent monitoring with this equipment. Refer to local standards for mandatory monitoring.

- ⚠ European, international, and national standards require the following monitoring be used with this system:
  - Exhaled volume monitoring.
  - O<sub>2</sub> monitoring.
  - CO<sub>2</sub> monitoring.
  - Anesthetic agent monitoring be used when anesthetic vaporizers are in use.
  
- ⚠ Always make sure that the pipeline supply hoses and the breathing circuit components are not toxic and will not:
  - Cause an allergic reaction in the patient.
  - React with the anesthetic gases or agent to produce dangerous by-products.
  
- ⚠ To prevent incorrect values or equipment malfunction, use only Datex-Ohmeda cables, hoses and tubing.
  
- ⚠ This system operates correctly at the electrical interference levels of IEC 60601-1-2. Higher levels can cause nuisance alarms that may stop mechanical ventilation.

- ⚠ To help prevent false alarms from devices with high-intensity electrical fields:
  - Keep the electrosurgical leads away from the breathing system, the flow sensors, and the oxygen cell.
  - Do not allow the electrosurgical leads to contact any part of the anesthesia system.
  - Do not use cell phones near the anesthesia system.
  
- ⚠ To protect the patient when electrosurgical equipment is used:
  - Monitor the correct operation of all life support and monitoring equipment.
  - Keep backup manual ventilation available in case the electrosurgical equipment prevents safe use of the ventilator.
  
- ⚠ Do not use antistatic or electrically-conductive breathing tubes or masks. They can cause burns if used near high-frequency surgical equipment.
  
- ⚠ Use only reservoir bags that comply with EN1820 on this system.
  
- ⚠ Use only breathing tubes that comply with EN12342 on this system.
  
- ⚠ A malfunction of the medical gas central supply system may cause all connected devices to stop.

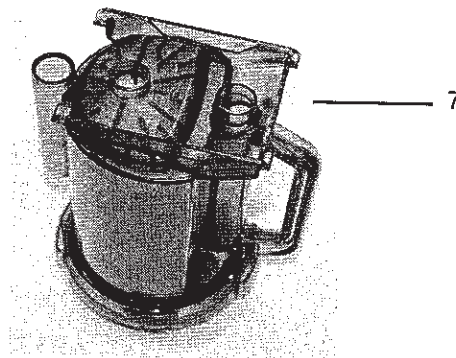
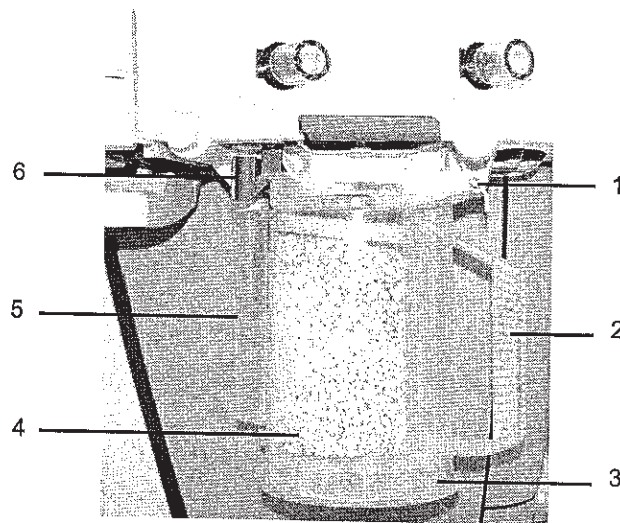


## Canister setup

The absorber canister is available in two versions: Disposable Multi Absorber and Reusable Multi Absorber. Both are removed and installed on the breathing system in the same way.

Each canister holds 800 grams of loose absorbent. The manufacturer recommends Medisorb™ absorbent.

Both absorber versions should only be used with mixtures of air, oxygen, nitrous oxide, halothane, enflurane, isoflurane, desflurane and sevoflurane.



AB.74p042  
AB.74p043

1. Canister support pin
2. Canister handle
3. Disposable Multi Absorber canister
4. Absorbent
5. Expiratory water reservoir
6. Canister release latch
7. Reusable Multi Absorber canister

Figure 8-1 • Canister

**WARNING** Obey applicable safety precautions:

- Do not use the absorber with chloroform or trichloroethylene.
- The Disposable Multi Absorber is a sealed unit which should not be opened or refilled.
- Avoid skin or eye contact with the contents of the absorber. In the event of skin or eye contact, immediately rinse the affected area with water and seek medical assistance.
- Do not remove the absorber canister to change the canister or to change the absorbent while ventilating a patient unless the system is equipped with the EZchange canister module.
- Change absorbent often to prevent the buildup of non-metabolic gases when the system is not in use.
- Inspect absorbent color at the end of a case. During non-use, absorbent can go back to the original color. Refer to the absorbent labeling for more information about color changes.
- If the absorbent completely dries out, it may give off carbon monoxide (CO) when exposed to anesthetic agents. For safety, replace the absorbent.
- Desiccated (dehydrated) absorbent material may produce dangerous chemical reactions when exposed to inhalation anesthetics. Adequate precautions should be taken to ensure that absorbent does not dry out. Turn off all gases when finished using the system.

### **When to change the absorbent**

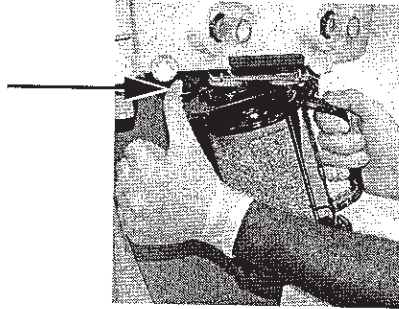
A gradual color change of the absorbent in the canister indicates absorption of carbon dioxide. The color change of the absorbent is only a rough indicator. Use carbon dioxide monitoring to determine when to change the canister.

Discard the absorbent when it has changed color. If left standing for several hours, absorbent may regain its original color giving a misleading indication of activity.

Read the absorbent manufacturer's instructions completely before using the product.

### Removing a canister

1. Hold the canister by the handle and push on the release latch to unlock the canister.

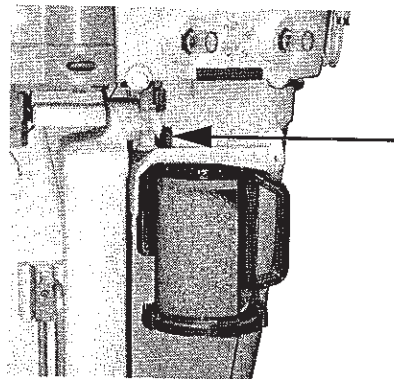


AB.74p058

2. Remove the canister by tilting it downward and off the two support pins.

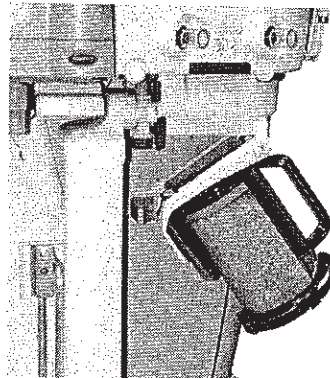
### Removing an EZchange canister

1. Hold the canister by the handle and push the canister cradle release latch to unlock the canister cradle.



AB.75p088

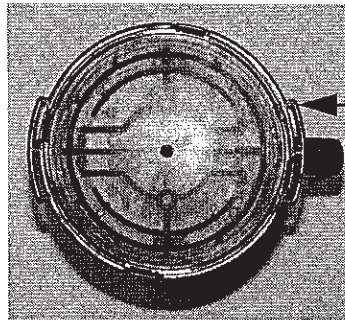
2. Slide the canister up and out of the cradle.



AB.75p089

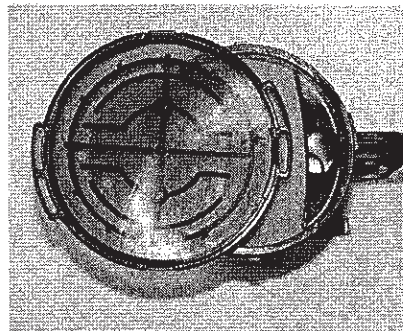
### Reusable Multi Absorber canister filling

1. Turn the canister upside down and, using your thumbs, turn the cover locking ring counterclockwise to unlock it.



AB.74p044

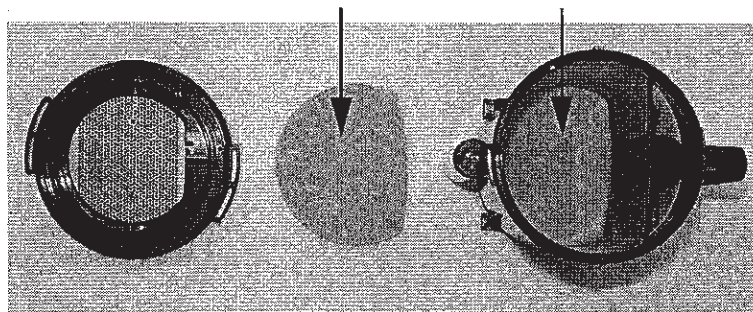
2. Push up to release the seal.
3. Lift off the cover to remove it.



AB.74p046

4. Remove and properly discard the foam filters, the absorbent, and any water in the reservoir.

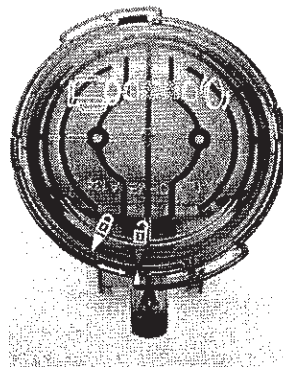
**WARNING** Be careful when draining condensate from the absorber. The liquid is caustic and may burn skin.



AB.74p047

5. To clean and disinfect the canister, refer to the "Absorber canister cleaning" in the "Advanced Breathing System Cleaning and Sterilization" manual.

6. Place a new filter in the bottom of the canister, pour absorbent into the canister and place a new filter over the absorbent before closing and locking the cover. Wipe off any absorbent dust.
7. Align the cover slots with the canister locking tabs and press the cover down into place. Turn the cover locking ring clockwise to lock the cover in place. Ensure cover is properly sealed to prevent leaks and spillage. Alignment of the arrows helps to indicate correct assembly.



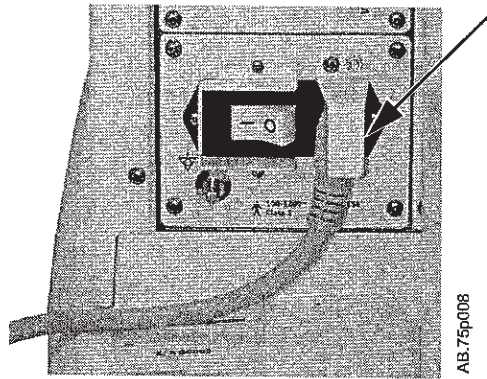
**WARNING** The filters must be in place to help prevent dust and particles from entering the breathing circuit.

8. When replacing the canister, make sure that it is seated properly on the support pins or in the EZchange canister module before latching it into place.

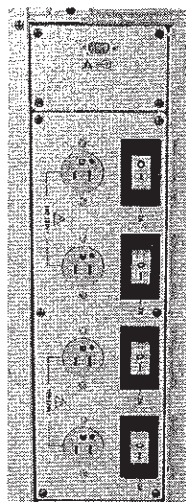


## Electrical connections

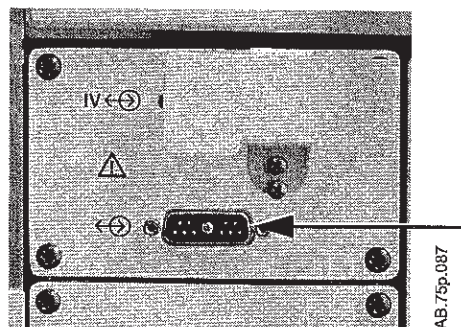
**Mains inlet** Arrow shows the mains power inlet and cord.



**Outlets** Labels show outlet voltage ratings and circuit breaker amp ratings. These are isolated outlets. Regularly test the leakage current.



**Patient monitoring battery backup** The port for the battery backup of the Datex-Ohmeda S/5™ Anesthesia Monitor with 12-inch display is located above the isolated outlets.

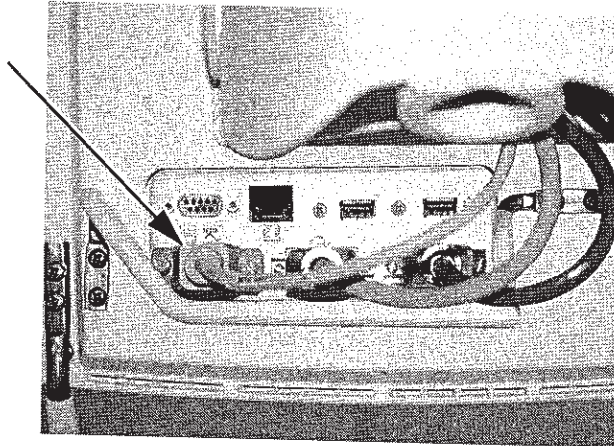


## Serial port

The system has an RS-232C electrical interface. The RS-232C connector allows serial input/output of commands and data. The 15-pin connector is located on the back of the display unit.

The 15-pin female D connector - Data Communications Equipment configuration (DCE):

- Pin 1 - Monitor On/Standby
- Pin 5 - Signal ground
- Pin 6 - Receive data
- Pin 9 - Monitor On/Standby Return
- Pin 13 - Transmit data



AB.75p080

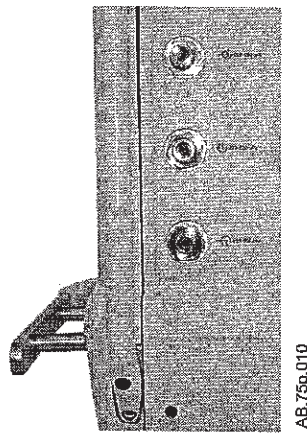
## Pneumatic connections

**CAUTION** Use only medical grade gas supplies. Other types of gas supplies may contain water, oil, or other contaminants which could affect the operation of the pneumatic system.

The gas supplies provide gas to these devices through internal connections:

- venturi suction regulator (optional).
- auxiliary O<sub>2</sub> flowmeter (optional).

## Pipeline inlets

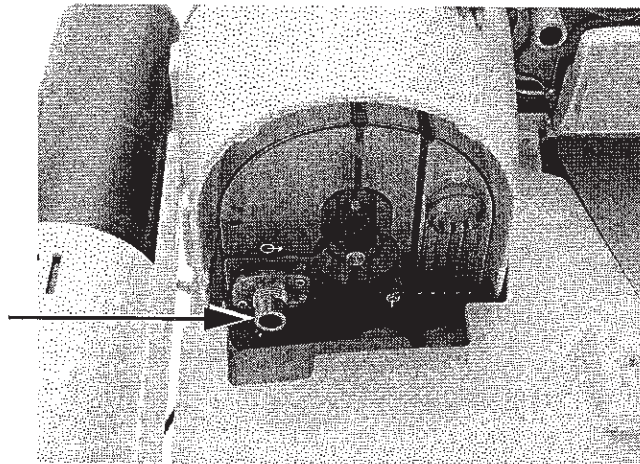


AB.75p.010

## Scavenging

The scavenging assembly is located below the bellows on the breathing system. Adapters may be necessary to interface to the scavenging connector.

See "*Passive AGSS (optional)*" and "*Active AGSS (optional)*" in the "*Operation*" section for more scavenging information.



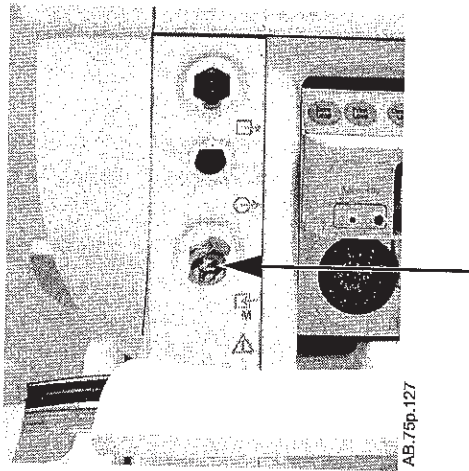
AB.91p045



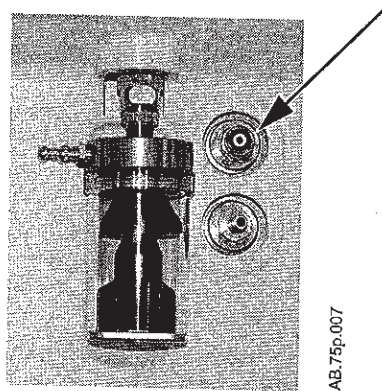
Aisys

**Sample gas return  
port**

Connect the Datex-Ohmeda sample gas exhaust tube to the gas return port. Exhaust gas will be directed to the scavenging system.

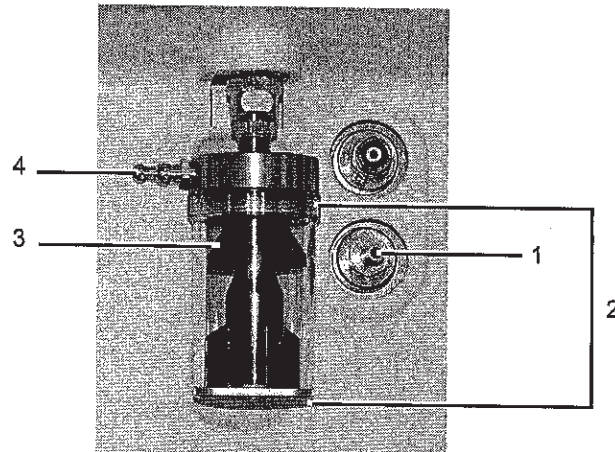


**Pneumatic power  
outlet**



**Vacuum suction regulator (optional)**

The vacuum suction regulator uses an external vacuum supply. Connect the vacuum connection to the source vacuum supply. Connect the collection bottle connection to the collection bottle.



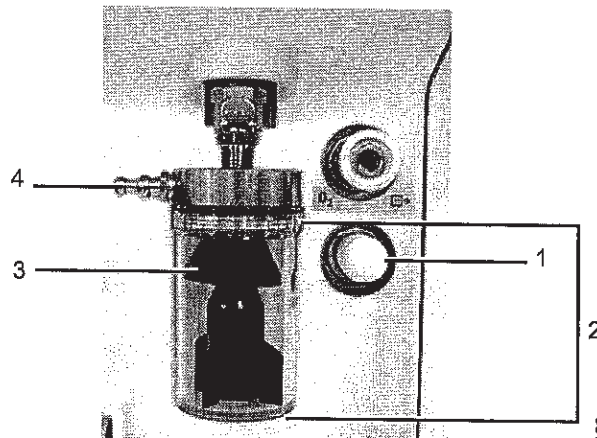
AB.75p007

- 1. External vacuum connection
- 2. Overflow safety trap
- 3. Splash guard
- 4. Collection bottle connection

Figure 8-2 • External vacuum suction

**Venturi suction regulator (optional)**

The venturi suction regulator uses the system air or O2 supply source. Connect the collection bottle connection to the collection bottle.

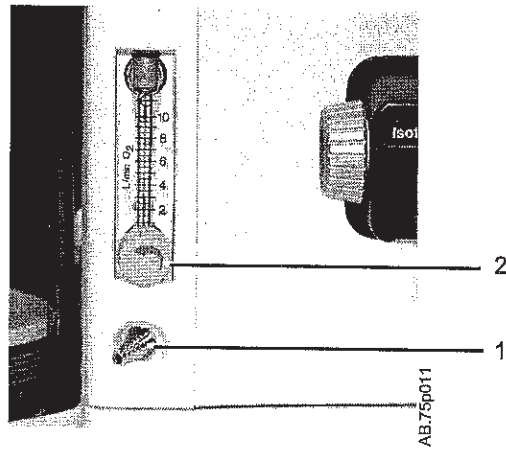


AB.75p126

- 1. Venturi muffler
- 2. Overflow safety trap
- 3. Splash guard
- 4. Collection bottle connection

Figure 8-3 • Venturi suction

### Auxiliary O2 flowmeter (optional)



- 1. Auxiliary O2 outlet
- 2. Auxiliary O2 flow control

Figure 8-4 • Auxiliary O2 flowmeter

## How to install gas cylinders

**CAUTION** Do not leave gas cylinder valves open if the pipeline supply is in use. Cylinder supplies could be depleted, leaving an insufficient reserve supply in case of pipeline failure.

### Pin indexed cylinder yokes

1. Locate the cylinder wrench.
2. Close the cylinder valve on the cylinder to be replaced.
3. Loosen the tee handle.
4. Open the cylinder yoke.
5. Remove the used cylinder and the used gasket.
6. Remove the cap (if equipped) from the cylinder valve on the new cylinder.

**WARNING** Make sure there is only one gasket on the cylinder connection. No gasket or more than one gasket can cause a leak.

7. Install a new gasket.
8. Align the cylinder post with the index pins.
9. Close the yoke gate and tighten the tee handle.
10. Make sure there is a cylinder plug and gasket in any empty cylinder yokes.
11. Perform a *"High-pressure leak test."*

### DIN cylinder connections

1. Close the cylinder valve on the cylinder to be replaced.
2. Loosen the adapter and remove the cylinder.
3. Remove the cap from the cylinder valve on the new cylinder.
4. Install the cylinder.
5. Perform a *"High-pressure leak test."*

## High-pressure leak test

1. Turn on the system.
2. Disconnect pipeline supplies.
3. Turn off the auxiliary O<sub>2</sub> flowmeter and the venturi suction.
4. Open the cylinder.
5. Record the cylinder pressure.
6. Close the cylinder.
  - If the cylinder pressure decreases more than 690 kPa (100 psi) in one minute there is a significant leak.
7. To repair a leak, install a new cylinder gasket and tighten the adapter.
8. Repeat the leak test. If the leak continues, do not use the system.

## How to attach equipment to the top of the machine

**WARNING** The top of the machine has a weight limit of 45 kg (100 lb).

Check the stability of the system in its final configuration. Make sure that weight is evenly distributed throughout the system.

1. Locate the clips or slots.
2. Install the straps. See the "Parts" section for more information.
3. Fully tighten the straps.
4. Make sure the straps hold the equipment in position.

**WARNING** Fully tighten the straps. If straps are not fully tightened, equipment can fall off the top of the machine.

# 9 User Maintenance

**WARNING** To help prevent fires:

- Do not use lubricants that contain oil or grease. They may burn or explode in high O<sub>2</sub> concentrations.
- All covers used on the system must be made from antistatic (conductive) materials. Static electricity can cause fires.
- Desiccated (dehydrated) absorbent material may produce dangerous chemical reactions when exposed to inhalation anesthetics. Adequate precautions should be taken to ensure that absorbent does not dry out. Turn off all gases when finished using the system.

⚠ Obey infection control and safety procedures. Used equipment may contain blood and body fluids.

⚠ Moveable parts and removable components may present a pinch or a crush hazard. Use care when moving or replacing system parts and components.

<b>In this section</b>	Repair policy . . . . .	9-2
	Maintenance summary and schedule . . . . .	9-2
	Circuit O <sub>2</sub> cell replacement . . . . .	9-4
	Calibration menu . . . . .	9-5
	Flow and pressure calibration . . . . .	9-5
	Circuit O <sub>2</sub> cell calibration . . . . .	9-6
	Airway gas calibration . . . . .	9-6
	Backlight test . . . . .	9-7
	How to help prevent water buildup . . . . .	9-7

## Repair policy

Do not use malfunctioning equipment. Make all necessary repairs or have the equipment serviced by a Datex-Ohmeda trained service representative. After repair, test the equipment to ensure that it is functioning properly, in accordance with the manufacturer's published specifications.

To ensure full reliability, have all repairs and service done by a Datex-Ohmeda trained service representative. If this cannot be done, replacement and maintenance of those parts listed in this manual may be undertaken by a competent, trained individual having experience in the repair of devices of this nature.

**CAUTION** No repair should ever be attempted by anyone not having experience in the repair of devices of this nature.

Replace damaged parts with components manufactured or sold by Datex-Ohmeda. Then test the unit to ascertain that it complies with the manufacturer's published specifications.

Contact the local Datex-Ohmeda Field Service Representative for service assistance.

## Maintenance summary and schedule

These schedules indicate the minimum frequency of maintenance based on typical usage of 2000 hours per year. Service the equipment more frequently if it is used more than the typical yearly usage.

**Note** Local policies or regulations may require that maintenance be performed more frequently than stated here.

Minimum Frequency	Maintenance
Daily	<ul style="list-style-type: none"><li>• Clean the external surfaces.</li><li>• Perform a flow and pressure calibration.</li><li>• Empty the water reservoir and replace the absorbent in the canister.</li></ul>
Monthly	<ul style="list-style-type: none"><li>• Perform a Backlight test.</li><li>• Perform 21% and 100% O2 cell calibrations.</li></ul>
During cleaning and setup	<ul style="list-style-type: none"><li>• Inspect the parts for damage. Replace or repair as necessary.</li></ul>



Minimum Frequency	Maintenance
As necessary	<ul style="list-style-type: none"> <li>• Install new cylinder gaskets on cylinder yokes.</li> <li>• Empty the water reservoir and replace the absorbent in the canister.</li> <li>• Empty the overflow trap on the optional suction regulator.</li> <li>• Replace the circuit O2 cell. (Under typical use the cell meets specifications for 1 year.)</li> <li>• Replace the disposable flow sensor (plastic). (Under typical use the sensor meets specifications for a minimum of 3 months.)</li> <li>• Replace the autoclavable flow sensors (metal). (Under typical use the sensor meets specifications for a minimum of 1 year.)</li> <li>• Replace the receiver filter (active gas scavenging only.)</li> <li>• Calibrate the airway modules every 6 months or when there are indications of errors in the gas readings. Calibrate airway modules that get extensive usage every 2 months.</li> <li>• Inspect and clean the fan filters (display, power supply, and airway module).</li> </ul>

### **Datex-Ohmeda approved service**

This is the minimum level of maintenance recommended by Datex-Ohmeda. Local regulations may contain additional maintenance requirements. Datex-Ohmeda advocates compliance with local regulations which meet or exceed this minimum level of maintenance.

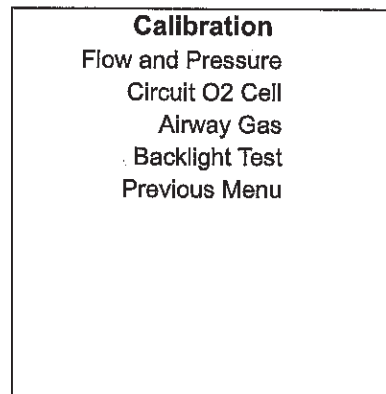
Minimum Frequency	Maintenance
12 months	Have a Datex-Ohmeda trained service representative complete the scheduled service maintenance checks, test, calibrations, and parts replacements as defined in the Technical Reference manual.

## Calibration menu

Access the Calibration menu by pushing the Main Menu key and selection Calibration from the Main Menu. Select the calibration procedure and follow the instructions shown.

See "Calibration" in the "Airway Modules" section for information on calibrating the airway modules.

See "Backlight test" for information on testing the backlights.



## Flow and pressure calibration

Calibrate the flow sensors by removing them from the system. On-screen instructions are available through **Main Menu - Calibration - Flow and Pressure**.

**Important** Room temperature fluctuations of more than 5°C may affect sensor measurements. Recalibrate the flow sensors if the room temperature changes by more than 5°C.

1. Set the Bag/Vent switch to Bag.
2. Remove the flow sensor module.
3. Wait for 'No insp flow sensor' and 'No exp flow sensor' alarms to occur.
4. Reinsert the flow sensor module. Wait for alarms to clear.
5. Start mechanical ventilation when ready.

## Circuit O<sub>2</sub> cell calibration

### 21% O<sub>2</sub> calibration

1. Push the **Main Menu** key.
2. Select **Calibration**.
3. Select **Circuit O2 Cell**.
4. Remove the flow sensor module. Unscrew the O2 cell to expose it to room air.
5. Select **21% O2** and push the ComWheel to start calibration.
6. Put the O2 cell back in and reconnect the flow sensor module when the calibration passes.

### 100% O<sub>2</sub> calibration

1. Ensure patient Y-piece is not plugged or there is no patient tubing connected to the system.
2. (ACGO option only.) Set the ACGO switch to Circle.
3. Set the Bag/Vent switch to Vent.
4. Select **100% O2** and push the ComWheel to start the calibration.
5. System will flow O2 to calibrate.

## Airway gas calibration

The airway gas selection is only available on the **Calibration** menu when the system detects an airway module and the module has completed the warm up phase. See the "Airway Modules" section for calibration instructions.

## Backlight test

1. Push the **Main Menu** key.
2. Select **Calibration**.
3. Select **Backlight Test**.
4. Select **Start Test**.
5. The display will show the test running on light 1 and then on light 2. If the display goes completely blank or flickers during the test, one of the lights has failed. Contact a Datex-Ohmeda trained service representative to replace the backlights.

## How to help prevent water buildup

Pooled water in the flow sensors or water in the sensing lines may cause false alarms. Small beads of water or a foggy appearance in the flow sensors is okay.

Water results from exhaled gas and the chemical reaction between CO<sub>2</sub> and the absorbent that takes place within the absorber canister.

At lower fresh gas flows more water builds up because less gas is scavenged and:

- More CO<sub>2</sub> stays in the absorber to react and produce water.
- More moist, exhaled gas stays in the patient circuit and the absorber.

Solutions:

- Equip systems with the optional condenser. See the "Parts" section for information.
- Empty the water reservoir in the canister when changing the absorbent.
- Ensure that water condensing in the breathing circuit tubes is kept lower than the flow sensors and is not allowed to drain back into the flow sensors.
- Water condensation in the breathing circuit tubing might be lessened by using a Heat and Moisture Exchange (HME) filter at the airway connection.

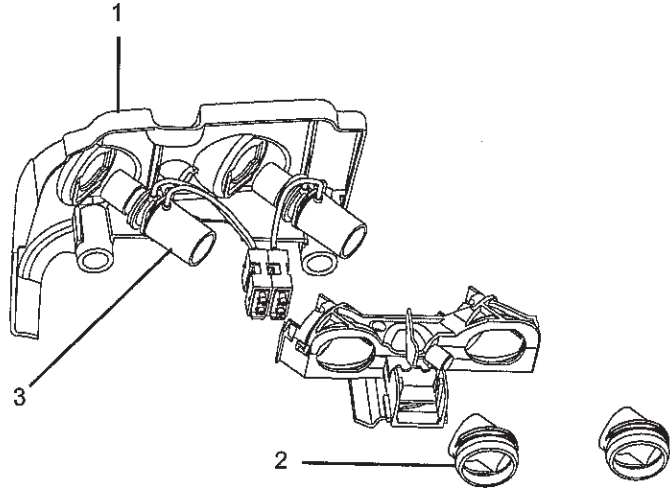
# 10 Parts

**Note** This section lists user-replaceable parts only. For other components, refer to the Technical Reference manual.

<b>In this section</b>	Flow sensor module . . . . .	10-2
	Breathing circuit module . . . . .	10-3
	Bellows . . . . .	10-4
	Complete Advanced Breathing System . . . . .	10-5
	Absorber canister . . . . .	10-6
	Exhalation valve assembly . . . . .	10-7
	AGSS . . . . .	10-8
	EZchange canister system . . . . .	10-9
	Condenser . . . . .	10-10
	Test tools and system parts . . . . .	10-11

Aisys

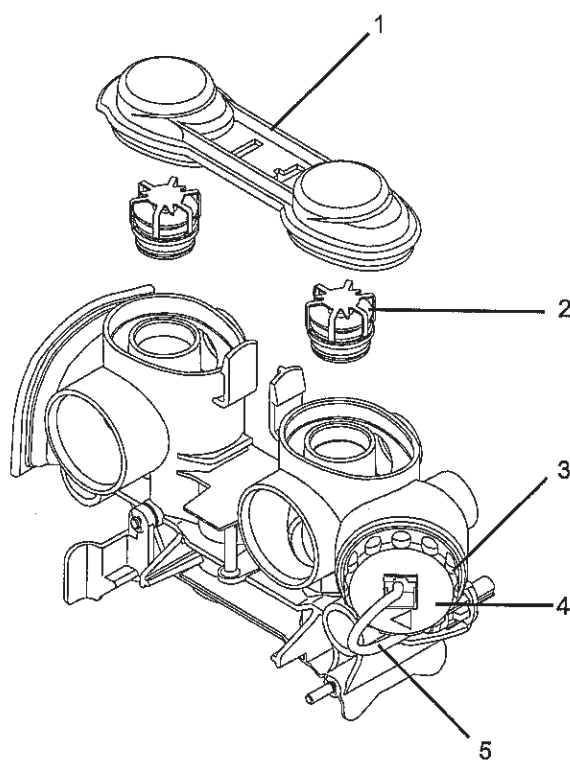
## Flow sensor module



AB.02.019

Item	Description	Stock number
	Flow sensor module (does not include flow sensors)	1407-7022-000
1	Flow sensor cover	1101-3283-000
2	Flow sensor cuff	1407-3004-000
3	Flow sensor, disposable (plastic)	1503-3858-000
	Flow sensor, autoclavable (metal)	1503-3244-000

## Breathing circuit module

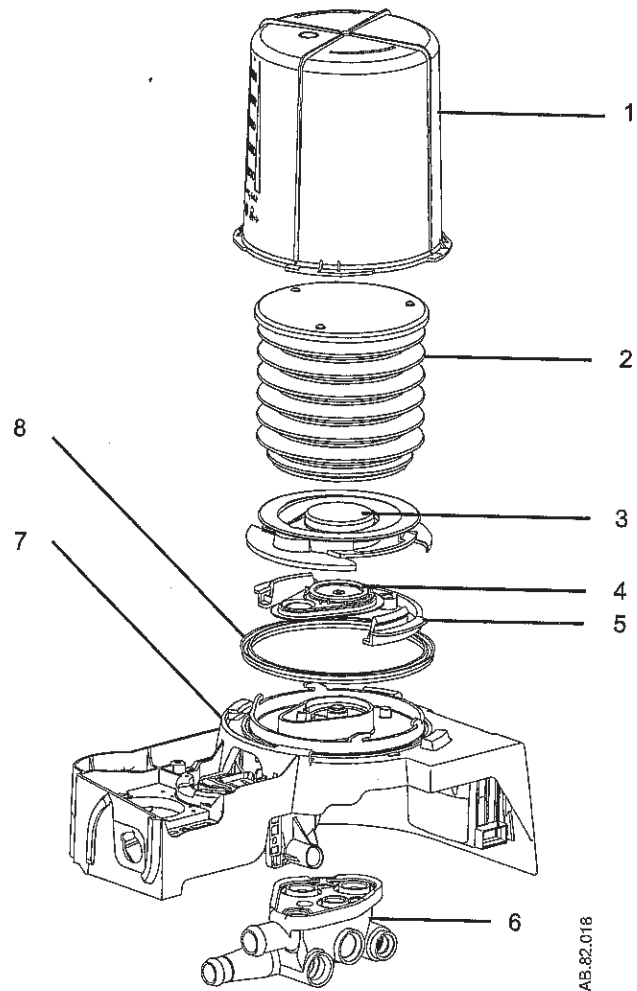


AB.82.021

Item	Description	Stock number
	Breathing circuit module (does not include O2 cell, o-ring, or cable)	1407-7002-000
1	Check valves circuit lens	1407-3101-000
2	Check valve assembly	1406-8219-000
3	O-ring for O2 cell or plug	1406-3466-000
4	O2 cell (includes o-ring)	6050-0004-110
5	Cable, O2 cell	1009-5570-000
-	Plug (includes o-ring; for systems without O2 sensing)	1503-3857-000

Aisys

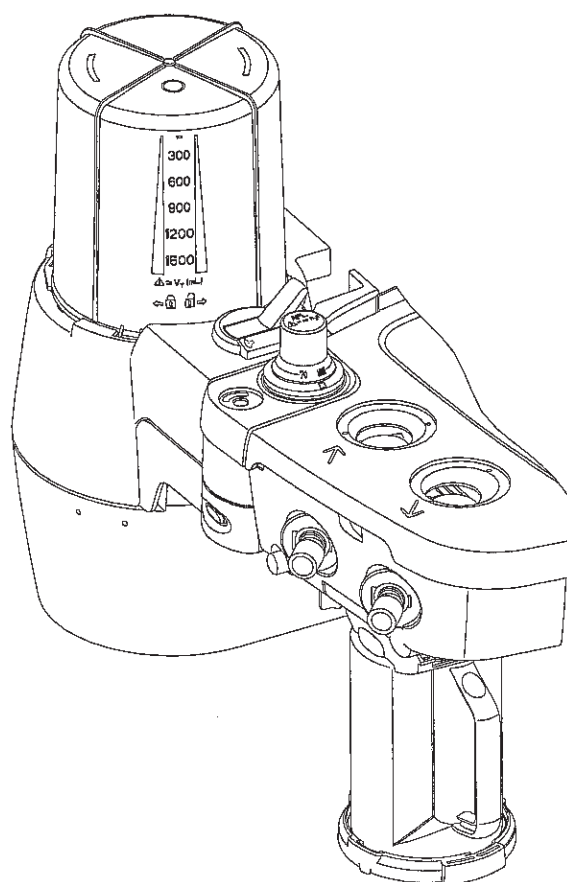
## Bellows



Item	Description	Stock number
1	Bellows housing	1500-3117-000
2	Bellows	1500-3378-000
3	Rim	1500-3351-000
4	Pressure relief valve assembly	1500-3377-000
5	Latch, rim	1500-3352-000
6	Manifold, bellows base	1407-3702-000
7	Bellows base with latch	1407-7006-000
8	Seal, base	1500-3359-000
-	Diaphragm, APL	1406-3331-000
-	Poppet, APL valve	1406-3332-000
-	Cage, APL	1406-3333-000



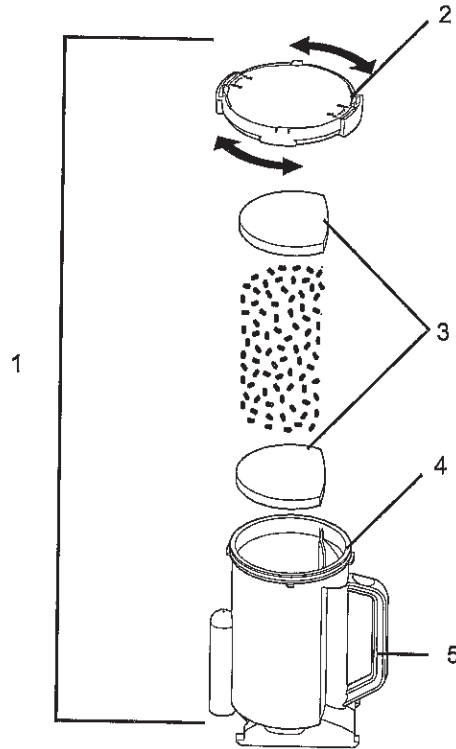
## Complete Advanced Breathing System



Item	Description	Stock number
Complete breathing system assembly includes:		
	• Flow sensor module (does not include flow sensors)	
	• Breathing circuit module (does not include APL valve, O <sub>2</sub> cell, o-ring, or cable)	
	• Complete bellows base	
	• Canister not included	
-	Autoclavable breathing assembly	1407-7017-000
-	Autoclavable breathing assembly, Australia	1407-7018-000

Aisys

## Absorber canister

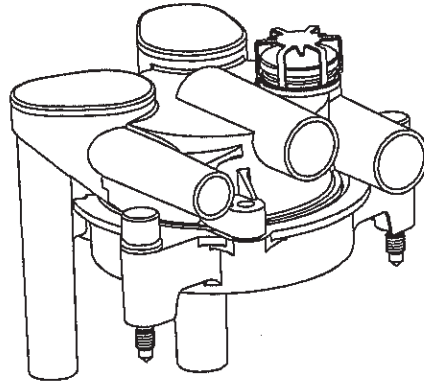


AB.82.017

Item	Description	Stock number
1	Multi absorber, reusable (includes 40 pack of foam) (does not include absorbent)	1407-7004-000
2	Cover assembly, CO2 canister	1009-8240-000
3	Foam, CO2 canister (pack of 40)	1407-3201-000
4	O-ring	1407-3204-000
5	Canister, CO2 with handle	1407-3200-000
-	Multi absorber, disposable, white to violet, (pack of 6)	8003138
-	Multi absorber, disposable, pink to white (pack of 6)	8003963

10 Parts

## Exhalation valve assembly



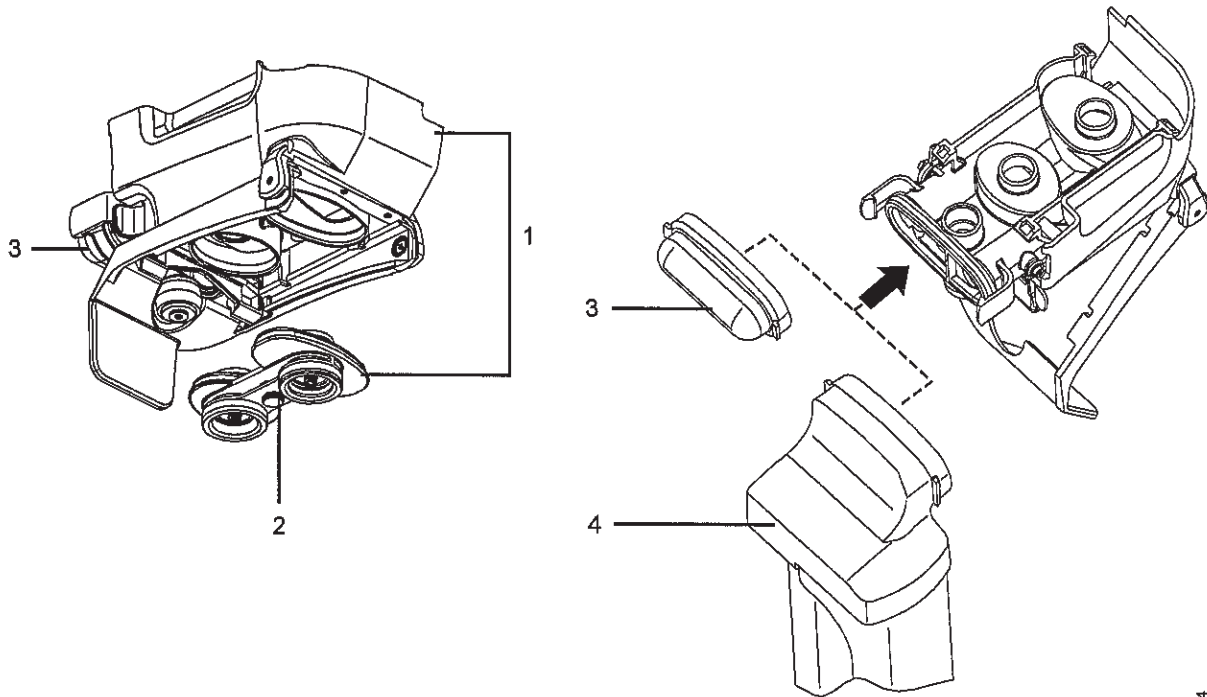
Description	Stock number
Exhalation valve assembly	1407-7005-000

Aisys

## AGSS

Description	Stock number
<b>Common</b>	
Cap 3.18 barb silicone	1406-3524-000
Connector, inlet 30 mm male to 19 mm male	M1003947
Connector, inlet 30 mm male to 30 mm male	M1003134
O-ring for connector, 21.95 ID	1406-3558-000
O-ring for receiver, 22 ID	1407-3104-000
O-ring for thumbscrews, 4.47 ID	1407-3923-000
Reservoir scavenger	1407-3903-000
Seal, down tube scavenger	1407-3904-000
Seal, receiver scavenger	1407-3901-000
Thumbscrew M6 X 28.5	1406-3305-000
Thumbscrew, M6 X 43	1406-3304-000
Valve, unidirectional (complete assembly)	1406-8219-000
<b>Passive AGSS</b>	
Adapter, outlet 30 mm female to 19 mm male (pack of 5)	1500-3376-000
Exhaust hose	8004461
Plug assembly 30 mm ISO	1407-3909-000
Screw, shoulder 4 diameter X 4 L M3 X 0.5 sst	1407-3915-000
<b>Active AGSS, adjustable flow</b>	
Bag with 30 mm male connector	8004460
Plug assembly 30 mm ISO	1407-3909-000
<b>Active AGSS, high flow</b>	
Filter, 225 micrometer nylon screen AGSS	1406-3521-000
Seal, filter scavenger	1407-3902-000
<b>Active AGSS, low flow</b>	
Filter, 225 micrometer nylon screen AGSS	1406-3521-000
Seal, filter scavenger	1407-3902-000

# EZchange canister system

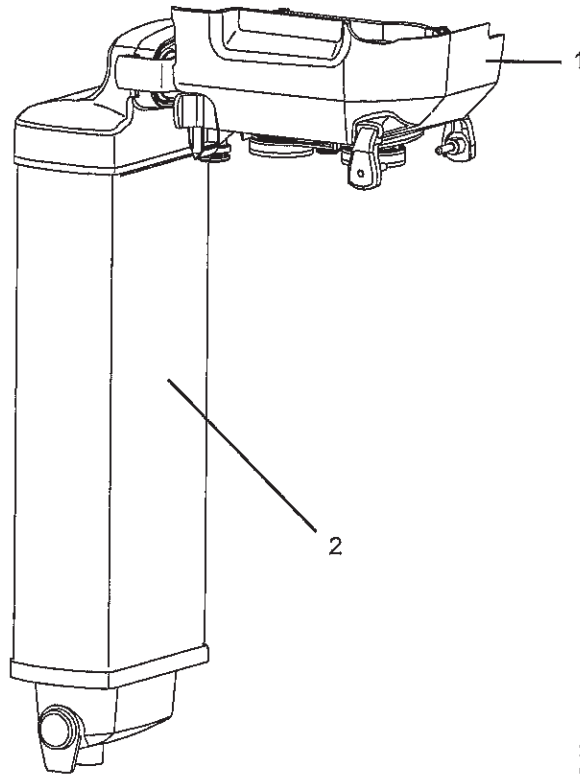


AB.82.044  
AB.82.057

Item	Description	Stock number
1	EZchange canister module, includes valve and cap	1407-7021-000
2	Valve	1407-7023-000
3	Cap	1407-3130-000
4	Condenser	1407-7024-000
-	EZchange canister module with condenser	1407-7027-000

Aisys

# Condenser



AB.82.045

Item	Description	Stock number
	Condenser assembly (includes module and condenser)	1407-7026-000
1	Condenser module	1407-7025-000
2	Condenser	1407-7024-000

## Test tools and system parts

Description	Stock number
Airway module calibration gas	755583
Airway module calibration gas (U.S. variant only)	755571
Airway module exhaust line	8004463
Calibration gas regulator	755534
Calibration gas regulator (U.S. variant only)	M1006864
Cylinder gasket (pin indexed cylinders only)	0210-5022-300
Cylinder wrench (DIN 477 and high-pressure hose)	1202-3651-000
Cylinder wrench for pin-indexed cylinder	0219-3415-800
DIN O2 plug (cylinder connection)	1202-7146-000
Handle for yoke tee	0219-3372-600
Negative low pressure leak test device	0309-1319-800
Positive low pressure leak test device (BSI)	1001-8975-000
Positive low pressure leak test device (ISO)	1001-8976-000
Positive pressure leak test adapter	1009-3119-000
Ring, sealing gasket (for DIN 477 and O2 high-pressure hose)	1001-3812-000
Ring, sealing gasket (for N2O high-pressure hose)	1202-3641-000
Test lung	0219-7210-300
Test plug	2900-0001-000
Touch-up paint, Neutral Gray N7 (Medium Dark), 18 ml	1006-4198-000
Touch-up paint, Neutral Gray N8 (Medium), 18 ml	1006-4199-000
Touch-up paint, Neutral Gray N9 (Light), 18 ml	1006-4200-000
Yoke plug	0206-3040-542
Kit, monitor to shelf mounting straps	0236-0039-870
Aladin <sub>2</sub> bottle adapter Easy-Fil isoflurane	1100-3025-000
Aladin <sub>2</sub> bottle adapter Easy-Fil enflurane	1100-0327-000
Aladin <sub>2</sub> bottle adapter Easy-Fil sevoflurane	1100-0328-000
Aladin bottle adapter keyed halothane	1100-3003-000
Aladin bottle adapter keyed enflurane	1100-3001-000
Aladin bottle adapter keyed isoflurane	1100-3002-000
Aladin bottle adapter keyed sevoflurane	1100-3007-000

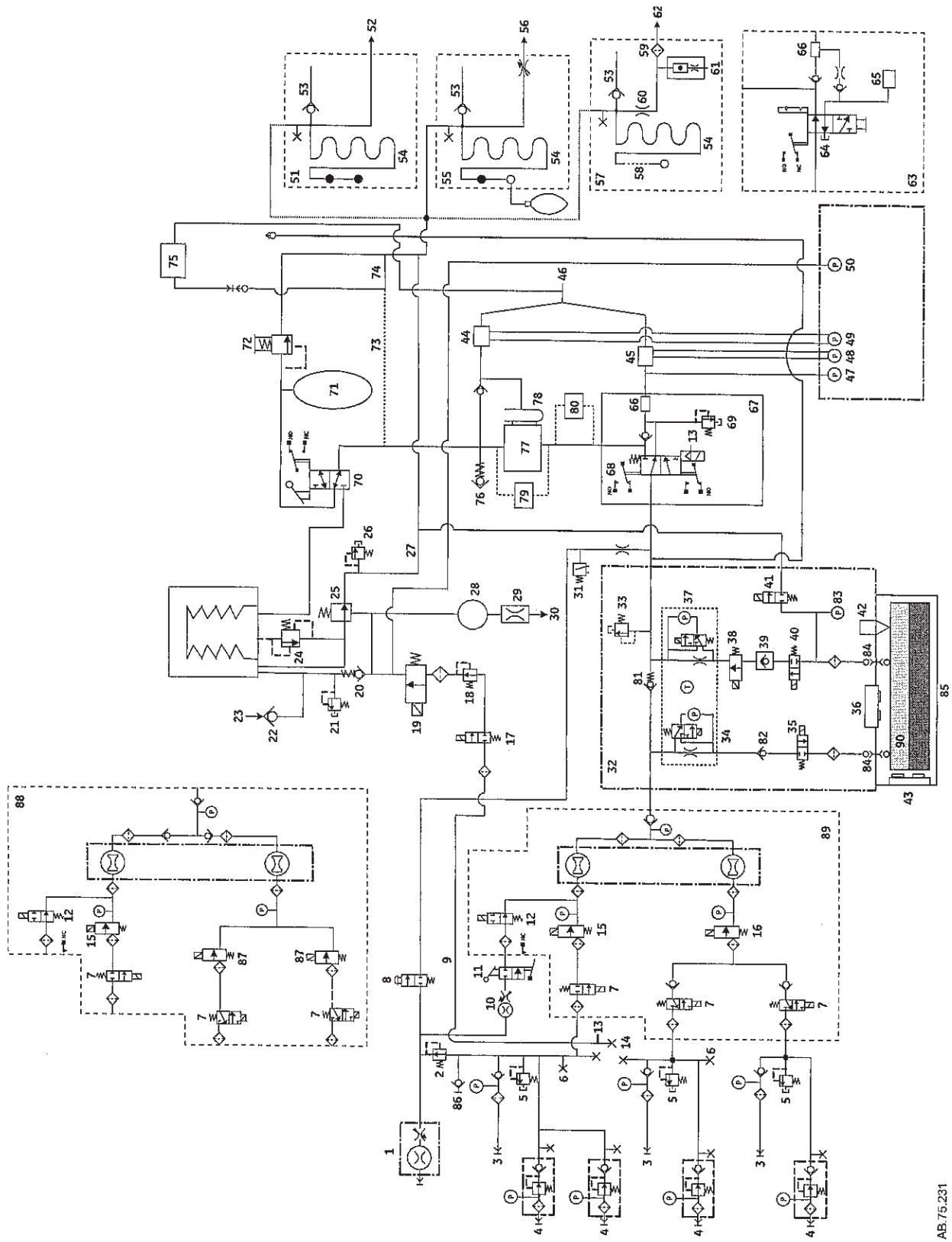
# 11 Specifications and Theory of Operation

- Note** All specifications are nominal and subject to change without notice.
- Note** All displayed values are shown at ambient temperature and pressure dry.

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# System pneumatic circuits



## 11 Specifications and Theory of Operation

1. Auxiliary O<sub>2</sub>, 0-10 l/min (optional)
2. 241 kPa (35 psi) secondary O<sub>2</sub> regulator
3. Pipeline: O<sub>2</sub>, Air, N<sub>2</sub>O
4. Cylinder: O<sub>2</sub>, Air, N<sub>2</sub>O
5. 758 kPa (110 psi) relief
6. Venturi drive gas connection
7. Selector valve, O<sub>2</sub>, Air, N<sub>2</sub>O
8. O<sub>2</sub> flush
9. 0-120 l/min flow
10. Alternate O<sub>2</sub>
11. System switch
12. Alternate O<sub>2</sub> disable valve
13. ACGO/non-circle pilot
14. Vent drive gas select
15. O<sub>2</sub> flow controller
16. Balance flow controller
17. Gas inlet valve
18. Vent drive gas regulator 172 kPa (25 psi) at 15 l/min
19. Inspiratory flow control valve
20. Drive gas check valve (3.5 cmH<sub>2</sub>O bias)
21. Mechanical over pressure valve (110 cmH<sub>2</sub>O)
22. Free breathing check valve
23. Atmosphere
24. Pressure relief valve
25. Exhalation valve (2 cmH<sub>2</sub>O bias)
26. Relief valve 10 cmH<sub>2</sub>O
27. 0-10 l/min drive gas, 0-10 l/min patient and fresh gas, 0-20 l/min total typical flow
28. 200 ml reservoir
29. Control bleed to ambient approximately 1 l/min at 3 cmH<sub>2</sub>O if continuous (rate dependent)
30. Vent to ambient
31. Flush switch 37.2 kPa (5.4 psi)
32. Electronic vaporizer
33. ACGO port relief valve
34. Cassette inflow measure
35. Cassette inflow valve
36. Cassette identification
37. Cassette outflow measure
38. Cassette flow control valve
39. Liquid flow prevention valve
40. Cassette outflow valve
41. Scavenging valve
42. Cassette temperature sensor
43. Liquid level indicator (not available on all cassettes)
44. Expiratory flow sensor
45. Inspiratory flow sensor
46. Patient Y
47. Airway transducer
48. Inspiratory flow transducer
49. Expiratory flow transducer
50. Manifold pressure transducer
51. Passive gas scavenging interface
52. 30 mm male, to disposal system
53. 0.3 cmH<sub>2</sub>O entrainment
54. Reservoir
55. Adjustable gas scavenging interface
56. DISS EVAC connector
57. Active gas scavenging interface
58. Room air
59. Filter
60. high or low flow restrictor
61. Flow indicator
62. To disposal system
63. ACGO variant
64. Circle or ACGO mode switch
65. 22 mm ACGO port
66. O<sub>2</sub> cell
67. Non-circle variant
68. Circle or non-circle mode switch
69. Non-circle circuit pressure limiting valve
70. Bag/Vent switch
71. Bag
72. APL valve 0-70 cmH<sub>2</sub>O
73. Optional factory connection
74. Default factory connection
75. Gas monitor
76. Negative pressure relief valve
77. Absorber
78. Drain
79. EZchange canister
80. Condenser
81. Bypass back-pressure valve
82. Inflow check valve
83. Cassette pressure sensor
84. Cassette connection valve
85. Aladin cassette
86. Pneumatic power outlet
87. Balance flow controller
88. Mixer II circuit
89. Mixer I circuit
90. Embedded temperature sensor (not available on all cassettes)

## Gas supplies

Pressurized gas supplies enter the system through a pipeline or cylinder connection. All connections have indexed fittings, filters, and check valves.

A regulator decreases the cylinder pressures to the appropriate system pressure. A pressure relief valve helps protect the system from high pressures.

To help prevent problems with the gas supplies:

- Install yoke plugs on all empty cylinder connections.
- When a pipeline supply is connected, keep the cylinder valve closed.
- Disconnect the pipeline supplies when the system is not in use.

## WARNING

Do not leave gas cylinder valves open if the pipeline supply is in use. Cylinder supplies could be depleted, leaving an insufficient reserve supply in case of pipeline failure.

## O2 flow

Pipeline or regulated cylinder pressure supplies O2 directly to the O2 channel of the gas mixer and to the ventilator if O2 is configured as drive gas. If the pressure is too low, an alarm appears on the display. A second regulator decreases the pressure for the flush valve and the auxiliary O2 flowmeter.

The flush valve supplies high flows (between 35 and 50 l/min) of O2 to the fresh gas outlet when the O2 flush button is pushed. The flush switch uses pressure changes to monitor the position of the flush valve.

## Air and N2O

Pipeline or regulated cylinder pressure supplies Air directly to the air channel of the gas mixer and to the ventilator if Air is configured as drive gas. If the pressure is too low, an alarm appears on the display.

Pipeline or regulated cylinder pressure supplies N2O directly to the N2O channel of the gas mixer. If the pressure is too low, an alarm appears on the display.

## Mixed gas

Either Air or N2O can be selected as the balance gas. The balance gas flow is controlled by the mixer. When Alternate O2 control is in use, only O2 is flowing and balance gas is disabled.

The mixed gas goes from the mixer outlet through the vaporizer to the fresh gas outlet and into the breathing system. A pressure-relief valve sets the maximum outlet pressure.

### Note

When the total flow is adjusted toward the lower flow limit and the calculated O2 flow is required to go below 100 ml, a message shows in the gas settings area of the screen. The anesthesia system calculates the required O2% to maintain the user-set total flow.

## 11 Specifications and Theory of Operation

### EZchange canister

When activated, this mode permits continued ventilation and rebreathing of exhaled gases without any gas passing through the absorbent.

### Condenser

The condenser removes water in the system that is produced from the reaction of CO<sub>2</sub> gas with the absorbent. When fresh gas flow settings of less than the patient minute volume are used during ventilation, the amount of re-breathed gas increases. More CO<sub>2</sub> flows through the breathing system increasing the absorbent consumption. The moisture buildup in the breathing system is also increased.

The condenser is connected between the outlet of the absorber canister and the inlet of the circuit module. Moisture in the gas is condensed into water droplets, which run into the condenser's reservoir.

## Pneumatic specifications

**CAUTION** All gases supplied to the system must be medical grade.

### Gas supplies

Pipeline gases	O <sub>2</sub> , Air, N <sub>2</sub> O
Cylinder gases	O <sub>2</sub> , Air, N <sub>2</sub> O (3 cylinder maximum)
Cylinder connections	Pin indexed Nut and gland DIN-477
Primary regulator output pressure	Pin indexed: The primary regulator is set to pressure less than 345 kPa (50 psi). DIN-477: The primary regulator is set to pressure less than 414 kPa (60 psi).
Pressure-relief valve	Approximately 758 kPa (110 psi)
Pipeline connections (filtered)	DISS - Male; DISS-Female; DIN 13252; AS 4059 (Australian); S90-116 (French Air Liquide); BSPP 3/8 (Scandinavian) or NIST (ISO 5359). All fittings available for O <sub>2</sub> , Air, and N <sub>2</sub> O.
Pressure displays	On system display.
Pipeline inlet pressure	280-600 kPa (41-87 psi)
Flush flow	35 l/min to 50 l/min
Internal O <sub>2</sub> supply pressure at which N <sub>2</sub> O shutoff	O <sub>2</sub> pipeline less than 252 kPa (36 psi). O <sub>2</sub> cylinder less than 2633 kPa (381 psi).

### ACGO Port relief

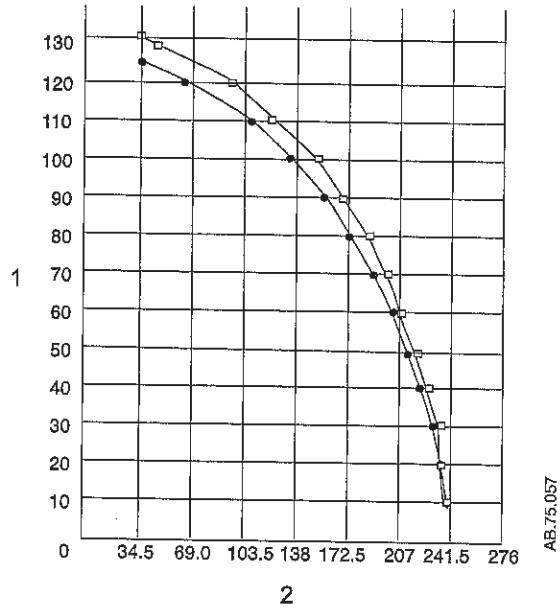
A relief valve on the vaporizer manifold limits the fresh gas pressure at the ACGO port to 55 kPa (8 psi) at 45 l/min.

### Non-circle circuit relief

A relief valve limits the fresh gas pressure at the inspiratory port to 27 kPa (4 psi) at 55 l/min when non-circle circuit is selected.

### Pneumatic power outlet

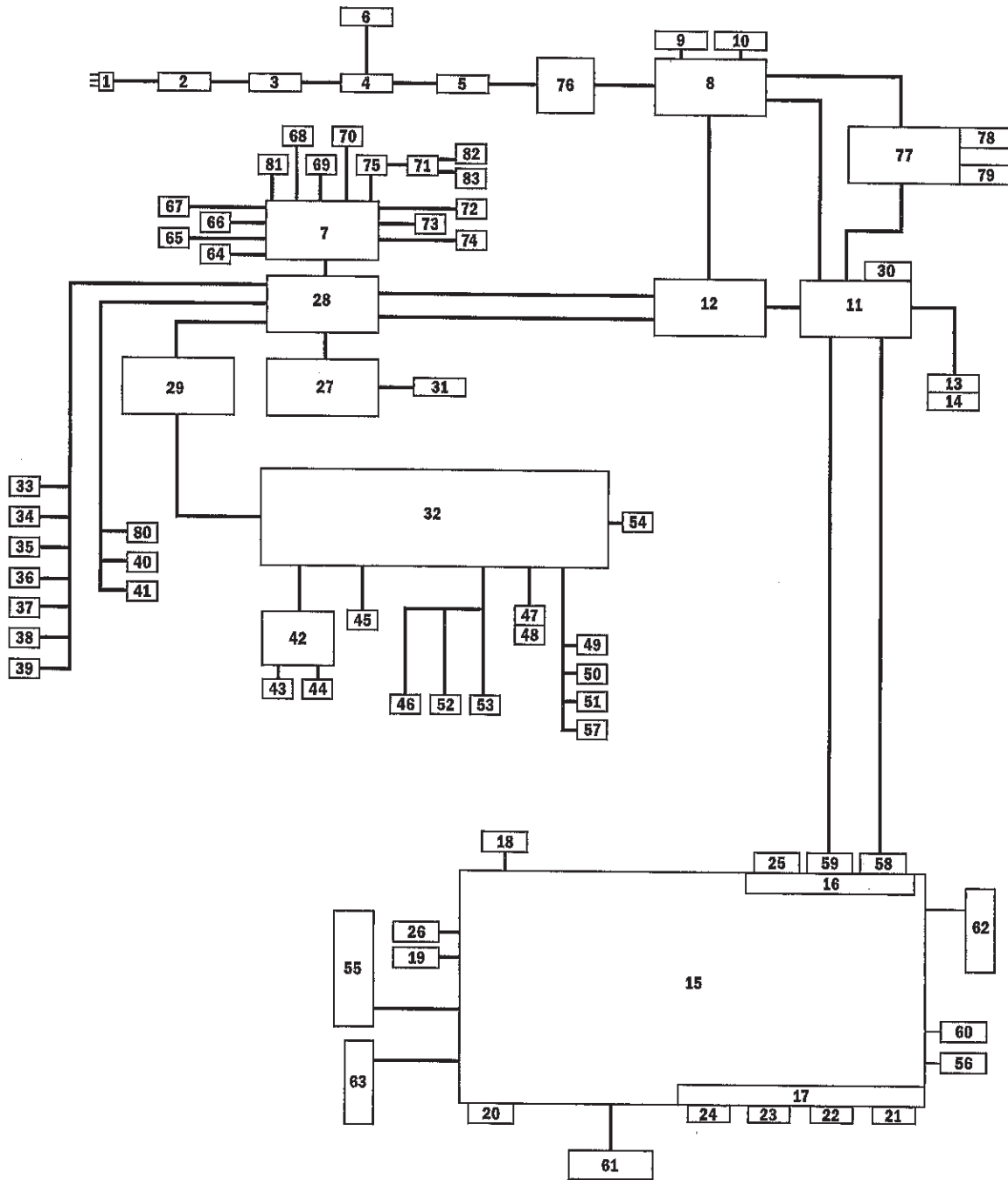
The DISS power outlet is shown as a dot curve. The ISO power outlet is shown as a box curve. The inlet pressure is constant at 241.5 kPa.



- 1. O2 flow in l/min
- 2. Outlet pressure in kPa

Figure 11-1 • Pneumatic power outlet

# Electrical block diagram



AB.75.101

## Aisys

1. Power cord
2. AC inlet and breaker
3. Inrush board
4. Transformer
5. Fuse block
6. Outlet box with breakers
7. Agent delivery board
8. Power controller board
9. Power supply fan with cable
10. Power supply with batteries
11. Display connector board
12. Anesthesia control board
13. Airway module power supply board
14. Airway module
15. Display unit CPU board
16. Display unit system interface board
17. Display unit user interface board
18. Display unit fan with cable
19. LCD backlight 1
20. Compact flash I/O port
21. USB I/O port
22. USB I/O port
23. Network I/O port (Ethernet)
24. Patient monitoring on/standby
25. Serial I/O port
26. LCD backlight 2
27. Electronic gas mixer board
28. Pan connector board
29. Ventilator interface board
30. I/O port
31. Pan fan with cable
32. ABS filter board
33. Air cylinder pressure transducer
34. N<sub>2</sub>O cylinder pressure transducer
35. O<sub>2</sub> cylinder pressure transducer
36. Air pipeline pressure transducer
37. N<sub>2</sub>O pipeline pressure transducer
38. O<sub>2</sub> pipeline pressure transducer
39. Second O<sub>2</sub> cylinder pressure transducer
40. Alternate O<sub>2</sub> switch
41. On/Standby switch and LED
42. Vent engine board
43. Flow control valve with cable
44. Gas inlet valve with cable
45. Expiratory and inspiratory flow sensors
46. O<sub>2</sub> cell
47. Light strip boards
48. Light strip switch
49. CGO valve
50. ACGO/non-circle circuit switch
51. CGO switch
52. Bag/vent switch
53. ABS connected switch
54. EZchange canister switch
55. LCD
56. Display unit speaker with cable
57. O<sub>2</sub> flush switch
58. DC power in
59. Communication to system
60. ComWheel encoder
61. Lower membrane switch
62. Right membrane switch
63. Left membrane switch
64. Cassette temperature sensor
65. Inflow zero valve
66. Outflow zero valve
67. Inflow pressure sensor board
68. Outflow pressure sensor board
69. Inflow shutoff valve
70. Outflow shutoff valve
71. Cassette
72. Scavenging valve
73. Cassette pressure sensor
74. Proportional valve
75. Cassette interface board
76. Universal power supply
77. Auxiliary connector board
78. I/O port
79. Battery backup for monitor
80. AC mains LED
81. Manifold temperature sensor
82. Liquid level sensor (not available on all cassettes)
83. Embedded temperature sensor (not available on all cassettes)

## Electrical power

Supply voltage	100-120 or 220-240 Vac +/-10% at 50 or 60 Hz		
Inlet circuit breakers	100-120 Vac		220-240 Vac
	15 A		8 A
Outlet circuit breakers	110-120 Vac	Japan	220-240 Vac
	(3) 2 A	2) 2 A	(3) 1 A
	(1) 3 A	(1) 4 A	(1) 2 A
System leakage current limit - do not exceed:	UL and CSA rated systems (U.S.A. and Canada): less than 300 $\mu$ amps for the system and all systems connected to electrical outlets.		
	IEC rated systems (Not U.S.A. and Canada): less than 500 $\mu$ amps for the system and all systems connected to electrical outlets.		
	Note: Products connected to electrical outlets may increase the leakage current above these limits		
Resistance to ground	less than 0.2 $\Omega$		

## Power cord

Length	5 meters
Voltage rating	100 to 240 Vac
Current capacity	10 A for 220-240 Vac
	15 A for 100-120 Vac
Type	Three conductor power supply cord (medical grade where required).

**WARNING** Unplug the system power cord to run the system on the battery power if the integrity of the protective earth conductor is in doubt.



## Battery information

The system is not a portable unit; a sealed lead acid battery supplies backup power in the event of a power failure.

- Capacity to operate for 90 minutes under typical operating conditions; 30 minutes under extreme conditions.
- The system functions to specifications through the transition to battery power.

Only trained service representatives are to replace the battery. Batteries must be disposed of in accordance with applicable regulatory requirements in effect at the time and place of disposal. Contact a trained service representative to disconnect the battery if the equipment is not likely to be used for an extended time.

## Flow specifications

<b>Alternate O2</b>	
Minimum flow	500 ml/min to 700 ml/min
Maximum flow	10 l/min to 13 l/min
Indicator	Flow tube
Indicator accuracy	+/- 5% full scale

<b>Fresh gas</b>	
Flow range	Off and 200 ml/min to 15 l/min
Total flow accuracy	+/- 10% or +/- 40 ml/min of setting (larger of)
O2 flow accuracy	+/- 5% or +/- 20 ml/min of setting (larger of)
Balance gas flow accuracy	+/- 5% or +/- 20 ml/min of setting (larger of) Air/N2O
O2 concentration range	21%, 25% to 100%
O2 concentration accuracy	+/- 5% of setting
Electronic mixer response time	500 ms (10% to 90% flow step)
Compensation	Temperature and atmospheric pressure compensated to standard conditions of 20°C and 101.3 kPa (14.7 psi)
Hypoxic guard	Electronic

Note: Leakage from one gas inlet to another gas inlet is less than 10 ml per hour.

Note: The stated concentration accuracy may not be met for total flows between 200 and 400 ml/min. The total flow will maintain a minimum of 21% O2.

## Breathing system specifications

Volume	Ventilator side 2730 ml; bag side 1215 ml With EZchange canister system and condenser: ventilator side 3445 ml; bag side 1930 ml
Absorbent	950 ml canister
Connections	Auxiliary Common Gas Outlet: ISO 5356 type connector on the front of the system (standard 22 mm OD or 15 mm ID conical friction fit connectors).
System leakage	Less than or equal to 150 ml/min total at 3 kPa (30 cmH <sub>2</sub> O) with EZchange canister system and condenser (both in absorber mode and with canister removed).
System compliance	Volume of gas lost due to internal compliance (bag mode only) 1.82 ml/0.098 kPa (1 cmH <sub>2</sub> O) 55 ml/3 kPa (30 cmH <sub>2</sub> O)  With EZchange canister system and condenser: 2.67 ml/0.98 kPa (1 cmH <sub>2</sub> O) 80 ml/3 kPa (30 cmH <sub>2</sub> O)
Pressure required to open Inspiratory or expiratory valves	Dry: 0.49 cmH <sub>2</sub> O Wet: 0.91 cmH <sub>2</sub> O
Pressure generated by a wet unidirectional valve	0.81 cmH <sub>2</sub> O
APL valve	Approximately 0 to 70 cmH <sub>2</sub> O

### Breathing system resistance in bag mode\*

	l/min	kPa	cmH <sub>2</sub> O
	5	0.06	0.6
	30	0.22	2.2
	60	0.52	5.3
EZchange canister system and condenser, absorber mode			
	5	0.06	0.6
	30	0.24	2.4
	60	0.57	5.8
EZchange canister system and condenser, canister removed			
	5	0.06	0.6
	30	0.21	2.1
	60	0.49	5.0

\*Values include patient circuit tubing and Y-piece 4.9 kPa (0.5 cmH<sub>2</sub>O) at 1 l/s. Patient circuit tubing and breathing system configurations may affect resistance.

Pressure flow data (APL valve completely open)		
Flow (l/min)	Flow (l/s)	APL pressure cmH2O
3	0.05	0.78
10	0.17	1.14
30	0.51	1.43
60	1.0	2.61
70	1.17	3.21

## Gas scavenging

All scavenging	
Positive pressure relief	10 cmH2O
Passive scavenging	
Negative pressure relief	0.3 cmH2O
Outlet connector	30 mm male taper ISO

Active scavenging			
Disposal system type	Outlet connector*	Flow range	Pressure
Adjustable	DISS EVAC	Up to 30 l/min	not applicable
High flow, low vacuum	BS6834	50 to 80 l/min	1.6 kPa (12 mmHg)
Low flow, high vacuum	DISS EVAC	36 +/- 4 l/min	305 mmHg (12 inHg) minimum vacuum
Low flow, low vacuum	12.7 mm hose barb	36 +/- 4 l/min	not applicable
Low flow, low vacuum	25 mm barb	36 +/- 4 l/min	not applicable
Low flow, low vacuum	30 mm ISO taper	36 +/- 4 l/min	not applicable

\*Other market-specific connectors may be available. Particle filter at the outlet has a pore size of 225 microns. All flow data uses a new filter.

## Physical specifications

All specifications are approximate values and can change without notice.

**CAUTION** Do not subject the system to excessive shock and vibration.

⚠ Do not place excessive weight on flat surfaces or drawers.

System	Height	136 cm
	Width	76 cm
	Depth	76 cm
	Weight	135 kg
	Top of machine weight limit	45 kg
	Optional top shelf weight limit	23 kg
Casters	13 cm with brakes on the front casters	
Drawers	23 cm Height x 33 cm Width x 27 cm Depth	
Ventilator display	146 x 184 mm (31 cm diagonal)	

## Environmental requirements

	Operation	Storage	Compensation range
Temperature	10 to 35°C Oxygen cell operates to specifications at 10 to 40°C	-25 to 60°C Oxygen cell storage is -15 to 50°C, 10 to 95% RH, 500 to 800 mmHg	Not applicable
Humidity	15 to 95% RH, non-condensing	10 to 95%, non-condensing	Not applicable
Altitude	500 to 800 mmHg (3565 to -440 meters)	375 to 800 mmHg (5860 to -440 meters)	525 to 795 mmHg (3000 to -100 meters)

## Airway module specifications

Use only airway modules that have anesthetic agent monitoring and O2 monitoring on this system. The following modules can be used on this system: E-CAiO, E-CAiOV, E-CAiOVX, M-CAiO, M-CAiOV, and M-CAiOVX. (E Series modules must be software version 4.5 and above. M series modules must be software revision 3.2 and above.)

## Gas specifications

Airway humidity	0 to 100% condensing
Sampling delay	2.5 seconds typical with a 3 m sampling line
Total system response time	2.9 seconds typical with a 3 m sampling line, including a sampling delay and rise time
Warm-up time	2 minutes for operation with CO2, O2, and N2O 5 minutes for operation of anesthetic agents 30 minutes for full specifications
Diversion flow	200 ml/min

Accuracy under different conditions:		
	<ul style="list-style-type: none"> <li>Ambient temperature 10 to 40°C.</li> <li>Ambient pressure 500 to 800 mmHg, +/- 50 mmHg of calibration</li> <li>Ambient humidity 10 to 98% RH, +/- 20% RH of calibration.</li> <li>During warm-up 10 to 30 minutes, under normal conditions.</li> </ul>	<ul style="list-style-type: none"> <li>During warm-up 2 to 10 minutes (anesthetic agents 5 to 10 minutes), under normal conditions.</li> </ul>
CO2	+/- (0.3 vol% + 4% of reading)	+/- (0.4 vol% + 7% of reading)
O2	+/- (2 vol% + 2% of reading)	+/- (3 vol% + 3% of reading)
N2O	+/- (3 vol% + 3% of reading)	+/- (3 vol% + 5% of reading)
Hal, Enf, Iso, Sev, Des	+/- (0.2 vol% + 10% of reading)	+/- (0.3 vol% + 10% of reading)

## 11 Specifications and Theory of Operation

### Typical performance

CO <sub>2</sub>	Measurement range 0 to 15 vol% (0 to 15 kPa, 0 to 113 mmHg). Measurement rise time less than 400 ms typical. Accuracy +/- (0.2 vol% + 2% of reading). Gas cross effects less than 2 vol% (O <sub>2</sub> , N <sub>2</sub> O, anesthetic agents).
O <sub>2</sub>	Measurement range 0 to 100 vol%. Measurement rise time less than 400 ms typical. Accuracy +/- (1 vol% + 2% of reading). Gas cross effects less than 1 vol% anesthetic agents, less than 2 vol% N <sub>2</sub> O.
N <sub>2</sub> O	Measurement range 0 to 100 vol%. Measurement rise time less than 450 ms typical. Accuracy +/- (2 vol% + 2% of reading). Gas cross effects less than 2 vol% anesthetic agents.
Anesthetic agents	Measurement range Hal, Enf, Iso 0 to 6 vol%. Measurement range Sev 0 to 8 vol%. Measurement range Des 0 to 20 vol%. Measurement rise time less than 400 ms typical. Accuracy +/- (0.15 vol% + 5% of reading). Gas cross effects less than 0.15 vol% N <sub>2</sub> O.

## Suction regulators (optional)

<b>Venturi Suction Regulator</b>	
Performance Category	Pharyngeal Suction
Supply	Air or O <sub>2</sub> from system gas supply
Drive Gas Consumption*	28 l/min with pipeline drive gas at 280 kPa 52 l/min with pipeline drive gas at 600 kPa
Maximum Vacuum*	600 mmHg with pipeline drive gas at 280 kPa 550 mmHg with pipeline drive gas at 600 kPa
Maximum Flow*	29 l/min with pipeline drive gas at 280 kPa 32 l/min with pipeline drive gas at 600 kPa
Vacuum Gauge Accuracy	+/- 5% of full scale
*Values are approximate.	

<b>Continuous Suction Regulator</b>	
Performance Category	Pharyngeal Suction
Supply	External vacuum
Maximum Vacuum*	540 mmHg with external vacuum applied of 540 mmHg and 40 l/min free flow
Maximum Flow*	39 l/min with external vacuum applied of 540 mmHg and 40 l/min free flow
Vacuum Gauge Accuracy	+/- 5% of full scale
*Values are approximate.	

### Ventilator theory

The ventilator pneumatics are at the rear of the breathing system. A precision valve controls gas flow to the patient. During inspiration, this gas flow closes the exhalation valve and pushes the bellows down. During expiration, a small flow pressurizes the exhalation diaphragm to supply PEEP pressure.

Volume and flow measurements come from flow sensors in the flow sensor module. Two tubes from each sensor connect to a transducer that measures the pressure change across the sensor, which changes with the flow. A third transducer measures airway pressures at the inspiratory flow sensor.

The ventilator uses the data from the flow sensors for volume-related numerics and alarms. The ventilator also uses the flow sensors to adjust its output for changes in fresh gas flow, small leaks, and gas compression upstream of the breathing circuit. There is adjustment for compression in the patient circuit.

In volume ventilation modes, certain alarm conditions prevent the automatic adjustment of ventilator delivery based on measured flow values. In these cases, 'Vent mode: TV accuracy decreased. Adj. manually.' shows above the ventilator setting area on the screen. When this message shows, the ventilator may not be able to deliver within the accuracy range specified. When this occurs, manually adjust the tidal volume until the volume delivered reaches the desired level. If compensation stops for a number of breaths, the condition causing the hold shows as an alarm. Automatic volume compensation resumes when alarm conditions are resolved.

For better precision a small quantity of gas bleeds through a resistor to help keep the pressure on the exhalation valve constant. At high airway pressures, this can cause a slight hiss during inspiration.

**WARNING** Always connect the expiratory flow sensor. If it is not connected, the patient disconnect alarm can not operate correctly.



## **O2 monitoring theory of operation**

O2 monitoring measures O2 concentration in the patient circuit. The O2 concentration measured from the O2 cell is shown on the ventilator display.

The O2 cell is an electrochemical device (galvanic cell). Oxygen diffuses through a membrane into the cell and oxidizes a base metal electrode. This oxidation produces an electrical current proportional to the partial pressure of the oxygen at the electrode's sensing surface. The base metal electrode gradually wears out from the oxidation process.

The voltage from the cell cartridge is affected by the temperature of the monitored gas mixture. A thermistor in the cell's housing automatically compensates for temperature changes in the cell.

O2 monitoring uses signal processing and analyzing circuitry to convert the cell signal into a corresponding % oxygen value. The system displays this value and compares it to saved alarm limits. If the value falls outside the limits, the monitor produces the appropriate alarms.

## **Ventilation modes**

The system has six modes of mechanical ventilation:

- Volume Control Ventilation (VCV).
- Pressure Control Ventilation (PCV) (optional).
- Synchronized Intermittent Mandatory Ventilation/Pressure Support (SIMV/PSV) (optional).
- Pressure Support Ventilation (PSVPro) (optional).
- Synchronized Intermittent Mandatory Ventilation-Pressure Control (SIMV-PC) (optional).
- Pressure Control Ventilation-Volume Guaranteed (PCV-VG) (optional).

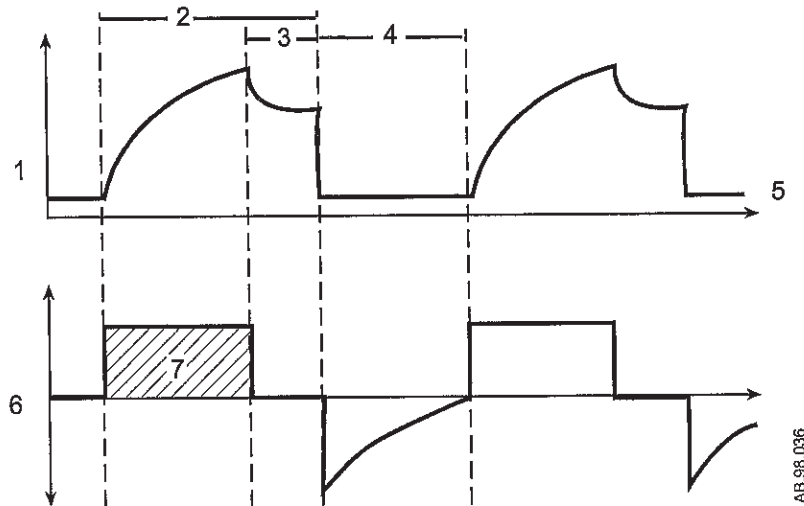
**Volume control mode**

Volume control supplies a set tidal volume. The ventilator calculates a flow based on the set tidal volume and the length of the inspiratory time (TI) to deliver that tidal volume. It then adjusts that output by measuring delivered volumes at the flow sensors. Since the ventilator adjusts output, it can compensate for breathing system compliance, fresh gas flow, and moderate breathing system leaks.

A typical volume-controlled pressure waveform increases throughout the entire inspiratory period, and rapidly decreases at the start of expiration. An optional inspiratory pause is available to improve gas distribution.

Volume control mode settings:

- TV
- RR
- I:E
- Tpause
- PEEP
- Pmax



1. Paw waveform
2. T<sub>insp</sub>
3. Insp Pause
4. T<sub>exp</sub>
5. PEEP
6. Flow waveform
7. TV

Figure 11-2 • Volume control diagram

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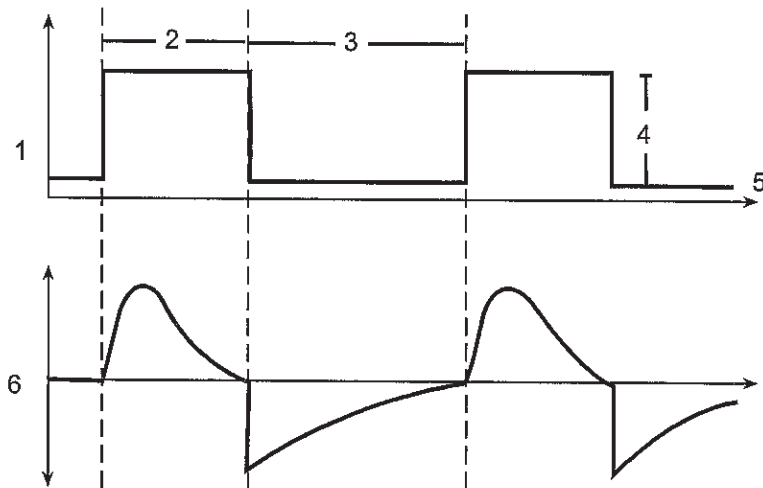
**Pressure control mode**

Pressure control supplies a constant set pressure during inspiration. The ventilator calculates the inspiratory time from the frequency and I:E ratio settings. A high initial flow pressurizes the circuit to the set inspiratory pressure. The flow then decreases to maintain the set pressure (Pinspired).

Pressure sensors in the ventilator measure patient airway pressure. The ventilator automatically adjusts the flow to maintain the set inspiratory pressure.

Pressure control mode settings:

- P<sub>insp</sub>
- RR
- I:E
- PEEP
- P<sub>max</sub>
- Rise Rate



1. Paw waveform
2. T<sub>insp</sub>
3. T<sub>exp</sub>
4. P<sub>insp</sub>
5. PEEP
6. Flow waveform

Figure 11-3 • Pressure control diagram

**SIMV/PSV mode**

Synchronized Intermittent Mandatory Ventilation/Pressure Support is a mode in which periodic volume breaths are delivered to the patient at preset intervals (time-triggered). Between the machine delivered breaths, the patient can breathe spontaneously at the rate, tidal volume and timing that the patient desires.

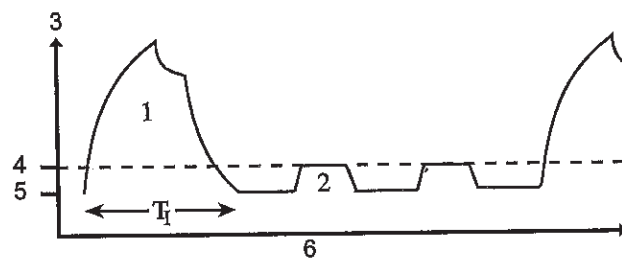
At the specified time interval, the ventilator will wait for the next inspiratory effort from the patient. The sensitivity of this effort is adjusted using the flow trigger level. When the ventilator senses the beginning of inspiration it synchronously delivers a volume breath using the set tidal volume, and inspiratory time that is set on the ventilator. If the patient fails to make an inspiratory effort during the trigger window time interval, the ventilator will deliver a machine breath to the patient. The ventilator will always deliver the specific number of breaths per minute that the clinician has set.

In SIMV/PSV, the spontaneous breaths can be pressure supported to assist the patient in overcoming the resistance of the patient circuit and the artificial airway. When the P<sub>support</sub> level is set, the ventilator will deliver the pressure support level to the patient during inspiration. PEEP can also be used in combination with this mode.

Spontaneous breaths that occur during this mode are indicated by a color change in the waveform.

SIMV/PSV mode settings:

- TV
- RR
- T<sub>insp</sub>
- T<sub>pause</sub>
- P<sub>support</sub>
- PEEP
- P<sub>max</sub>
- Trig Window
- Flow Trigger
- End of Breath
- Rise Rate



1. Mandatory SIMV breath
2. Spontaneous pressure supported breath
3. P<sub>aw</sub>
4. P<sub>support</sub>
5. PEEP
6. Time

Figure 11-4 • SIMV/PSV diagram

**PSVPro mode**

PSVPro is pressure supported ventilation with apnea backup.

PSVPro is a spontaneous mode of ventilation that provides a constant pressure once the ventilator senses that the patient has made an inspiratory effort. In this mode, the clinician sets the Pressure Support (Psupport) and PEEP levels. The patient establishes the rate, inspiratory flow and inspiratory time. The tidal volume is determined by the pressure, lung characteristics and patient effort.

PSVPro uses an inspiration termination level that establishes when the ventilator will stop the pressure supported breath and cycle to the expiratory phase. The inspiration termination level is user adjustable from 5% to 75%. This parameter sets the percent of the peak inspiratory flow that the ventilator uses to end the inspiratory phase of the breath and to cycle into the expiratory phase. If the inspiration termination is set to 30% then the ventilator will stop inspiration when the flow decelerates to a level equal to 30% of the measured peak inspiratory flow. The lower the setting the longer the inspiratory time and conversely, the higher the setting the shorter the inspiratory phase.

An apnea backup mode is provided in the event the patient stops breathing. When setting this mode the clinician adjusts the inspiratory pressure (P<sub>insp</sub>), respiratory rate (RR) and the inspiratory time (T<sub>insp</sub>). As long as the patient is triggering the ventilator and the apnea alarm does not activate, the patient will get pressure-supported breaths and the ventilator will not deliver machine breaths.

If the patient stops triggering the ventilator for the set apnea delay time, the apnea alarm will activate and the ventilator will automatically switch to the backup mode that is SIMV-PC mode. Once in this mode the ventilator will begin delivering machine Pressure Control breaths at the inspiratory pressure level, inspiratory time and rate that the user has set. If, during this mode, the patient takes spontaneous breaths in between the machine breaths, the patient will receive pressure supported breaths.

PSVPro mode settings:

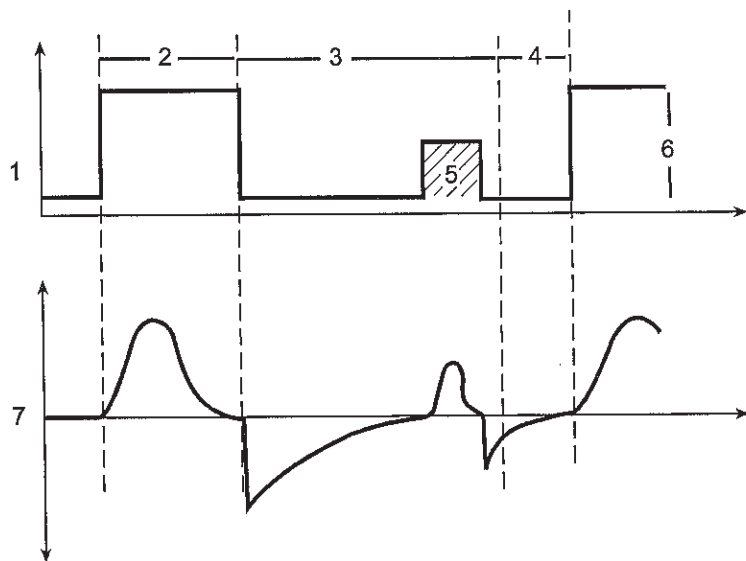
- P<sub>support</sub>
- PEEP
- Trig Window
- Flow Trigger
- End of Breath
- P<sub>max</sub>
- Backup Time
- P<sub>insp</sub>
- RR
- T<sub>insp</sub>
- Rise Rate
- Exit Backup

**SIMV-PC mode**

Synchronized Intermittent Mandatory Ventilation, Pressure Control is a mode in which a relatively slow mandatory breathing rate is set with pressure-controlled breathing. This mode combines mandatory breaths with spontaneous breath support. If a trigger event occurs within the synchronization window, a new pressure-controlled breath is initiated. If a trigger event occurs elsewhere during the expiratory phase, a support for a spontaneous breath is provided with pressure support added as set by the clinician.

SIMV-PC mode settings:

- P<sub>insp</sub>
- RR
- T<sub>insp</sub>
- P<sub>support</sub>
- PEEP
- P<sub>max</sub>
- Trig Window
- Flow Trigger
- End of Breath
- Rise Rate
- Exit Backup



1. Paw waveform
2. T<sub>insp</sub>
3. Spontaneous breathing period
4. Trigger window
5. Pressure supported breath
6. P<sub>insp</sub>
7. Flow waveform

Figure 11-6 • SIMV-PC waveforms

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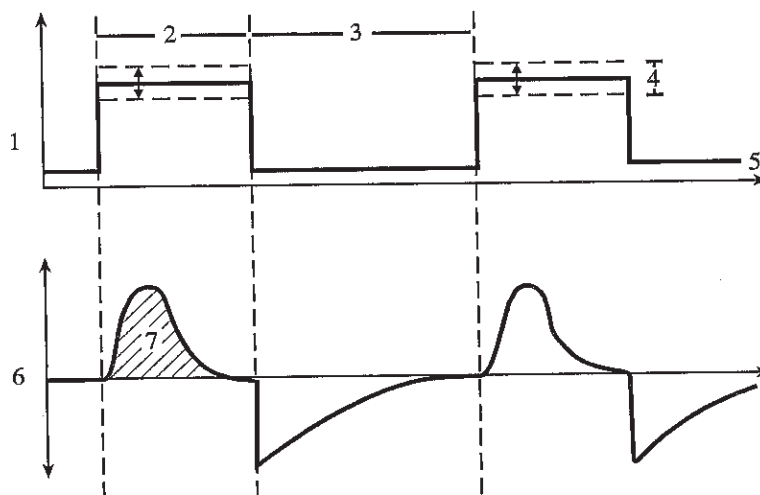
**PCV-VG mode**

In PCV-VG, a tidal volume is set and the ventilator delivers that volume using a decelerating flow and a constant pressure. The ventilator will adjust the inspiratory pressure needed to deliver the set tidal volume breath-by-breath so that the lowest pressure is used. The pressure range that the ventilator will use is between the PEEP + 2 cmH<sub>2</sub>O level on the low end and 5 cmH<sub>2</sub>O below P<sub>max</sub> on the high end. The inspiratory pressure change between breaths is a maximum of ± 3 cmH<sub>2</sub>O.

This mode will deliver breaths with the efficiency of pressure controlled ventilation, yet still compensate for changes in the patient's lung characteristics. PCV-VG begins by first delivering a volume breath at the set tidal volume. The patient's compliance is determined from this volume breath and the inspiratory pressure level is then established for the next PCV-VG breath.

PCV-VG mode settings:

- TV
- RR
- I:E
- PEEP
- P<sub>max</sub>
- Rise Rate



1. Paw waveform
2. T<sub>insp</sub>
3. T<sub>exp</sub>
4. Variable pressure to deliver desired TV
5. PEEP
6. Flow waveform
7. TV

Figure 11-7 • PCV-VG waveforms

## Ventilation modes factory default settings

The ventilation mode factory default settings show in the following table. A \* indicates the setting is not available for the ventilation mode.

Setting	Range	Modes					
		VCV	PCV	PCV-VG	SIMV-PC	SIMV/PSV	PSVPro
TV	20 - 1500 ml	500	*	500	*	500	*
RR	4 - 100 bpm	12	12	12	*	*	*
RR	2 - 60 bpm	*	*	*	12	12	12
I:E	2.0:1 - 1:8.0	1:2.0	1:2.0	1:2.0	*	*	*
Tpause	Off, 5 - 60% of T <sub>insp</sub>	Off	*	*	*	Off	*
PEEP	Off, 4 - 30 cmH <sub>2</sub> O	Off	Off	Off	Off	Off	Off
Pmax	Off, 12 - 100 cmH <sub>2</sub> O	40	40	40	40	40	40
P <sub>insp</sub>	5 - 60 cmH <sub>2</sub> O	*	5	*	5	*	5
P <sub>support</sub>	Off, 2 - 40 cmH <sub>2</sub> O	*	*	*	2	2	2
T <sub>insp</sub>	0.02 - 5 seconds	*	*	*	1.70	1.70	1.70
Rise Rate	Auto, 1 - 10	*	Auto	*	Auto	Auto	Auto
Rise Rate	1 - 10	*	*	5	*	*	*
Trig Window	Off, 5 - 80% of Texp	*	*	*	25	25	25
Flow Trigger	0.2 - 10 l/min	*	*	*	2	2	2
End of Breath	5 - 75% of peak inspiratory flow	*	*	*	30	30	30
Backup Time	10 - 30 seconds	*	*	*	*	*	30
Exit Backup	Off, 1 - 5 spontaneous breaths	*	*	*	2	*	2

## Ventilation mode transition

Ventilation settings selectable through the **Vent Setup** menu are set to the factory default at start up of the system and at the end of each case. The ventilation settings remain at the factory default until changed by the user. If a ventilation setting is changed, the new setting remains active in all applicable modes until the setting is changed again. Exceptions include:

- For modes that use RR 4 to 100, the RR transfers to the new mode at the set RR or 60 whichever is smaller. For example, if the mode is use has RR of 75 and the new mode does not support a RR of 75, the RR is set at 60.
- For modes that use RR 2 to 60, the RR does not transfer to modes that use RR 4 to 100. The RR is set to the factory default or the last set if previously used during the case. For example, if during the first case the RR (2 to 60) is set to 2 and the new mode uses RR 4 to 100, the RR is set to the factory default.
- For modes that use I:E, when transferring to a mode that uses T<sub>insp</sub>, the T<sub>insp</sub> is set to a calculation of I:E or 5 seconds whichever is lower.



## Ventilator operating specifications

### Pneumatics

Gas source	Anesthesia system
Gas composition	Medical Air or O <sub>2</sub>
Nominal supply pressure	350 kPa (50 psi)
Pressure range at inlet	240 to 700 kPa (35 to 102 psi)
Peak gas flow	120 l/min at 240 kPa (35 psi), 0.75 seconds
Continuous gas flow	80 l/min at 240 kPa (35 psi)
Flow valve range	1 to 120 l/min at 240 kPa (35 psi)

### Fresh gas compensation

Flow compensation range	200 ml/min to 15 l/min
Gas composition	O <sub>2</sub> , N <sub>2</sub> O, Air, anesthetic agents

### Pressure

Patient airway pressure range	-20 to +120 cmH <sub>2</sub> O, +/- 1 cmH <sub>2</sub> O resolution
High pressure alarm set range	12 to 100 cmH <sub>2</sub> O, 1 cm increment
Sustained pressure alarm range	6 to 30 cmH <sub>2</sub> O, 1 cm increment
Display range	-20 to 120 cmH <sub>2</sub> O

### Volume

Tidal volume display range	0 to 9999 ml, 1 ml resolution
Setting range	20 to 1500 ml
Minute volume	0.0 to 99.9 liters, 0.1 liter resolution
Breath rate	4 to 100 bpm (non-spontaneous) 2 to 60 bpm (spontaneous) 1 bpm resolution
Volume sensor type	Variable flow orifice

### Oxygen

Display range	0 to 110% O <sub>2</sub>
Display resolution	1% increments
Sensor type	Galvanic fuel cell
Measurement range	0 to 100% O <sub>2</sub>
Measurement accuracy	Better than $\pm 3\%$ of full scale
Cell response time	35 seconds Note: Response time of cell and adapters is measured using the test method described in ISO 7767 (1997).
Low O <sub>2</sub> alarm range	18% to 99%
High O <sub>2</sub> alarm setting	19% to 100% or Off Note: Low O <sub>2</sub> limit may not be set above high O <sub>2</sub> limit. High O <sub>2</sub> limit may not be set below the low O <sub>2</sub> limit.
Expected cell life	Four months of shelf life (23°C room air) and one year of normal operation.

## Ventilator accuracy data

The following accuracy data are based on patient conditions and settings described in ASTM F1101. The ventilator is assumed to be operating in volume mode. For the following to be true, the ventilator is operating with 100 percent oxygen in the breathing system; or it is connected to an anesthesia gas analyzer. If the ventilator is operating without being connected to an anesthesia gas analyzer, additional errors may occur as described in the gas composition chart.

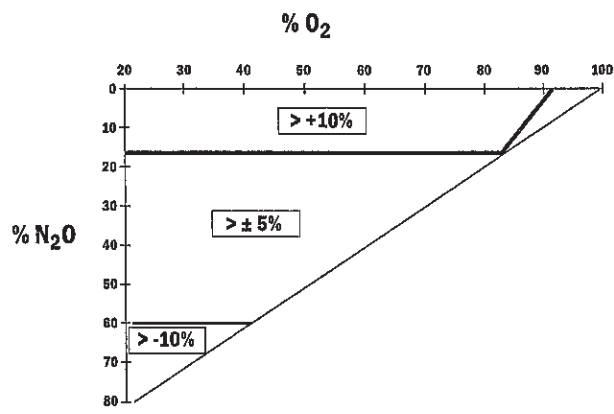
The minimum detectable breath size is 5.0 ml.

### Delivery accuracy

Volume delivery accuracy	greater than 210 ml tidal volume - accuracy better than 7%
	less than 210 ml but greater than 60 ml tidal volume - accuracy better than 15 ml
	less than 60 ml tidal volume - accuracy better than 10 ml
Volume monitoring accuracy	greater than 210 ml tidal volume - accuracy better than 9%
	less than 210 ml but greater than 60 ml tidal volume - accuracy better than 18 ml
	less than 60 ml tidal volume - accuracy better than 10 ml
Inspiratory pressure delivery accuracy	greater of +/- 10% or +/- 3 cmH2O
PEEP delivery accuracy	+/- 1.5 cmH2O
Pressure monitoring accuracy	greater of +/- 5% or +/- 2 cmH2O

Note: Gas composition errors may be in addition to the above normalized accuracy. When adding errors, positive errors can have the effect of nulling out negative errors.

Note: Use of anesthetic agent could affect the errors by approximately -0.95%/volume agent in normal mode.



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Figure 11-8 • Gas composition related errors

## Electronically controlled vaporizer and Aladin cassette

Electronically controlled vaporizer for delivery of five agents: halothane, isoflurane, enflurane, sevoflurane, and desflurane. The cassettes can be handled safely without excessive leakage of anesthetic agent to the environment. The electronically controlled vaporizer is calibrated using 100% O<sub>2</sub> at multiple flows.

<b>Agent setting ranges</b>	
Halothane, enflurane, isoflurane	Off, 0.2 to 5% in fresh gas flow, resolution 0.1%
Sevoflurane	Off, 0.2 to 8% in fresh gas flow, resolution 0.1%
Desflurane	Off, 1 to 18% in fresh gas flow, resolution 0.2%
<b>Accuracy</b>	
Halothane, enflurane, isoflurane, and sevoflurane in typical operating conditions. Fresh gas flow range 1 to 10 l/min. Ambient temperature 18 to 25°C.	±10% of setting or ±0.2% v/v, whichever is the greatest
Halothane, enflurane, isoflurane, and sevoflurane in other operating conditions. Fresh gas flow range 0.2 to 10 l/min. Ambient temperature 10 to 35°C.	±20% of setting or ±0.4% v/v, whichever is the greatest
Desflurane in typical operating conditions. Fresh gas flow range 1 to 10 l/min. Ambient temperature 18 to 25°C.	±10% of setting or ±0.5% v/v, whichever is the greatest
Desflurane in other operating conditions. Fresh gas flow range 0.2 to 10 l/min. Ambient temperature 10 to 35°C.	±20% of setting or ±1% v/v, whichever is the greatest
<p>Note: Sevoflurane concentrations above 5% may not be reached if the ambient temperature is below 18°C and the fresh gas flow is above 5 l/min.</p> <p>Note: For Aladin<sub>2</sub> desflurane, if not operating in enhanced temperature sensing mode, the agent output accuracy claims above may not be met using high fresh gas flows and high concentration settings.</p> <p>Note: Sevoflurane and desflurane concentration at high fresh gas flows (greater than 5 l/min) and high concentration settings (sevoflurane greater than 5%, desflurane greater than 12%) will decline after some minutes of use. The rate of decline will increase with higher setting, higher fresh gas flow, and lower temperature.</p> <p>Note: The effect of the fresh gas composition and back pressure on the agent concentration are included in the accuracy specifications.</p> <p>Note: Ambient pressure does not affect output accuracy. The system delivers the same %V/V within the specified altitude range.</p>	
<b>Response time</b>	
To 90% of step; measured at fresh gas outlet	Less than 7 seconds at fresh gas flow of 2 l/min

**Aladin<sub>2</sub> cassettes**

<b>Filling</b>	
Filling system	Easy-Fil: Adapter filler system for isoflurane, enflurane, and sevoflurane. Quick-Fil: Filler system compatible to Abbot's system for sevoflurane. Saf-T-Fil: Filler system compatible to the Datex-Ohmeda Saf-T-Fil bottle for desflurane.
Filling speed	greater than 2 ml/s
Overfilling protection	Overfilling prevention systems built into the cassettes.

<b>Liquid capacity</b>	<b>Enf, Iso, Sev</b>	<b>Des</b>
Maximum	220 ml	240 ml
Normal fill when indicator shows empty	125 ml (residual volume 95 ml)	140 ml (residual volume 100 ml)

<b>Cassette</b>	
Empty weight	2.8 kg
Height	7 cm
Depth	24 cm
Width	14 cm

**Aladin cassettes**

<b>Filling</b>	
Filling system	Adapter filling: Rectangular keyed adapter filler system for halothane, isoflurane, enflurane, and sevoflurane. Quick-fil: filler system compatible to abbot's system for sevoflurane. Cylindrical keyed adapter: Filler system compatible to the Datex-Ohmeda Saf-T-Fil bottle for desflurane.
Filling speed	greater than 2 ml/s
Overfilling protection	Overfilling prevention systems built into the cassettes.
<b>Liquid capacity</b>	
Maximum	250 ml
Normal fill when indicator shows empty	150 ml (residual volume 100 ml)
<b>Cassette</b>	
Empty weight	2 kg: enflurane, isoflurane, sevoflurane with keyed filler. 2.5 kg: halothane with keyed filler, sevoflurane with Quik-Fil. 3 kg: desflurane.
Height	7 cm
Depth	23 cm
Width	14 cm 16 cm with keyed filler

## Electromagnetic compatibility (EMC)

**WARNING** Changes or modifications to this equipment not expressly approved by the manufacturer could cause EMC issues with this or other equipment. Contact the manufacturer for assistance. This device is designed and tested to comply with applicable regulations regarding EMC as follows.

⚠ Use of portable phones or other radio frequency (RF) emitting equipment (that exceed electromagnetic interference levels specified in IEC 60601-1-2) near the system may cause unexpected or adverse operation. Monitor operation when RF emitters are in the vicinity.

⚠ Use of other electrical equipment on or near this system may cause interference. Verify normal operation of equipment in the system before use on patients.

### Guidance and manufacturer's declaration - electromagnetic emissions

The system is suitable for use in the specified electromagnetic environment. The customer and/or the user of the system should assure that is used in an electromagnetic environment as described below.

Emissions test	Compliance	Electromagnetic environment guidance
RF emissions CISPR 11	Group 1	The system uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The system is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

## Guidance and manufacturer's declaration - electromagnetic immunity

The system is suitable for use in the specified electromagnetic environment. The customer and/or the user of the system should assure that it is used in an electromagnetic environment as described below.

### Power immunity

Immunity test	IEC 60601-1-2 test Level	Compliance level	Electromagnetic environment guidance
Electrostatic discharge (ESD) IEC 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output lines	± 2 kV for power supply lines ± 1 kV for input/output lines	Mains power quality should be that of a typical commercial and/or hospital environment.
Surge IEC 61000-4-5	± 1 kV differential mode ± 2 kV common mode	± 1 kV differential mode ± 2 kV common mode	Mains power quality should be that of a typical commercial and/or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5% $U_T$ (>95% dip in $U_T$ ) for 0.5 cycle 40% $U_T$ (60% dip in $U_T$ ) for 5 cycles 70% $U_T$ (30% dip in $U_T$ ) for 25 cycles <5% $U_T$ (>95% dip in $U_T$ ) for 5 sec.	<5% $U_T$ (>95% dip in $U_T$ ) for 0.5 cycle) 40% $U_T$ (60% dip in $U_T$ ) for 5 cycles 70% $U_T$ (30% dip in $U_T$ ) for 25 cycles <5% $U_T$ (>95% dip in $U_T$ ) for 5 sec.	Mains power quality should be that of a typical commercial and/or hospital environment. If the user of the system requires continued operation during power mains interruptions, it is recommended that the system be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8 3	3 A/m	3 A/m	If display distortion or other abnormalities occur, it may be necessary to position the Anesthetic System further from sources of power frequency magnetic fields or to install magnetic shielding. The power frequency magnetic field should be immersed in the intended installation location to assure that it is sufficiently low.

Note:  $U_T$  is the AC mains voltage before application of the test level.



## Radiated immunity

Immunity test	IEC 60601-1-2 test Level	Compliance level	Electromagnetic environment guidance Recommended separation distance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz outside ISM bands	3 Vrms (V1)	Portable and mobile RF communications equipment should be used no closer to any part of the system, including cables, than the recommended separation distance calculated from the equation appropriate for the frequency of the transmitter. $D=3.5\sqrt{P}$
	10 Vrms 150 kHz to 80 MHz in ISM bands	10 Vrms (V2)	$D=12\sqrt{P}$
Radiated RF IEC 61000-4-6	10 V/m 80 MHz to 2.5 GHz	10 V/m (E1)	$D=1.2\sqrt{P}$ 80 MHz to 800 MHz $D=3.5\sqrt{P}$ 800 MHz to 2.5 GHz Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and D is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than the compliance level in each frequency range.

The ISM (industrial, scientific and medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz.

The compliance levels in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz are intended to decrease the likelihood that a portable communications device could cause interference if it is inadvertently brought into patient areas. For this reason, an additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in these frequency ranges.

Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the system is used exceeds the applicable RF compliance level above, the system should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the system.

Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 1 V/m.

Note: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.



## Recommended separation distances

The system is intended for use in the electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the system can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the system as recommended below, according to the maximum power of the communications equipment.

Rated maximum output power of transmitter watts (W)	Separation distance in meters (m) according to frequency of the transmitter			
	150 kHz to 80 MHz Outside ISM bands $D = \left[ \frac{3.5}{V1} \right] \sqrt{P}$	150 kHz to 80 MHz In ISM bands $D = \left[ \frac{12}{V2} \right] \sqrt{P}$	80 MHz to 800 MHz $D = \left[ \frac{1.2}{E1} \right] \sqrt{P}$	800 MHz to 2.5 GHz $D = \left[ \frac{2.3}{E1} \right] \sqrt{P}$
0.01	0.35	1.2	0.12	0.23
0.1	1.1	3.8	0.38	0.73
1	3.5	12	1.2	2.3
10	11	38	3.8	7.3
100	35	120	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance D in meters (m) can be determined using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

Note 1: At 80 MHz to 800 MHz the separation distance for the higher frequency range applies.

Note 2: The ISM (Industrial, Scientific and Medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz.

Note 3: An additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2.5 GHz to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas.

Note 4: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

## Electrical safety

**WARNING** The system provides connections for items such as printers, visual displays and hospital information networks (only connect items that are intended to be part of the system). When these items (non-medical equipment) are combined with the system, these precautions must be followed:

- Do not place items not approved to IEC 60601-1 closer than 1.5 m to the patient.
- All items (medical electrical equipment or non-medical electrical equipment) connected to the system by a signal input/signal output cable must be supplied from an AC power source which uses a separating transformer (in accordance with IEC 60989) or be provided with an additional protective earth conductor.
- If a portable multiple socket outlet assembly is used as an AC power source, it must comply with IEC 60601-1. The assembly must not be placed on the floor. Using more than one portable multiple socket outlet assembly is not recommended. Using an extension cord is not recommended.

Do not connect non-medical electrical equipment directly to the AC outlet at the wall instead of an AC power source which uses a separating transformer. Doing so may increase enclosure leakage current above levels allowed by IEC 60601-1 in normal conditions and under single-fault conditions. This may cause an unsafe electrical shock to the patient or operator.

After connecting anything to these outlets, conduct a complete system leakage current test (according to IEC 60601-1).

**WARNING** An operator of the medical electrical system must not touch non-medical electrical equipment and the patient simultaneously. This may cause an unsafe electrical shock to the patient.

## IEC 60601-1 Classification

This system is classified as follows.

- Class I Equipment.
- Type B Equipment.
- Type BF Equipment.
- Ordinary Equipment.
- Not for use with flammable anesthetics.
- Continuous operation.

## Standards

Devices used with this anesthesia system shall comply with the following standards where applicable:

- Breathing system and breathing system components ISO 8835-2.
- Anesthetic vapor delivery devices ISO 8835-4.
- Anesthetic agent monitors ISO 11196.
- Oxygen monitors ISO 7767.
- Carbon dioxide monitors ISO 9918.
- Exhaled volume monitors IEC 60601-2-13.

## System components

### Integral

This anesthesia system contains the following integral components, monitoring devices, alarm systems, and protection devices that comply with European, international, and national standards:

- Breathing system pressure-measuring device.
- Airway pressure-limitation device.
- Exhaled-volume monitor.
- Breathing system integrity alarm.
- Breathing system continuing-pressure alarm.
- O<sub>2</sub> monitor (optional O<sub>2</sub> cell).
- Anesthesia ventilator.
- Breathing system.

### Not integral

These devices are not integral to this anesthesia system:

- CO<sub>2</sub> monitor.
- Anesthetic agent monitor.
- O<sub>2</sub> monitor.

### WARNING

European, international, and national standards require the following monitoring be used with this system:

- Exhaled volume monitoring.
- O<sub>2</sub> monitoring.
- CO<sub>2</sub> monitoring.
- Anesthetic agent monitoring be used when anesthetic vaporizers are in use.

When adding devices to the anesthesia system, follow the installation instructions provided by the device manufacturer. Whoever adds individual devices to the anesthesia system shall provide instructions on how to enable the individual devices. For example, a preoperative checklist.

# 12 Super User Mode

**In this section**

Install/Service menu .....	12-2
Menus .....	12-4

## Install/Service menu

**WARNING** Do not enter the *Install/Service* menu when a patient is connected to the system. Gas flow will cease, and the system must be powered down in order to restart gas flow.

**Important** Changes made to the super user mode affect the system configuration. All changes made are permanent and preserved until changed again.

Several settings can be changed in the super user mode. These changes should only be made by the person responsible for the configuration of the system.

The Installation and Service menus are password protected. Go to **Main Menu - Screen Setup - Install/Service**. Enter the password 16, 4, 34.

The system must be turned off to exit the *Install/Service* menu.

Install/Service - Page 1		
Cumulative Gas Usage		
Show Alarm Limits	Yes	Yes, No
Fresh Gas Controls	O2%	O2%, Flow, User
VCV Cardiac Bypass	No	Yes, No
External Gas Monitor	No	Yes, No
Volume Apnea Setup		
Time and Date		
Factory Defaults		
Install/Service - Page 2		
Exit		

Install/Service - Page 2	
Trends Setup	
Colors and Units	
Parameter Settings	
Page Setup	
Case Defaults	
Installation	
Service	
Install/Service - Page 1	
Exit	

## Using super user mode

Select a menu item showing the submenu symbol to go to the corresponding submenu. Access the **Cumulative Gas Usage**, **Volume Apnea Setup**, **Time and Date**, **Trends Setup**, **Colors and Units**, **Parameter Settings**, **Page Setup**, and **Case Defaults** menus through the **Install/Service** menu.

Set **Show Alarm Limits** to **Yes** to display the alarm limits next to the measured values on the normal screen.

Set the default style for the fresh gas controls. Set to **O2%** for O2% and total flow controls. Set to **Flow** for individual gas flow controls. Set to **User** to allow the user to select the flow control style through the **Screen Setup** menu.

Set the **VCV Cardiac Bypass** to **Yes** to enable alveolar support during cardiac bypass. This menu item is only available on systems with the VCV Cardiac Bypass option installed.

Set the **External Gas Monitor** to **Yes** only if the system uses a stand-alone monitor for O2, agent, and CO2. Selecting **Yes** disables the O2 limit alarms and the 'O2 monitoring not connected' alarm when there is not O2 cell or airway module detected in the system. The 'AA, CO2 monitoring not connected' alarm is also disabled.

Factory defaults are the settings installed by the manufacturer. These cannot be changed. Select **Factory Defaults** to return the system to the factory defaults.

**Installation** is a password-protected menu selection.

**Service** is a password-protected menu selection.

## Menus

Not all menu items are available depending on the system configuration. Inactive menu items are grayed out and are not selectable.

Menu selections shown are the factory default values. The options are listed to the right of the menu shown.

### Cumulative gas usage

View the total system fresh gas usage since the last reset or reset the gas usage to 0 through the **Cumulative Usage** menu.

Cumulative Usage
Reset Usage
Desflurane
Enflurane
Halothane
Isoflurane
Sevoflurane
O2 (*1000 l)
Air (*1000 l)
N2O (*1000 l)
Previous Menu

To reset the gas usage:

1. From **Install/Service - Page 1**, select **Cumulative Gas Usage**.
2. **Reset Usage** is selected by default. Push the ComWheel to confirm the reset.
  - Cumulative gas usage totals are set to 0.
  - Cumulative agent usage totals are set to 0.
  - The current date and time shows.
3. Select **Previous Menu** to return to the **Install/Service - Page 1**.



## Volume apnea setup

Use the **Volume Apnea Setup** menu to enable or disable the user's ability to turn the volume apnea alarms off during manual ventilation.

Set the **Volume Apnea Selection** to **Enable** to allow the user to turn the volume apnea alarm on or off from the **Start Case** menu and the **Alarm Setup** menu. Set the **Volume Apnea Selection** for each case type default through this menu.

Set the **Volume Apnea Selection** to **Disable** to set the volume apnea alarms to be always on during manual ventilation. When set to **Disable**, the **Volume Apnea** menu selection is not available from the **Start Case** menu and the **Alarm Setup** menu.

Menu selection names shown in all capital letters are configured from the **Case Defaults** menu

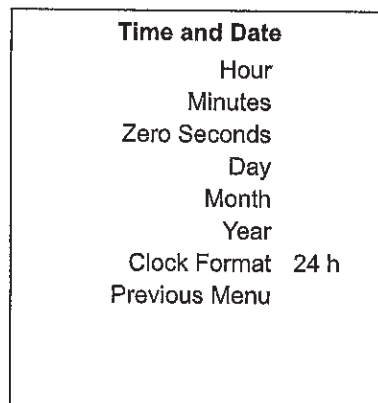
Volume Apnea Setup		
Volume Apnea Selection	Enable	Enable, Disable
Case Defaults:		
ADULT		
Volume Apnea	Off	On, Off
PEDIATRIC		
Volume Apnea	Off	On, Off
LOCAL		
Volume Apnea	Off	On, Off
CUSTOM 1		
Volume Apnea	Off	On, Off
Previous Menu		

To set the volume apnea for each case default:

1. From **Install/Service - Page 1**, select **Volume Apnea Setup**.
2. Set **Volume Apnea Selection** to **Enable**.
3. Set the Volume Apnea for each case default.
4. Select **Previous Menu** to return to the **Install/Service - Page 1**.

## Setting time and date

Use the **Time and Date** menu to set the time and date. The **Hour** field is dependent on the **Clock Format** setting. The **Clock Format** can be set to a 12 or 24 hour format.

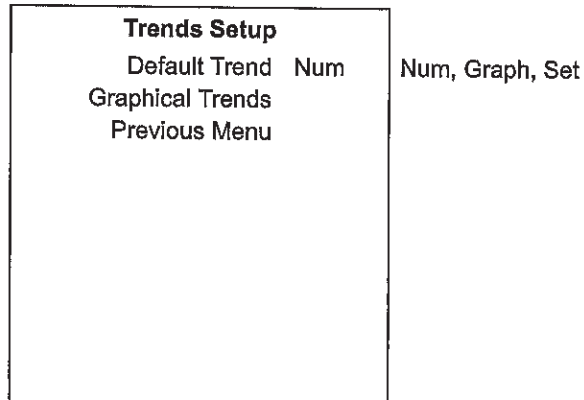


To set the time and date or change the clock format:

1. From **Install/Service - Page 1**, select **Time and Date**.
2. Select the item to change. Make the change.
  - The clock format factory default is 24 hours.
  - When the clock format is set to 12, the hour selections are in '1a' format for a.m. and '1p' format p.m.
  - When the clock format is set to 24, the hour selections are 0 to 23 in one hour increments.
3. Select **Previous Menu** to return to **Install/Service - Page 1**.

**Trends setup**

Use the **Trends Setup** menu to set the default trend that shows in the right window on the user **Trends** menu. Access the **Graphical Trends** menu from the **Trends Setup** menu.

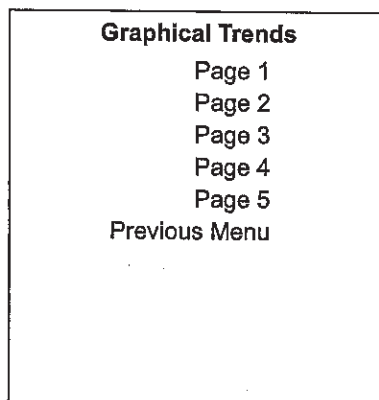


To change the **Default Trend** setting:

1. From **Install/Service - Page 2**, select **Trends Setup**.
2. Select **Default Trend**.
3. Set the trend type.
  - **Num** shows the numerical trends.
  - **Graph** shows the graphical trends.
  - **Set** shows the trends for the settings.
4. Select **Previous Menu** to return to the **Install/Service - Page 2**.

**Setting graphical trends pages**

Use the **Graphical Trends** menu to configure the graphical trends pages that show in the right window on the user **Trends** menu.



<b>Page 1</b>	
Field 1	Pres
Field 2	TVexp
Field 3	CO2
Previous Menu	

The available selections for Field 1, Field 2, and Field 3 are the same for each field on each page. Selections are Off, rr+co2, Pres, MVexp, CO2, O2, Bal, AA1, AA2, N2O, MAC, TVexp, Pmean, Spont, Compl, VO2. The default settings for Field 1, Field 2, and Field 3 of each page show in the table.

Default settings for Fields on each Page menu					
	Page 1	Page 2	Page 3	Page 4	Page 5
Field 1	Pres	O2	AA2	Bal	rr+co2
Field 2	TVexp	N2O	N2O	MAC	Compl
Field 3	CO2	AA1	MAC	MVexp	Off

To set the fields for each page view:

1. From *Install/Service - Page 2*, select *Trends Setup - Graphical Trends*.
2. Select the page to set.
3. Select the field to set. Set the value.
4. Select *Previous Menu* to return the *Graphical Trends* menu.
5. Repeat for each page.
6. Select *Previous Menu* to return the *Graphical Trends* menu.
7. Continue selecting *Previous Menu* to return to the desired menu.

## Setting colors and units

Set the units of the parameters through the **Colors and Units** menu. Access the **Colors** menu through **Colors and Units** menu.

Colors and Units		
Colors		
Patient Weight	kg	kg, lb
CO2	%	%, kPa, mmHg
Gas Supply Pressure	kPa	psi, kPa, bar
Paw	cmH2O	kPa, hPa, cmH2O, mmHg, mbar
Previous Menu		

To set the units:

1. From **Install/Service - Page 2**, select **Colors and Units**.
2. Select the item to change. Make the change.
3. Select **Previous Menu** to return to **Install/Service - Page 2**.

## Setting colors

Set the colors of the parameter waveform information, digit fields, and trends through the **Colors** menu.

Colors		
Paw	Yellow	Yellow, White, Green, Red, Blue
Flow	Green	Yellow, White, Green, Red, Blue
Resp	White	Yellow, White, Green, Red, Blue
CO2	White	Yellow, White, Green, Red, Blue
Previous Menu		

To set the colors:

1. From **Install/Service - Page 2**, select **Colors and Units - Colors**.
2. Select the item to change. Make the change.
3. Select **Previous Menu** to return to the **Colors and Units** menu.
4. Continue selecting **Previous Menu** to return to the desired menu.

## Parameter settings

Set the volume conditions and the CO2 humidity compensation through the **Parameter Settings** menu. Set the volume calculation conditions to be based on ATPD (ambient temperature and pressure, dry humidity conditions) or BTPS (body temperature, ambient pressure, saturated humidity condition). Set the humidity compensation type in CO2 partial pressure values to wet or dry.

Parameter Settings	
TV Based on	ATPD ATPD, BTPS
CO2 Numbers	Dry Dry, Wet
Previous Menu	

## Page Setup

Set the preset normal screen layouts through the **Page Setup** menu. Menu selection names shown in all capital letters are configured from the corresponding submenu.

Page Setup	PAW TUBES
Edit/View Page:	Back
Available Pages	Name PAW TUBES
PAW TUBES	Waveform Field 1 Paw
LOOPS	Waveform Field 2 Flow
BIG WAVE	Waveform Field 3 CO2
LOCAL	Digit Field AA
Previous Menu	Split Screen Paw

The default settings for each page type show in the following table. The fields for each page type have the same selections available:

- Waveform Fields are AA, CO2, Flow, Paw, Off.
- Digit Field is Supply, Flow, AA.
- Split Screen is None, Gas, Trend, Spiro, Metab, Paw.

Default settings for default page views				
	PAW TUBES	LOOPS	BIG WAVE	LOCAL
Name	PAW TUBES	LOOPS	BIG WAVE	LOCAL
Waveform Field 1	Paw	Paw	Paw	Off
Waveform Field 2	Flow	Flow	Off	Off
Waveform Field 3	CO2	CO2	CO2	CO2
Digit Field	AA	AA	Flow	Supply
Split Screen	Paw	Spiro	Gas	None

To change the normal screen for the preset layout:

1. From *Install/Service - Page 2*, select *Page Setup*.
  - **Edit/View Page:** is selected.
  - An arrow to the right of the page name indicates the selected page.
2. Select the page name to enter the adjustment window.
3. To change the name of the page, select **Name**.
  - Select **Clear** to remove the existing name.
  - Select up to 10 characters from the list.
  - Select Delete to delete a character.
  - Select **Save** to save the name and close the selection window.
  - Select Reset to return the name to the factory default name.
  - When the 10 character maximum is reached, the name is automatically saved. The selection window closes.
4. Select another item to change. Make the change.
5. When done, select **Back** to return to the *Page Setup* menu.
6. Select **Previous Menu** to return to *Install/Service - Page 2*.

## Configuring case defaults

Set the user selectable default case types that show in the user's **Start Case** menu through the **Case Defaults** menu. The **Set to Last Case** selection is only available on submenus if a case has occurred.

Case Defaults	ADULT
Edit/View Default:	Back
Available Defaults:	Set to Last Case
ADULT	Name ADULT
PEDIATRIC	Patient and Sensor Type Adult
LOCAL	Patient Weight 70 kg
CUSTOM 1	Patient Age 40 y
Previous Menu	Other Gas Air
	Circuit Circle
	Data Source Vent
	Vent Mode VCV
	-More-

To change the settings for the default case types:

1. From **Install/Service - Page 2**, select **Case Defaults**.
  - **Edit/View Default:** is selected.
  - An arrow to the right of the default case name indicates the selected case name.
2. Select the case name to enter the adjustment window.
3. To change the name of the case, select **Name**.
  - Select **Clear** to remove the existing name.
  - Select up to 10 characters from the list.
  - Select **Delete** to delete a character.
  - Select **Save** to save the name and close the selection window.
  - Select **Reset** to return the name to the factory default name.
  - When the 10 character maximum is reached, the name is automatically saved. The selection window closes.
4. Select another item to change. Make the change.
5. When finished setting the defaults, select **Confirm**.
6. Repeat to set the defaults for the other default case types.
7. Select **Previous Menu** to return to **Install/Service - Page 2**.



Each case type has multiple settings. The default settings for the default case types show in the following table. Values in bold are different from the default case type **ADULT**. A \* indicates that the setting is not available for the default ventilation mode. Use the empty columns to write in facility changes.

**Note** VCV ADULT settings are used as the default if the system does not have the optional ventilation mode shown.

Default settings for default case types								
	ADULT		PEDIATRIC		LOCAL		CUSTOM 1	
Name	ADULT		PEDIATRIC		LOCAL		CUSTOM 1	
Patient and Sensor Type	Adult		Pedi		Adult		Adult	
Patient Weight	70 kg		<b>18 kg</b>		70 kg		70 kg	
Patient Age	40 y		<b>5 y</b>		40 y		40 y	
Other Gas	Air		Air		Air		Air	
Circuit	Circle		Circle		Circle		Circle	
Data Source	Vent		Vent		Vent		Vent	
Vent Mode	VCV		<b>PCV</b>		VCV		VCV	
TV	500		*		500		500	
RR	12		*		12		12	
I:E	1:2		*		1:2		1:2	
Tpause	Off		*		Off		Off	
PEEP	Off		*		Off		Off	
Pmax	40		*		40		40	
Pinsp	*		5		*		*	
RR	*		12		*		*	
I:E	*		1:2		*		*	
PEEP	*		Off		*		*	
Pmax	*		40		*		*	
Rise Rate	*		Auto		*		*	
O2 %	100		100		100		100	
Total Flow	6.00		6.00		<b>0.20</b>		6.00	
Sweep Speed	Fast		Fast		Fast		Fast	
Split Screen	Paw		<b>Gas</b>		<b>Gas</b>		<b>Gas</b>	
Waveform Field 1	Paw		Paw		Paw		Paw	
Waveform Field 2	Flow		Flow		Flow		Flow	
Waveform Field 3	CO2		CO2		CO2		CO2	
Digit Field	AA		AA		AA		AA	
Auto MV Limit	Off		Off		Off		Off	
Alarm Volume	3		3		1		3	
MV/TV Alarms	On		On		<b>Off</b>		On	
Volume Apnea	On		On		<b>Off</b>		On	
MV High	10.0		10.0		<b>Off</b>		10.0	
MV Low	2.0		2.0		<b>Off</b>		2.0	
TV High	1000		1000		<b>Off</b>		1000	
TV Low	Off		Off		Off		Off	
RR High	Off		Off		Off		Off	
RR Low	Off		Off		Off		Off	
EtCO2 High	8.0		8.0		8.0		8.0	
EtCO2 Low	3.0		3.0		3.0		3.0	
FICO2 High	Off		Off		Off		Off	
FIO2 High	Off		Off		Off		Off	
FIO2 Low	21		21		21		21	
EtO2 High	Off		Off		Off		Off	
EtO2 Low	Off		Off		Off		Off	
FIISO High	5		5		5		5	

Aisys

Default settings for default case types								
	ADULT		PEDIATRIC		LOCAL		CUSTOM 1	
FIISO Low	Off		Off		Off		Off	
EtISO High	Off		Off		Off		Off	
EtISO Low	Off		Off		Off		Off	
FISEV High	8		8		8		8	
FISEV Low	Off		Off		Off		Off	
EtSEV High	Off		Off		Off		Off	
EtSEV Low	Off		Off		Off		Off	
FIDES High	15		15		15		15	
FIDES Low	Off		Off		Off		Off	
EtDES High	Off		Off		Off		Off	
EtDES Low	Off		Off		Off		Off	
FIENF High	5		5		5		5	
FIENF Low	Off		Off		Off		Off	
EtENF High	Off		Off		Off		Off	
EtENF Low	Off		Off		Off		Off	
FIHAL High	5		5		5		5	
FIHAL Low	Off		Off		Off		Off	
EtHAL High	Off		Off		Off		Off	
EtHAL Low	Off		Off		Off		Off	

# 13 Vaporizer cassettes

<b>In this section</b>	Vaporizer .....	13-2
	Installing cassettes .....	13-6
	Cleaning .....	13-6
	Draining cassettes .....	13-6
	Draining halothane cassettes .....	13-7
	Filling Aladin <sub>2</sub> cassettes .....	13-7
	Filling Aladin cassettes .....	13-12

## Vaporizer

The electronically controlled vaporizer consists of the internal electronic control unit and the Aladin agent cassette. The agent cassettes are color coded, have indexed filling ports, and are magnetically coded for each agent. The electronic control unit governs the flow through the agent cassette and the agent concentration in the fresh gas flow.

Both the Aladin<sub>2</sub> and the Aladin cassettes can be used on this system.

Remove the cassette from the active bay when not administering anesthetic agent. Store cassettes in the cassette bay when they are not in use. Store the cassettes and agent at the same temperature as the system.

### Aladin<sub>2</sub> cassette variants

All Aladin<sub>2</sub> cassettes have electronic agent level sensing. The agent level shows graphically in the agent settings area of the screen. If the electronic agent level sensing is not functioning, the agent level unknown symbol shows on the screen. In this case, refer to the liquid level indicator.

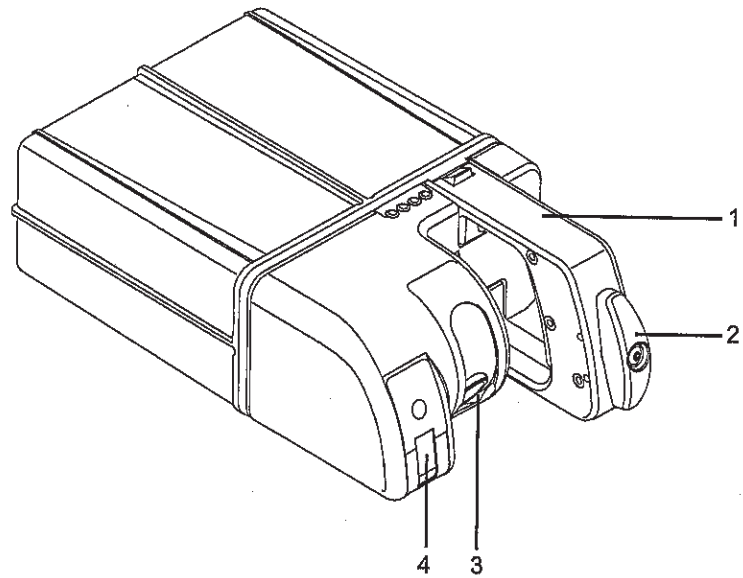
Some Aladin<sub>2</sub> cassettes have internal temperature sensing. If available, an enhanced temperature sensing symbol shows on the front of the cassette and the symbol shows in the agent settings area of the screen.

There are three types of Aladin<sub>2</sub> cassette filler systems. Enflurane, and isoflurane use a color-coded, Easy-Fil mechanism. Sevoflurane cassettes are available with a color-coded, Easy-Fil or Quik-Fil mechanism. The desflurane cassettes have a filling mechanism that is compatible with Saf-T-Fil desflurane bottles.

**Note** Sevoflurane Quik-Fil Aladin<sub>2</sub> cassettes are not available in all countries.

Anesthetic agent	Filling system	Color code
Enflurane	Easy-Fil	Orange
Isoflurane	Easy-Fil	Purple
Sevoflurane	Easy-Fil or Quik Fil	Yellow
Desflurane	Compatible with Saf-T-Fil	Blue

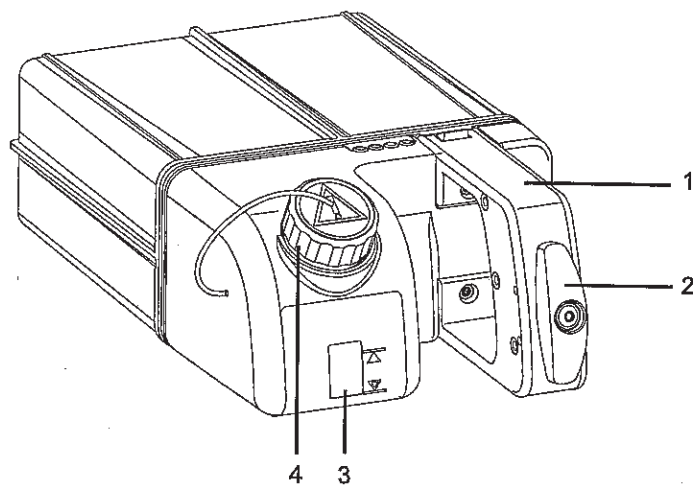
## 13 Vaporizer cassettes



AB.60.050

1. Handle with release trigger
2. Lock
3. Agent filling port
4. Liquid level indicator

Figure 13-1 • Aladin<sub>2</sub> desflurane cassette with Saf-T-Fil system



AB.60.038

1. Handle with release trigger
2. Lock
3. Liquid level indicator
4. Agent filling port

Figure 13-2 • Aladin<sub>2</sub> cassette for enflurane, isoflurane, and sevoflurane with Easy-Fil or Quik-Fil system

### Aladin cassette variants

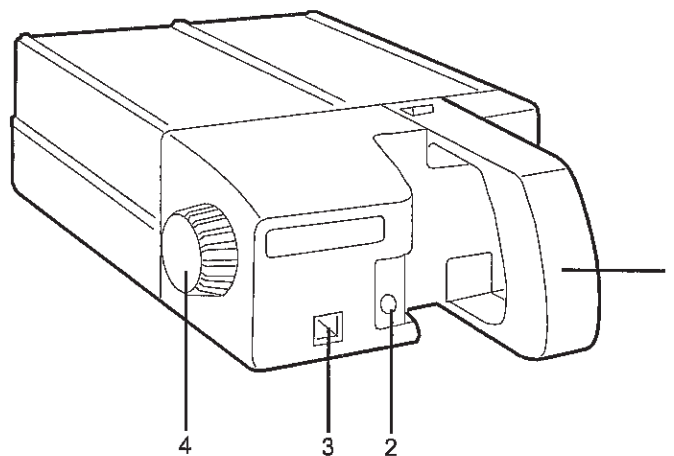
Aladin desflurane cassettes have electronic agent level sensing. No other Aladin cassettes have electronic level sensing. The agent level shows graphically in the agent settings area of the screen. If the electronic agent level sensing is not functioning, the agent level unknown symbol shows on the screen.

When electronic level sensing is unavailable for an Aladin cassette, the agent level unknown symbol shows in the agent settings area of the screen. In this case, refer to the liquid level indicator.

There are three types of Aladin cassette filler systems. Halothane, enflurane, and isoflurane use color-coded, keyed fillers. Sevoflurane cassettes are available with a color-coded, keyed filler or a Quik-Fil mechanism. The desflurane cassettes have a filling mechanism that is compatible with Saf-T-Fil desflurane bottles.

**Note** Sevoflurane Quik-Fil Aladin cassettes are not available in all countries.

Anesthetic agent	Filling system	Color code
Halothane	Keyed	Red
Enflurane	Keyed	Orange
Isoflurane	Keyed	Purple
Sevoflurane	Keyed or Quik Fil	Yellow
Desflurane	Compatible with Saf-T-Fil	Blue

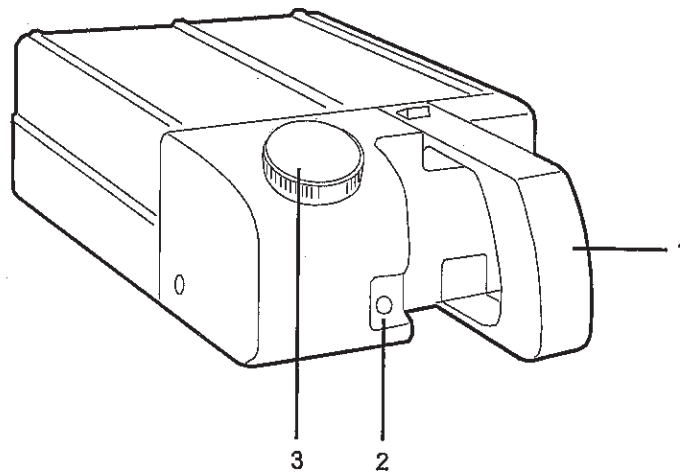


AB.60.004

1. Handle with release trigger
2. Liquid level indicator
3. Agent filling port
4. Lock and fill wheel

Figure 13-3 • Aladin cassette for halothane, enflurane, isoflurane, and sevoflurane with keyed filler system

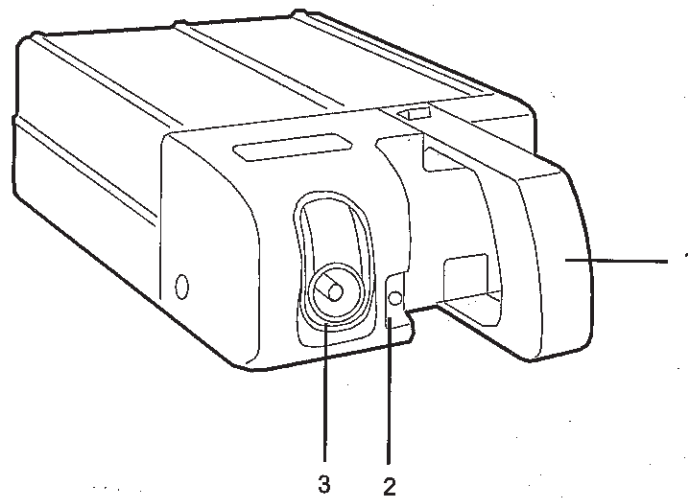
## 13 Vaporizer cassettes



AB.60.005

1. Handle with release trigger
2. Liquid level indicator
3. Agent filling port

Figure 13-4 • Aladin cassette for sevoflurane with Quik-Fil system



AB.60.003

1. Handle with release trigger
2. Liquid level indicator
3. Agent filling port

Figure 13-5 • Aladin cassette for desflurane with Saf-T-Fil compatible filler system

## Installing cassettes

1. Using the liquid level indicator check that the cassette is filled to the appropriate level.
2. If using Aladin<sub>2</sub>, unlock the cassette handle before installing it in the active bay.
3. Insert cassette into the active bay until a click is heard, ensuring the cassette is in position.
4. Turn the lock on the handle to the horizontal position (Aladin<sub>2</sub> cassettes only).
5. The cassette is properly inserted when the agent is identified on the display. Make sure that the displayed agent matches the cassette.

**Note** Store the cassettes in the cassette bay when they are not in use.

## Cleaning

Remove the cassette from the machine. Clean the cassette surface with a cloth moistened in mild soap solution.

**CAUTION** Do not wipe Aladin cassettes with alcohol or alcohol-based detergents. This may damage the surface of the cassette.

## Draining cassettes

**Note** All types of Aladin cassettes must be emptied before shipping. Package the cassettes in suitable wrapping when shipping.

1. Remove the cassette from the machine, and place it on a horizontal surface. Ensure that the valve pins on the back of the cassette do not come in contact with the machine or any other object.
2. Connect an empty bottle with the appropriate filler type to the cassette filler port and hold the connection tight.
3. Turn the cassette so that the agent flows into the bottle and wait until the cassette is empty.
4. To get the maximum amount of agent out, rock the cassette from left to right and tip it forward and back several times.
5. Remove the bottle.
6. Return the cassette to the horizontal position.
7. After draining, the cassette needs to be inserted into a machine with a high fresh gas flow and concentration set for at least 15 minutes to dry out the cassette.



## Draining halothane cassettes

The decomposition of halothane causes the release of halides, which may corrode metal components particularly in the presence of moisture. A preservative added to halothane by its manufacturers, to impede decomposition, can leave a residue which may cause cassette components to stick.

- Have the halothane cassettes drained every two weeks.
- If halothane is used infrequently, have the halothane cassette drained after use.
- Do not flow gas through the cassette to dry out the cassette.

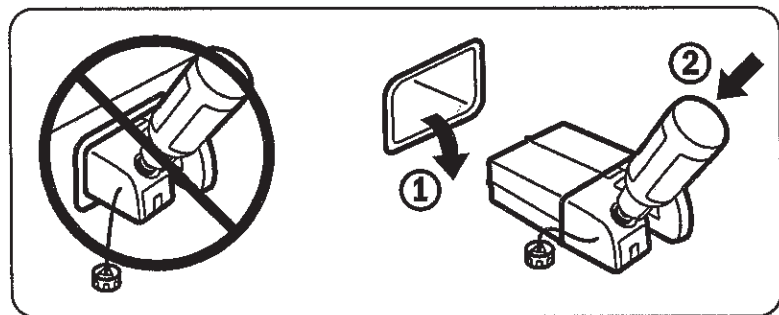
## Filling Aladin<sub>2</sub> cassettes

Remove the cassette from the machine before filling the cassette. Ensure the cassette remains in a horizontal position during filling. If the cassette is tilted, the flow of liquid is shut off to prevent overfilling.

Ensure that the valve pins on the back of the cassette do not come in contact with the machine or any other object that could depress the valve pins and let gas out of the cassette. Observe the liquid level indicator of the cassette during filling. When the liquid level reaches the full mark, stop filling.

**CAUTION** To avoid spray from anesthetic agent after filling, slowly remove the agent bottle from the filling port.

**WARNING** Always remove the Aladin cassette from the machine and put it on a horizontal surface before filling. Never try to fill a cassette while it is in the machine.

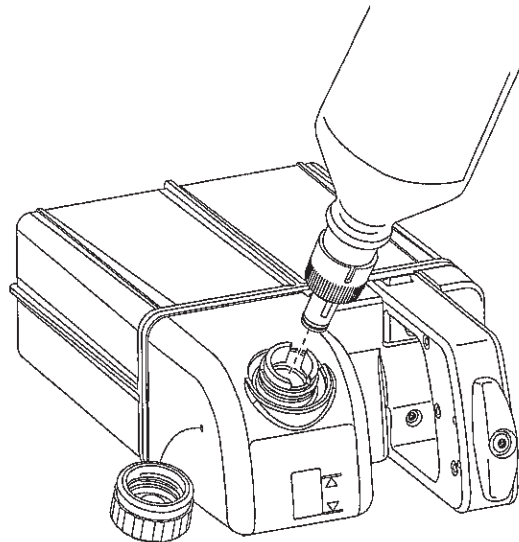


AB.60.054

## Filling with Easy-Fil system

The Easy-Fil system consists of three elements:

- The bottle collar.
- The bottle adapter.
- The agent filling port.



AB.60.040

Figure 13-6 • Aladin<sub>2</sub> cassette with Easy-Fil system

### WARNING

Do not open or press the cassette filling port or the gas connection valves with fingers or any kind of instrument. Anesthetic agent liquid or gas may squirt into the air.

1. Remove the cassette from the machine, and place it on a horizontal surface. Ensure that the valve pins on the back of the cassette do not come in contact with the machine or any other object.
2. Align the notches on the bottle adapter to the agent bottle collar, and tighten the adapter onto the bottle.

### WARNING

To avoid exposure to anesthetic agent during filling, ensure that the bottle adapter is properly connected to the bottle.

3. Remove the filling port cap from the cassette by turning the cap counterclockwise.
4. Align the bottle adapter keys with the index slots in the filling port.
5. Push the agent bottle firmly into the filling port. Let the agent flow into the cassette. Keep the agent bottle aligned with the filling port to prevent leakage while filling the cassette.
6. Watch the liquid level indicator. When the liquid level reaches the full mark, slowly remove the bottle from the filling port. Removing the bottle quickly may cause the agent to splash or squirt out of the filling port.

7. Put the cap back on the filling port.
8. Remove the bottle adapter from the anesthetic agent bottle. Put the cap back on the agent bottle.

### Filling with Quik-Fil system

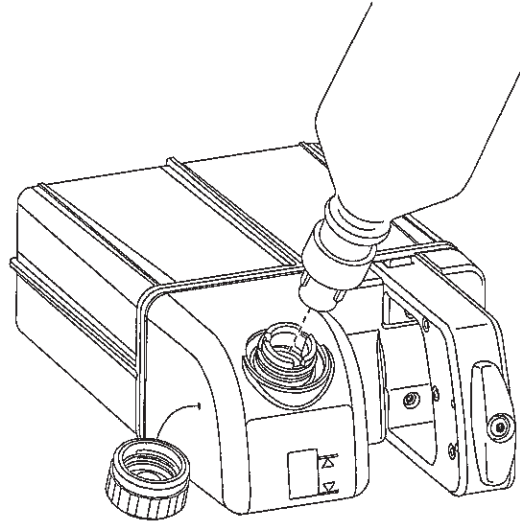


Figure 13-7 • Aladin<sub>2</sub> cassette with Quik-Fil system

**WARNING** Do not open or press the cassette filling port or the gas connection valves with fingers or any kind of instrument. Anesthetic agent liquid or gas may squirt into the air.

1. Remove the cassette from the machine, and place it on a horizontal surface. Ensure that the valve pins on the back of the cassette do not come in contact with the machine or any other object.
2. Remove the yellow protective cap from the anesthetic agent bottle. Check that the filling mechanism on the bottle is not damaged.
3. Remove the filling port cap from the cassette by turning the cap counterclockwise.
4. Align the bottle nozzle keys with the index slots in the filling port.
5. Push the agent bottle firmly into the filling port. Let the agent flow into the cassette.
6. Watch the liquid level indicator. When the liquid level reaches the full mark, slowly remove the bottle from the filling port. Removing the bottle quickly may cause the agent to splash or squirt out of the filling port.
7. Put the cap back on the filling port.
8. Put the cap back on the agent bottle.

## Filling with Saf-T-Fil bottle

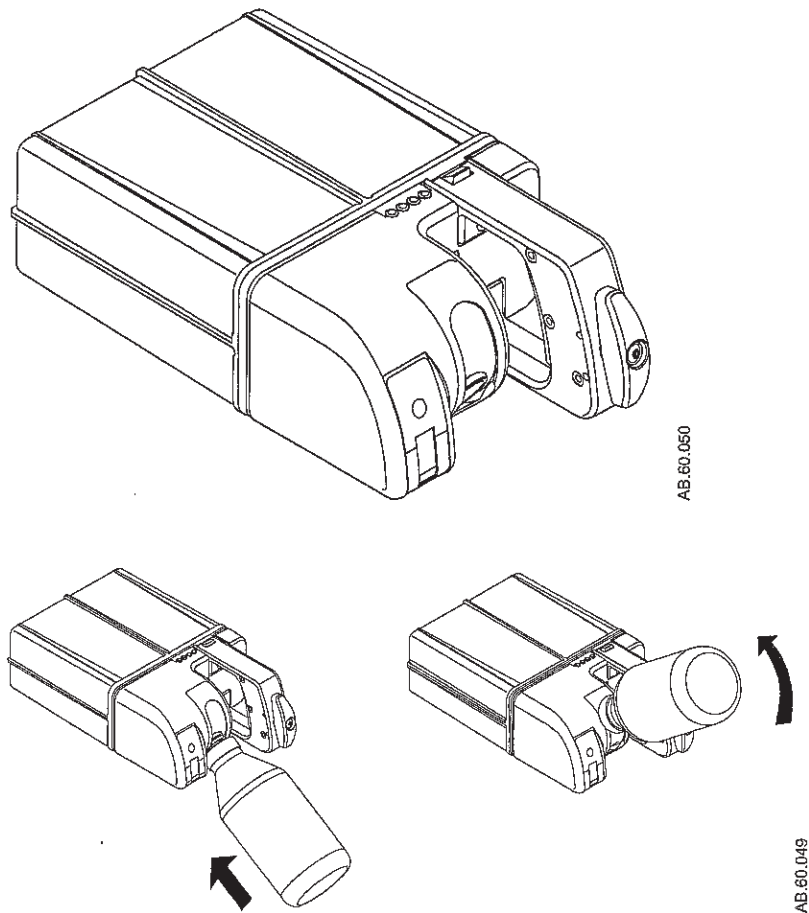


Figure 13-8 • Aladin<sub>2</sub> cassette with Saf-T-Fil mechanism

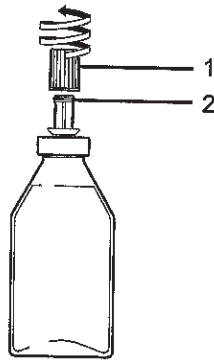
### WARNING

Do not store filled or partially filled desflurane cassettes above the normal working temperature of 35°C/95°F. Storage at high temperature may cause the overpressure valve to vent desflurane vapor into the ambient air.



Do not open or press the cassette filling port or the gas connection valves with fingers or any kind of instrument. Anesthetic agent liquid or gas may squirt into the air.

1. Remove the cassette from the machine, and place it on a horizontal surface. Ensure that the valve pins on the back of the cassette do not come in contact with the machine or any other object.
2. Remove the cap from the desflurane bottle. Check that the o-ring is correctly fitted on the bottle nozzle.



1. Bottle cap
2. O-ring

*Figure 13-9 • Removing the bottle cap*

3. Insert the nozzle into the filling port, and push the bottle firmly against the spring pressure until it stops.
4. Keep the bottle firmly inserted, and lift the bottle upwards.
5. Watch the liquid level indicator. Do not leave the bottle unattended while it is attached to the cassette.
6. When the liquid level reaches the full mark, lower the bottle to the lower stop position. Keep the bottle firmly inserted. Wait 5 seconds to allow the agent to drain from the filling port back into the bottle.
7. Slowly remove the bottle from the filling port. Removing the bottle quickly may cause the agent to splash or squirt out of the filling port.
8. Put the cap back on the agent bottle.


## Filling Aladin cassettes

Remove the cassette from the machine before filling the cassette. Ensure the cassette remains in a horizontal position during filling. If the cassette is tilted, the flow of liquid is shut off to prevent overfilling.

Ensure that the valve pins on the back of the cassette do not come in contact with the machine or any other object that could depress the valve pins and let gas out of the cassette. Observe the liquid level indicator of the cassette during filling. When the liquid level reaches the full mark, stop filling.

**CAUTION** To avoid spray from anesthetic agent after filling, slowly remove the agent bottle from the filling port.

**WARNING** Always remove the Aladin cassette from the machine and put it on a horizontal surface before filling. Never try to fill a cassette while it is in the machine.

 Inaccurate anesthetic agent dosages may temporarily occur after filling if the temperature of the liquid is considerably different from the normal operating temperature.

### Filling with keyed filler system

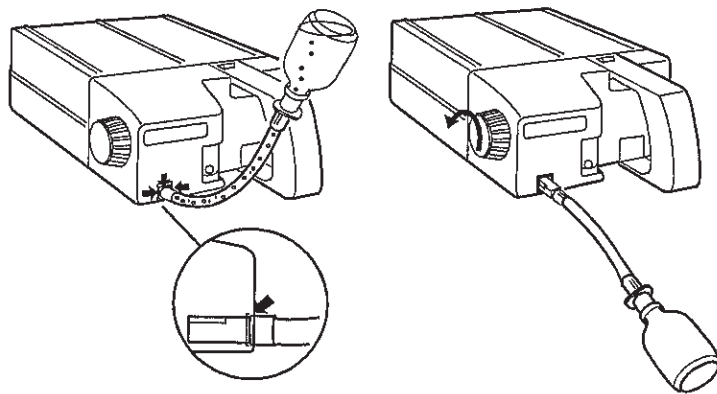


Figure 13-10 • Filling Aladin cassette with keyed filler system

**WARNING** Do not open or press the cassette filling port or the gas connection valves with fingers or any kind of instrument. Anesthetic agent liquid or gas may squirt into the air.

1. Remove the cassette from the machine, and place it on a horizontal surface. Ensure that the valve pins on the back of the cassette do not come in contact with the machine or any other object.

2. Align the notches on the bottle adapter to the agent bottle collar, and tighten the adapter onto the bottle.

**WARNING** To avoid exposure to anesthetic agent during filling, ensure that the bottle adapter is properly connected to the bottle.

3. Insert the keyed filler into the agent filling port on the cassette. Make sure that the square end of the filler is flush with the cassette body as shown.

**CAUTION** Ensure that the keyed filler is properly inserted into the filling port on the cassette. If air leaks into the system, the overfill protection mechanism of the cassette will not function properly. Overfilling the cassette may result in vaporizer delivery failure.

4. Lock the keyed filler by turning the lock and fill wheel fully clockwise.
5. Turn the bottle upside down. Check that the liquid flows evenly into the cassette. If it does not, tighten the wheel until the liquid starts to flow.
6. Watch the liquid level indicator. When the cassette is full, lower the bottle to stop the flow of liquid.
7. Turn the lock and fill wheel a half turn counterclockwise to close the filling port. Wait for the residual anesthetic agent to trickle back into the bottle.
8. Turn the lock and fill wheel fully counterclockwise, and remove the keyed filler from the filling port.
9. Remove the bottle adapter from the anesthetic agent bottle. Put the cap back on the agent bottle.

## Filling with Quik-Fil system

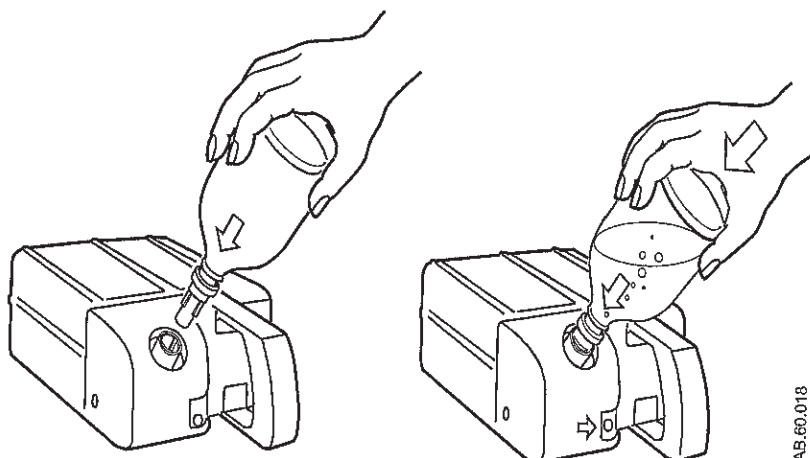


Figure 13-11 • Filling Aladin cassette with Quik-Fil system

### WARNING

Do not open or press the cassette filling port or the gas connection valves with fingers or any kind of instrument. Anesthetic agent liquid or gas may squirt into the air.

1. Remove the cassette from the machine, and place it on a horizontal surface. Ensure that the valve pins on the back of the cassette do not come in contact with the machine or any other object.
2. Remove the yellow protection cap from the anesthetic agent bottle. Check that the filling mechanism of the bottle is not damaged.
3. Remove the filling port cap from the cassette by turning the cap counterclockwise.
4. Insert the nozzle of the bottle into the filling port.
5. Push the agent bottle firmly into the filling port. Let the agent flow into the cassette.
6. Watch the liquid level indicator. When the liquid level reaches the full mark, slowly remove the bottle from the filling port. Removing the bottle quickly may cause the agent to splash or squirt out of the filling port.
7. Put the cap back on the filling port.
8. Put the cap back on the agent bottle.



## Filling with Saf-T-Fil bottle

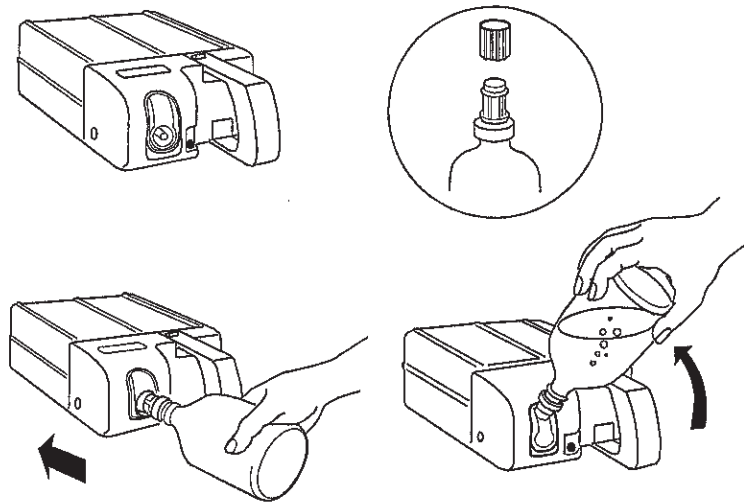


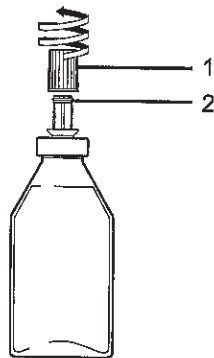
Figure 13-12 • Filling Aladin cassette with Saf-T-Fil bottle

**CAUTION** Do not attempt to fill the cassette with desflurane that is warmer than 26°C/78°F. The overfill prevention system may lock and prevent cassette filling.

**WARNING** Do not store filled or partially filled desflurane cassettes above the normal working temperature of 35°C/95°F. Storage at high temperature may cause the overpressure valve to vent desflurane vapor into the ambient air.

⚠ Do not open or press the cassette filling port or the gas connection valves with fingers or any kind of instrument. Anesthetic agent liquid or gas may squirt into the air.

1. Remove the cassette from the machine, and place it on a horizontal surface. Ensure that the valve pins on the back of the cassette do not come in contact with the machine or any other object.
2. Remove the cap from the desflurane bottle. Check that the o-ring is correctly fitted on the bottle nozzle.



AA-43.129

1. Bottle cap
2. O-ring

*Figure 13-13 • Removing the bottle cap*

3. Insert the nozzle into the filling port, and push the bottle firmly against the spring pressure until it stops.
4. Keep the bottle firmly inserted, and lift the bottle upwards.
5. When the liquid level reaches the full mark, lower the bottle to the lower stop position. Keep the bottle firmly inserted. Wait 5 seconds to allow the agent to drain from the filling port back into the bottle.
6. Slowly remove the bottle from the filling port. Removing the bottle quickly may cause the agent to splash or squirt out of the filling port.
7. Remove the bottle from the filling port.
8. Put the cap back on the agent bottle.

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