

# Aespire View

## User's Reference Manual

Software Revision 6.X



Datex-Ohmeda, Inc., a General Electric Company, doing business as GE Healthcare.

## 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; 04 = 2004, <b>05</b> = 2005, etc.

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# 1 Introduction

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## Intended use

The Aespire anesthesia system is a compact, integrated, and intuitive anesthesia delivery system. The 7900 Ventilator provides mechanical ventilation for patients during surgery as well as monitoring and displaying various patient parameters.

The 7900 Ventilator uses a microprocessor-controlled ventilator with internal monitors, electronic PEEP, Volume Mode, and other optional features. A serial interface permits communication to external monitoring.

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

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

**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.






















## Symbols used in the manual or on the equipment

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

























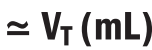



Warnings and Cautions tell about the dangerous conditions that can occur if the instructions in the manual are not followed.

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
	Dangerous voltage		Frame or chassis ground
	Direct current		Alternating current
	Caution		Attention, refer to product instructions
	Refer to product instructions		Exhaust
	Electrical input		Electrical output
	Electrical input/output		Sample gas inlet to scavenging
			
	Pneumatic inlet		Pneumatic outlet
<b>SN</b>	Serial number	<b>REF</b>	Stock number

# Aespire View

	Equipotential		Lamp, lighting, illumination
	Protective earth ground		Earth ground
	Variability		Variability in steps
	Suction bottle outlet		Vacuum inlet
	Max		Vacuum
	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
	Autoclavable		Not autoclavable
	Bellows volumes are approximate		O <sub>2</sub> cell connection
	APL settings are approximate		Anesthetic Gas Scavenging System



Pinch hazard



Read to top of float



EZchange Canister (CO2 bypass)



Caution: federal law prohibits dispensing without prescription



Open drain (remove liquid)



Close drain



Alarm silence touch key



Menu touch key



Silence alarm touch key (Tec 6)



Volume alarms On/Off touch key



End case touch key



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 GE Healthcare's Quality Systems.



Authorized representative in the European Community



Manufacturer



Date of manufacture



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 Datex-Ohmeda for information concerning the decommissioning of equipment.



GOST R Russian certification



This way up



USB port



Ethernet connection



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.)

## Typeface conventions used

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

Messages that are displayed on the screen are enclosed in single quotes: for example, 'Total pressure exceeds Pmax.'

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

#### A

ABS	Advanced breathing system
ACGO	Auxiliary common gas outlet
AGSS	Anesthetic gas scavenging system
APL	Adjustable pressure-limiting valve

#### C

CO <sub>2</sub>	Carbon dioxide
-----------------	----------------

#### D

DAC	Digital to analog converter
-----	-----------------------------

#### E

EMC	Electromagnetic compatibility
ESD	Electrostatic discharge
I:E	Inspiratory-expiratory ratio

#### F

FiO <sub>2</sub>	Fraction of inspired oxygen
------------------	-----------------------------

#### M

MIN	Minimum
MV	Minute volume
MV <sub>exp</sub>	Expired minute volume

#### O

O <sub>2</sub>	Oxygen
----------------	--------


<b>P</b>	
Paw	Patient airway pressure
PCV	Pressure controlled ventilation
PCV-VG	Pressure controlled ventilation - volume guaranteed
PEEP	Positive end expiratory pressure
Pmax	Maximum pressure
Pmean	Average pressure calculated over the patient breath
Pinsp	Target airway pressure
Ppause	Positive airway pressure measured at the end of Tpause
Ppeak	Maximum airway pressure measured during patient breath
Psupport	Pressure support
PSVPro	Pressure supported ventilation with apnea backup
<b>R</b>	
RR	Respiratory rate
<b>S</b>	
SIMV-PC	Synchronized intermittent mandatory ventilation - pressure controlled
SIMV/PSV	Synchronized intermittent mandatory ventilation / pressure supported ventilation
<b>T</b>	
TFS	Total flow sensing
Tpause	Pause time
Tinsp	Inspired tidal volume
TV	Tidal volume
TVexp	Expired tidal volume
<b>V</b>	
VCV	Volume controlled ventilation





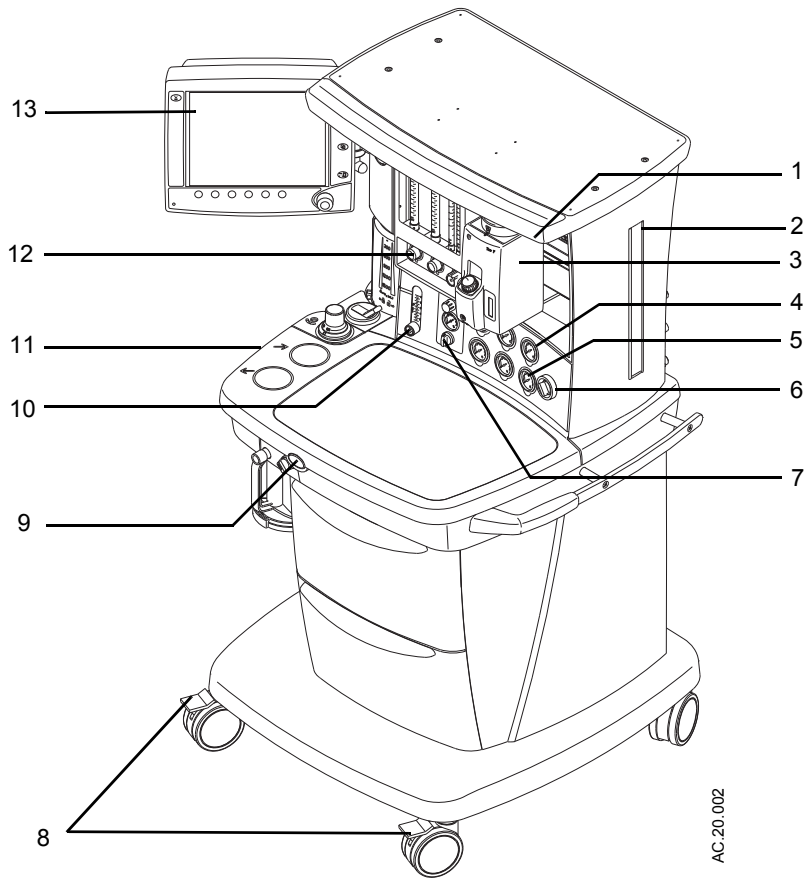
# 2 System Controls and Menus

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

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


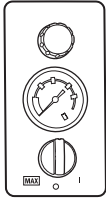



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## Anesthesia system controls

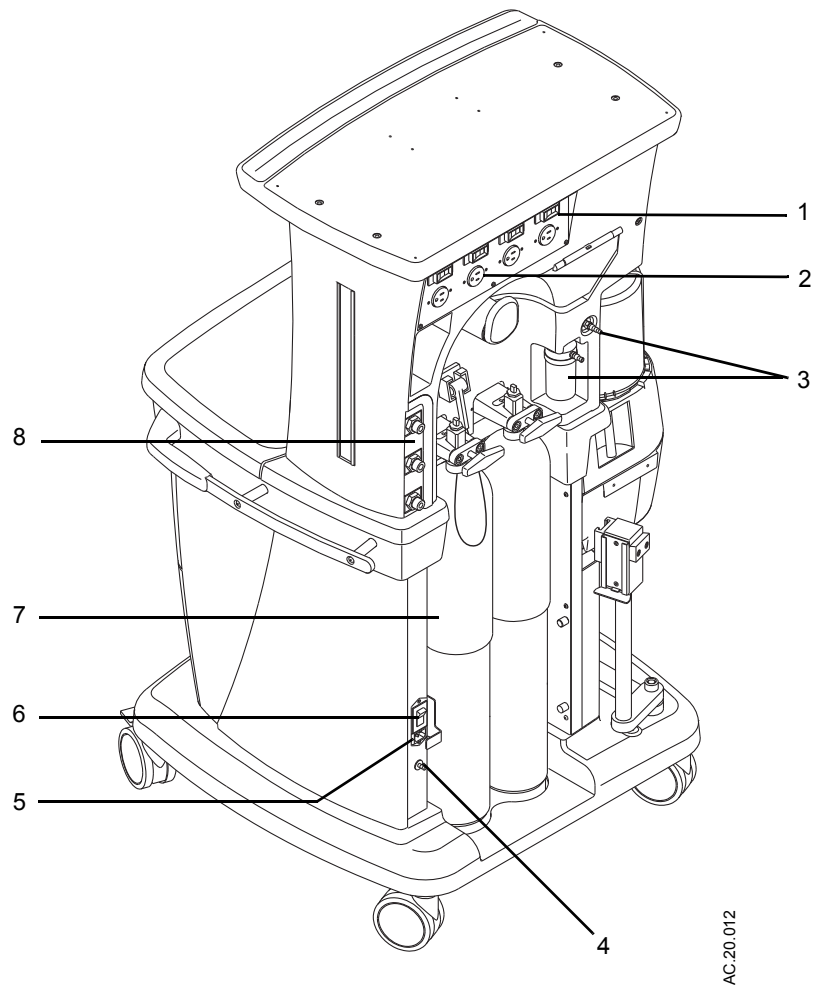


- |   |  |
|---|--|
| 1. Light switch                           | 8. Brake                                 |
| 2. Dovetail rails                         | 9. O2 flush button                       |
| 3. Vaporizer                              | 10. Auxiliary O2 flow control (optional) |
| 4. Pipeline pressure gauge(s) (upper row) | 11. Breathing system                     |
| 5. Cylinder pressure gauge(s) (lower row) | 12. Flow controls                        |
| 6. System switch                          | 13. Ventilator display                   |
| 7. Integrated suction (optional)          |  |

Figure 2-1 • Front view

Item, Figure 2-1		Description
6	System switch	<p>Set the switch to the On (I) position to permit gas flow and to turn on the system.</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> 
10	Auxiliary O2 flow control (optional)	<p>Turn the knob counterclockwise to increase the flow. Turn the knob clockwise to decrease the flow.</p> 
12	Flow controls	<p>Turn the knob counterclockwise to increase the flow. Turn the knob clockwise to decrease the flow. The System switch must be On for gas to flow.</p>

# Aespire View

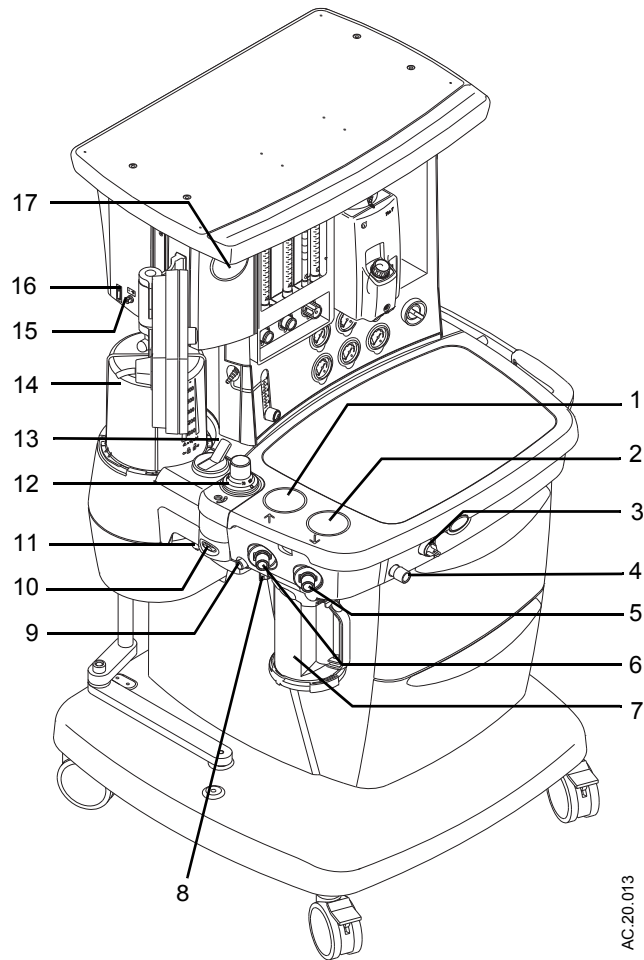


AC.20.012

- |                             |                           |
|-----------------------------|---------------------------|
| 1. Outlet circuit breaker   | 5. Mains inlet            |
| 2. Electrical outlet        | 6. System circuit breaker |
| 3. Suction items (optional) | 7. Cylinder               |
| 4. Equipotential stud       | 8. Pipeline connections   |

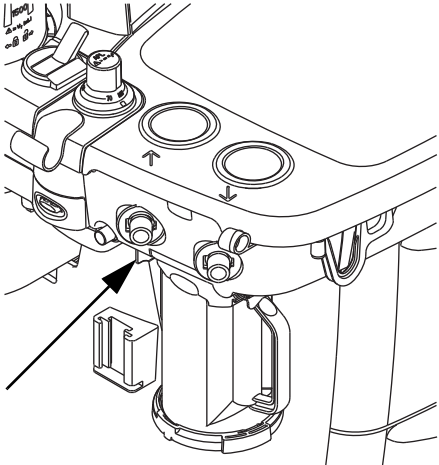
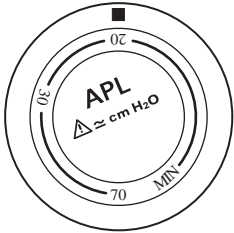
*Figure 2-2 • Rear view*

## Advanced breathing system (ABS) components

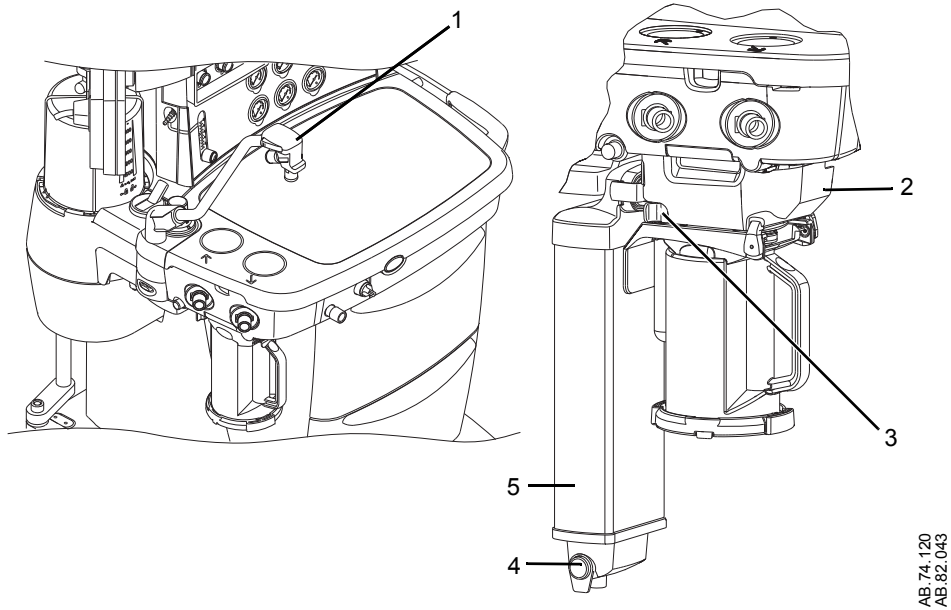


- |  |  |
|--|--|
| 1. Expiratory check valve                    | 10. Breathing system release                 |
| 2. Inspiratory check valve                   | 11. Manual bag port                          |
| 3. Auxiliary common gas outlet (ACGO) switch | 12. Adjustable pressure-limiting (APL) valve |
| 4. ACGO                                      | 13. Bag/Vent switch                          |
| 5. Inspiratory flow sensor                   | 14. Bellows assembly                         |
| 6. Expiratory flow sensor                    | 15. Sample gas return port                   |
| 7. Absorber canister                         | 16. Scavenger flow indicator (optional)      |
| 8. Absorber canister release                 | 17. Airway pressure gauge                    |
| 9. Leak test plug                            |  |

Figure 2-3 • Advanced breathing system

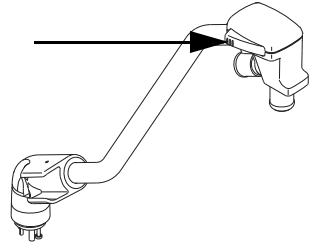
Item, Figure 2-3		Description
3	Auxiliary common gas outlet (ACGO) switch	Sends fresh gas to the ACGO when the switch is activated. The ACGO provides fresh gas to an external manual breathing circuit.
5,6	Inspiratory flow sensor and Expiratory flow sensor	Flow sensors provide volume measurements for some monitoring functions and tidal volume delivery.
8	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> 
12	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> 
13	Bag/Vent switch	Selects between manual ventilation (bag) or mechanical ventilation (ventilator).

### Optional ABS components



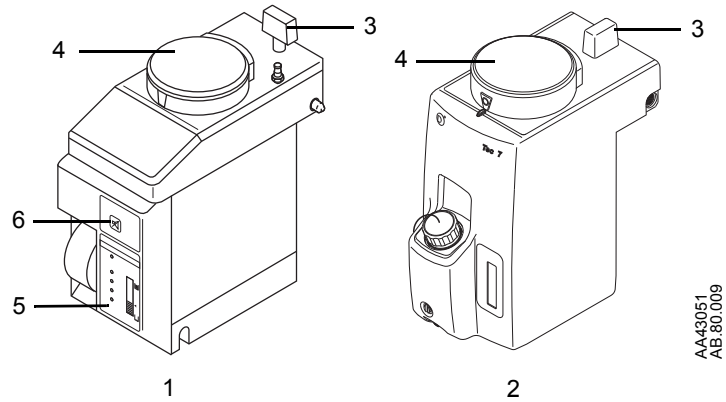
- 1. Bag support arm
- 2. EZchange canister system (CO2 bypass)
- 3. EZchange canister release
- 4. Condenser drain button
- 5. Condenser

Figure 2-4 • Breathing system options

Item, Figure 2-4		Description
1	Bag support arm	Squeeze the button to raise or lower the arm. 
3	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.
4	Condenser drain button	Push to drain water out of the condenser.

## Vaporizer controls

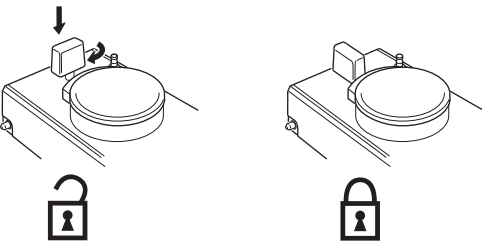
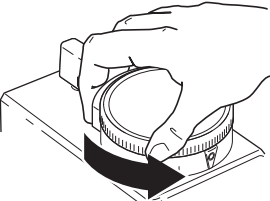

Refer to the vaporizer User's Reference manual for more detailed information on the vaporizer.



1. Tec 6 series
2. Tec 7
3. Lock lever
4. Concentration control and release
5. Indicators (Tec 6 series)
6. Silence alarm touch key (Tec 6 series)

*Figure 2-5 • Vaporizer controls*



Item, Figure 2-5		Description
3	Lock Lever	<p>Turn the lever fully clockwise to lock the vaporizer in position.</p> 
4	Concentration control and release	<p>Push the release and turn the concentration control to set the agent concentration. The Tec 6 series concentration control does not turn as long as the warm-up indicator is on.</p> 
5	Indicators (Tec 6 series)	<p>All indicators come on briefly at the start. The warm-up indicator goes off after approximately 10 minutes and the operational indicator comes on. Other indicators come on to advise the user of required action.</p>
6	Silence alarm touch key (Tec 6 series)	<p>Push to silence alarms. Hold for 4 seconds to sound the speaker and light all indicators (alarm test).</p> 

## ACGO

Fresh gas flow with anesthetic agent is directed through the Auxiliary Common Gas Outlet (ACGO) on the front of the system 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.

O<sub>2</sub> monitoring of fresh gas is available automatically when the ACGO is selected. 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 delivered 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.

**Important** Use an external O<sub>2</sub> monitor if using a rebreathing circuit on ACGO. Do not use an external ventilator on the ACGO. Do not use the ACGO to drive external ventilators or for jet ventilation. See “*Scavenging*” in the “*Setup and Connections*” section for more information on connections.

**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 O<sub>2</sub> cell in the breathing system to show the O<sub>2</sub> numerics on the monitor display. 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 circle circuit by connecting the Y-piece to the plug located to the rear of 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 ACGO switch is set to ACGO).
  - If the Bag/Vent switch is set to 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 male - 30 mm male connector (or a 30 mm male - 19 mm male connector) into the auxiliary port under the breathing system.

#### Important

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.

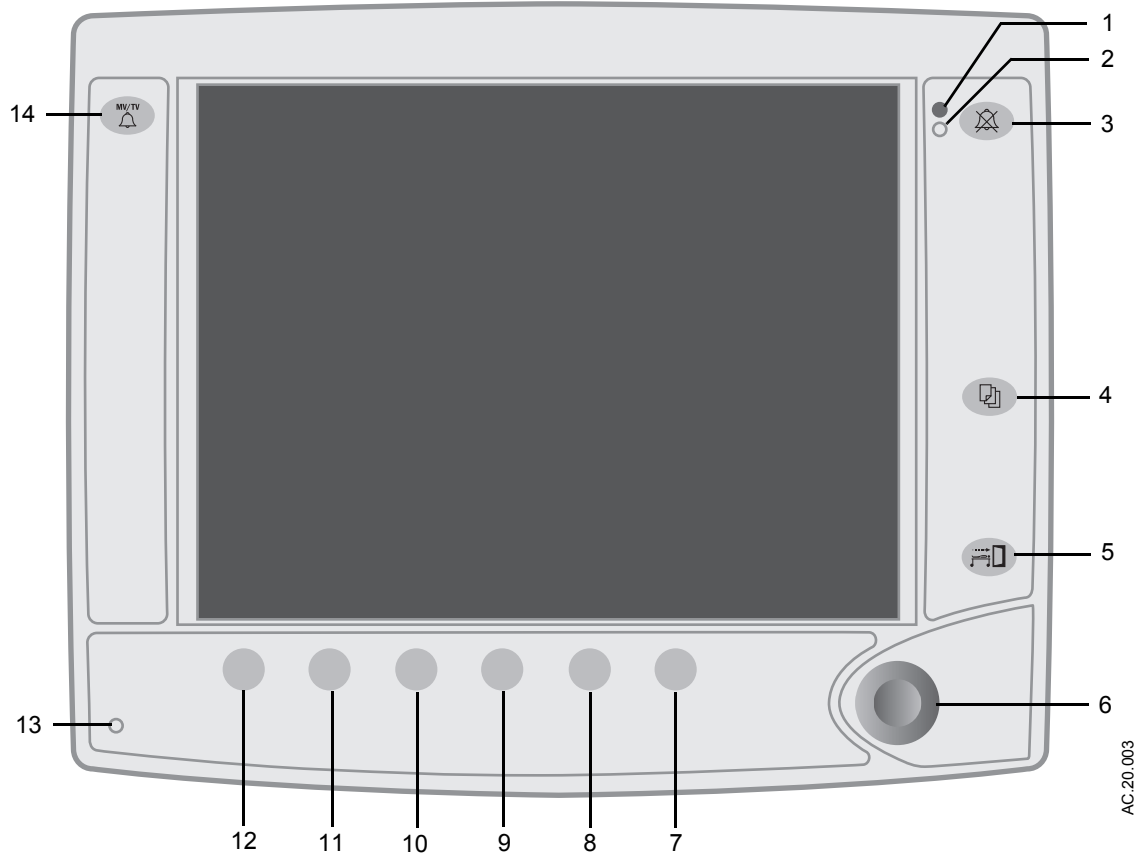
A separate exhaust hose is needed from the auxiliary manual breathing circuit to the disposal point for all AGSS units.

### 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.

## Ventilator controls

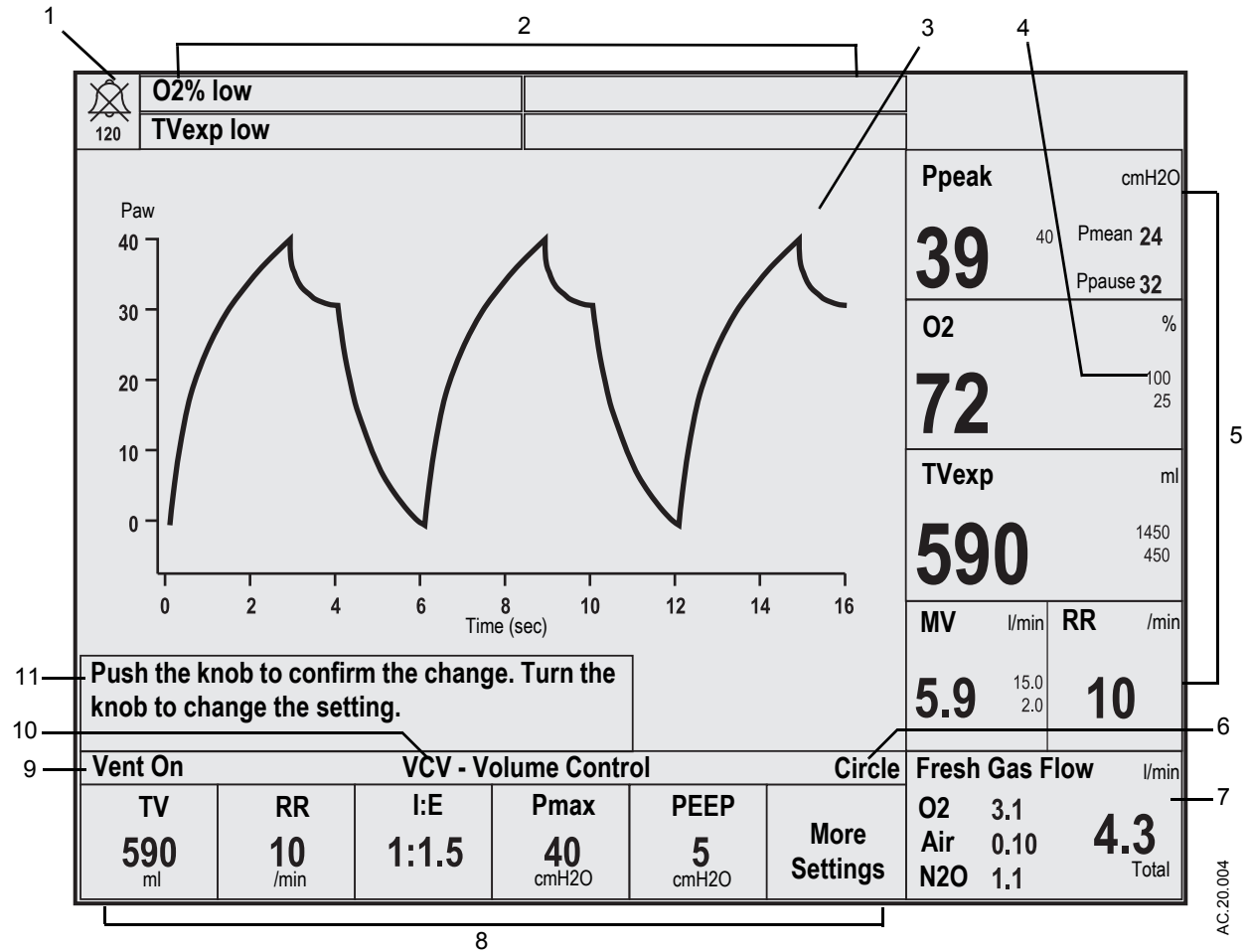
The ventilator controls include touch keys, menu screens, and a control knob (ComWheel). The System switch provides power functions to the ventilator display. The Bag/Vent switch starts and stops mechanical ventilation.



- |   |  |
|---|--|
| 1. High priority alarm indicator          | 8. PEEP quick key                        |
| 2. Low or medium priority alarm indicator | 9. Pmax or Psupport quick key            |
| 3. Alarm silence key                      | 10. I:E or Tinsp quick key               |
| 4. Menu key                               | 11. Respiratory rate (RR) quick key      |
| 5. End case key                           | 12. Tidal volume (TV) or Pinsp quick key |
| 6. ComWheel                               | 13. Mains power indicator                |
| 7. More settings quick key                | 14. Volume alarms On/Off key             |

Figure 2-6 • Ventilator controls

# Ventilator screen



- 1. Alarm silence indicator and countdown clock
- 2. Alarm message areas
- 3. Waveform area
- 4. Alarm limit settings
- 5. Measured values area
- 6. Circuit type
- 7. Total flow sensing (optional)
- 8. Ventilator settings
- 9. Mechanical ventilation status
- 10. Ventilation mode
- 11. User message area

Figure 2-7 • Normal view

## Using menus

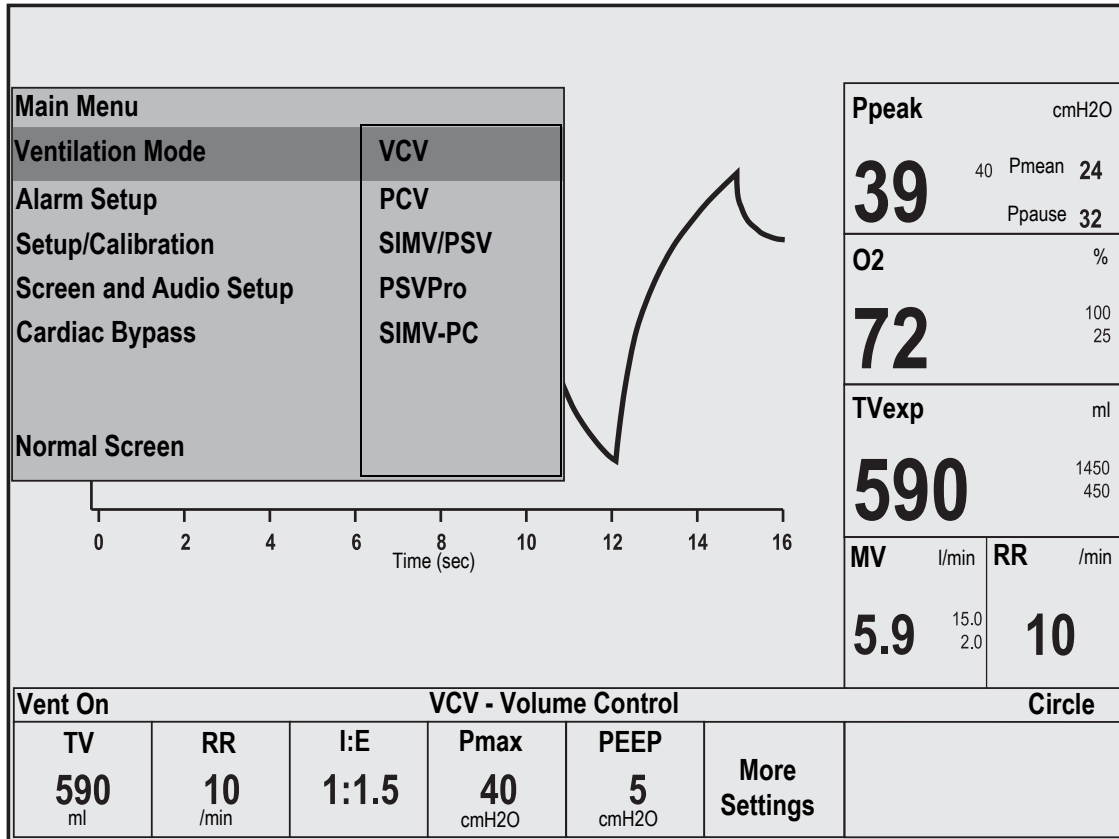


Figure 2-8 • Menu example

1. Push the Menu key to show the **Main 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 highlighted window or a sub menu.
4. Turn the ComWheel clockwise or counterclockwise to highlight the desired selection.
5. Push the ComWheel to confirm the selection.
6. Push the Menu key to exit the menu and return to the normal monitoring screen.

# 3 Operation

**WARNING** Maintain sufficient fresh gas flow when using sevoflurane.

<b>In this section</b>	Turning on the system . . . . .	3-2
	Start mechanical ventilation . . . . .	3-2
	Start manual ventilation . . . . .	3-2
	Ventilator setup . . . . .	3-3
	Alarm Setup . . . . .	3-5
	Setup/Calibration . . . . .	3-6
	Screen and audio setup . . . . .	3-7
	Cardiac Bypass . . . . .	3-8
	Measure circuit compliance . . . . .	3-9
	Pressure waveform . . . . .	3-9
	EZchange canister (optional) . . . . .	3-10
	Condenser (optional) . . . . .	3-11
	Passive AGSS (optional) . . . . .	3-12
	Active AGSS (optional) . . . . .	3-13
	Total flow sensing (optional) . . . . .	3-15

## Turning on the system

1. Plug the power cord into an electrical outlet. Make sure the system circuit breaker is on.
  - The mains indicator comes on when AC power is connected.
  - The battery is charging if not already fully charged.
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.
  - A status bar is provided to show progress.

## Start mechanical ventilation

**WARNING** Make sure that the patient circuit is correctly assembled and that the ventilator settings are clinically appropriate before starting ventilation.

1. Set the ACGO switch to the circle system position.
2. Set the Bag/Vent switch.
  - If Bag/Vent switch is set to Vent, move Bag/Vent switch to Bag and then back to Vent to start mechanical ventilation.
  - If Bag/Vent switch is set to Bag, move Bag/Vent switch to Vent to start mechanical ventilation.
3. Push the O2 flush button to inflate the bellows if needed.

## Start manual ventilation

1. Connect a manual breathing circuit.
2. Make sure that the APL valve is set to a clinically appropriate setting.
3. Set the Bag/Vent switch to Bag.



## Ventilator setup

The system has the following mechanical ventilation modes:

- Volume Control Ventilation (VCV).  
The ventilator delivers the tidal volume to the patient at the set respiratory rate (RR).
- Pressure Control Ventilation (PCV) (optional).  
The airway pressure is controlled to the value of P<sub>insp</sub> in every breath.
- Synchronized Intermittent Mandatory Ventilation with Pressure Support Ventilation (SIMV/PSV) (optional).  
Sets a minimum number of mechanical breaths using volume control to be delivered to the patient, but allows the patient to have spontaneous breaths which can be pressure supported.
- Pressure Support Ventilation (PSVPro) (optional).  
This is a spontaneous mode that provides the set amount of pressure to the patient during each triggered breath or, if the patient does not have any spontaneous breaths in a set period of time, the ventilator transitions to SIMV-PC where it delivers a minimum number of mechanically controlled breaths.
- Synchronized Intermittent Mandatory Ventilation with Pressure Control (SIMV-PC) (optional).  
Sets a minimum number of mechanical breaths using pressure control to be delivered to the patient, but allows the patient to have spontaneous breaths which can be pressure supported.
- Pressure Control Ventilation-Volume Guaranteed (PCV-VG) (optional).  
A tidal volume is set and the ventilator delivers that volume using a decelerating flow and a constant pressure. The ventilator adjusts the inspiratory pressure needed to deliver the set tidal volume breath-by-breath so that the lowest pressure is used.

**Note** See the “*Specifications and Theory of Operation*” section for more information on ventilation modes.

## Using quick keys

The ventilator settings for each mode can be easily 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 or quick key to activate (confirm) the change.

## Changing ventilator modes and settings

1. Push the Menu key.
2. Select **Ventilation Mode** from the **Main Menu**.

Main Menu	
Ventilation Mode	VCV
Alarm Setup	PCV
Setup/Calibration	SIMV/PSV
Screen and Audio Setup	PSVPro
Cardiac Bypass                      Off	SIMV-PC
	PCV-VG
Normal Screen	

3. Use the ComWheel to highlight the desired setting (PSVPro shown), and push the ComWheel to confirm the change.
4. Set the values for the selected ventilation mode.
  - The value is highlighted while being set.
5. Push the ComWheel or the quick key to activate the change.
  - The system returns to the normal monitoring screen.
  - The ventilation mode shows on the screen.

## Alarm Setup

### Setting volume alarms

Use the volume alarms key to turn the volume alarms on and off. When the alarms are off, an X covers the alarm limits. Use this control during manual ventilation when constant attention is on the patient.

Use the End case key to minimize alarms between cases. The alarms will reactivate when two or more breaths are detected within 30 seconds.

### WARNING

Do not turn off volume alarms for a spontaneously breathing patient. The system will not alarm for low volume.

### Alarm limit setup

To set or change alarm limits:

1. Push the Menu key.
2. Select **Alarm Setup** from the **Main Menu**.

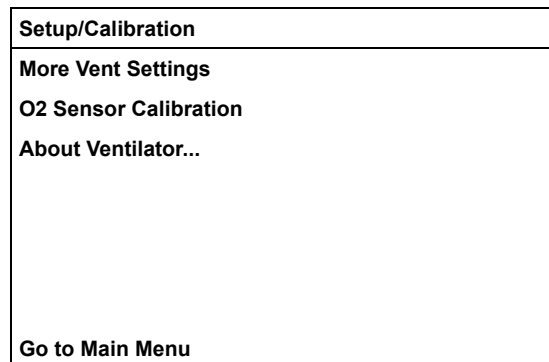
Alarm Setup		
<b>O2</b>	<b>21</b>	<b>99</b>
<b>MV</b>	<b>3.0</b>	<b>7.0</b>
<b>TVexp</b>	<b>200</b>	<b>600</b>
<b>Leak Audio</b>	<b>On</b>	
<b>Go to Main Menu</b>		

3. To set an alarm limit, use the ComWheel to scroll to the desired alarm limit. Push the ComWheel to select the limit. The following alarm limits can be set or changed:
  - O2, MV, and TVexp - Alarm limits for both high and low can be set. The low limit is the left numeric field, and the high limit is the right numeric field.
  - Leak Audio - The patient circuit leak alarm activates during mechanical ventilation if less than half of the inspired volume returns through the expiratory flow sensor. Prevent expected alarms from known circuit leaks by setting the **Leak Audio** to **Off**.
4. Change the value with the ComWheel.
5. Select **Go to Main Menu** to return to the **Main Menu**, or push the Menu key to return to the normal monitoring screen.

## Setup/Calibration

To change or enter Setup and Calibration information:

1. Push the Menu key.
2. Select **Setup/Calibration** from the **Main Menu**.



3. Use the ComWheel to scroll to the desired submenu. Push the ComWheel to confirm the selection. Select **More Vent Settings** to set the following ventilator values:
  - Pmax.
  - Trig Window.
  - Trigger.
  - End of Breath.
  - Backup Mode Active.
  - Tpause.
  - Rise Rate.

**Note** See the “*Specifications and Theory of Operation*” section for more information on individual settings.

4. After selecting a ventilator setting, set it to the desired value by turning the ComWheel. Confirm the value is correct by pushing the ComWheel.
5. Select **Go to Setup/Calibration Menu** to return to the **Setup/Calibration**, or push the Menu key to return to the normal monitoring screen.

## Screen and audio setup

To change the audio and visual appearance of the screen:

1. Push the Menu key.
2. Select **Screen and Audio Setup** from the **Main Menu**.

Screen and Audio Setup	
Brightness	5
Alarm Volume	4
Alarm Limits	Show
Units of Measure	Show
Go to Main Menu	

3. Use the ComWheel to select the desired setting and push the ComWheel to confirm the change. The following settings are available:
  - Brightness - Sets the brightness of the screen.
  - Alarm Volume - Sets the volume, or loudness of audible alarms.
  - Alarm Limits - Simplifies the screen by hiding the alarm limits. To do this, select **Hide** for this option. If the screen is set to hide the alarm limits, the limits automatically show when the corresponding alarm occurs.
  - Units of Measure - Simplifies the screen by hiding the units of measure. To do this, select **Hide** for this option.
4. Select **Go to Main Menu** to return to the **Main Menu**, or push the Menu key to return to the normal monitoring screen.

## Cardiac Bypass

Cardiac Bypass suspends alarms for patients on cardiac bypass when the ventilator is not mechanically ventilating. Mechanical ventilation must be off. When mechanical ventilation is turned on, Cardiac Bypass is automatically turned off, the alarms are enabled, and monitoring is available.

**WARNING** Cardiac Bypass mode should only be used when the patient is receiving extra-corporeal oxygenation by means of a heart-lung machine. This mode of ventilation is not intended to provide metabolic levels of ventilation to the patient.

1. Set the Bag/Vent switch to Bag.
2. Push the Menu key.
3. Select **Cardiac Bypass**.
4. Set **Cardiac Bypass** to **On**.
5. Push the ComWheel to activate the change.
  - The screens shows 'Cardiac bypass' and 'Apnea alarm off' in the alarm area.
6. Select **Go to Main Menu** to return to the **Main Menu**, or push the Menu key to return to the normal monitoring screen.

## Measure circuit compliance

Exhaled tidal volume (TV<sub>exp</sub>) measures the gas needed to fill the patient circuit at the measured pressure. The compliance factor can be used to calculate the approximate gas which goes into expanding the compliant patient tubing and not delivered into the patient.

1. Set the ventilator to volume control ventilation (VCV) mode.
2. Set the ventilator parameters.
  - TV = 25 ml.
  - RR = 20.
  - I:E = 1:1.
  - P<sub>max</sub> = 100 cmH<sub>2</sub>O.
  - PEEP = Off.
3. Occlude the patient Y.
4. Turn on mechanical ventilation.
5. Monitor the exhaled tidal volume (TV<sub>exp</sub>) and the measured peak airway pressure (P<sub>peak</sub>).
6. Calculate the tubing compliance factor.
  - $TV_{exp}/(P_{peak} - 2.5 \text{ cmH}_2\text{O}) = \text{Compliance factor in ml/cmH}_2\text{O}.$
  - Example:
    - P<sub>peak</sub> = 30 cmH<sub>2</sub>O.
    - TV<sub>exp</sub> = 25 ml.
    - $25/(30 - 2.5) = 0.9 \text{ ml/cmH}_2\text{O}.$

\*Pressure created by the force of the bellows.

## Pressure waveform

The pressure waveform shows the measured value of the airway pressure. The waveform automatically adjusts the time and pressure scales. The time scale changes with the respiratory rate. The pressure scale changes with the pressure limit.

**Note** See the “*Specifications and Theory of Operation*” section for more waveform information on the ventilation modes.

Respiratory Rate (breaths per minute)	Time scale (seconds)
0 to 25	0 to 16
26 to 75	0 to 8
76 to 100	0 to 4

## 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 replacing the absorber canister.

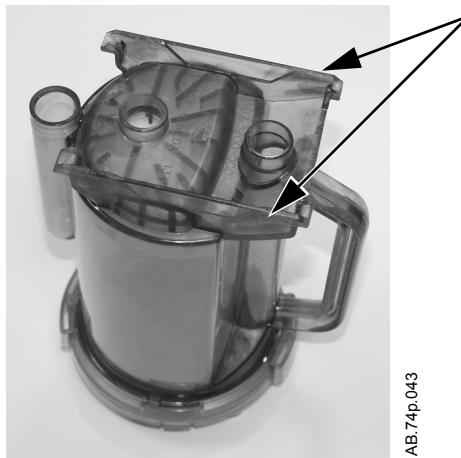
Systems with EZchange canister have the following label on the canister holder. When the system is in EZchange position, the message 'No CO<sub>2</sub> absorption' shows on the ventilator display.



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To return to absorber mode, reinsert the canister into the holder, 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 on the EZchange canister holder.



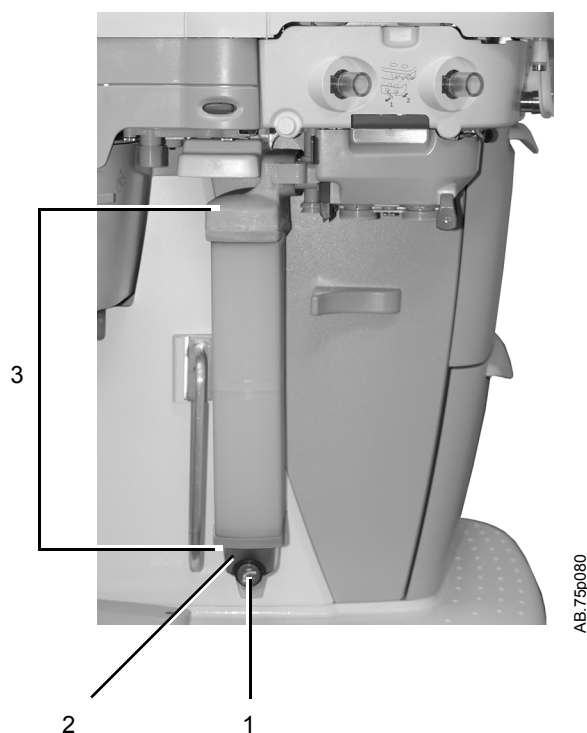
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## Condenser (optional)

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.



1. Drain button
2. Reservoir
3. Condenser

*Figure 3-1 • 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 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 facility ventilation system for waste gas disposal. The tubing connection from passive AGSS to the non-recirculating facility ventilation system should be an open connection, essentially at atmospheric pressure, such as to an exhaust grill.

**Note** See “*Setup and Connections*” for additional scavenging connection information.

### Connecting passive AGSS

To use the optional passive AGSS installed on the system, connect it as follows:

1. Connect the proper large diameter tubing to the AGSS 30 mm outlet connector on the bottom of the AGSS underneath the breathing system.

**Note** The tubing connection from the passive AGSS to the non-circulating facility ventilation system should be an open connection, essentially an atmospheric pressure, such as to an exhaust grill.

2. Connect the free end of the tubing to the building exterior or outside ventilation system.
3. The passive scavenging system relies on slight positive pressure of gases, or on slight negative pressure caused by an exhaust fan, to move gases through the system. For this reason, all unused ports must be capped to prevent gas from leaking into the room and to maintain the expected pressures.

**Note** In the event that excess gas accumulates in the scavenging system and cannot exit the machine properly, pressure could build. If this pressure reaches 10cmH<sub>2</sub>O, the brass weight of the positive relief valve will be lifted up allowing the gas to escape into the room. This prevents the pressure from backing up into the patient circuit.

## 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. Active scavenging systems contain two relief valves to protect the patient from excess gas pressure, or from the opposite situation, gas being drawn from the breathing circuit.

The positive relief valve for the scavenging system is mounted on the exhalation valve assembly. In the event that excess gas accumulates in the scavenging system and cannot exit the machine properly, pressure could build. If this pressure reaches 10 cmH<sub>2</sub>O, the positive relief valve will be lifted up, allowing gas to escape into the room. This prevents the pressure from backing up into the patient circuit.

The negative relief valve (which is located in the same place on all scavenging receivers) serves to protect the patient in the event that the extract flow exceeds system input flow. That is, it prevents gas from being pulled out of the breathing circuit. If more than a small amount of negative pressure (-0.3 cmH<sub>2</sub>O) is applied to the scavenging system, the negative relief valve opens, allowing room air to be drawn into the scavenging system instead of pulling gas from the patient circuit. 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 50 to 80 l/min extract flow. 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 beneath 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 extract flow is limited to 36 l/min and 300 mmHg (12 inHg) vacuum.
- The active low flow system with a 12.7 mm hose barb connector is for use with a low vacuum disposal system. It requires an external venturi/ejector system with a flowmeter and a minimum 36 l/min extract flow.

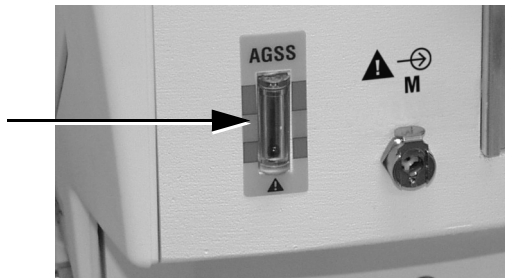
- The active low flow system with a 25 mm barb connector is for use with low vacuum disposal systems. It requires an external venturi/ejector system with a 40 to 50 l/min extract flow. A flow indicator on the system indicates when the unit is in operation.
- The active low flow system with 30-mm ISO taper is for use with low vacuum disposal systems. It requires an external venturi/ejector system with a 40 to 50 l/min extract flow. A flow indicator on the system indicates when the unit is in operation.

See “*Setup and Connections*” for additional scavenging connection information.

### 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, beneath 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 the filter is blocked.

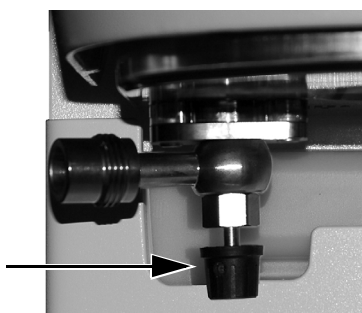
3. Complete the tests in the “*Preoperative Tests*” section of this manual.

## 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 (beneath). 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.



5. Complete the tests in the “*Preoperative Tests*” section of this manual.

## Total flow sensing (optional)

The total flow sensing (TFS) option electronically measures the fresh gas flow at the mechanical flow tubes. The total fresh gas flow measurement displays on the bottom right corner of the screen. The measurement specifies:

- Total gas flow.
- O<sub>2</sub> gas flow.
- Air gas flow.
- N<sub>2</sub>O gas flow.



# 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 this system:

- Complete the preoperative checkout.
- For in-depth test instructions, see 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 and adequately filled.
- Check the system suction connections.
- Check the vaporizer installation:
  - The top of each vaporizer is horizontal (not on crooked).
  - Each vaporizer is locked and cannot be removed.
  - The alarms and indicators operate correctly (Tec 6 series vaporizers).
  - More than one vaporizer cannot be turned on at the same time.
  - All vaporizers are full.
- Check that the breathing circuit is correctly connected, not damaged, and the breathing system contains sufficient absorbent.
- Turn the System switch to On.
- Connect the scavenging and verify proper operation.
- Do the Pipeline test and Cylinders test.
- Do the Flow control tests.
- Do the Vaporizer back pressure tests.
- Do a Low-pressure leak test.
- Do the Alarm tests.
- Do the Breathing system tests.
- 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”* check was done.

- Check that necessary emergency equipment is available and in good condition.
  
- Check the vaporizer installation:
  - The top of each vaporizer is horizontal (not on crooked).
  - Each vaporizer is locked and cannot be removed.
  - The alarms and indicators operate correctly (Tec 6 series vaporizers).
  - More than one vaporizer cannot be turned on at the same time.
  - All vaporizers are full.
  
- Do the Breathing system tests.
  
- Set the appropriate controls and alarm limits for the case.



# 5 Preoperative Tests

<b>In this section</b>	Inspect the system . . . . .	5-2
	Power failure alarm test . . . . .	5-3
	Pipeline test . . . . .	5-3
	Total flow sensing test (if equipped) . . . . .	5-3
	Cylinder test . . . . .	5-4
	Flow control test . . . . .	5-5
	Vaporizer installation . . . . .	5-7
	Vaporizer back pressure test . . . . .	5-8
	Low-pressure leak test . . . . .	5-9
	Alarm tests . . . . .	5-11
	Breathing system tests . . . . .	5-13
	Monitor and ventilator tests. . . . .	5-15

## Inspect the system

**WARNING** Do not exceed the top shelf weight limit of 34 kg (75 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, make sure 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 vaporizers are locked in position and contain sufficient agent.
- Pipeline gas supplies are connected and the pressures are correct.
- Cylinder valves are closed on models with cylinder supplies.
- 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 auxiliary O<sub>2</sub> flowmeter is present, ensure there is adequate flow.
- If an optional suction regulator is present, ensure proper connections and that there is adequate suction.
- The brakes are set and prevent movement.
- The power cord is connected to a wall 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.
- The O<sub>2</sub> flush button is in working condition.

## Power failure alarm test

1. With the System switch set to On, unplug the power cord.
2. Make sure that the power failure alarm sounds.
3. Connect the power cord to the electrical outlet.
4. Verify that the alarm tone stops.

## Pipeline test

1. Disconnect the pipeline supplies and close all cylinder valves.
2. If the pipeline and cylinder pressure gauges are not at zero.
  - Connect an O2 supply.
  - Set the System switch to On.
  - Set the flow controls to mid range.
  - Make sure that all of the gauges except for O2 go to zero.
  - Disconnect the O2 supply.
  - Make sure that the O2 gauge goes to zero. As the pressure decreases, the alarms for O2 supply failure should occur.
3. Connect the pipeline supplies.
4. Verify the pipeline pressure is between 280-600 kPa (41-87 psi).

## Total flow sensing test (if equipped)

1. Connect the pipeline supplies to the anesthesia system.
2. Set the System switch to On.
3. Set the Bag/Vent switch to Bag.
4. Set each gas flow to 0.80 l/min using flow tubes. Refer to "*Flow controls*" for more information.
5. Verify that the flow readings on the display for each gas read between 0.60 l/min and 1.0 l/min.

## Cylinder test

**CAUTION** To prevent damage to the system, open the cylinder valves slowly and do not force the flow controls.

**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.

1. Disconnect the pipeline supplies and close all cylinder valves.
2. If the pipeline and cylinder pressure gauges are not at zero:
  - Connect an O<sub>2</sub> supply.
  - Set the System switch to On.
  - Set the flow controls to mid range.
  - Make sure that all of the gauges except for O<sub>2</sub> go to zero.
  - Disconnect the O<sub>2</sub> supply.
  - Make sure that the O<sub>2</sub> gauge goes to zero. As the pressure decreases, the alarms for O<sub>2</sub> supply failure should occur.
3. Make sure that the cylinders are full.
  - Open each cylinder valve.
  - Make sure that each cylinder has sufficient pressure.
  - If the cylinder does not have sufficient pressure, close the cylinder valve and install a full cylinder.
4. Set the System switch to Standby.
5. Turn off the auxiliary O<sub>2</sub> flowmeter (if equipped).
6. Turn off the suction (if equipped).
7. Test one cylinder at a time for high-pressure leaks.
  - Open the cylinder.
  - Note the cylinder pressure.
  - Close the cylinder valve.
  - Wait for one minute and record the cylinder pressure again.
  - If the cylinder pressure for Air or O<sub>2</sub> decreases more than 690 kPa (100 psi), there is a leak.
  - If the cylinder pressure for N<sub>2</sub>O decreases more than 690 kPa (100 psi), there is a leak.

## Flow control test

**WARNING** The Link-25 system cannot replace an O<sub>2</sub> monitor. Sufficient O<sub>2</sub> in the fresh gas may not prevent hypoxic mixtures in the breathing circuit.

⚠ Nitrous oxide (N<sub>2</sub>O), if available, flows through the system during this test. Use a safe and approved procedure to collect and remove the N<sub>2</sub>O.

⚠ Incorrect gas mixtures can cause patient injury. If the Link-25 system does not supply O<sub>2</sub> and N<sub>2</sub>O in the correct proportions, do not use the system.

⚠ This procedure tests for significant malfunction of the Link-25 system. It does not confirm the proper calibration of the Link-25 system. Perform periodic calibrations using an accurate and properly calibrated O<sub>2</sub> monitor as recommended in the “*User Maintenance*” section.

1. Connect the pipeline supplies or slowly open the cylinder valves.
2. Turn all flow controls fully clockwise for minimal flow.
3. Set the ACGO switch to ABS.
4. Set the System switch to On.

**Note** Do not use the system if the Low battery or any ventilator failures occur.

5. Make sure that the O<sub>2</sub> flow tube shows approximately 0.025 to 0.075 l/min.

**WARNING** Keep the Link-25 system engaged. Adjust only the test control for the following steps.

- Test N<sub>2</sub>O first and then O<sub>2</sub>.
- The O<sub>2</sub> cell must be correctly calibrated.

6. Test the Link-25 system by increasing the N2O flow.
  - Slowly turn the N2O flow control counterclockwise.
  - Increase the N2O flow as specified in the following table and make sure the O2 flow is as specified.

N2O flow l/min	O2 flow greater than l/min
0.8	0.2
2	0.5
4	1.0
10	2.5

7. Test the Link-25 system with O2 flow decreasing.
  - Set the N2O flow to 9 l/min.
  - Set the O2 flow to 3 l/min or higher.
  - Slowly turn the O2 flow control clockwise. Set the N2O flow to the rates shown in the following table.

N2O flow l/min	O2 flow greater than l/min
8	2
4	1
0.8	0.2

8. Adjust the flow of all gases through the full range and make sure that the flow tube floats move smoothly.
9. Disconnect the O2 pipeline supply or close the O2 cylinder valve.
10. Make sure that:
  - The low O2 supply alarm occurs.
  - The N2O and the O2 flows stop. The O2 flow should stop last.
  - The air flow continues (if equipped).
  - The gas supply alarms occur on the ventilator if the ventilator uses O2 as the drive gas.
11. Turn all the flow controls fully clockwise for minimum flow.
12. Reconnect the O2 pipeline supply.



## Vaporizer installation

**WARNING** Use only Datex-Ohmeda, Inc. Selectatec series vaporizers Tec 4 or greater.

- ⚠ Do not use a vaporizer if it lifts off the manifold when the lock lever is in the locked position.
  
- ⚠ Do not use the system if more than one vaporizer can be turned on at the same time.
  
- ⚠ Tec 6 series vaporizers need the power cable to go through the channel on the bottom of the vaporizer for proper alignment. Do not put the power cable on the top of the manifold or between the vaporizers.
  1. Place the vaporizer straight on the manifold.
  2. Make sure that the top of each vaporizer is horizontal.
    - If a vaporizer is not horizontal, remove it and reinstall it.
  3. Set each vaporizer lock lever to the locked position.
  4. Try to lift each vaporizer straight up off the manifold.
    - Do not pull forward on the vaporizer.
    - Do not rotate the vaporizer on the manifold.
  5. If the vaporizer lifts off of the manifold, install it again and repeat this “*Vaporizer installation*” procedure. If the vaporizer lifts off a second time, do not use the system.
  6. For a Tec 6 series vaporizer:
    - Connect the vaporizer to an electrical outlet.
    - Hold the Silence alarm touch key (minimum of 4 seconds).
    - Make sure all indicators turn on and that the alarm tone occurs.
    - Release the Silence alarm touch key.
  7. Try to turn on more than one vaporizer at the same time.
    - Test each possible vaporizer combination.
    - If more than one vaporizer turns on at the same time, remove the vaporizers, install them again, and repeat the “*Vaporizer installation*” procedure. If the test continues to fail, contact a Datex-Ohmeda trained service representative.

## Vaporizer back pressure test

**WARNING** Anesthetic agent comes out of the common gas outlet during this test. Use a safe, approved procedure to remove and collect the agent.

**CAUTION** To prevent damage to the vaporizer, turn the flow controls fully clockwise (minimum flow or off) before turning on the system.

1. Set the System switch to On. Alarms may occur.
2. Set the O<sub>2</sub> flow to 6 l/min.
3. Make sure that the O<sub>2</sub> flow stays constant and the float moves freely.
4. Adjust the vaporizer concentration from 0 to 1%. The O<sub>2</sub> flow must not decrease more than 1 l/min through the full range.
  - If the O<sub>2</sub> flow decreases more than 1 l/min, install a different vaporizer and repeat the steps 1 through 4.
  - If the O<sub>2</sub> flow decreases less than 1 l/min when testing a different vaporizer, the malfunction is in the vaporizer that failed the test.
  - If the O<sub>2</sub> flow decreases more than 1 l/min with the different vaporizer, the malfunction is most likely in the system. Do not use the system.
5. Repeat steps 1 through 4 for each vaporizer.

## Low-pressure leak test

**WARNING** Do not use a system that has a low-pressure leak. Anesthetic agent will go into the atmosphere instead of into the breathing circuit.

Perform either the “*Negative low-pressure leak test*” or the “*Positive low-pressure leak test*” depending on local requirements. It is not necessary to perform both tests.

### Negative low-pressure leak test

1. Make sure the System switch is set to Standby.
2. Turn off all vaporizers.
3. Turn the ACGO switch to the ACGO position.
4. Compress and release the bulb until all air is removed from the bulb.
  - Occlude the inlet of the test device. Make sure it is a tight seal.
  - If the bulb of the test device inflates in less than 60 seconds, use a different test device.
5. Test the system for low-pressure leaks.
  - Turn the flow controls one and a half turns counterclockwise.
  - Connect the test device to the auxiliary gas outlet.
  - Compress and release the bulb until all air is removed from the bulb.
  - The floats will move. If the bulb inflates in 30 seconds or less, there is a leak in the low-pressure circuit. See “*Pneumatic problems*” in the “*Alarms and Troubleshooting*” section.
  - Disconnect the test device.
6. Test each vaporizer for low-pressure leaks.
  - Turn on one vaporizer.
  - Set the vaporizer to 1%.
  - Perform step 5.
  - Repeat this test with each vaporizer.
  - If a low-pressure leak occurs while testing any of the vaporizers, see “*Pneumatic problems*” in the “*Alarms and Troubleshooting*” section.
  - Turn off all vaporizers.
7. Turn all flow controls fully clockwise for minimum flow. Do not overtighten.

**WARNING** Agent mixtures from the low-pressure leak test stay in the system. Clear the system by flowing O<sub>2</sub> at 1 l/min for one minute.

8. Clear the system of agent.
  - Set the System switch to On.
  - Set the O<sub>2</sub> flow to 1 l/min.
  - Flow O<sub>2</sub> for one minute.
  - Turn the O<sub>2</sub> flow control fully clockwise for minimum flow.

### **Positive low-pressure leak test**

**Note** Push the positive-pressure leak test adapter into the ACGO port throughout the test to maintain a tight seal.

**CAUTION** Do a positive low-pressure leak test at the ACGO port only.

2. Turn the ACGO switch to the ACGO position.
3. Turn all flow controls fully clockwise for minimum flow.
4. Turn all vaporizers off.
5. Fully open the needle valve on the test device.

**Note** Keep the test device flow tube vertical for accurate results.

**CAUTION** If the needle valve is not fully open, this test can damage the pressure gauge on the test device.

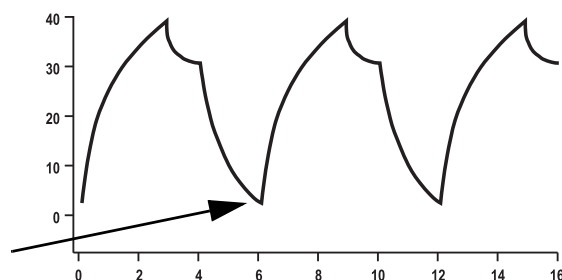
6. Open the O<sub>2</sub> flow control and set for a total flow on the test device of 0.4 l/min.
7. Make sure that the pressure gauge on the test device is at zero, and make sure that all other flow controls are fully closed.
8. Close the needle valve on the test device until the gauge reads 20 kPa (3 psi) for (BSI) or 3 kPa (.4 psi) for ISO.
9. If the flow through the test device is less than 0.35 l/min ISO or 0.3 l/min (BSI), there is a low pressure leak in the system. See *"Pneumatic problems"* in the *"Alarms and Troubleshooting"* section.
10. Test each vaporizer.
  - Turn on the vaporizer being tested, and set it to 1%.
  - Perform steps 5 through 9 of this test for each vaporizer.
11. Make sure all vaporizers are turned off.

**WARNING** Agent mixtures from the low-pressure leak test stay in the system. Clear the system by flowing O<sub>2</sub> at 1 l/min for one minute.

12. Clear the system of agent.
  - Set the O<sub>2</sub> flow to 1 l/min.
  - Flow O<sub>2</sub> for one minute.
  - Turn the O<sub>2</sub> flow control fully clockwise for minimum flow.

## Alarm tests

1. Connect a test lung to the patient connection.
2. Set the Bag/Vent switch to Vent.
3. Set the System switch to On.
4. Push the Menu key.
5. Select **Ventilation Mode - VCV**.
6. Set the ventilator parameters.
  - TV 400 ml.
  - Rate 12.
  - I:E 1:2.
  - Pmax 40 cmH<sub>2</sub>O.
  - PEEP Off.
7. Set the O<sub>2</sub> flow to the minimum flow.
8. Turn off all other gases.
9. Push the O<sub>2</sub> flush button to fill the bellows.
10. Set the Bag/Vent switch to Bag and then to Vent. Make sure that:
  - Mechanical ventilation starts.
  - A subatmospheric pressure alarm does not occur.
  - The ventilator shows the correct data based on settings.
  - The bellows inflate and deflate during mechanical ventilation.
11. Set the O<sub>2</sub> flow control to 5 l/min. Make sure that:
  - The pressure at the end of the breath is approximately 2 cmH<sub>2</sub>O. This can be seen on the pressure waveform displayed below.



- The ventilator shows the correct data based on settings.
- The bellows inflate and deflate during mechanical ventilation.

12. Test the O<sub>2</sub> monitor and alarms (alarms other than Low O<sub>2</sub> and High O<sub>2</sub> may occur).
  - Remove the O<sub>2</sub> cell, and make sure that the cell measures approximately 21% O<sub>2</sub> in room air.
  - Push the Menu key.
  - Select **Alarm Setup** from the **Main Menu**.
  - Set the Low O<sub>2</sub> alarm to 50%, and make sure that a Low O<sub>2</sub> alarm occurs.
  - Set the Low O<sub>2</sub> alarm to 21%, and make sure that the Low O<sub>2</sub> alarm stops. This will create a latched alarm, acknowledge this by pushing the Alarm silence key.
  - Put the O<sub>2</sub> cell back into the circuit.
  - Set the High O<sub>2</sub> alarm to 50%.
  - Push the O<sub>2</sub> flush button to fill the breathing system, and make sure that the High O<sub>2</sub> alarm occurs.
  - Set the High O<sub>2</sub> alarm to Off, and make sure that the alarm stops.
  - Flow 100% O<sub>2</sub> for 2 minutes, and make sure that the O<sub>2</sub> cell measures 100% O<sub>2</sub>.
13. Test the low minute volume alarm.
  - Push the Menu key.
  - Select **Alarm Setup** from the **Main Menu**.
  - Set the alarm limit for low minute volume to 6 l/min.
  - Make sure that the low minute volume alarm occurs.
  - Set the low minute volume alarm to Off.
14. Test the low airway pressure alarm.
  - Remove the test lung from the patient connection.
  - Make sure that the low airway pressure alarm occurs (other alarms may occur).
15. Test the sustained airway pressure alarm.
  - Set the APL valve to 70 cmH<sub>2</sub>O.
  - Set the Bag/Vent switch to Bag.
  - Occlude the patient connection and push the O<sub>2</sub> flush button.
  - Make sure that the Ppeak high. Blockage? (sustained airway pressure) alarm occurs after approximately 15 seconds at the sustained pressure limit.

## Breathing system tests

1. Make sure that the auxiliary equipment is functioning correctly.
2. Verify that AGSS is functioning correctly.
  - Some breathing systems with active AGSS have a flow indicator on the side. Make sure that the flow indicator shows a flow in the green range.
3. Make sure that the check valves on the breathing circuit module work correctly.
  - The expiratory check valve rises during expiration and falls at the start of inspiration.
  - The inspiratory check valve rises during inspiration and falls at the start of expiration.

**WARNING** Objects in the breathing system can stop gas flow to the patient, causing injury or death. Use a test plug that is the appropriate size so that it will not fall into the breathing system.

After performing the breathing system tests, make sure that there are no test plugs or other objects caught in the breathing system.

### Bellows test

1. Set the System switch to Standby.
2. Set the Bag/Vent switch to Vent.
3. Set all flow controls to minimum flow.
4. Occlude the patient connection.
5. Push the O<sub>2</sub> flush button to fill the bellows. Release the O<sub>2</sub> flush button.
6. Make sure that the pressure does not increase to more than 15 cmH<sub>2</sub>O on the pressure gauge.
7. If the bellows falls lower than the top of the indicator, there is a leak. See *“Breathing system problems”* in the *“Alarms and Troubleshooting”* section.

## **Breathing circuit test**

1. Set the System switch to On.
2. Set the Bag/Vent switch to Bag.
3. Occlude the bag port.
4. Set the APL valve to 70 cmH<sub>2</sub>O.
5. Set the O<sub>2</sub> flow to 250 ml/min.
6. Occlude the patient connection.
7. Push the O<sub>2</sub> flush button and pressurize the bag to approximately 30 cmH<sub>2</sub>O.
8. Release the O<sub>2</sub> flush button. The pressure must not decrease. Any pressure decrease shown on the pressure gauge indicates a leak. Repair any leaks in the breathing circuit.

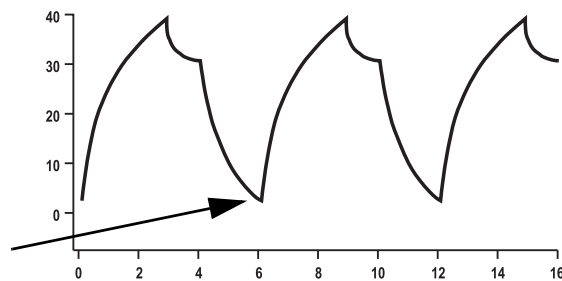
## **APL valve test**

1. Set the System switch to On.
2. Occlude the patient connection.
3. Occlude the bag port.
4. Set the APL valve to 70 cmH<sub>2</sub>O.
5. Set the O<sub>2</sub> flow to 3 l/min. Make sure that the value on the inspiratory pressure gauge does not exceed 85 cmH<sub>2</sub>O. Some pressure fluctuation is normal.
6. Set the APL valve to MIN.
7. Make sure that the value on the inspiratory pressure gauge is less than approximately 5 cmH<sub>2</sub>O.
8. Push the O<sub>2</sub> flush button. Make sure that the value on the inspiratory pressure gauge stays near zero.
9. Set the O<sub>2</sub> flow to minimum and make sure that the value on the inspiratory pressure gauge does not decrease below 0 cmH<sub>2</sub>O.



## Monitor and ventilator tests

1. Connect a test lung to the patient connection.
2. Set the Bag/Vent switch to Bag.
3. Set the System switch to On.
4. Push the Menu key.
5. Select **Ventilation Mode - VCV**.
6. Set the ventilator parameters.
  - TV 400 ml.
  - Rate 12.
  - I:E 1:2.
  - Pmax 40 cmH<sub>2</sub>O.
  - PEEP Off.
7. Set the Bag/Vent switch to Vent.
8. Push the O<sub>2</sub> flush button to fill the bellows.
9. Make sure that:
  - Mechanical ventilation starts.
  - A subatmospheric pressure alarm does not occur.
  - The ventilator shows the correct data based on settings.
  - The bellows inflate and deflate during mechanical ventilation.
10. Set the O<sub>2</sub> flow control to 5 l/min.
11. Make sure that:
  - The end expiratory pressure is approximately 2 cmH<sub>2</sub>O. Positive end expiratory pressure that occurs when PEEP is Off may indicate that the scavenging system is not removing enough gas.



- The ventilator shows the correct data based on settings.
- The bellows inflate and deflate during mechanical ventilation.

12. Set the ventilator controls and alarm limits to clinically appropriate levels.
13. Prepare the system.
  - Turn all vaporizers off.
  - Set the APL valve to MIN.
  - Set the Bag/Vent switch to Bag.
  - Set all flow controls to minimum.
  - Set sufficient patient suction.
  - Make sure that the breathing system is correctly connected and not damaged.

**WARNING** Flush the system with 5 l/min of O<sub>2</sub> for at least one minute to remove any gas mixtures or by-products from the system.

# 6 Alarms and Troubleshooting

**WARNING** Set alarm levels appropriately before starting ventilation (manual or mechanical).

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

⚠ Do not use malfunctioning equipment. Contact a Datex-Ohmeda trained representative for service.

⚠ 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.

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## Alarms

When an alarm occurs during a case, an alarm tone sounds and the alarm message is displayed in the alarm message field. The alarm message area has room for four alarms to be shown at one time. If more than four alarms occur, the alarms cycle every two seconds.

Alarms have three general causes:

- Malfunctions - Result in reduced system function or prevent mechanical ventilation.
- Patient monitoring - Are caused by high and low limit settings that are adjusted by the user.
- Informational - Are caused by control settings or system conditions that may change system operation.

### Audio

Alarm priority is dependent on the level of risk to the patient.

A high-priority alarm tone sounds in two bursts of five tones, a 10 second pause, and then repeats. Some high-priority alarms can be silenced for 120 seconds.

Medium-priority alarm tones sound in three tones with a 25 second pause, then repeats. Medium priority alarms can be silenced for 120 seconds.

Informational alarms have a single alarm tone and the tone does not repeat.

Silencing an alarm stops the audible tone for 120 seconds. Pushing the Alarm silence key when no medium or high-priority alarms are active suspends audible alarm tones for 90 seconds.

### Display

Messages for alarms are displayed as follows:

- High-priority alarms show in white text on a red background.
- Medium priority alarms show in yellow text on a dark gray background.
- Informational messages show in white text on a dark gray background.

## Latching alarms

Some patient parameter alarms continue to be displayed (latch) when the alarm condition is corrected. When an alarm is latched, the alarm messages show in white text on a black background.

Latching alarm	Flashing parameter
O2% low	O2
No O2 pressure	None
Ppeak high	Ppeak
PEEP high. Blockage?	Ppeak
Negative airway pressure	None
Apnea > 120 s	TVexp
Inspiration stopped	None

The alarm remains in this condition until it is acknowledged by pushing the Alarm silence key or until the alarm reoccurs. When the alarm is acknowledged, it is removed from the screen. If an alarm has latched and the alarm reoccurs before it is acknowledged, the alarm will revert to an active state.

## List of alarms

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

Message	Priority	Cause	Action
+15V Analog out-of-range	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable. Contact a Datex-Ohmeda trained service representative.
+6V Analog out-of-range	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable. Contact a Datex-Ohmeda trained service representative.
-6V Analog out-of-range	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable. Contact a Datex-Ohmeda trained service representative.
5V Ref out-of-range	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable. Contact a Datex-Ohmeda trained service representative.
1.225 V Ref out-of-range	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable. Contact a Datex-Ohmeda trained service representative.
12 hour test recommended	Informational	System is in use for more than 12 hours without a power-up self test.	At end of the case, move the System switch from On to Standby to On.
A/D converter failure	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable. Contact a Datex-Ohmeda trained service representative.
Absorber panel open	Medium	The breathing system is not fully latched.	Fully latch the breathing system.
ACGO on	Medium (Informational after acknowledge)	The outlet selection switch is set to the auxiliary common gas outlet.	Connect the patient circuit to the auxiliary outlet. For mechanical ventilation or ventilation with monitoring, select the circle system setting.
Apnea > 120 s	<b>High</b>	No mechanical breaths or spontaneous breaths greater than 5 ml in last 120 seconds.	Check the patient. Bag as needed. Check for disconnects. If the patient is on a heart lung machine, select Cardiac Bypass from the Main menu.
Apnea	Medium	No mechanical breaths or spontaneous breaths greater than 5 ml in last 30 seconds.	Check the patient. Bag as needed. Check for disconnects. If the patient is on a heart lung machine, select Cardiac Bypass on the Main Menu.
Apnea alarm off	Informational	The Cardiac Bypass option is set to On in the Main Menu.	Set Cardiac Bypass to Off in the Main Menu.
Apnea alarm standby	Informational	Normal condition after End Case, power-up, or ACGO change from On to Off.	Monitoring resumes after first breath (mechanical) or two breaths within 30 seconds (non-mechanical).
Backup mode active	Informational	No spontaneous breaths in set period of time and 30 seconds have elapsed since starting PSVPro mode.	Select a new ventilation mode or switch to manual ventilation.
Battery charger fail	Informational	The current in the battery charging circuit is too high.	System is operational, but may fail on battery if mains power is lost. Contact a Datex-Ohmeda trained service representative.
Battery charging	Informational	Battery is not fully charged.	Leave the system plugged in to charge the battery.
Battery circuit failure	Informational	Battery measures less than 7 V or higher than 16.5 V.	System is operational, but may fail on battery if mains power is lost. Contact a Datex-Ohmeda trained service representative.
Battery current high	Informational	Battery current greater than 6 amps for 10 seconds.	System is operational, but may fail on battery if mains power is lost. Contact a Datex-Ohmeda trained service representative.

## 6 Alarms and Troubleshooting

Message	Priority	Cause	Action
Battery failure high	Informational	Battery voltage greater than 16 V for 10 seconds.	System is operational, but may fail on battery if mains power is lost. Contact a Datex-Ohmeda trained service representative.
Battery failure low	Informational	The battery voltage is too low (less than 7 V) to supply the system if power fails.	System is operational, but will fail on battery if mains power is lost. Leave the system plugged in to charge the battery. If the battery does not charge in 24 hours, contact a Datex-Ohmeda trained service representative.
Calibrate flow sensors	Informational	The last flow sensor calibration failed.	Zero the flow sensors. Look for water in the flow sensor tubes and dry if necessary. Replace sensor if necessary. Contact a Datex-Ohmeda trained service representative if calibrating or replacing the sensor does not correct the problem.
Calibrate O2 sensor	Informational	Calibration failure or O2% > 110%.	Calibrate the O2 sensor. Replace the sensor if calibration is unsuccessful. Contact a Datex-Ohmeda trained service representative if calibrating or replacing the sensor does not correct problem.
Cardiac bypass	Informational	The Cardiac Bypass option is set to On. Apnea alarms are off.	Set Cardiac Bypass to Off in the Main Menu.
Check flow sensors	Medium (Informational after acknowledge)	System has detected an improper flow pattern in the breathing circuit.	Check if the flow sensors are correctly installed. Check for water buildup in the flow sensor tubes. Inspect one way valves (breathing circuit module.) Check the condition of the flow sensor and its tubing.
Circuit leak	Medium	Exhaled volume less than 50% of inspired volume for at least 30 seconds (mechanical ventilation).	Check breathing circuit and flow sensor connections. Patient circuit leak audio can be turned off in the Alarm Setup menu.
Circuit leak audio off	Informational	Leak Audio is set to Off on the Alarm Setup menu.	Turn Leak Audio to On on the Alarm Setup menu.
Connect O2 sensor	Medium	O2 cell is not installed in the breathing system. The O2 cell is not measuring gas in the breathing circuit.	Install or replace the O2 cell.
CPU failure	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable. Contact a Datex-Ohmeda trained service representative.
Display failure	Medium	Backlight input supply is less than 9.35V or greater than 13.65V. This alarm message may not always be viewable.	Continue to use the system normally. Contact a Datex-Ohmeda trained service representative.
Dry or replace flow sensors	Medium (Informational after acknowledge)	Expired volume is greater than inspired volume for six breaths with a circle module.	Check patient condition. Check that the flow sensors are installed correctly. Check that there is no water buildup in the flow sensor tubes. Verify proper check valve operation. Inspect one way valves (breathing circuit module). Replace flow sensors.
Gas inlet valve failure	Minimum shutdown (High)	Ventilator pressure sensor malfunction.	Ventilate manually. Monitoring is not available. Contact a Datex-Ohmeda trained service representative.
Increase low MV limit	Medium	The low MV limit is set to Off.	Turn on the MV low setting.
Inspiration stopped	<b>High</b>	Drive gas safety switch activated (high pressure).	Adjust the controls. Check the system for blockages. Contact a Datex-Ohmeda trained service representative if problem continues.
Internal ventilator clock too fast	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable. Contact a Datex-Ohmeda trained service representative.
Internal ventilator clock too slow	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable. Contact a Datex-Ohmeda trained service representative.

## Aespire View

Message	Priority	Cause	Action
Invalid circuit module	Informational	Absorber switches do not detect a valid breathing circuit module.	Make sure the breathing system is correctly installed. Continue to use normally. Contact a Datex-Ohmeda trained service representative.
Limit task light use	Informational	The system is operating on battery power.	Manually ventilate the patient to save power. Make sure power is connected and circuit breakers are closed.
Loss of backup audio	Medium (Informational after acknowledge)	Alarm audio malfunction.	Continue to use normally. Contact a Datex-Ohmeda trained service representative.
Low battery voltage	Medium	Voltage is less than 11.65V while using battery power.	Manually ventilate the patient to save power. Make sure power is connected and circuit breakers are closed.
Memory (EEPROM) failure	Informational	The system cannot access some stored values.	Default settings are used. Ventilation is still possible but service is necessary. Contact a Datex-Ohmeda trained service representative.
Memory (flash) failure	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable. Contact a Datex-Ohmeda trained service representative.
Memory (redundant storage) fail	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is still available. Contact a Datex-Ohmeda trained service representative.
Monitoring only	Medium	A severe malfunction prevents mechanical ventilation. Other alarms may also occur.	Ventilate manually. Cycle system power (On-Standby-On). If the alarm clears, restart mechanical ventilation. Contact a Datex-Ohmeda trained service representative.
MVexp high	Medium	Exhaled minute volume is greater than the high limit setting. This alarm is suspended for nine breaths or one minute (whichever is greater) after the ventilator settings are changed.	Check patient for spontaneous breathing. Adjust control settings.
MVexp low	Medium	Exhaled minute volume less than the low limit alarm setting. This alarm is suspended for nine breaths or one minute (whichever is greater) after the ventilator settings are changed.	Check patient condition. Check tubing connections. Check alarm settings.
Negative airway pressure	<b>High</b>	Subatmospheric pressure (less than -10 cmH <sub>2</sub> O).	Check the patient condition for spontaneous activity. Increase fresh gas flow. Look for high flow through gas scavenging. Calibrate the flow sensors. With active scavenging, check the negative relief valve on the receiver.
No CO <sub>2</sub> absorption	Medium (Informational after acknowledged)	Absorber canister is not latched when CO <sub>2</sub> bypass is in place.	Check that the absorber canister is properly latched. Continue to use the system normally. Contact a Datex-Ohmeda trained service representative.
No exp flow sensor	Medium (Informational after acknowledge)	Electrical signals show the flow sensor is not connected.	Connect the flow sensors. Make sure the flow sensor module is on all the way.
No insp flow sensor	Medium (Informational after acknowledge)	Electrical signals show the flow sensor is not connected.	Connect the flow sensors. Make sure the flow sensor module is on all the way.
No O <sub>2</sub> pressure	<b>High</b> (cannot be silenced)	The O <sub>2</sub> supply has failed for 10 seconds.	Air flow will continue. Ventilate manually if necessary. Connect a pipeline supply or install an O <sub>2</sub> cylinder.
O <sub>2</sub> flush stuck on?	Informational	O <sub>2</sub> flush flow is detected for greater than or equal to 30 seconds.	Stop pressing the O <sub>2</sub> flush button. If this alarm occurs when flush is not in use, contact a Datex-Ohmeda trained service representative.
O <sub>2</sub> % high	Medium	O <sub>2</sub> % is greater than the alarm high limit setting.	Verify that the limit is set correctly. Check that the O <sub>2</sub> flow is adequate. Calibrate the O <sub>2</sub> sensor. If calibration fails, replace the O <sub>2</sub> sensor.



## 6 Alarms and Troubleshooting

Message	Priority	Cause	Action
O2% low	<b>High</b>	O2% is less than the alarm low limit setting.	Verify that the limit is set correctly. Check that the O2 flow is adequate. Calibrate the O2 sensor. If calibration fails, replace the O2 sensor. As the cell wears out, the measured % of O2 decreases.
PEEP high. Blockage?	Minimum shutdown (High)	Paw greater than 100 cmH2O for 10 seconds.	Check the tubing and breathing system for blockages. Ventilate manually. Contact a Datex-Ohmeda trained service representative.
PEEP high. Blockage?	<b>High</b>	Paw greater than or equal to sustained pressure limit for 15 seconds <sup>1</sup> .	Check tubing for kinks, blockages, disconnects. Calibrate the flow sensors.
Plug in power cable. On battery.	Medium (Informational after acknowledge)	The mains supply is not connected or has failed and the system is using battery power.	Ventilate manually to save power. At full charge, the battery permits approximately 90 minutes of mechanical ventilation. Make sure power is connected and circuit breakers are closed.
Positive SIB Vref out-of-range	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is still available. Contact a Datex-Ohmeda trained service representative.
Ppeak high	<b>High</b>	Ppeak is greater than Pmax. The ventilator cycles to expiration.	Verify Pmax and other controls are set correctly. Look for blockages. Check patient connection.
Ppeak low. Leak?	Medium	Ppeak is less than 4 cm above Pmin for 20 seconds when RR is greater than or equal to four. Ppeak is less than 4 cm above Pmin for 35 seconds when RR is less than four.	Verify circuit connections are okay. Look at the Paw gauge on the absorber. Look for circuit disconnection.
Pressure/volume monitor inactive	Medium (Informational after acknowledge)	The outlet selection switch is set to the ACGO.	Connect the patient circuit to the auxiliary outlet. For mechanical ventilation or ventilation with monitoring, select the circle system setting.
Replace exp flow sensor	Informational	The system cannot read the calibration data stored in the sensor.	Operation continues with reduced accuracy. Replace the flow sensor.
Replace insp flow sensor	Informational	The system cannot read the calibration data stored in the sensor.	Operation continues with reduced accuracy. Replace the flow sensor.
Replace O2 sensor	Informational	O2% is less than 5%.	Make sure the patient receives O2. Use a different monitor. Calibrate the O2 sensor. Replace the O2 cell.
Reverse exp flow	Medium (Informational after acknowledge)	Flow through the expiratory sensor during inspiration (for six breaths in a row).	Look at the check valves. Check for water buildup in the flow sensor tubes. Check the flow sensor condition. Replace the expiratory check valve.
Reverse insp flow	Medium (Informational after acknowledge)	Flow through the inspiratory sensor during expiration (for six breaths in a row).	Look at the check valves. Check for water buildup in the flow sensor tubes. Check the flow sensor condition. Replace the expiratory check valve.
Select gas outlet	Medium	With ACGO On, the flow sensors have detected three breaths in patient circuit during the last 30 seconds.	Turn the ACGO off or connect the non-circle patient circuit to the ACGO. Note: The bag arm will not ventilate a patient at the auxiliary outlet.
Service calibration	Informational	Corrupt or invalid calibration data for the flow valve.	The system is operational. Contact a Datex-Ohmeda trained service representative.
Software error	Minimum Shutdown (High)	Indicates that a software error has occurred.	Ventilate manually. Monitoring is not reliable. Contact a Datex-Ohmeda trained service representative.
Software/Hardware Incompatibility	Minimum Shutdown (High)	Compatibility error between the software and the hardware.	Ventilate manually. Contact a Datex-Ohmeda trained service representative.
System leak?	Medium (Informational after acknowledge)	Leak detected between ventilator and patient circuit.	Look for leaks in the absorber system. Check the integrity of the flow sensors. Zero the flow sensors. Inspect for leaks (repair). Inspect or replace flow sensors.
TFS module error	Informational	TFS module connected but not operating correctly.	System is operational, but TFS is not functioning correctly. Contact a Datex-Ohmeda trained service representative.

# Aespire View

Message	Priority	Cause	Action
TFS module error - Air sensor	Informational	TFS module connected but the Air sensor is reporting an error.	System is operational, but the Air flow sensor is not functioning correctly. Contact a Datex-Ohmeda trained service representative.
TFS module error - N2O sensor	Informational	TFS module connected but N2O fresh gas sensor is reporting an error.	System is operational, but N2O sensor is not functioning correctly. Contact a Datex-Ohmeda trained service representative.
TFS module error - O2 sensor	Informational	TFS module connected but O2 fresh gas sensor is reporting an error.	System is operational, but the O2 flow sensor is not functioning correctly. Contact a Datex-Ohmeda trained service representative.
TVexp high	Medium	Exhaled tidal volume is greater than the high alarm limit. This alarm is suspended for nine breaths after a change in the ventilator settings.	Check patient for spontaneous breathing. Check ventilator and alarm settings.
TVexp low	Medium	Exhaled tidal volume is less than the low alarm limit. This alarm is suspended for nine breaths after a change in the ventilator settings.	Check patient condition. Check tubing connections. Check alarm settings.
TV not achieved	Informational	Tidal volume measured by inspiratory flow sensor is less than the set value for six breaths in a row after the first minute of mechanical ventilation.	Adjust controls to supply adequate tidal volumes. Check I:E, Pmax, and volume settings. Possible leak. Modify settings or check for system leaks.
Unable to drive bellows	Informational	Manifold pressure is greater than Paw.	Check the drive gas. Increase fresh gas flow (or push the O2 flush button) to fill the bellows.
Ventilator has no drive gas	Medium (Informational after acknowledge)	The ventilator does not detect supply pressure.	Manually ventilate the patient. Make sure that the appropriate gas supplies (O2 or Air) are connected and pressurized.
Vol vent only. No PEEP or PSV.	Medium	Manifold pressure error. Pressure control unavailable.	Continue to use volume control ventilation or ventilate manually. Shut down system as soon as possible. Contact a Datex-Ohmeda trained service representative.

<b><sup>1</sup>The sustained pressure threshold is calculated from the pressure limit setting. The sustained limit is calculated as follows:</b>	
<b>Mechanical ventilation with PEEP Off</b>	For Pmax less than or equal to 30 cmH2O, the sustained pressure limit is 6 cmH2O.
	For Pmax between 30 and 60 cmH2O, the sustained pressure limit is 20% of Pmax.
	For Pmax greater than or equal to 60 cmH2O, the sustained pressure limit is 12 cmH2O.
<b>Mechanical ventilation with PEEP On</b>	For Pmax less than or equal to 30 cmH2O, the sustained pressure limit is 6 cmH2O plus "set PEEP" minus 2 cmH2O.
	For Pmax between 30 and 60 cmH2O, the sustained pressure limit is 20% of Pmax plus "set PEEP" minus 2 cmH2O.
	For Pmax greater than 60 cmH2O, the sustained pressure max is 12 cmH2O plus "set PEEP" minus 2 cmH2O.
<b>Mechanical Ventilation Off</b>	For Pmax between 12 and 60 cmH2O, the sustained pressure limit is 50% of Pmax.
	For Pmax greater than 60 cmH2O, the sustained pressure limit is 30 cmH2O.

### **Minimum system shutdown and monitoring alarms**

There are two special alarm types:

- Minimum system monitoring alarms stop mechanical ventilation.
- Minimum system shutdown alarms stop mechanical ventilation and monitoring.

The software goes to minimum system monitoring when a non-recoverable error occurs during bootup or normal operation. The ventilator shows data and mechanical ventilation stops. 'Monitoring only' appears in the Alarm message area and a specific failure message appears in the User message area.

The following are minimum system monitoring alarms:

- Manifold pressure sensor failure.
- Pressure limit switch failure.
- Flow valve (DAC) failure.
- Flow valve (current) failure.
- Valve power failure.

A severe malfunction causes minimum system shutdown alarms. This condition prevents mechanical ventilation and monitoring. If this condition occurs:

- Ventilate manually.
- Use a stand-alone monitor.
- Cycle system power (On-Standby-On).

If the alarm clears, restart mechanical ventilation. If the alarm does not clear, contact a Datex-Ohmeda trained service representative.

## Alarm ranges

Alarm	Range	Increment	Default
O2% high	Off, 21-99%	1%	Off
O2% low	18-99%	1%	21%
MVexp high	Off, 0.5-30 l/min	0.5 l/min	10.0 l/min
MVexp low	Off, 0.1-10 l/min	0.1 l/min	2.0 l/min
TVexp high	20-1600 ml	20 ml	1000 ml
TVexp low	Off, 5-1500 ml	5 ml for less than 20 ml, otherwise 20 ml	Off
Leak Audio	On, Off	N/A	On

## Alarm tests

Test the system to verify that alarms are functioning:

1. Connect a test lung to the patient connection.
2. Start a case.
3. Set the Bag/Vent switch to Vent.
4. Set the controls.
  - Ventilation mode: Volume Control (VC).
  - Ventilator.
    - Tidal Vol: 400 ml
    - Rate: 12
    - I:E Ratio: 1:2
    - Plimit: 40 cmH2O
    - PEEP: Off
  - Anesthesia machine.
    - O2 flow: minimum flow (25-75 ml/min).
    - All other gases: Off
    - Push O2 flush button to fill bellows.
5. Set the O2 concentration to 30% and allow the O2 reading to stabilize.

6. Test the O<sub>2</sub> alarms.
  - Remove the O<sub>2</sub> cell from the breathing circuit and make sure it measures approximately 21% O<sub>2</sub> in room air.
  - Set the **O<sub>2</sub> low** alarm limit to 50%. Make sure the **O<sub>2</sub>% low** alarm occurs.
  - Set the **O<sub>2</sub> low** alarm limit back to 21% and make sure that the **O<sub>2</sub>% low** alarm cancels.
  - Install the O<sub>2</sub> cell in the breathing circuit.
  - Set the **O<sub>2</sub> high** alarm limit to 50%.
  - Push the O<sub>2</sub> flush button to fill the breathing system.
  - Make sure the **O<sub>2</sub>% high** alarm occurs.
  - Set the **O<sub>2</sub> high** alarm limit back to Off. Make sure that the **O<sub>2</sub>% high** alarm cancels.
  - After two minutes in pure O<sub>2</sub>, the O<sub>2</sub> cell measures approximately 100% O<sub>2</sub>.
7. Test the **MVexp low** alarm.
  - Go to the **Alarm Setup** menu.
  - Set the **MV** low alarm limit to 6.0 l/min
  - Make sure the **MVexp low** alarm occurs.
  - Set the **MV** low alarm limit to Off.
8. Test the **Ppeak high** alarm.
  - Set **Pmax** to less than the peak airway pressure.
  - Make sure the **Ppeak high** alarm occurs.
  - Set **Pmax** to the desired level.
9. 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<sub>2</sub> flush button.
  - Make sure the **PEEP high. Blockage?** alarm occurs after approximately 15 seconds.
10. 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.
11. Set all alarm limits to approved clinical values.

## Breathing system problems

System	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. See <i>"Remove the AGSS Receiver Filter"</i> in the <i>"ABS Cleaning and Sterilization"</i> 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 the 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.	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 <i>"Bellows test."</i>	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.

System	Problem	Solution
Mains indicator is not on.	The electrical power cable is not connected.	Connect the power cable.
	The inlet 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 had no power.	Use a different electrical socket.
	An internal fuse is open.	Have a Datex-Ohmeda trained service representative 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 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.	Have a Datex-Ohmeda trained service representative repair the system.
Tec 6 series vaporizer has no power.	Not plugged into outlet.	Connect power cable.
	The outlet circuit breaker is off	Turn the circuit breaker on.

## Pneumatic problems

System	Problem	Solution
High-pressure leak test fails.	Controls are not set correctly.	Make sure that 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 test fails with a vaporizer on.	The vaporizer is not correctly installed.	Correctly install the vaporizer.
	The vaporizer filler is loose (funnel fill type vaporizer).	Tighten the filler.
	Vaporizer port o-rings (external) are damaged or not installed.	Install new o-rings.
	A vaporizer malfunction (the leak stops if a different vaporizer is used in the same manifold position).	Send the vaporizer to an approved service center for repair.
	A port valve malfunction (the leak continues if a different vaporizer in the same manifold position).	Contact a Datex-Ohmeda trained service representative to repair the vaporizer manifold.
Low-pressure leak with a vaporizer off.	Anesthesia machine problem.	Contact a Datex-Ohmeda trained service representative.



# 7 User Maintenance

**WARNING** To help prevent fires:

- Only use lubricants approved for anesthesia or O2 equipment, such as Krytox.
- Do not use lubricants that contain oil or grease. They may burn or explode in high O2 concentrations.
- All materials used to cover 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 . . . . .	7-2
	Maintenance summary and schedule . . . . .	7-2
	Breathing system maintenance. . . . .	7-3
	O2 cell replacement . . . . .	7-4
	O2 cell calibration . . . . .	7-5
	Zeroing flow sensor . . . . .	7-6
	Prevent water buildup. . . . .	7-7

## 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 Datex-Ohmeda's published specifications.

To ensure full reliability, have all repairs and service done by a Datex-Ohmeda trained service representative.

No repair should ever be attempted by anyone not having training and 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 Datex-Ohmeda's published specifications.

Contact a 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. Equipment should be serviced more frequently if it is used more than the typical yearly usage.

For detailed cleaning instructions, refer to the Advanced Breathing System Cleaning and Sterilization manual which accompanies the machine.

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

## User maintenance

Minimum Frequency	Maintenance
Daily	<ul style="list-style-type: none"> <li>• Clean the external surfaces.</li> <li>• Perform 21% O<sub>2</sub> calibration.</li> <li>• Check the condenser reservoir (if equipped). Drain if needed.</li> <li>• Zero the flow sensors.</li> </ul>
Two weeks	Drain the vaporizers and discard the agent. This is not necessary for the Tec 6 series vaporizers.
Monthly	<ul style="list-style-type: none"> <li>• Perform 100% O<sub>2</sub> calibration.</li> <li>• Lubricate all cylinder supply tee handle threads with Krytox or a lubricant approved for use with 100% O<sub>2</sub>.</li> </ul>
During cleaning and setup	Inspect the parts for damage. Replace or repair as necessary.
Annually	Replace the external o-rings on the vaporizer ports.
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 (if equipped).</li> <li>• Replace the circuit O<sub>2</sub> cell (under typical use the cell meets specifications for 1 year).</li> <li>• Replace the disposable (plastic) flow sensors (under typical use the non-offset flow sensors meet specifications for a minimum of three months and the offset flow sensors meet specifications for a minimum of six months).</li> <li>• Replace the autoclavable (metal) flow sensors (under typical use the sensors meet specifications for a minimum of one year).</li> <li>• Replace the receiver filter (if equipped - active gas scavenging only).</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, tests, calibrations, and parts replacement as defined in the Technical Reference manual.

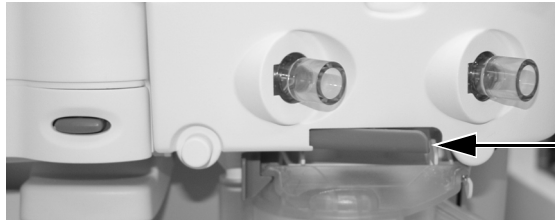
## Breathing system maintenance

Replace any parts that are visibly cracked, chipped, distorted, or worn when cleaning the breathing system.

## O2 cell replacement

**WARNING** Handle and dispose of O2 cells according to site biohazard policies. Do not incinerate.

1. Pull the latch to unlock the flow sensor module.



AB.74p.052

2. Pull the flow sensor module out of the breathing system.
3. Remove the cable connector from the O2 cell, and unscrew the cell counterclockwise.



AB.74p.065

**Important** Make sure that the o-ring is on the replacement O2 cell before installation.



AB.74p.083

4. Install the replacement O2 cell and reconnect the O2 cell cable.
5. Put the flow sensor module back into the system and push the latch closed to secure the flow sensor module.
6. Perform "O2 cell calibration" after O2 cell replacement.

## O2 cell calibration

**WARNING** Do not perform O2 cell calibration while the system is connected to a patient.

⚠ The O2 cell must be calibrated at the same environment pressure at which it will be used to monitor oxygen delivery in the patient circuit.

⚠ Operation at pressures other than the pressures present during calibration may result in readings outside of the stated monitoring accuracy.

**Important** It may take a new O2 cell 90 minutes to stabilize. If the O2 cell calibration fails after a new O2 cell has been installed, wait 90 minutes and repeat the calibration.

### 21% O2 cell calibration

Complete a 21% O2 cell calibration before performing the 100% O2 cell calibration.

1. Push the Menu key.
2. Select **Setup/Calibration**.
3. Select **O2 Sensor Calibration**.
4. Select **21% O2**.
5. Remove the O2 cell from the circuit.
  - Pull the latch to unlock the flow sensor module.
  - Pull the flow sensor module out of the breathing system.
  - Remove the O2 cell by unscrewing the cell counterclockwise. This exposes the O2 cell to room air.
6. Select **Start Calibration**. 'Calibrating . . .' shows on the screen while the O2 cell is being calibrated to the room air.
7. 'Complete' shows on the screen upon successful calibration:
  - Reinstall the O2 cell.
  - Select **Go to Setup/Calibration Menu**.
8. If the screen shows 'Failure,' repeat the 21% O2 cell calibration.
9. If the calibration fails after another attempt, perform a 100% O2 cell calibration. Then try the 21% O2 cell calibration again.
10. Replace the O2 cell if repeated failures occur.

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

Complete a 21% O<sub>2</sub> cell calibration before performing a 100% O<sub>2</sub> cell calibration.

1. Make sure that the O<sub>2</sub> cell is in the circuit.
2. After performing a 21% calibration, select **100% O<sub>2</sub>**.
3. Push the O<sub>2</sub> flush button for 5 seconds and set the O<sub>2</sub> flow to 5 l/min and set other gases to minimal flow.
4. Select **Start Calibration**.
5. 'Complete' shows on the screen upon successful calibration.
6. If 'Failure' shows on the screen, repeat the 100% O<sub>2</sub> cell calibration.
  - If the calibration fails after another attempt, decrease the airway pressure and try the 100% O<sub>2</sub> cell calibration again.
  - If calibration fails after repeated attempts, perform a 21% O<sub>2</sub> cell calibration. Then try a 100% O<sub>2</sub> cell calibration again.
  - If the 100% O<sub>2</sub> cell calibration does not pass, replace the O<sub>2</sub> cell.
7. Perform the *"Breathing system tests"* in the *"Preoperative Tests"* section before using the system.

## Zeroing flow sensor

**WARNING** Do not perform calibration while system is connected to a patient.

**Note** The system automatically corrects for zero offset when the flow sensor connectors are unplugged and the system power is on.

1. Set the Bag/Vent switch to Bag.
2. Remove the flow sensor module.
  - Pull the latch to unlock the flow sensor module from the breathing system.
  - Pull the flow sensor module out of the breathing system.
3. 'No insp flow sensor' and 'No exp flow sensor' show on the display when the zeroing is complete.
4. Reinstall the flow sensor module.
5. Perform the *"Breathing system tests"* in the *"Preoperative Tests"* section before using the system."

## Prevent water buildup

Water is created from exhaled gas and a chemical reaction between CO<sub>2</sub> and the absorbent. Water buildup increases when the system is used at low fresh gas flows. At low flows, more CO<sub>2</sub> stays in the absorber producing water and more moist exhaled gas remains in the absorber.

**Note** Pooled water in the flow sensor or water in the sensing lines can cause inaccurate alarms. Small beads of water or a foggy appearance in the flow sensors is acceptable.

To manage excess water:

- Empty the water reservoir in the absorbent canister when changing the absorbent.
- Make sure that any water condensing in the breathing circuit tubes is not allowed to drain 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.
- Install the condenser or EZchange canister option.





# 8 Setup and Connections

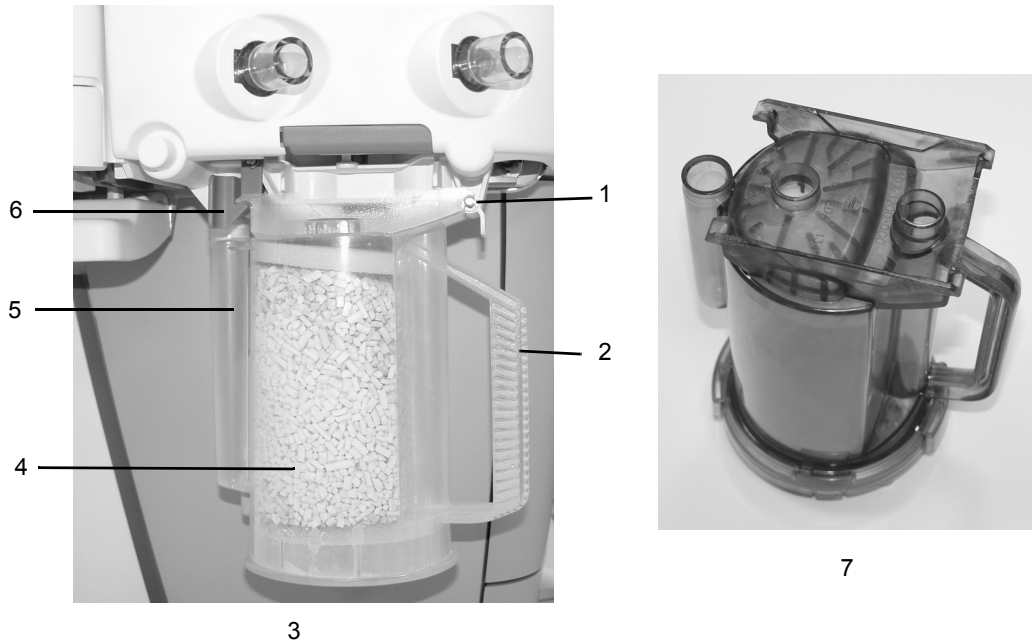
<b>In this section</b>	Canister setup. . . . .	8-4
	Electrical connections. . . . .	8-9
	Pneumatic connections. . . . .	8-10
	How to install gas cylinders. . . . .	8-13
	How to attach equipment to the top of the machine . . . . .	8-14

**WARNING** Datex-Ohmeda strongly recommends the use of O<sub>2</sub> 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 cables, hoses, and tubing approved by Datex-Ohmeda.
  
- ⚠ 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, flow sensors, and O<sub>2</sub> 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



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*

AB.74p042  
AB.74p043

**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.
- The Disposable Multi Absorber cannot be disinfected and is not autoclavable. Be aware that cross-contamination is possible.
- 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 change the absorber during ventilation unless the EZchange canister system is installed.
- 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.

The absorber canister is available in two versions:

- Disposable Multi Absorber.
- Reusable Multi Absorber.

Both versions are removed and installed on the breathing system in the same way.

Each canister holds 800 grams of loose absorbent. Datex-Ohmeda recommends Medisorb™ absorbent.

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

## 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.

### Important

Read the canister instructions completely before using the product.

## Removing a canister

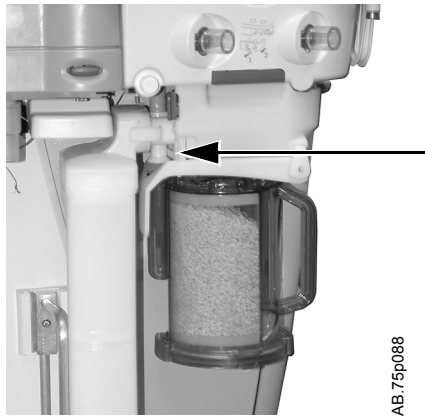
1. Hold the canister by the handle and push on the release latch to unlock the canister.



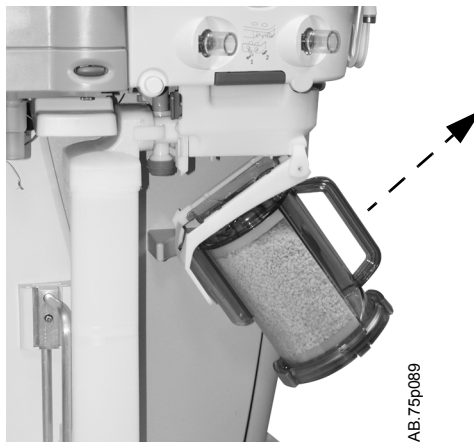
2. Remove the canister by tilting it downward and off the two support pins.

### Removing an EZchange canister

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

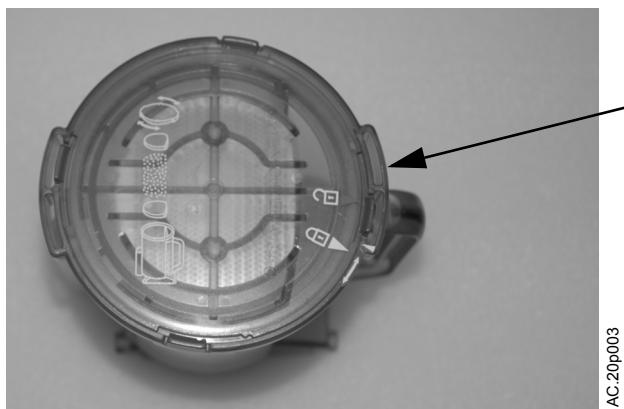


2. Slide the canister up and out of the cradle.



### Reusable Multi Absorber canister filling

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



2. Push up to release the seal.

3. Lift off the cover to remove it.

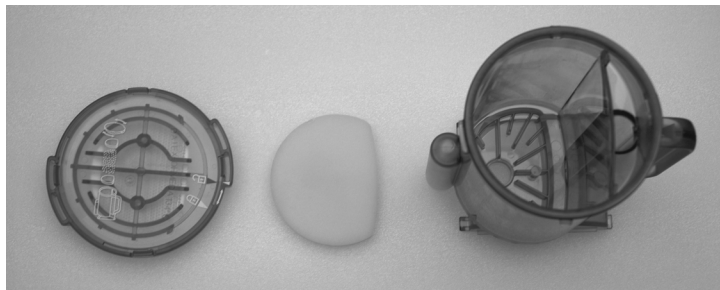


AC.20p003

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.



AC.20p004

5. To clean and disinfect the canister, see “Absorber canister” in the “Cleaning and Sterilization” manual.
6. Assemble canister.
  - Place a new filter in the bottom of the canister.
  - Pour absorbent into the canister.
  - Place a new filter over the absorbent.
  - 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.
  - Wipe off any absorbent dust.

**Note** Alignment of the arrows helps to indicate correct assembly.





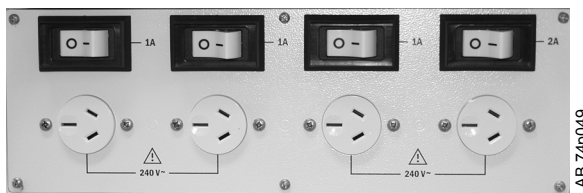
**WARNING** The filters must be in place to help prevent dust and particles from entering the breathing circuit.

7. 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

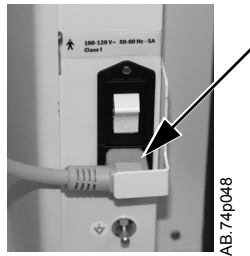
**Outlets** Labels show outlet voltage ratings and circuit breaker amp ratings. These are isolated outlets. Regularly test the leakage current.

**WARNING** Equipment connected to electrical outlets that are not isolated outlets can increase the leakage current. Regularly test the leakage current.



## Mains inlet

Arrow shows the mains power inlet and cord.



## 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 (DCE) configuration:

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

## 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 optional devices through internal connections:

- Venturi suction regulator (optional).
- Auxiliary O<sub>2</sub> flowmeter (optional).

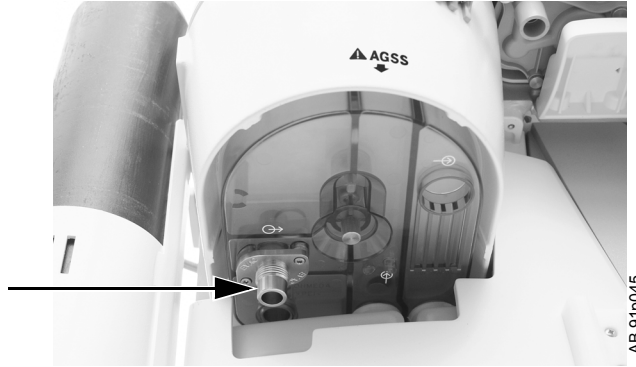
## Pipeline Inlets



## Scavenging

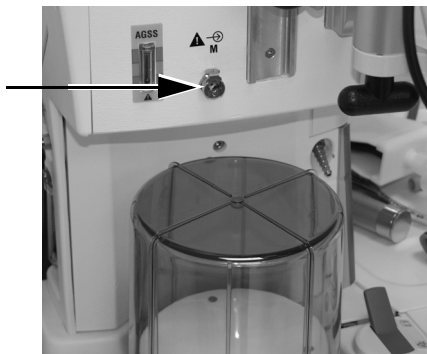
The scavenging assembly is located below the bellows on the breathing system. Adapters may be necessary to interface to the scavenging connector.

See the “*Operation*” section for more scavenging information.



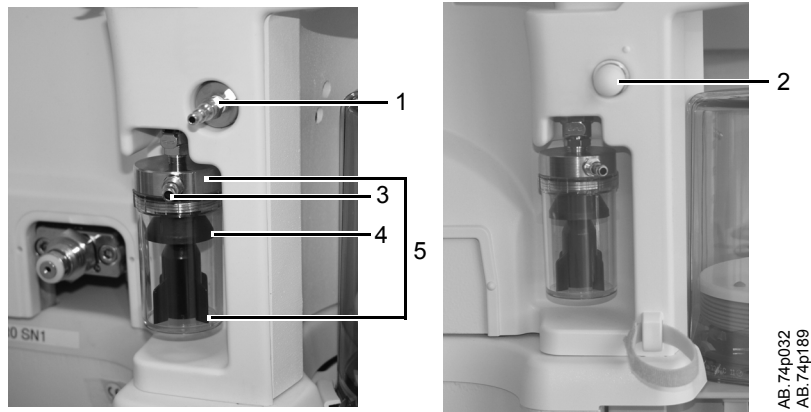
## Sample gas return port

Connect the sample gas exhaust tube from the airway module to the gas return port. Exhaust gas will be directed to the scavenging system.



## Suction regulator (optional)

Venturi regulators use the system air or O<sub>2</sub> supply. Vacuum regulators must be connected to an external vacuum supply.



1. External vacuum (non-venturi) connection
2. Venturi muffler
3. Collection bottle connection
4. Splash guard
5. Overflow safety trap

## Auxiliary O<sub>2</sub> flowmeter (optional)



1. Auxiliary O<sub>2</sub> outlet
2. Auxiliary O<sub>2</sub> flow control

## 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

- Note** Datex-Ohmeda recommends testing one cylinder at a time.
1. Turn on the system.
  2. Disconnect pipeline supplies.
  3. Turn off the auxiliary O2 flowmeter and the venturi suction (if equipped).
  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 tee handle.
  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** Do not exceed the top shelf weight limit of 34 kg (75 lb).

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

1. Locate the clips or slots.
2. Install the straps.
3. Fully tighten the straps.
4. Make sure the straps hold the equipment in position.

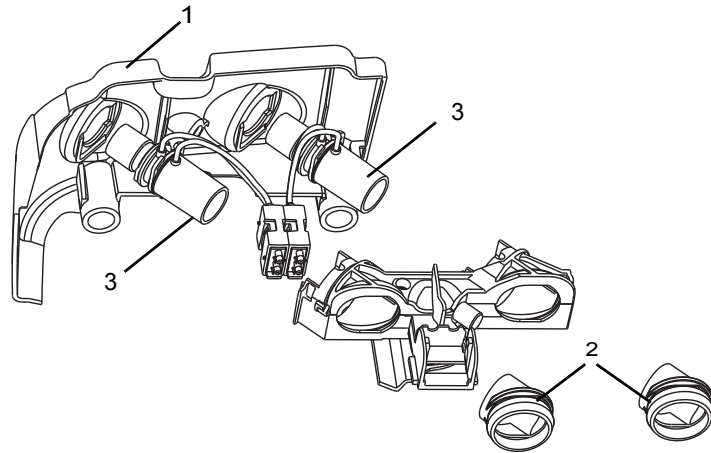
**WARNING** Fully tighten the straps. If straps are not fully tightened, equipment can fall off the top of the machine.

# 9 Parts

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

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

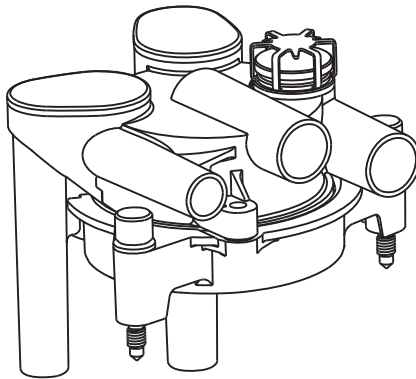
## Flow sensor module



AB.82.019

Item	Description	Stock number
	Flow sensor module (does not include flow sensors)	1407-7001-000
1	Flow sensor cover	1407-3000-000
2	Flow sensor cuff	1407-3004-000
3	Flow sensor, disposable (plastic) non-offset	1503-3858-000
	Flow sensor, disposable (plastic) offset	1503-3856-000
	Flow sensor, autoclavable (metal)	1503-3244-000

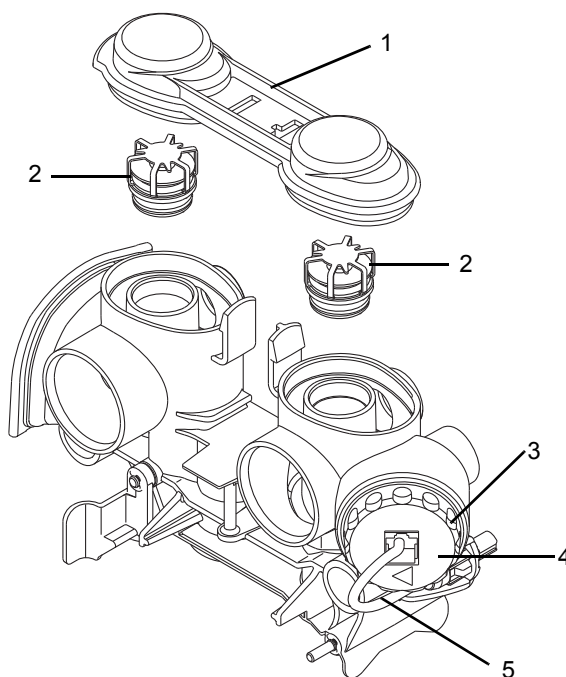
## Exhalation valve assembly



Description	Stock number
Exhalation valve assembly	1407-7005-000



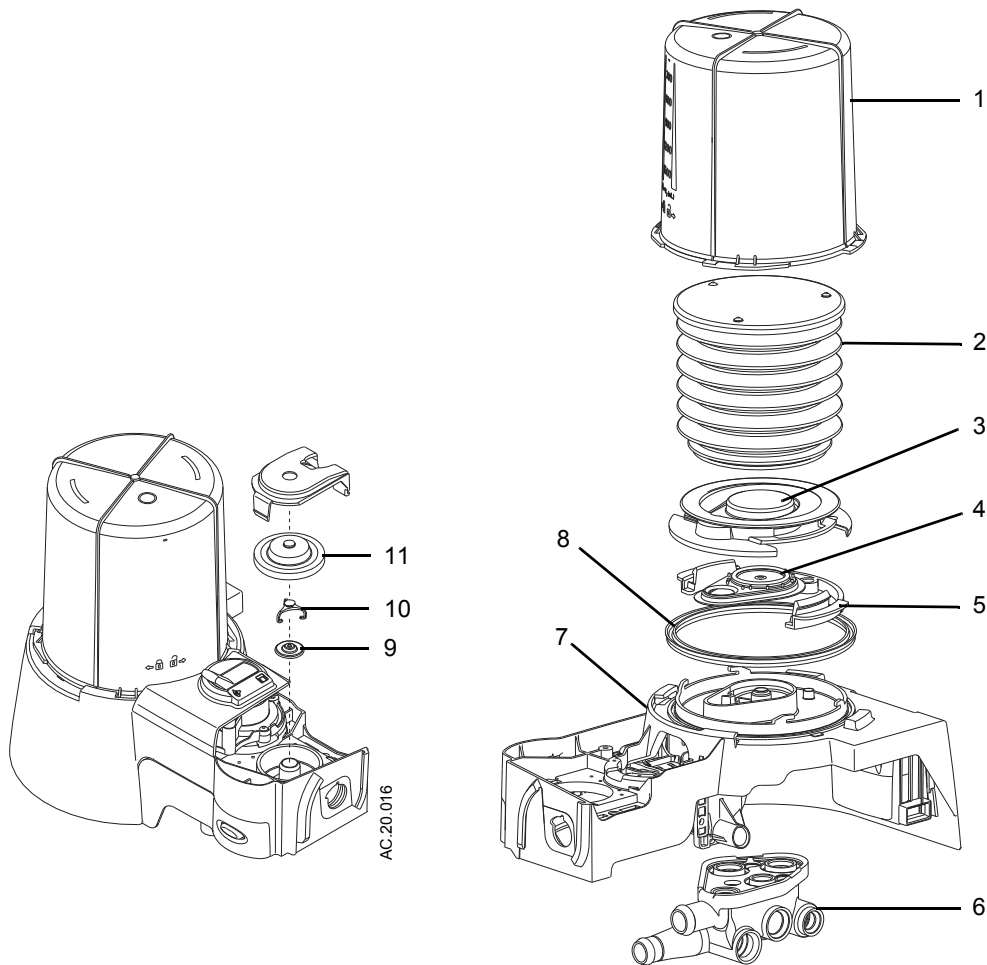
## Breathing circuit module



AB.82.021

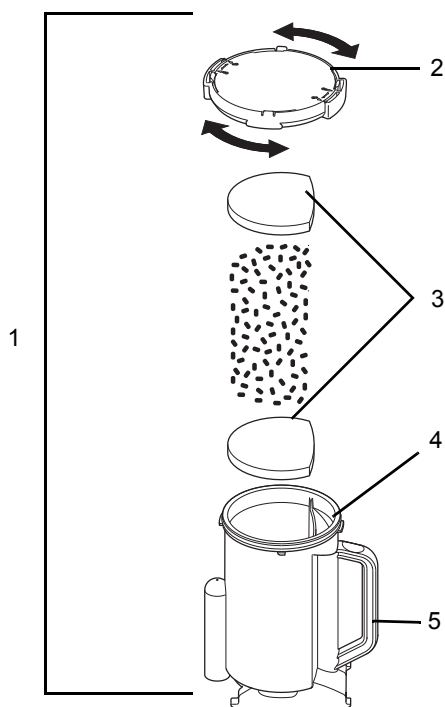
Item	Description	Stock number
	Breathing circuit module (does not include O2 cell, o-ring, or cable)	1407-7002-000
1	Check valves circuit lens	1407-3101-000
2	Check valve assembly	1406-8219-000
3	O-ring for O2 cell or plug	1406-3466-000
4	O2 cell (includes o-ring)	6050-0004-110
5	Cable, O2 cell	1009-5570-000

## Bellows assembly



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
9	Diaphragm, APL	1406-3331-000
10	Cage, APL	1406-3333-000
11	Poppet, APL valve	1406-3332-000

## Absorber canister



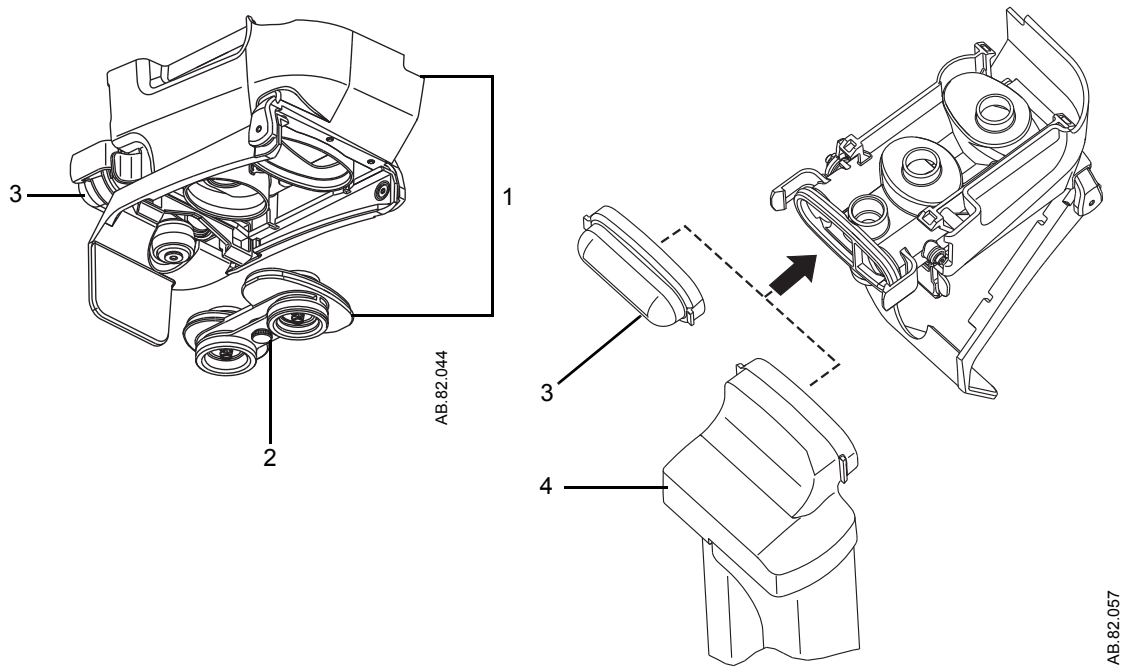
AB.82.017

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

**AGSS**

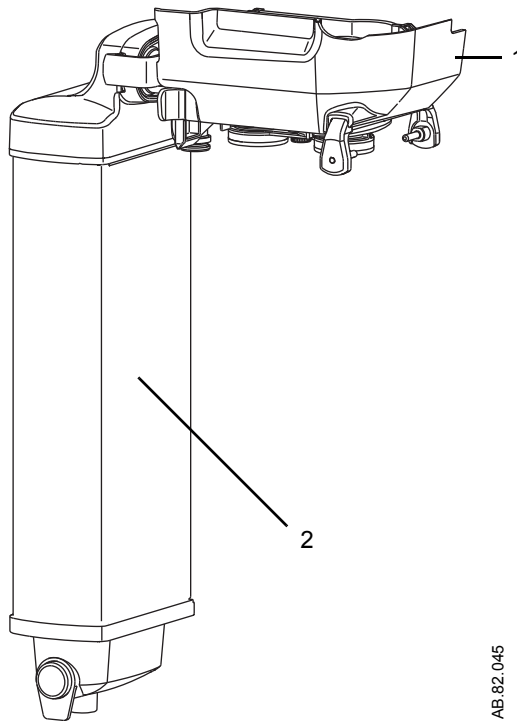
<b>Description</b>	<b>Stock number</b>
<b>Common</b>	
Cap 3.18 barb silicone	1406-3524-000
Connector, inlet 30 mm male to 9 mm male	M1003134
Connector, inlet 30 mm male to 30 mm male	M1003947
O-ring for connector, 21.95 ID	1406-3558-000
O-ring for receiver, 22 ID	1407-3104-000
O-ring for thumbscrews, 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



Item	Description	Stock number
1	EZchange canister module, includes valve and cap	1407-7021-000
2	Valve	1407-3126-000
3	Cap	1407-3130-000
4	Condenser	1407-7024-000
-	EZchange canister module with condenser	1407-7027-000

# 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
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)	1009-3356-000
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
Vaporizer port o-rings, external (6 pack)	1102-3016-000
Yoke plug	0206-3040-542





# 10 Specifications and Theory of Operation

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

<b>In this section</b>	System pneumatic circuits . . . . .	10-2
	Pneumatic specifications . . . . .	10-5
	Electrical block diagram . . . . .	10-6
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	Breathing system specifications . . . . .	10-10
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# System pneumatic circuits

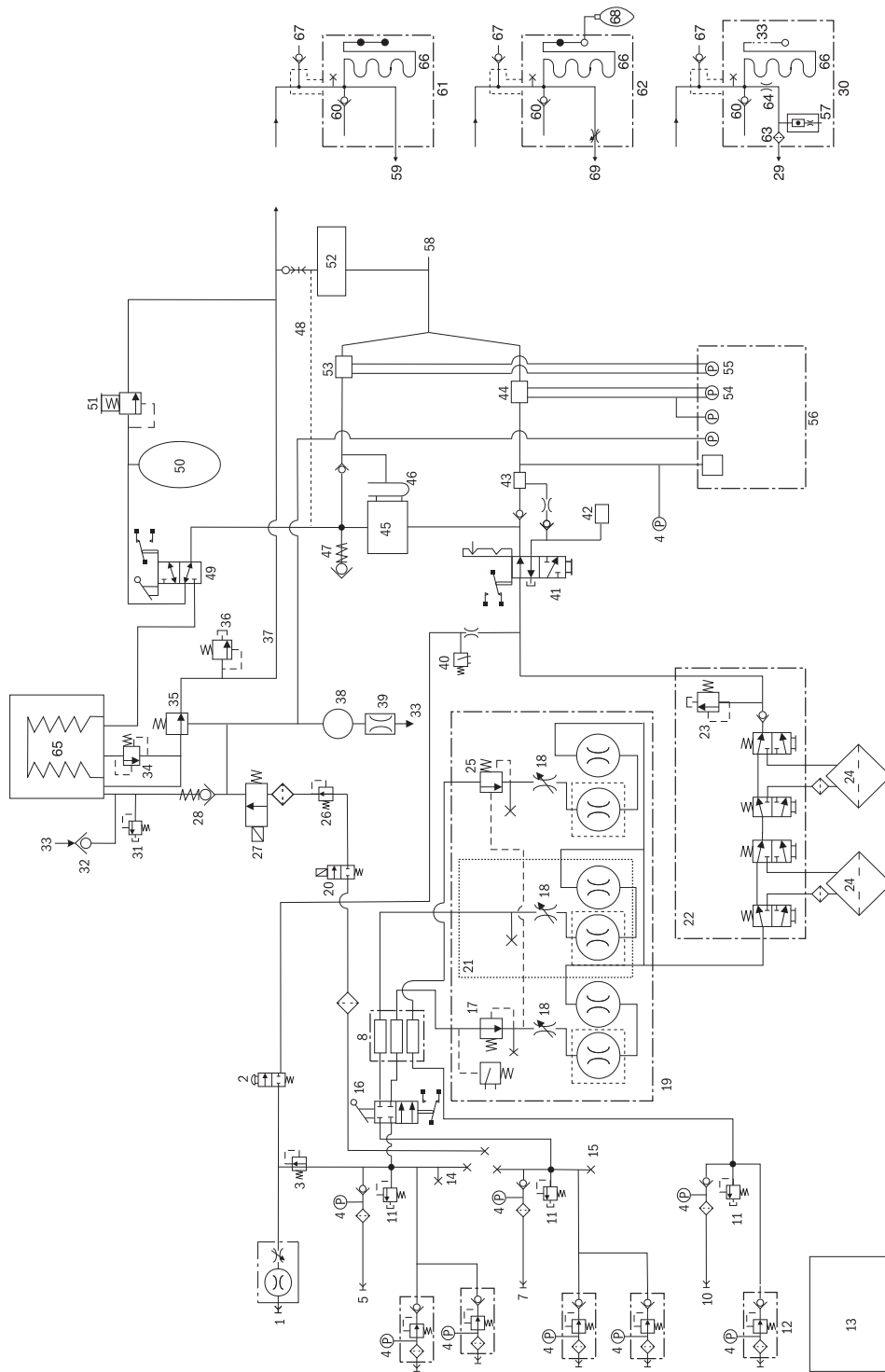


Figure 10-1 • Pneumatic circuit diagram

AC.20.001

## 10 Specifications and Theory of Operation

1. Auxiliary O<sub>2</sub>, 0-10 l/min (optional)
2. O<sub>2</sub> flush
3. 241 kPa (35 psi) second O<sub>2</sub> regulator
4. Paw Gauge
5. O<sub>2</sub> P-Line
6. O<sub>2</sub> cylinder (optional)
7. Air P-Line (optional)
8. Total flow sensor (optional)
9. Air cylinder (optional)
10. N<sub>2</sub>O P-Line (optional, standard U.S. variant)
11. 758 kPa (110 psi) relief
12. N<sub>2</sub>O cylinder (optional)
13. Cylinder supply and Pipeline supply
14. Ventilator drive gas select
15. Venturi (optional)
16. System switch
17. O<sub>2</sub> secondary regulator 207 kPa (30 psi)
18. Link-25
19. Flowmeter module (single flow tubes optional)
20. Gas inlet valve assembly
21. Air flow meter assembly (optional)
22. Selectatec manifold
23. 37.9 kPa (5.5 psi) pressure relief valve
24. Vaporizer
25. N<sub>2</sub>O balance regulator (required with N<sub>2</sub>O)
26. O<sub>2</sub> Flush regulator 172 kPa (25 psi) at 15 l/min
27. Inspiratory flow control valve
28. Drive gas check valve (3 cm H<sub>2</sub>O)
29. To disposal system
30. Active gas scavenging interface (optional)
31. Mechanical overpressure valve, 10.8 kPa (110 cmH<sub>2</sub>O)
32. Free breathing check valve
33. Room Air
34. Popoff valve (4 cmH<sub>2</sub>O)
35. Exhalation valve 0.20 kPa (2.0 cmH<sub>2</sub>O bias)
36. Scavenging pressure relief valve, 1.0 kPa (10 cmH<sub>2</sub>O)
37. Gas to scavenging: 0-10 l/min drive gas, 0-10 l/min patient and fresh gas, 0-20 l/min total typical flow
38. 200 mL reservoir
39. Control bleed approximately 1.0 l/min at 0.29 kPa (3.0 cmH<sub>2</sub>O) if continuous (rate dependent)
40. O<sub>2</sub> Flush pressure switch
41. ACGO selector valve
42. 22 mm port (ACGO)
43. O<sub>2</sub> sensor
44. Inspiratory flow sensor
45. Absorber
46. Drain
47. Negative pressure relief valve (-14 cmH<sub>2</sub>O)
48. Sample gas return connection
49. Bag/Vent switch
50. Bag
51. APL valve
52. Gas monitor (optional external gas monitor)
53. Expiratory flow sensor
54. Inspiratory flow transducer
55. Expiratory flow transducer
56. Sensor interface board
57. Scavenger flow indicator (optional)
58. Patient
59. 30 mm male - to disposal system
60. 0.05 kPa (0.5 cmH<sub>2</sub>O) entrainment
61. Passive gas scavenging interface
62. Adjustable scavenging system (optional)
63. Filter
64. High or low flow restrictor
65. Bellows
66. Scavenging reservoir
67. Scavenging over pressure relief valve
68. Scavenging reservoir bag with 30 mm male connector
69. Needle valve assembly (with DISS EVAC connector)

## Gas supplies

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

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.

## O<sub>2</sub> flow

Pipeline or regulated cylinder pressure supplies O<sub>2</sub> directly to the ventilator (O<sub>2</sub> Ventilator). A secondary regulator decreases the pressure for the flush valve and the auxiliary flowmeter.

The flush valve supplies high flows of O<sub>2</sub> to the fresh gas outlet when you push the flush button. The flush switch uses pressure changes to monitor the position of the flush valve.

When the System switch is ON, O<sub>2</sub> flows to the rest of the system and there is a minimum flow through the O<sub>2</sub> flowmeter.

A secondary regulator supplies a constant O<sub>2</sub> pressure to the flow control valve.

An electrical switch monitors the O<sub>2</sub> supply pressure. If the pressure is too low, an alarm appears on the ventilator.

## N<sub>2</sub>O flow

A balance regulator controls the flow of N<sub>2</sub>O to the flow control valve. Oxygen pressure at a control port adjusts the output of the regulator. This stops flow during an O<sub>2</sub> supply failure and ensures that the hypoxic gas pressures decrease with the O<sub>2</sub> supply pressure. Changes in O<sub>2</sub> pressure do not affect Air.

A chain linkage (Link-25) on the N<sub>2</sub>O and O<sub>2</sub> flow controls helps keep the O<sub>2</sub> concentration higher than approximately 21% at the fresh gas outlet.

## Air flow

Pipeline or regulated cylinder pressure directly supply Air to the ventilator (Air Ventilators). When the System switch is On, air flows to the rest of the system. Because there is no balance regulator, air flow continues at the set rate during an O<sub>2</sub> supply failure.

**Mixed gas** The mixed gas goes from the flowmeter outlet through the vaporizer that is ON, to the fresh gas outlet, and into the breathing system. A pressure relief valve sets the maximum outlet pressure.

**EZchange canister** When activated, this module 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 during low flow anesthesia (fresh gas flows less than 1.5 l/min). 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

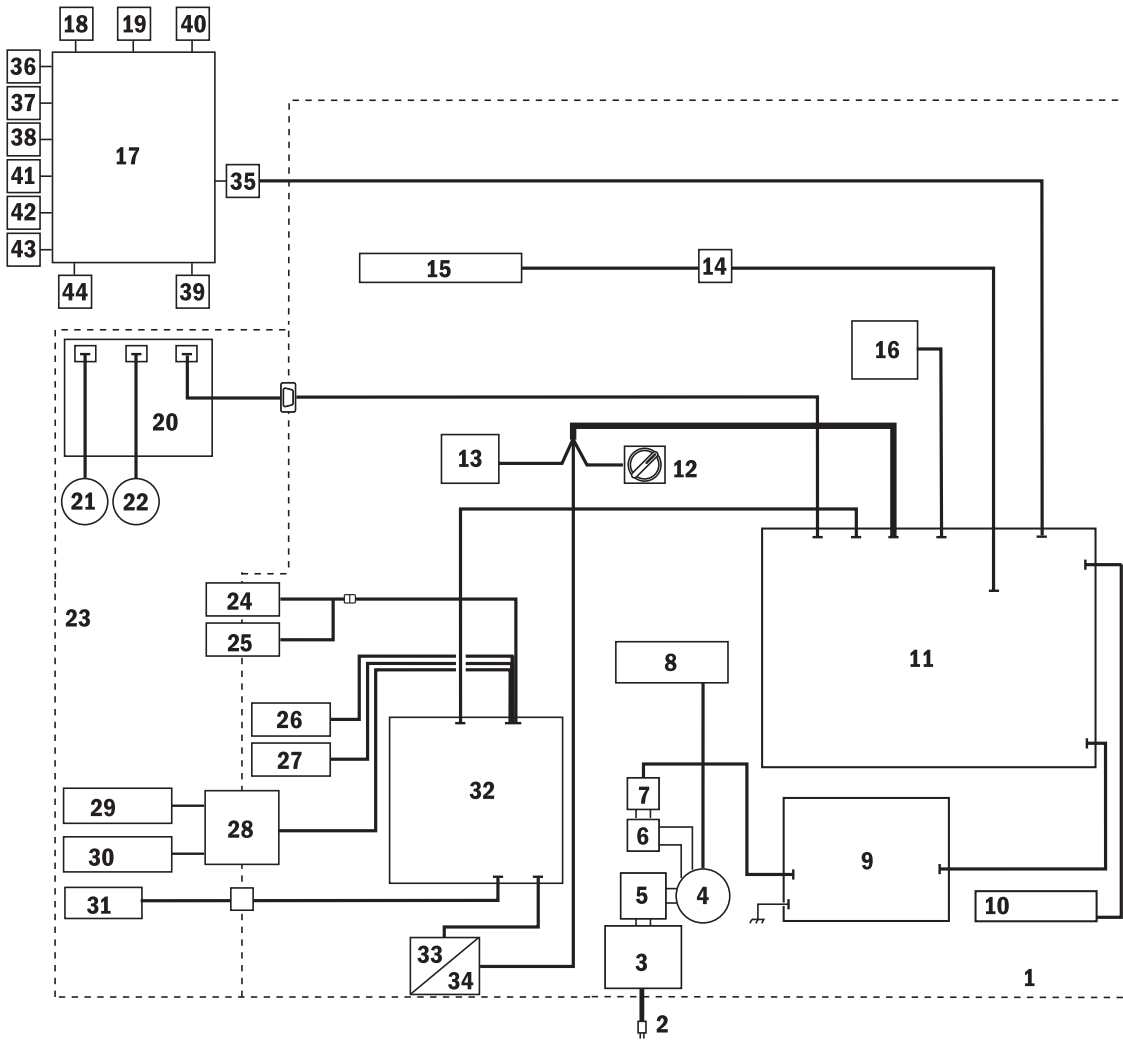
**CAUTION** All gases supplied to the system must be medical grade.

### Gas supplies

<b>Pipeline gases</b>	O <sub>2</sub> , Air, N <sub>2</sub> O
<b>Cylinder gases</b>	<ul style="list-style-type: none"> <li>• O<sub>2</sub>, Air, N<sub>2</sub>O (maximum: 2 cylinders of each gas) with 3 cylinders total.</li> <li>• 1 cylinder maximum on pendant model</li> </ul>
<b>Cylinder connections</b>	<ul style="list-style-type: none"> <li>• Pin indexed (all gases).</li> <li>• Nut and gland DIN-477 (O<sub>2</sub>, N<sub>2</sub>O, Air)</li> <li>• Large cylinder kit available for O<sub>2</sub> and N<sub>2</sub>O</li> </ul>
<b>Primary regulator output pressure</b>	<ul style="list-style-type: none"> <li>• Pin indexed: The primary regulator is set to pressure less than 345 kPa (50 psi).</li> <li>• DIN-477: The primary regulator is set to pressure less than 414kPa (60 psi).</li> </ul>
<b>Pressure-relief valve</b>	Approximately 758 kPa (110 psi)
<b>Pipeline connections (filtered)</b>	<ul style="list-style-type: none"> <li>• DISS - Male; DISS-Female; AS 4059 (Australian).</li> <li>• S90-116 (French Air Liquide)</li> <li>• BSPP 3/8 (Scandinavian) or NIST (ISO 5359).</li> <li>• All fittings available for O<sub>2</sub>, Air, and N<sub>2</sub>O.</li> </ul>
<b>Pressure displays</b>	Color coded gauges
<b>Pipeline inlet pressure</b>	280-600 kPa (41-87 psi)
<b>O<sub>2</sub> supply failure alarm</b>	193 to 221 kPa (28 to 32 psi)
<b>N<sub>2</sub>O shutoff</b>	3.5 kPa (0.5 psi)

**ACGO Port relief** Valve limits fresh gas pressure to 138 kPa (20 psi) at the flush flow.

# Electrical block diagram



AC.20.008

Figure 10-2 • Electrical block diagram

## 10 Specifications and Theory of Operation

1. Anesthesia system
2. Power cord
3. AC inlet with breaker and line filter
4. Isolation transformer
5. Inrush board
6. Fuses
7. Line filter
8. Outlet box
9. Universal power supply
10. Battery, 12 V
11. DAQ board
12. On/Standby switch
13. O<sub>2</sub> supply switch
14. Task light switch
15. Task light
16. Total flow sensor board (optional)
17. CPU board
18. LCD
19. ComWheel
20. Ventilator engine board
21. Gas inlet valve
22. Flow control valve
23. Breathing system
24. Bag/Ventilator switch
25. ABS on switch
26. Canister switch
27. CO<sub>2</sub> bypass switch
28. Bulkhead connector
29. Expiratory flow sensor
30. Inspiratory flow sensor
31. O<sub>2</sub> sensor
32. Enhanced sensor interface board
33. ACGO select
34. O<sub>2</sub> flush switch
35. AC power in/communication to system
36. LCD backlight 1
37. LCD backlight 2
38. Left membrane switch
39. Bottom membrane switch
40. Right membrane switch
41. USB I/O port
42. Network I/O port (Ethernet)
43. Patient monitoring port (Ohmeda Com)
44. Serial I/O port

## Electrical power

Supply voltage	100-120 or 220-240 Vac $\pm$ 10% at 50 or 60 Hz		
Average power consumption	less than 50 VA		
Note: Measured through the power cord when operated at the ventilation setting VCV, TV = 1500 l/min, RR = 26, I:E = 1:2, and PEEP is Off; three gas TFS option installed, LCD backlights at level 5, task light on maximum, and following 15 minutes of system running on battery power.			
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 (1) 3 A	(2) 2A (1) 4A	(3) 1 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.		
Resistance to ground	less than 0.2 $\Omega$		

### WARNING

The connection of equipment to the auxiliary mains electrical outlets may increase the patient leakage currents to values exceeding the allowable limits in the event of a defective earth conductor.

## Power cord

Length	5 meters (Danish: 3m)
Voltage rating	100 to 240 Vac
Current capacity	<ul style="list-style-type: none"><li>• 10 A for 220-240 Vac</li><li>• 15 A for 100-120 Vac</li></ul>
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.
- The system functions to specifications through the transition to battery power.

**CAUTION** Contact a Datex-Ohmeda trained service representative to replace or disconnect the battery if the equipment is not likely to be used for an extended time.

**Important** Batteries must be disposed of in accordance with applicable regulatory requirements in effect at the time and place of disposal.



## Flow specifications

### Pneumatic flow

Parameter	Range
Flush flow	35 to 75 l/min
Flow range	Minimum O2 flow 50 ml/min
O2	<ul style="list-style-type: none"> <li>• 0.05 to 0.95 l/min</li> <li>• 1 to 15 l/min</li> </ul>
N2O	<ul style="list-style-type: none"> <li>• 0.05 to 0.95 l/min</li> <li>• 1 to 10 l/min</li> </ul> <p>Note: The Link-25 system sets the nominal O2 flow to 25% of the total of O2 and N2O flow.</p>
Air	<ul style="list-style-type: none"> <li>• 0.05 to 0.95 l/min</li> <li>• 1 to 15 l/min</li> </ul>
Accuracy	<ul style="list-style-type: none"> <li>• At 20°C with gas supply pressures at 345 kPa (50 psi) and an outlet pressure of 101.3 kPa (absolute) (14.7 psi) flowmeter accuracy agrees with VDE 3513 Part 3, Accuracy Class 2.5 or better.</li> <li>• Different breathing circuit pressures, barometric pressures or temperatures change the accuracy. With some conditions, these changes can be larger than the tolerances.</li> </ul>

### Total flow sensing

	Flow Range
O2	0, 0.05 to 15.0 l/min
Air	0, 0.05 to 15.0 l/min
N2O	0, 0.05 to 10.0 l/min
Total	0 to 40.0 l/min
Accuracy	<ul style="list-style-type: none"> <li>• Greater of <math>\pm 25</math> ml/min or <math>\pm 6\%</math> of measured value at 20-25°C with gas supply pressures at 480.5 kPa (69.7 psi) and an outlet pressure of 101.3 kPa (absolute) (14.7 psi).</li> <li>• Different breathing circuit pressures, barometric pressures or temperatures change the accuracy. With some conditions, these changes can be larger than the tolerances.</li> </ul>

## Breathing system specifications

<b>Volume</b>	Ventilator side 2730 ml; bag side 1215 ml
	With EZchange canister system and condenser: <ul style="list-style-type: none"> <li>Ventilator side 3445 ml</li> <li>Bag side 1930 ml</li> </ul>
<b>Absorbent</b>	950 ml canister
<b>Connections</b>	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).
<b>System leakage</b>	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).
<b>System compliance</b>	Volume of gas lost due to internal compliance (bag mode only): <ul style="list-style-type: none"> <li>1.82 ml/0.098 kPa (1 cmH<sub>2</sub>O)</li> <li>55 ml/3 kPa (30 cmH<sub>2</sub>O)</li> </ul> With EZchange canister system and condenser: <ul style="list-style-type: none"> <li>2.67 ml/0.98 kPa (1 cmH<sub>2</sub>O)</li> <li>80 ml/3 kPa (30 cmH<sub>2</sub>O)</li> </ul>
<b>Pressure required to open Inspiratory or expiratory valves</b>	<ul style="list-style-type: none"> <li>Dry: 0.49 cmH<sub>2</sub>O</li> <li>Wet: 0.91 cmH<sub>2</sub>O</li> </ul>
<b>Pressure generated by a wet unidirectional valve</b>	0.81 cmH <sub>2</sub> O
<b>APL valve</b>	Approximately 0 to 70 cmH <sub>2</sub> O

### Breathing system resistance in bag mode\*

	<b>l/min</b>	<b>kPa</b>	<b>cmH<sub>2</sub>O</b>
	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	0.24	2.4
	60	0.49	5.0

\*Values include patient circuit tubing and Y-piece 0.15 kPa (0.20 psi) expiratory resistance 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 cmH <sub>2</sub> O
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 cmH<sub>2</sub>O

### Passive scavenging

Negative pressure relief 0.3 cmH<sub>2</sub>O

Outlet connector 30 mm male taper ISO


Active scavenging		
Disposal system type	Outlet connector*	Hospital waste gas disposal system requirements
Adjustable flow, high vacuum	DISS EVAC	305 mmHg (12 inHg) minimum at 36 l/min flow
High flow, low vacuum	BSI 30 mm threaded (BS6834)	50 to 80 l/min flow
Low flow, high vacuum	DISS EVAC	305 mmHg (12 inHg) minimum at 36 l/min flow
Low flow, low vacuum	12.7 mm barb	36 l/min flow
Low flow, low vacuum	25 mm barb	40 to 50 l/min flow
Low flow, low vacuum	30 mm ISO taper male	40 to 50 l/min flow

\*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 (53.5 in)
	Width	75 cm (29.5 in)
	Depth	74 cm (29.1 in)
	Weight	136 kg (300 lb)
	Top of machine weight limit	34 kg (75 lb)
Casters	12.5 cm (4.9 in) with brakes on the front casters	
Drawers	17.5 cm x 33 cm x 26.5 cm (6.9 in x 13 in x 10.4 in)	
Ventilator display	30.7 cm (12.1 in) color SVGA LCD	

## Environmental requirements

	Operation	Storage
Temperature	10 to 40°C O2 cell operates to specifications at 10 to 40°C	-25 to 60°C O2 cell storage is -15 to 50°C
Humidity	15 to 95% RH, non-condensing	10 to 95%, non-condensing
Altitude	500 to 800 mmHg (3565 to -440 meters)	375 to 800 mmHg (5860 to -440 meters)

## 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 (41 psi) 52 l/min with pipeline drive gas at 600 kPa (87 psi)
Maximum Vacuum**	600 mmHg with pipeline drive gas at 280 kPa (41 psi) 550 mmHg with pipeline drive gas at 600 kPa (87 psi)
Maximum Flow*	29 l/min with pipeline drive gas at 280 kPa (41 psi) 32 l/min with pipeline drive gas at 600 kPa (87 psi)
Vacuum Gauge Accuracy	±5% of full scale
*Values are approximate.	
**Approximate values are at sea level. Performance is reduced at higher elevations.	

<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.	

## Auxiliary O<sub>2</sub> flowmeter (optional)

Supply	O <sub>2</sub> from system gas supply
Flow rate	0 to 10 l/min
Accuracy	±5% of full scale; not pressure compensated

## Ventilator theory

The ventilator pneumatics are located in the rear of the breathing system. A precision flow 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 measurements come from flow sensors in the flow sensor module. Two tubes from each sensor connect to a transducer. The transducer measures the pressure change across each sensor, which changes with the flow. A third pressure transducer measures airway pressures at the inspiratory flow sensor.

The ventilator uses 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 and small leaks in the breathing system.

In volume ventilation modes, certain alarm conditions prevent the automatic adjustment of ventilator delivery based on measured flow values. In these cases, the ventilator may not be able to deliver within the accuracy range specified. 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** Do not try to silence the pneumatic resistor. If it is blocked, the ventilator can malfunction and cause patient injury.

### **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 sensor 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.

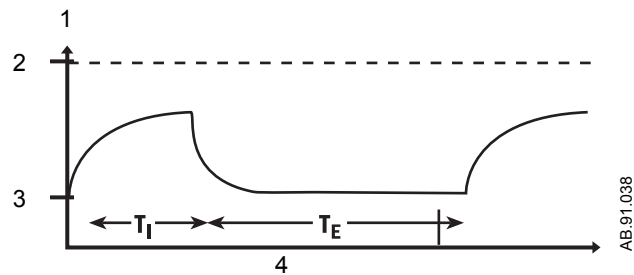
The voltage from the cell cartridge is affected by the temperature of the monitored gas mixture. A thermistor in the cell's housing automatically compensates for temperature changes in the cell.

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.

### **Modes**

The system has the following modes of mechanical ventilation:

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

**VCV**

1. Paw
2. Pmax
3. PEEP
4. Time

Figure 10-3 • Volume control diagram

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 from the I:E and respiratory rate settings. An optional inspiratory pause can be set to improve gas distribution in the lungs.

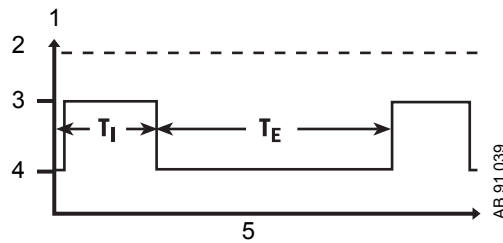
A typical volume-controlled pressure waveform increases throughout the entire inspiratory period and rapidly decreases at the start of expiration.

The ventilator adjusts gas flow to the bellows based on measured inspiratory volumes. This is called tidal volume compensation.

Volume control settings include:

- TV - sets the amount of tidal volume.
- RR - sets the rate of mechanically driven breaths.
- I:E - sets the amount of inspiration to expiration ratio.
- Pmax - sets the maximum airway pressure.
- Tpause - sets the inspiratory pause time.



**PCV**

1. Paw
2. Pmax
3. P<sub>insp</sub>
4. PEEP
5. Time

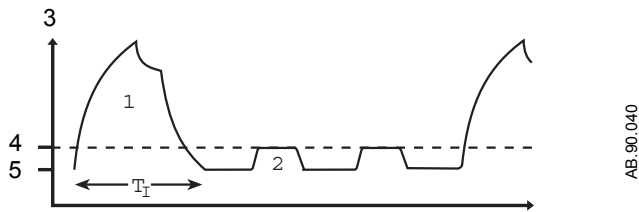
Figure 10-4 • Pressure control diagram

Pressure control supplies a constant set pressure during inspiration. The ventilator calculates the inspiratory time from the respiratory rate 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 (P<sub>insp</sub>).

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

Pressure control settings include:

- P<sub>insp</sub> - sets the target airway pressure.
- RR - sets the rate of mechanically driven breaths.
- I:E - sets the amount of inspiration to expiration ratio.
- P<sub>max</sub> - sets the maximum airway pressure.
- PEEP - sets the positive end expiratory pressure.
- Rise Rate - sets the amount of time to attain P<sub>insp</sub>.

**SIMV/PSV**

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

*Figure 10-5 • SIMV/PSV diagram*

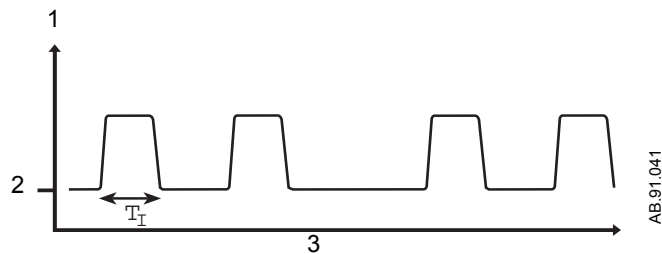
Synchronized Intermittent Mandatory Ventilation with Pressure Support (SIMV/PSV) is a mode in which periodic volume breaths are delivered to the patient at preset intervals (time-triggered). Between the machine delivered breaths, the patient can breathe spontaneously at the rate, tidal volume, and timing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

SIMV/PSV settings include:

- TV - sets the amount of tidal volume.
- RR - sets the rate of mechanically driven breaths.
- T<sub>insp</sub> - sets the inspiration time for a mechanical breath.
- P<sub>support</sub> - sets the pressure support level.
- PEEP - sets the positive end expiratory pressure.
- P<sub>max</sub> - sets the maximum airway pressure.
- Rise Rate - sets the amount of time to attain P<sub>insp</sub>.
- T<sub>pause</sub> - sets the inspiratory pause time.
- End of Breath - the drop in inspiratory flow from the peak inspiratory flow level where the ventilator stops pressure support mechanical inspiration and begins exhalation.
- Trigger - sets the flow trigger level.
- Trig Window - sets the range in percent of the exhalation phase where a patient may trigger a mechanical breath.

**PSVPro**

1. Paw
2. PEEP
3. Time

*Figure 10-6 • PSVPro diagram*

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 (P<sub>support</sub>) 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 50%. 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.

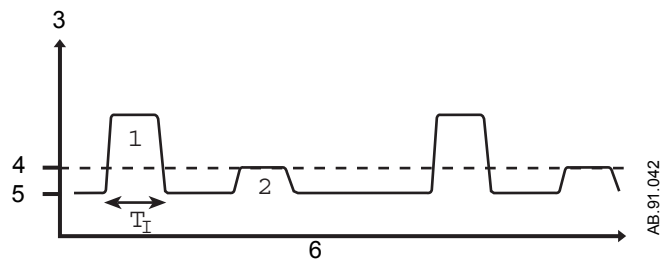
An apnea backup mode is provided in the event the patient stops breathing. When setting this mode the clinician adjusts the inspiratory pressure (P<sub>insp</sub>), respiratory rate, and the inspiratory time (T<sub>insp</sub>). As long as the patient is triggering the ventilator and the apnea alarm does 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. See “SIMV-PC” for operation details for this mode.

When the ventilator switches to the backup mode, the alarm text "Backup Mode active" displays and remains in the low priority message site until PSVPro is reinstated or until another mode is selected. To reactivate the PSVPro mode the user must go into the Ventilation Mode menu and select PSVPro. Upon selecting PSVPro the ventilator will immediately begin providing pressure supported breaths to the patient using the established settings.

PSVPro settings include:

- P<sub>insp</sub> - sets the target airway pressure.
- RR - sets the rate of mechanically driven breaths.
- T<sub>insp</sub> - sets the inspiration time for a mechanical breath.
- P<sub>support</sub> - sets the pressure support level.
- P<sub>max</sub> - sets the maximum airway pressure.
- PEEP - sets the positive end expiratory pressure.
- Rise Rate - sets the amount of time to attain P<sub>insp</sub>.
- End of Breath - the drop in inspiratory flow from the peak inspiratory flow level where the ventilator stops pressure support mechanical inspiration and begins exhalation.
- Trigger - sets the flow trigger level.
- Trig Window - sets the range in percent of the exhalation phase where a patient may trigger a mechanical breath.
- Backup mode active - sets the time for backup mode to activate.

**SIMV-PC**

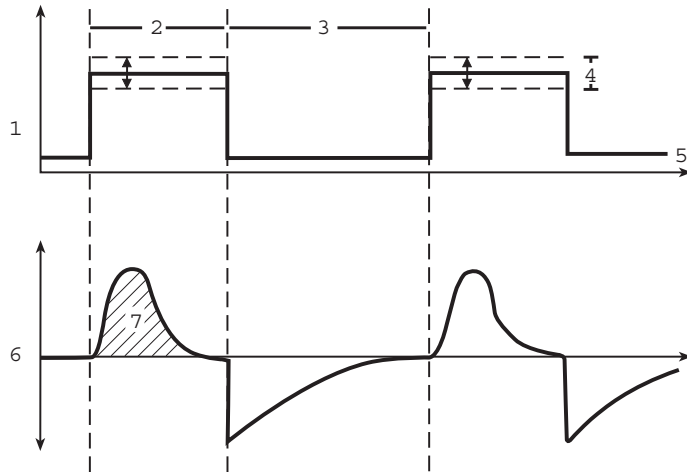
1. Mandatory pressure control breath
2. Spontaneous pressure supported breath
3. Paw
4. Psupport
5. PEEP
6. Time

Figure 10-7 • SIMV-PC diagram

Synchronized Intermittent Mandatory Ventilation with Pressure Controlled Ventilation 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 settings include:

- P<sub>insp</sub> - sets the target airway pressure.
- RR - sets the rate of mechanically driven breaths.
- T<sub>insp</sub> - sets the inspiration time for a mechanical breath.
- P<sub>support</sub> - sets the pressure support level.
- P<sub>max</sub> - sets the maximum airway pressure.
- PEEP - sets the positive end expiratory pressure.
- Rise Rate - sets the amount of time to attain P<sub>insp</sub>.
- End of Breath - the drop in inspiratory flow from the peak inspiratory flow level where the ventilator stops pressure support mechanical inspiration and begins exhalation.
- Trigger - sets the flow trigger level.
- Trig Window - sets the range in percent of the exhalation phase where a patient may trigger a mechanical breath.

**PCV-VG**

AB.98.034

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 10-8 • PCV-VG waveforms*

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  $\pm 3$  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 settings include:

- P<sub>insp</sub> - sets the target airway pressure.
- RR - sets the rate of mechanically driven breaths.
- I:E - sets the amount of inspiration to expiration ratio.
- PEEP - sets the positive end expiratory pressure.
- P<sub>max</sub> - sets the maximum airway pressure.
- Rise Rate - sets the amount of time to attain P<sub>insp</sub>.

## Ventilator operating specifications

### Pneumatics

Gas source	Anesthesia system
Gas composition	Medical air or O <sub>2</sub>
Nominal supply pressure	350 kPa (51 psi)
Pressure range at inlet	240 to 700 kPa (35 to 102 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
Patient airway display range	-20 to +120 cmH <sub>2</sub> O
Pinsp setting range	5 to 60 cmH <sub>2</sub> O
PEEP setting range	Off, 4 to 30 cmH <sub>2</sub> O
High pressure alarm set range	12 to 100 cmH <sub>2</sub> O, 1 cm increment
Sustained pressure alarm range (when 'PEEP high. Blockage?' alarm occurs)	<ul style="list-style-type: none"> <li>• 6 to 42 cmH<sub>2</sub>O, 1 cm increment (mechanical ventilation)</li> <li>• 6 to 30 cmH<sub>2</sub>O, 1 cm increment (manual ventilation)</li> </ul>

### Volume

Tidal volume display range	5 to 9999 ml, 1 ml resolution
Setting range	20 to 1500 ml
Minute volume display range	0.0 to 99.9 liters
Breath rate settings	<ul style="list-style-type: none"> <li>• For VCV, PCV, PCV-VG: 4 to 100 bpm, 1 bpm resolution</li> <li>• For SIMV-PC, SIMV/PSV: 2 to 60 bpm, 1 bpm resolution</li> </ul>
Flow sensor type	Variable flow orifice

### Oxygen

Display range	5 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	± 3% of full scale
Cell response time	35 seconds, 10 to 90%. 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	21% to 99%, Off 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.
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## 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. Errors may occur as described in the gas composition chart.

The minimum detectable breath size is 5.0 ml.

<b>Delivery accuracy</b>	
Volume control mode	Greater than 210 ml tidal volume - accuracy of $\pm 7\%$ of set TV 60 to 210 ml tidal volume - accuracy of $\pm 15$ ml Less than 60 ml tidal volume - accuracy of $\pm 10$ ml
Pressure mode	Inspiratory pressure - accuracy of $\pm 3.0$ cmH <sub>2</sub> O or 10% of delivered pressure PEEP - accuracy of $\pm 1.5$ cmH <sub>2</sub> O

<b>Monitoring accuracy</b>	
Volume control	Greater than 210 ml tidal volume - accuracy of $\pm 9\%$ of TV 60 to 210 ml tidal volume - accuracy of $\pm 18$ ml Less than 60 ml tidal volume - accuracy of $\pm 10$ ml
Pressure mode	Accuracy of $\pm 2.0$ cmH <sub>2</sub> O or $\pm 5\%$ of reading whichever is greater.

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.

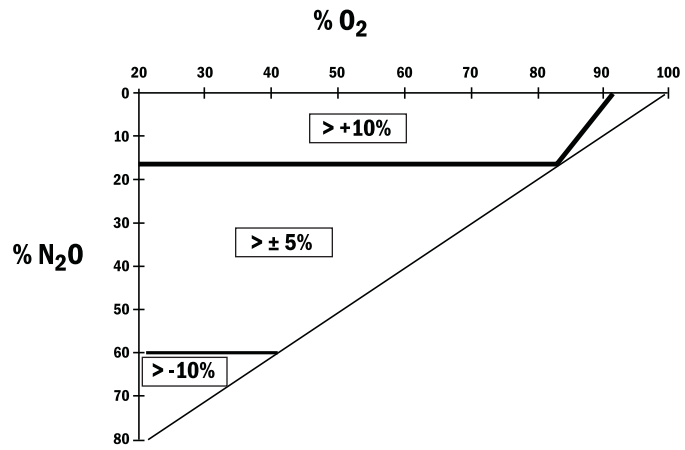
### Oxygen monitor accuracy

- When subjected to gas mixtures containing the following concentrations of gases, the oxygen monitor has been tested to be within  $\pm 5\%$  of the actual gas concentration.
- Gas mixtures other than the ones listed below may result in an accuracy of the oxygen monitor outside of the  $\pm 5\%$  V/V.

Gas:	At concentration:
Helium	50%
Carbon dioxide	5%
Nitrous oxide	80%
Halothane	4%
Enflurane	5%
Isoflurane	5%
Sevoflurane	5%
Desflurane	15%



# 10 Specifications and Theory of Operation



AB.74.027

Figure 10-9 • Gas composition related errors

## 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
			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.
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz outside ISM bands	3 Vrms (V1)	$D=3.5\sqrt{P}$
	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.

Separation distance in meters (m) according to frequency of the transmitter				
Rated maximum output power of transmitter watts (W)	150 kHz to 80 MHz Outside ISM bands	150 kHz to 80 MHz In ISM bands	80 MHz to 800 MHz	800 MHz to 2.5 GHz
	$D = \left[ \frac{3.5}{V1} \right] \sqrt{P}$	$D = \left[ \frac{12}{V2} \right] \sqrt{P}$	$D = \left[ \frac{1.2}{E1} \right] \sqrt{P}$	$D = \left[ \frac{1.2}{E1} \right] \sqrt{P}$
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. After connecting anything to these outlets, conduct a complete system leakage current test (according to IEC 60601-1).
- 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.

 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.
- 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 systems 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.
- Anesthesia ventilator.
- Breathing system.

**Not integral** These devices are not integral to this anesthesia system:

- CO<sub>2</sub> monitor.
- Anesthetic agent 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 systems, 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).



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## Warranty

This Product is sold by Datex-Ohmeda under the warranties set forth in the following paragraphs. Such warranties are extended only with respect to the purchase of this Product directly from Datex-Ohmeda or Datex-Ohmeda's Authorized Dealers as new merchandise and are extended to the Buyer thereof, other than for the purpose of resale.

For a period of twelve (12) months from the date of original delivery to Buyer or to Buyer's order, but in no event for a period of more than two years from the date of original delivery by Datex-Ohmeda to a Datex-Ohmeda Authorized Dealer, this Product, other than its expendable parts, is warranted against functional defects in materials and workmanship and to conform to the description of the Product contained in this User's Reference manual and accompanying labels and/or inserts, provided that the same is properly operated under the conditions of normal use, that regular periodic maintenance and service is performed and that replacements and repairs are made in accordance with the instructions provided. This same warranty is made for a period of thirty (30) days with respect to expendable parts. The foregoing warranties shall not apply if the Product has been repaired other than by Datex-Ohmeda or in accordance with written instructions provided by Datex-Ohmeda, or altered by anyone other than Datex-Ohmeda, or if the Product has been subject to abuse, misuse, negligence, or accident.

Datex-Ohmeda's sole and exclusive obligation and Buyer's sole and exclusive remedy under the above warranties is limited to repairing or replacing, free of charge, at Datex-Ohmeda's option, a Product, which is telephonically reported to the nearest Datex-Ohmeda Customer Service Center and which, if so advised by Datex-Ohmeda, is thereafter returned with a statement of the observed deficiency, not later than seven (7) days after the expiration date of the applicable warranty, to the Datex-Ohmeda Customer Service and Distribution Center during normal business hours, transportation charges prepaid, and which, upon Datex-Ohmeda's examination, is found not to conform with above warranties. Datex-Ohmeda shall not be otherwise liable for any damages including but not limited to incidental damages, consequential damages, or special damages.

*There are no express or implied warranties which extend beyond the warranties hereinabove set forth. Datex-Ohmeda makes no warranty of merchantability or fitness for a particular purpose with respect to the product or parts thereof.*

