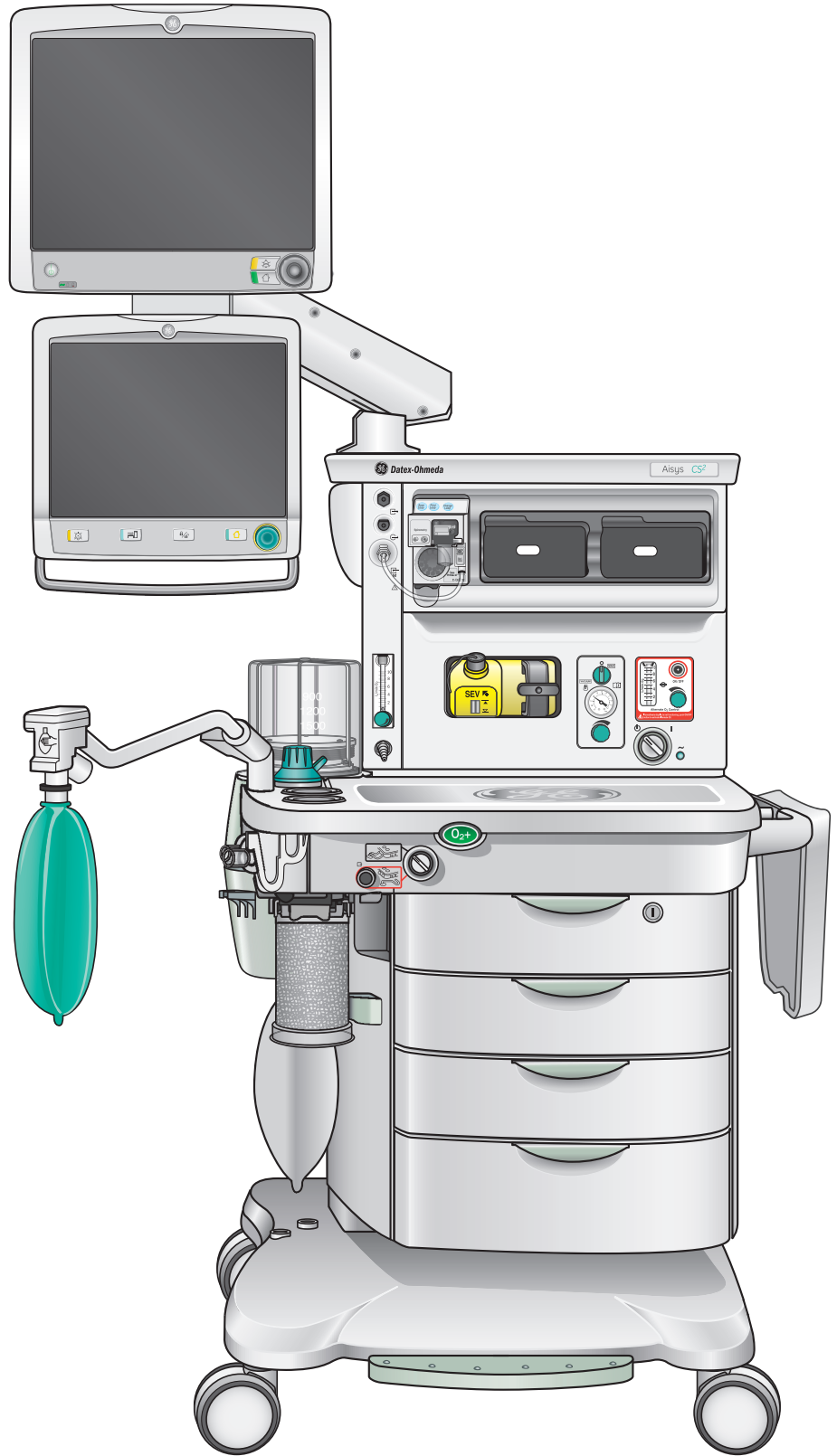GE Healthcare

Aisys CS²

Participant Guide

GE

Clinical Systems

Clinical and Educational Development

Aisys CS²

Participant Guide

Version A

Clinical Systems

Clinical and Educational Development

Customer Support Center: 800-345-2700

Notice

Configurations available for this product depend on local market and standards requirements. Illustrations in this course may not represent all configurations of the product. This course does not cover the operation of every accessory.

The materials contained in this document are intended for educational purposes only. This document does not establish specifications, operating procedures or maintenance methods for any of the products referenced. Always refer to the official written materials (labeling) provided with the product for specifications, operating procedures and maintenance requirements.

No diagnostic statements are inferred or included in these materials. All clinical diagnosis should be made by a trained physician or clinician. All patient names or other protected health information or data contained in any image within this material is fictitious. Any similarity to actual persons is coincidental.

Note! *This participant guide is not intended to replace the User's Reference Manuals that you received with the machine. Please refer to the disclaimer notice at the end of this participant guide for more information.*

This course is intended for Aisys CS² software level 10.X. The material contained in this course is intended for educational purposes only. Always refer to the official written materials provided with the Aisys CS² for specifications, operating procedures, and maintenance requirements.

Contents

1 Welcome

We would like to take a moment to thank you for choosing GE Healthcare for your anesthesia system needs. Our goal now is to provide you with the best training service available while continuing to support you as you use our products in your workplace.

Class Description

This course is designed to give Participants the information and product knowledge needed to proficiently operate the Aisys CS2 anesthesia system. This class will use discussion, scenarios and return demonstrations.

Participant Learning Objectives

Specific learning objectives will be listed for each section at the beginning of the section. Overall learning objectives include:

- Describe the main components of the system
- Power up and shut down the system
- Utilize the O_2 flush and alternate O_2 control
- Navigate the display
- Replace and fill an Aladin2 cassette
- Utilize the bag/vent switch and APL valve
- Replace the CO_2 canister
- Zero the flow sensors
- Start and end a case
- Change ventilation mode and balance gas
- Utilize ecoFLOW
- Manage alarms
- View trends
- Describe the eight modes of ventilation available
- View, save and erase a spirometry loop
- Perform a Pause Gas Flow, Cardiac Bypass, Vital Capacity and Cycling procedure
- Perform a full test from the checkout menu

2 Overview

Aisys CS² Overview Objectives

After completing this section, the participant will be able to:

- Describe the main components on the front of the system
- Describe the main components on the rear of the system
- Describe the main components of the Advanced Breathing System (ABS)
- Describe the optional breathing system options
- Describe the display controls
- Power up the system and recognize when AC power is connected
- Identify the three types of battery symbols
- Identify the components of the airway module and galvanic cell
- Utilize the O_2 flush button
- Active alternate O_2 control and adjust the flow.
- Describe the three types of scavenging systems available
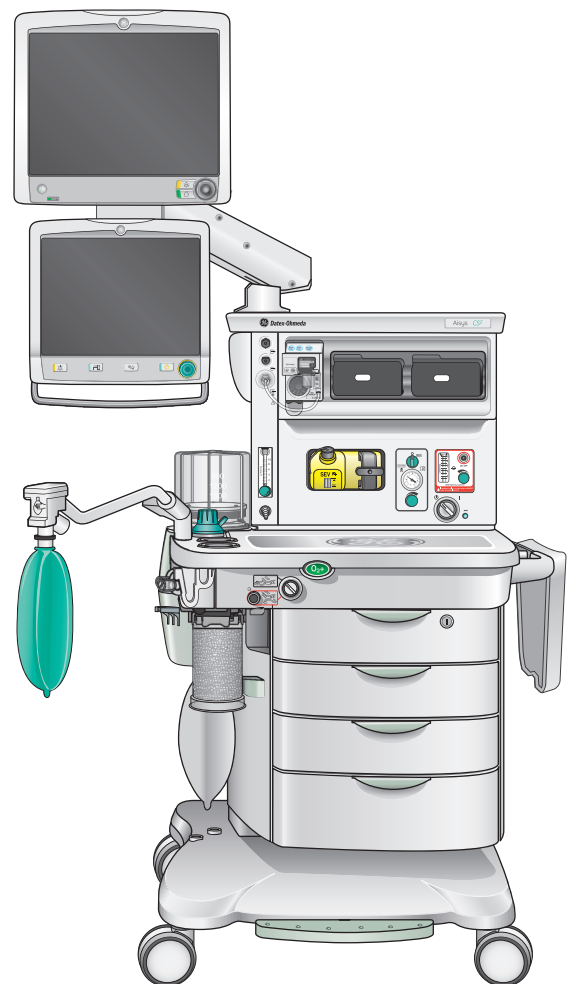
Front View

1. **Aladin2 Cassette Storage Bay:** Storage bay for Aladin cassettes that are not in use.

2. **Aladin2 Cassette and Active Bay:** The Aladin2 cassette is an electronic vaporizer that controls agent mixing and delivery.

3. **Alternate O2 Control:** The Alternate O_2 control activates automatically in the case of certain failures or errors and delivers O_2 through an independent path to the vaporizers and patient circuit. It can also be activated manually.

4. **System Switch:** Used to turn the system on and off. When the system is turned on, the display will show the power-up screen and the system does a series of automated self-tests.

5. **Mains Indicator:** The mains indicator is lit when AC power is connected.

6. **O_2 Flush Button:** Push the O_2 flush button to deliver a high flow of O_2 to the breathing system.

7. **Brake:** Push down the brake pedal to lock the system in place. Lift up on the brake pedal to release the brake.

8. **Integrated Suction:** The optional integrated suction adjusts the vacuum used to suction fluids from the patient during a case. The switch can be set to max for full vacuum, Off for no vacuum, or On for adjustable vacuum.

9. **Auxiliary O_2 Control:** The optional auxiliary O_2 flowmeter is most often used to deliver oxygen through a nasal cannula or mask.

10. **Anesthesia Display:** The anesthesia display is used throughout the anesthesia delivery process and allows the clinician to interact with the system. The display also provides real-time patient data.

Anesthesia Display **10**

Auxiliary O_2 Flow Control **9**

Integrated Suction **8**

1 Aladin2 cassette storage bay

2 Aladin2 cassette and active bay

3 Alternate O_2 Control

4 System Switch

5 Mains Indicator

6 O_2 Flush Button

7 Brake
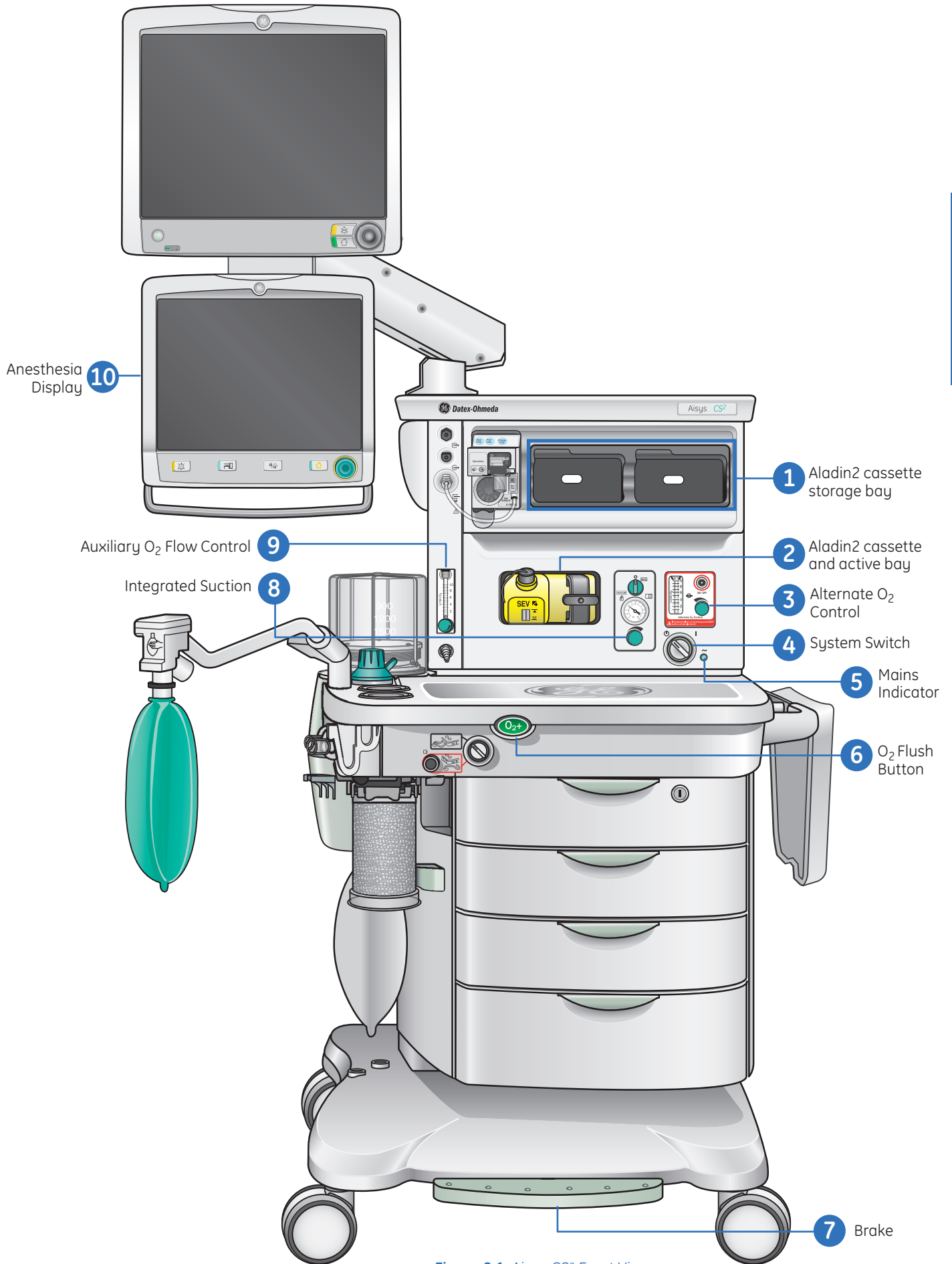
Figure 2.1 Aisys CS² Front View

Rear View

1. **Collection Bottle:** The collection bottle prevents fluids from entering the optional suction regulator.

2. **Vacuum Connection:** Connect the vacuum connection to the source vacuum supply.

3. **AGSS (Anesthesia Gas Scavenging System):** The scavenging system is designed to safely remove excess gas from the anesthesia machine.

4. **Mains Inlet**: AC power is connected to the system through the mains inlet.

5. **System Circuit Breaker:** This is the main circuit breaker. It should not be mistaken for an on/off switch. Accidentally pressing this switch will cause the system to be powered by its reserve battery instead of electricity from the wall outlet.

6. **Isolated Electrical Outlet:** A place to plug in low power accessories that are used in conjunction with the anesthesia machine.

   Note! *The electrical outlets are for low power only! Do not use these outlets for equipment such as blanket warmers and operating room beds.*

7. **Outlet Circuit Breaker:** An automatically operated electrical switch designed to protect the system from damage caused by overload. Unlike a fuse, which operates once and then must be replaced, a circuit breaker can be reset to resume normal operation.

8. **Cylinder Yokes:** Gas cylinders are mounted on the cylinder yoke.

9. **Pipeline Connections:** Hoses are connected between the pipeline inlets and the gas outlets in the hospital.

10. **Cylinder Wrench:** The cylinder wrench is used to open and close the gas cylinders.

Cylinder wrench **10**

Pipeline connections **9**

Cylinder yokes **8**

Outlet circuit breakers **7**

Isolated electrical outlet **6**

System circuit breaker **5**

Mains inlet **4**

1 Collection bottle

2 Vacuum connection

3 AGSS (Anesthesia Gas Scavenging System)
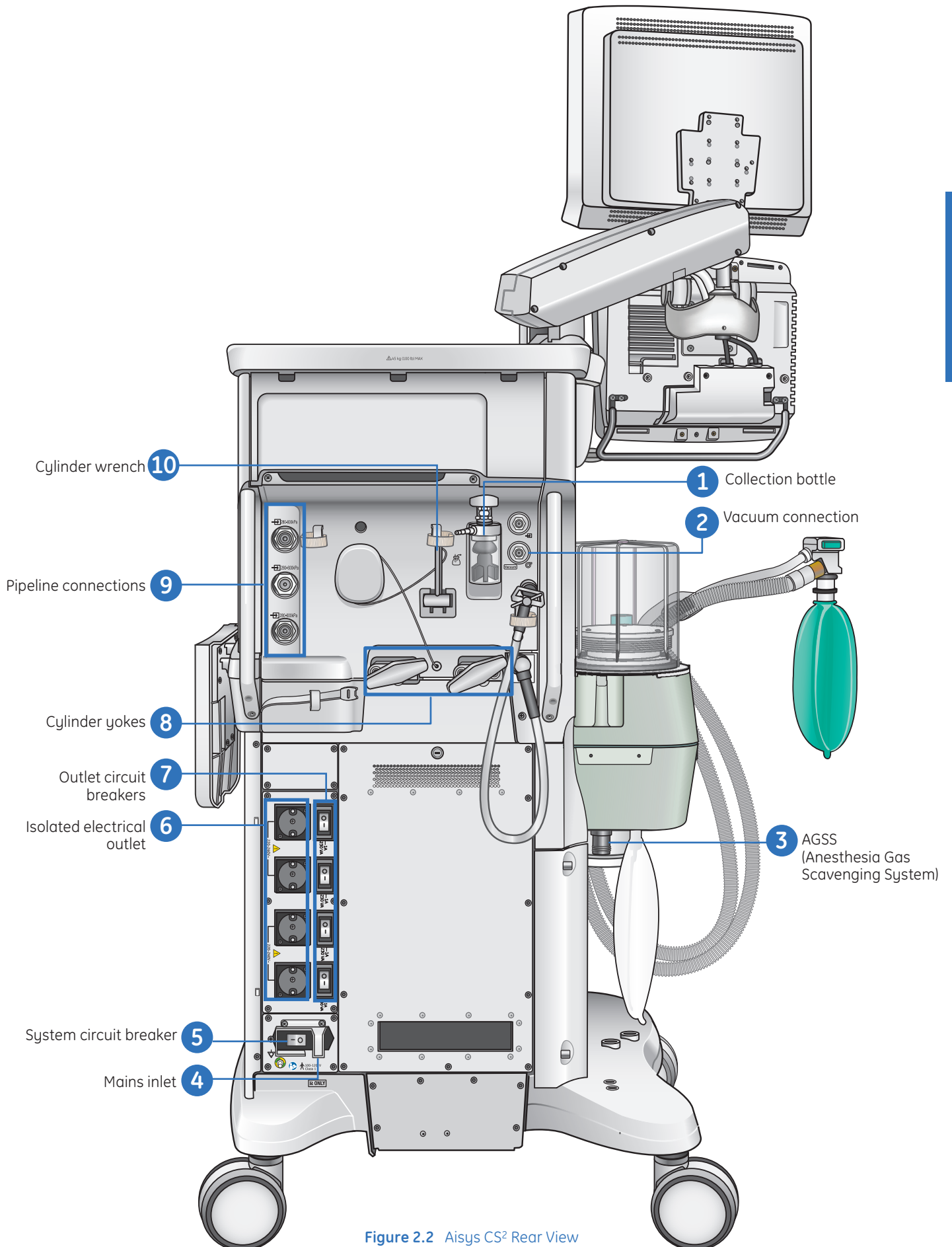
Figure 2.2 Aisys CS² Rear View

Advanced Breathing System (ABS) Components

1. **Airway Module (optional):** The airway module measures and monitors gases delivered to the patient. Depending on the configuration, this component may include sensors for measuring carbon dioxide, nitrous oxide, anesthetic agents and oxygen.

2. **Adjustable Pressure Limiting (APL) Valve:** During manual ventilation, the APL Valve allows you to change the pressure limit from minimum to 70 cmH$_2$O.

3. **Bellows Assembly:** During mechanical ventilation, the gases that are to be delivered to the patient are contained within the bellows assembly.

4. **Bag/Vent Switch:** The Bag/Vent switch selects between manual ventilation (bag) and mechanical ventilation (vent). When the switch is changed from bag to vent mode, the ventilator is automatically switched on.

5. **Expiratory Check Valve:** The expiratory check valve opens during expiration and closes at the start of inspiration.

6. **Inspiratory Check Valve:** The inspiratory check valve opens during inspiration and closes at the start of expiration.

7. **Inspiratory Flow Sensor:** The inspiratory flow sensor determines the volume of gas flowing to the patient.

8. **Expiratory Flow Sensor:** The expiratory flow sensor determines the volume of gas flowing from the patient.

9. **Absorber Canister:** This component removes carbon dioxide from the patient's exhaled breath. These scrubbed gases can then be sent back to the patient.

10. **Absorber Canister Release:** Push the absorber canister release to remove the canister from the holder.

11. **Leak Test Plug:** Occlude the breathing circuit using the leak test plug as part of the preoperative tests.

12. **Breathing System Release:** Push the absorber canister release to remove the breathing system.

13. **Manual Bag Port:** The bag hose and rebreathing bag attach to the manual bag port.

14. **AGSS Indicator (only on some AGSS versions):** With an active Anesthesia Gas Scavenging System (AGSS) that includes a flow indicator, the ball on the indicator should rise to the green zone.

.

1 Airway Module

2 Adjustable Pressure Limiting (APL) Valve)

Bellows Assembly

Bag/Vent Switch

3

4

Expiratory Check Valve

Inspiratory Check Valve

5

6

AGSS Indicator 14

Manual Bag Port 13

12

Breathing System Release

11 Leak Test Plug

7 Inspiratory Flow Sensor

8 Expiratory Flow Sensor

9 Absorber Canister

10 Absorber Canister Release
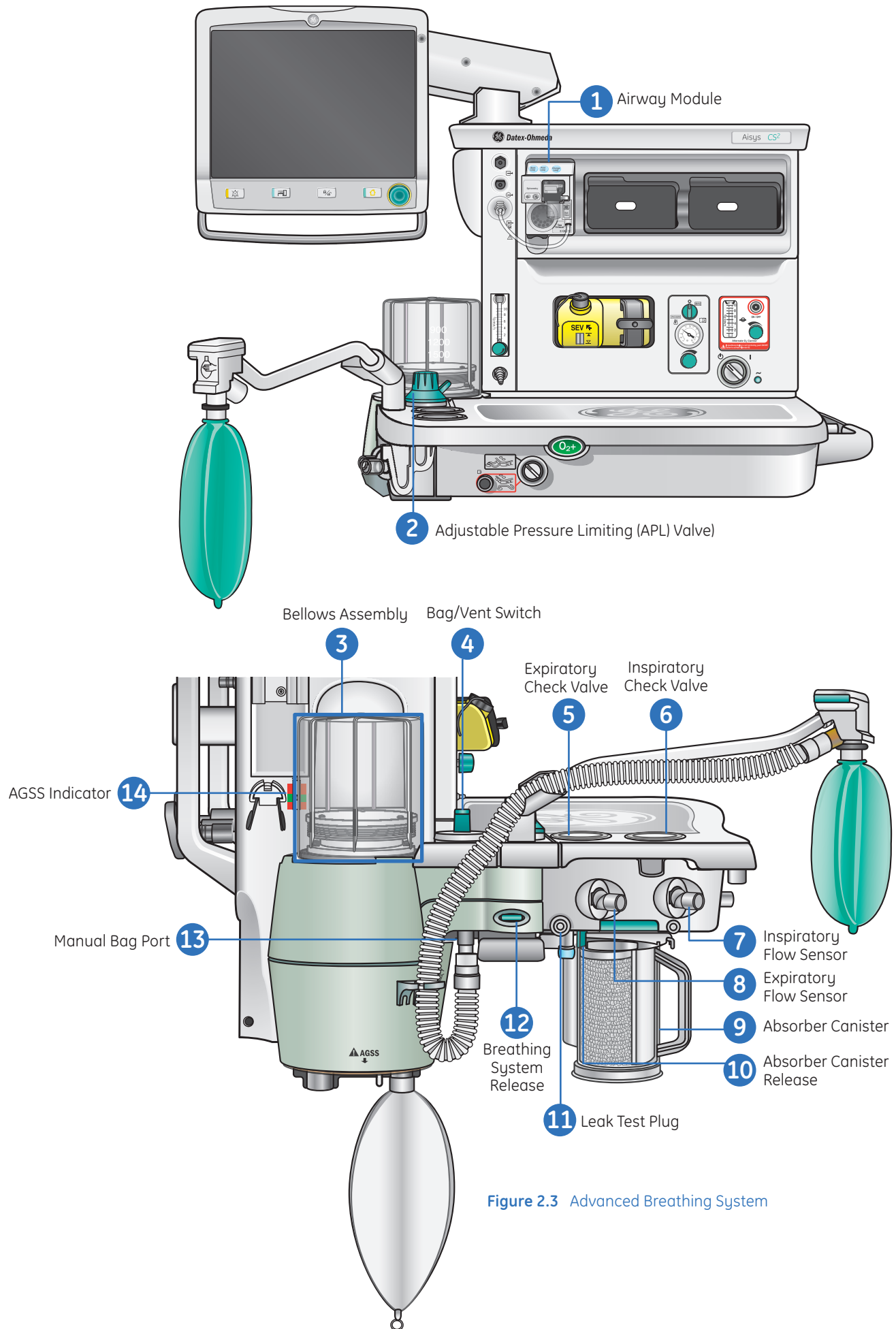
Figure 2.3 Advanced Breathing System

Breathing System Options

1. **Bag Support Arm:** Use the optional bag support arm to hold the breathing circuit bag.

2. **ACGO Port:** Fresh gas flows through the ACGO port when the ACGO switch is set to the ACGO position.

3. **Auxiliary Common Gas Outlet (ACGO) Switch:** Use the optional Auxiliary Common Gas Outlet (ACGO) switch to direct the fresh gas flow through the ACGO port on the front of the system to a manual breathing circuit.

4. **EZchange Canister Mode (CO$_2$ bypass):** Use the optional EZchange canister mode for continued ventilation of the patient while changing the absorber canister.

5. **EZchange Canister Release:** Push the EZchange canister release to unlock the canister cradle.

6. **Condenser**: Use the optional condenser to remove water in the system that is produced from the reaction of CO$_2$ gas with the absorbent.

7. **Condenser Drain Button:** Place a container under the reservoir and push the drain button to empty any water in the condenser.
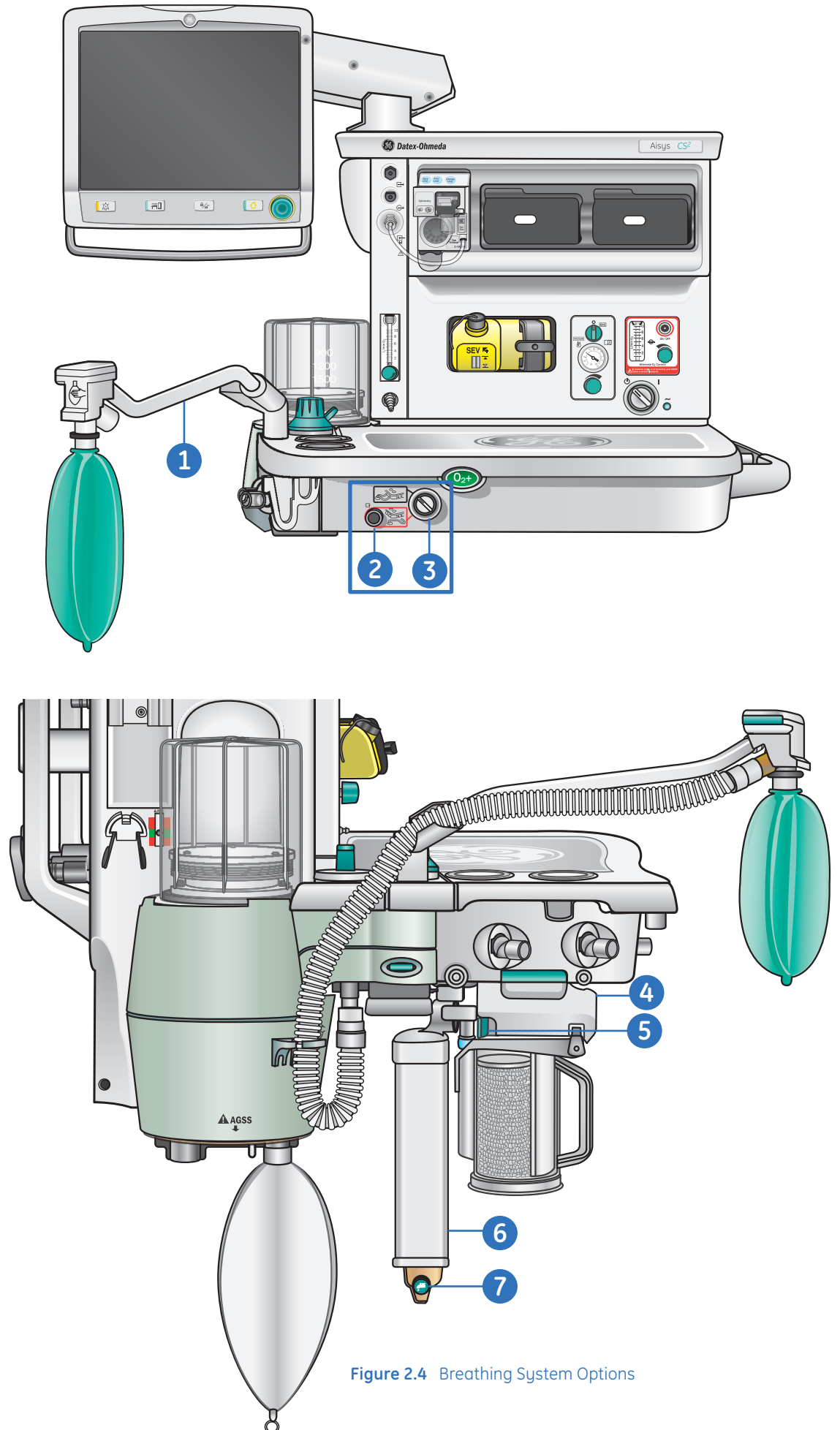
Figure 2.4 Breathing System Options

Display Controls

The touchscreen has numerous touch point areas that make accessing menus and settings quick and easy. The buttons on the right side of the screen provide direct access to commonly used functions. The ventilation quick keys enable setup of ventilation modes. The gas control quick keys provide a method to set up the gas used for a case.

Touch only one touch point at a time to ensure the correct selection is made.

1. **ComWheel:** Selects a menu item or confirms a setting. Turn clockwise or counterclockwise to scroll through menu items or change settings.

2. **Home Key:** Removes all menus from the screen.

3. **Screen Lock/Unlock Key:** Locks the touchscreen. Toggles between lock and unlock functions.

4. **Start/End Case Key:** Initiates Start or End Case function.

5. **Touchscreen:** Activates functions when touch areas on the screen are selected.

6. **Audio Pause Key:** Stops audio for 120 seconds for any active, eligible high and medium priority alarms. Prevents audio (audio off) for 90 seconds when no medium or high priority alarms are active. Allows the operator to acknowledge any non-active medium or high priority latched alarms. Hold the key for 2 seconds to cancel the audio pause function.

Figure 2.5 Display Controls

System Power

Turning On the System

1. Plug the power cord into an electrical outlet and make sure the system circuit breaker is on. The mains indicator is lit when AC power is connected and the battery is charging (if it is not already fully charged).

2. Check that the breathing system is properly connected.

3. Turn the System Switch to On. The display will show the power up screen and the system does a series of automated self-tests.

4. Perform a Full Test before the first case of the day (this is covered in full detail later in the course).

5. Perform a preoperative checkout before each case. See the **Preoperative checkout** section of the user's manual for more information.
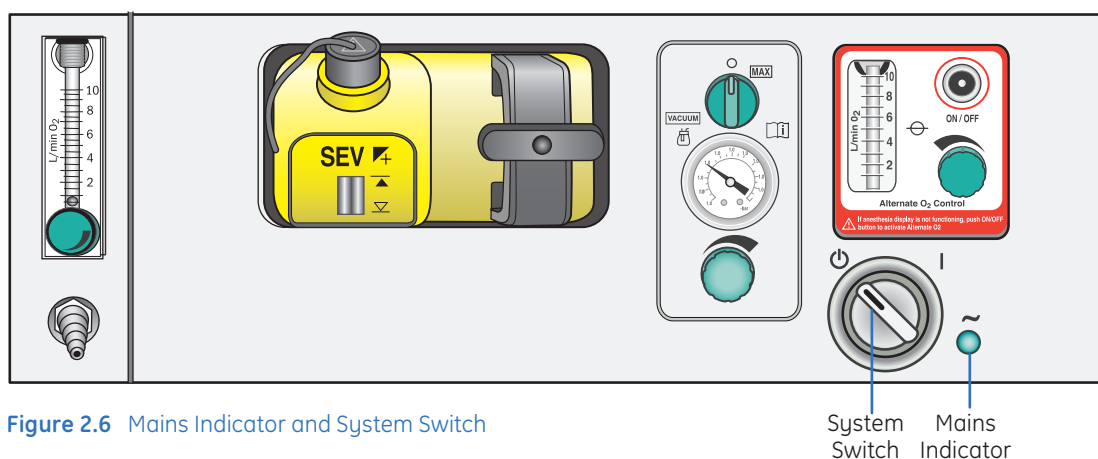
Figure 2.6 Mains Indicator and System Switch

System Switch

Mains Indicator

Battery Information

If AC power is lost, the battery has the capacity to operate for 50 minutes under typical operating conditions and 30 minutes under extreme conditions.

The color and fill amount of the **battery in use** symbol indicates the amount of battery power remaining.

Green indicates greater than 10 minutes.

Yellow indicates between 10 and 5 minutes.

Red indicates less than 5 minutes.

Note! *Electrical outlets (if provided) will not function while the system is on battery power.*
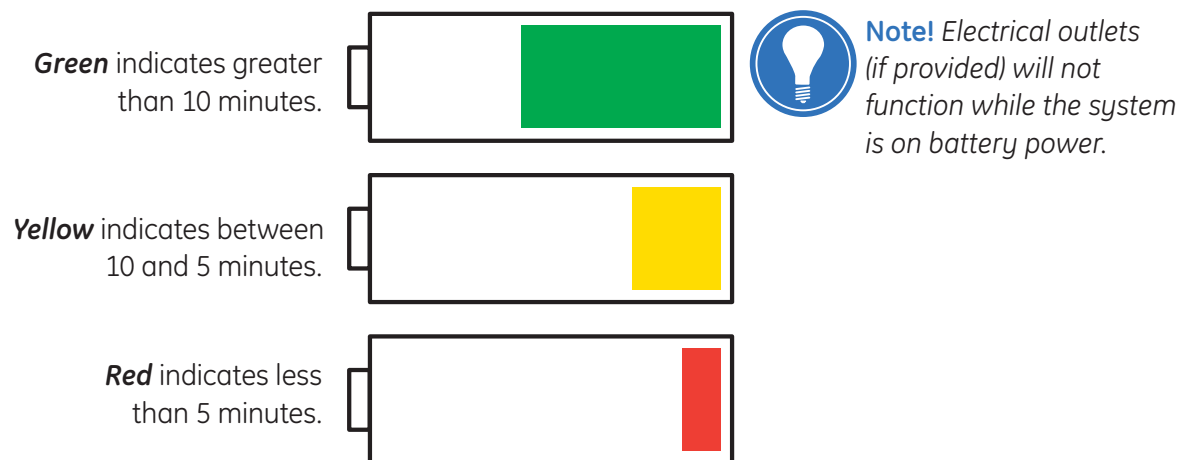
Figure 2.7 Battery in use symbol

O$_2$ Information Sources

Airway Modules

There are two sources of O$_2$ information available on the system. The first source is the optional compact airway module.

The compact airway modules measure and monitor gases delivered to the patient and exhaled through the breathing circuit. The modules consist of:

- An infrared sensor for measuring CO_2, N_2O, and anesthetic agents.
- A paramagnetic O$_2$ sensor.
- A gas sampling system with D-fend water separation system.
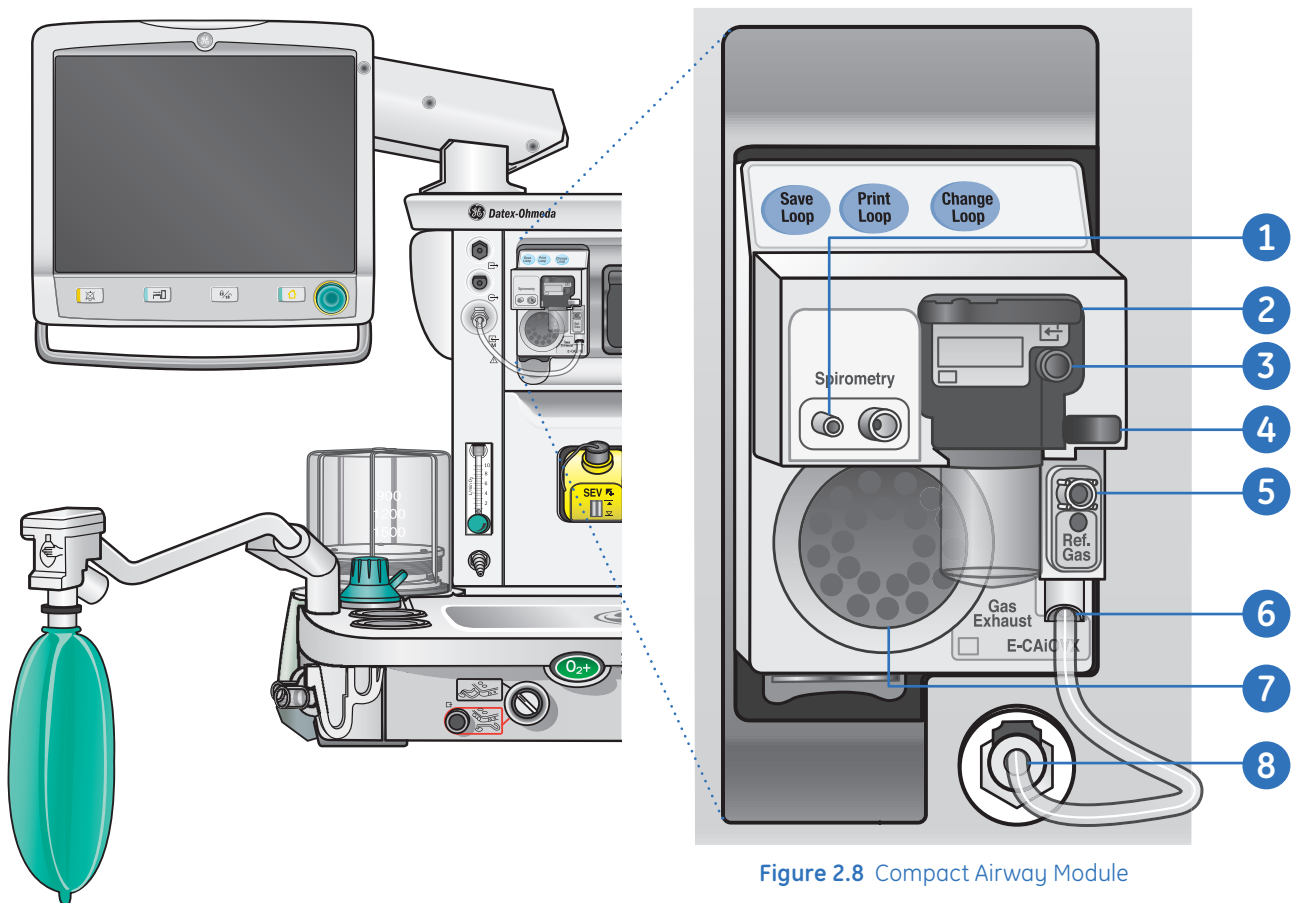
Figure 2.8 Compact Airway Module

1. Connectors for patient spirometry only.

2. D-fend water trap with washable container.

3. Sampling line connector on the D-fend water trap.

4. Water trap latch.

5. Oxygen reference gas inlet.

6. Sample gas outlet.

7. Cooling fan with dust filter.

8. Sample gas return port.

Galvanic Cell

The second O_2 information source is an optional Galvanic Cell, or O_2 Sensor, located within the Advanced Breathing System (ABS). The Galvanic Cell measures the circuit O_2. The O_2 sensor is calibrated daily during the system checkout, and can be expected to last approximately eighteen months. It CANNOT be disinfected.
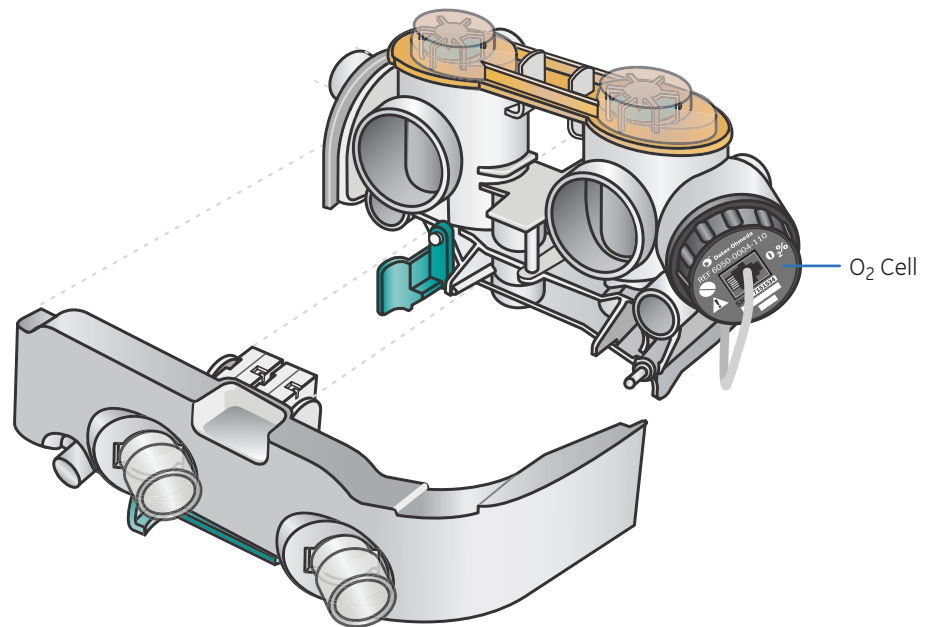
O_2 Cell

Figure 2.9 O_2 Sensor

Note! *Systems with an airway gas module may not include the optional Galvanic Cell. Systems with both an airway module and an O_2 cell will display the patient inspired O_2 value obtained from the airway module.*

O₂ Flush Button

The O$_2$ Flush Button delivers a high flow of 100% O$_2$ to the breathing system, bypassing the vaporizers.
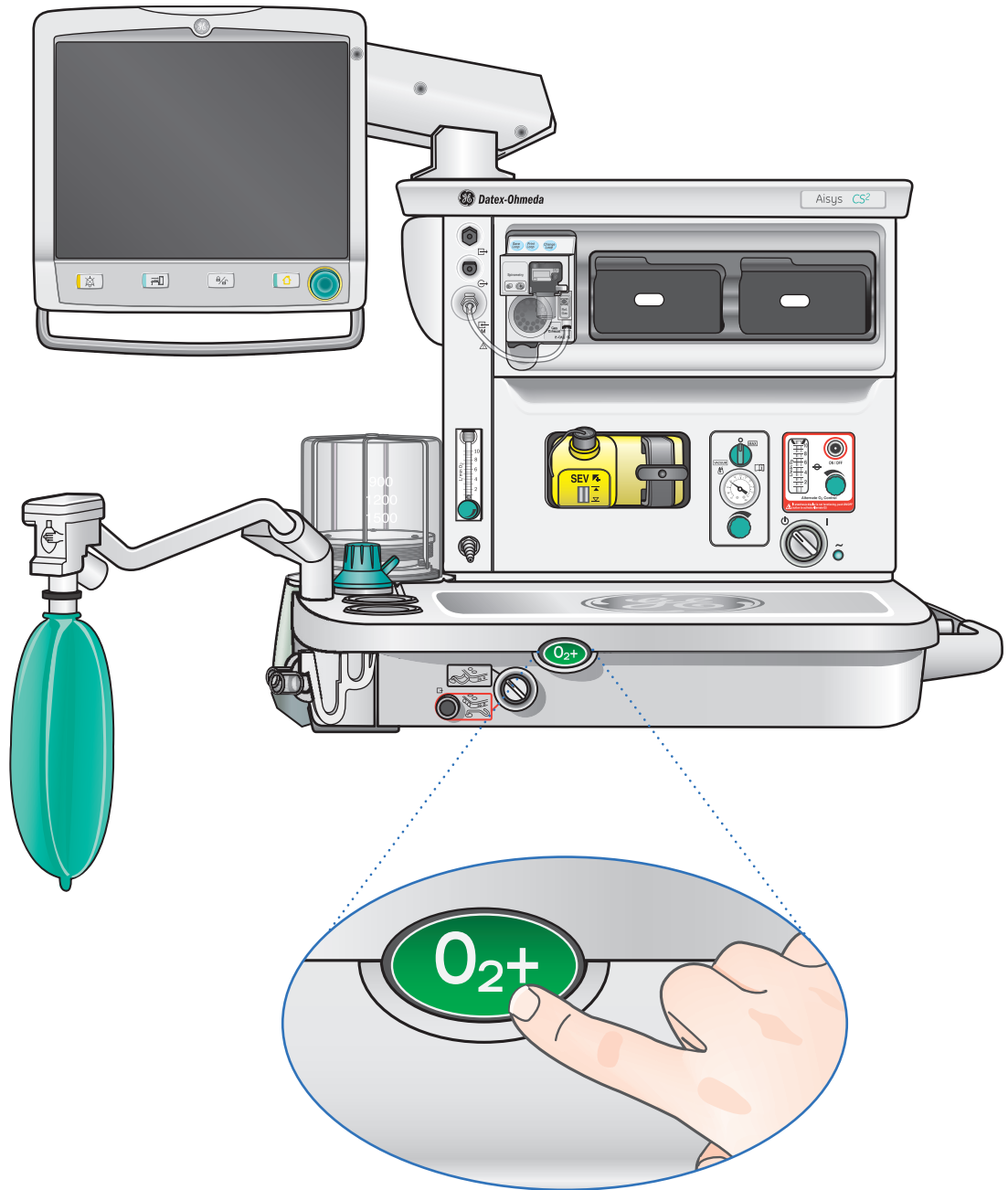
Figure 2.10 O$_2$ Flush Button

Alternate O$_2$ Control

When Alternate O$_2$ control is enabled, flow from the electronic mixer is stopped. O$_2$ is flowing through the Alternate O$_2$ control to the breathing system. To activate anesthetic agent flow to the breathing system, set the agent to the desired concentration.

Use the Alternate O$_2$ control to deliver O$_2$ through an independent pneumatic path to the vaporizer and patient circuit. Alternate O$_2$ is connected to the system O$_2$ supply. Alternate O$_2$ control activates automatically in the case of certain failures or errors. It can also be activated manually.

The Alternate O$_2$ control is available approximately 20 seconds after the system is turned on. The Alternate O$_2$ flow is adjustable from approximately 0.5 l/min to 10 l/min as indicated on the flow tube.
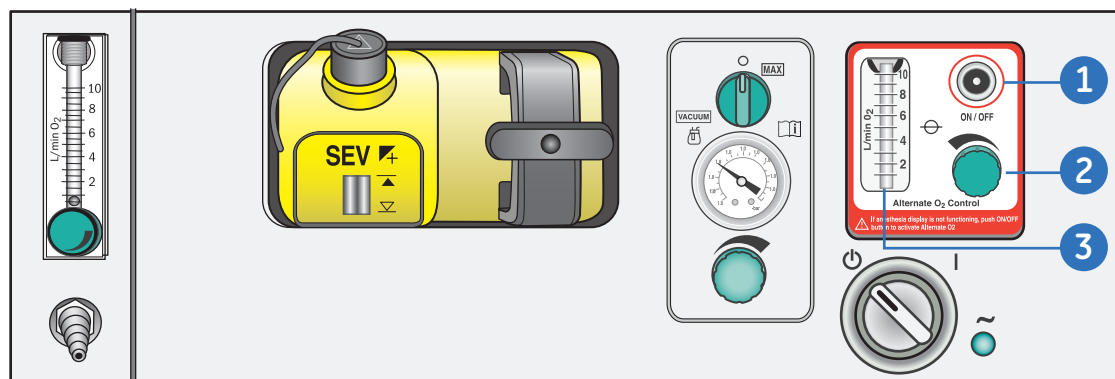
Figure 2.11   Alternate O$_2$ Control

1. Alternate O$_2$ ON/OFF button

2. Flow control

3. Flow tube

Using Alternate O$_2$ control

1. Push the Alternate O$_2$ ON/OFF button. The O2 flow is indicated on the flow tube.

2. Use the flow control to adjust the O$_2$ flow.

3. Set the agent to the desired concentration.

4. To end Alternate O$_2$ control, push the Alternate O$_2$ ON/OFF button.

Types of Scavenging Systems

Active Anesthesia Gas Scavenging Systems (AGSS)

There are several versions of the optional active Anesthesia Gas Scavenging System (AGSS) 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 Adjustable Flow

Provides the capability to adjust the flow with a needle valve and a visual indicator bag which should be properly inflated. To ensure adequate scavenging, adjust the needle valve so the visual indicator bag puffs out slightly with each breath. The bag should not be completely collapsed (close the needle valve slightly) nor completely inflated (open the needle valve slightly).

Problems with Active Adjustable Flow gas scavenging can cause a High Peep alarm. Make sure the scavenge hose is connected to suction. Make sure that the needle valve is open enough that the scavenger bag moves with inspiration and expiration.

You can connect the sample gas exhaust tube to the gas return port. Exhaust gas will be directed to the scavenging system.
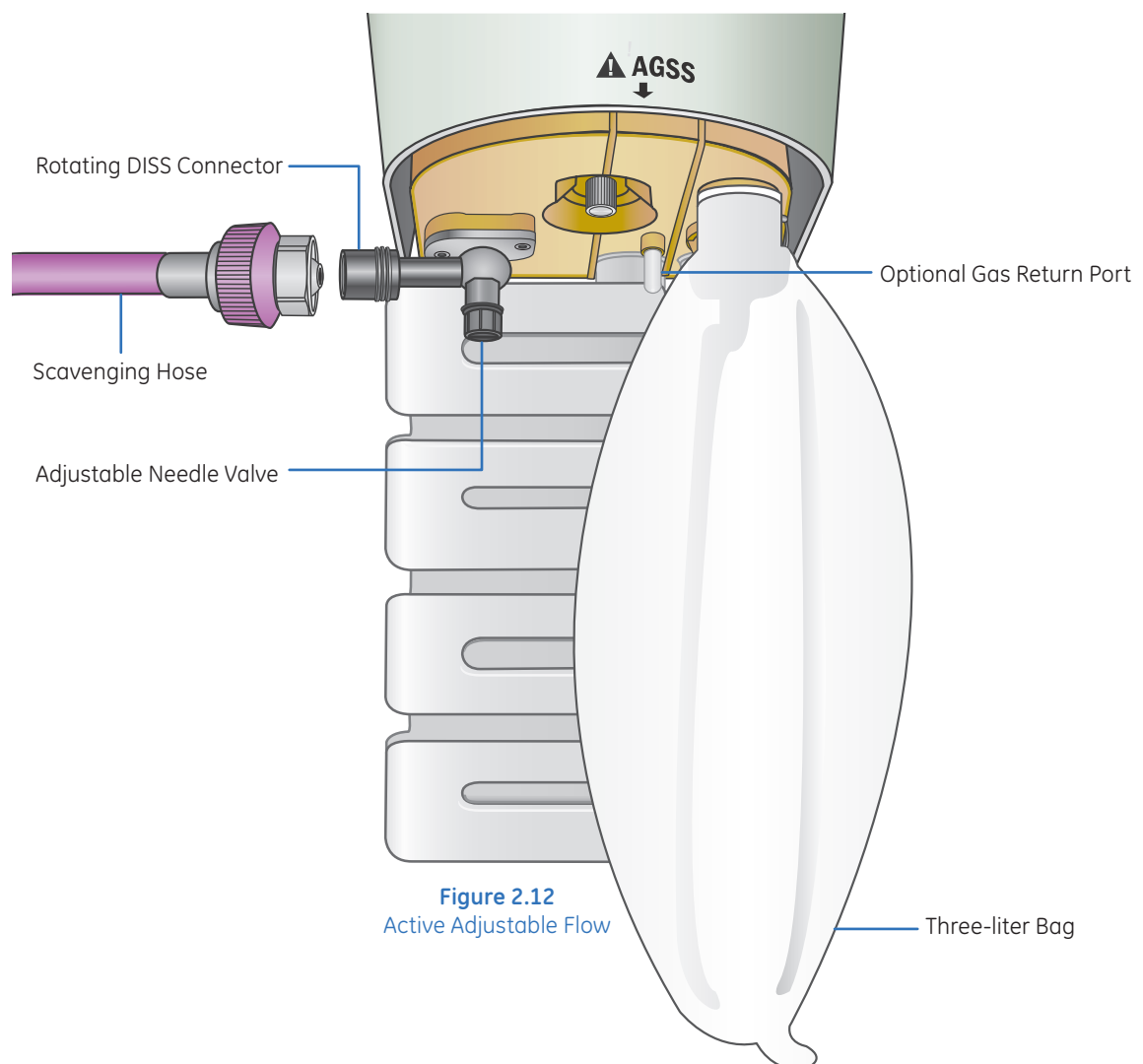
Figure 2.12
Active Adjustable Flow

Active AGSS with Flow Indicator

The active AGSS with flow indicator does not use a needle valve or a visual indicator bag. A flow indicator will verify that there is a proper extraction flow rate.

With the AGSS operating, verify that the ball on the flow indicator rises to the green zone, indicating adequate flow.

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

Scavenging Hose Connector
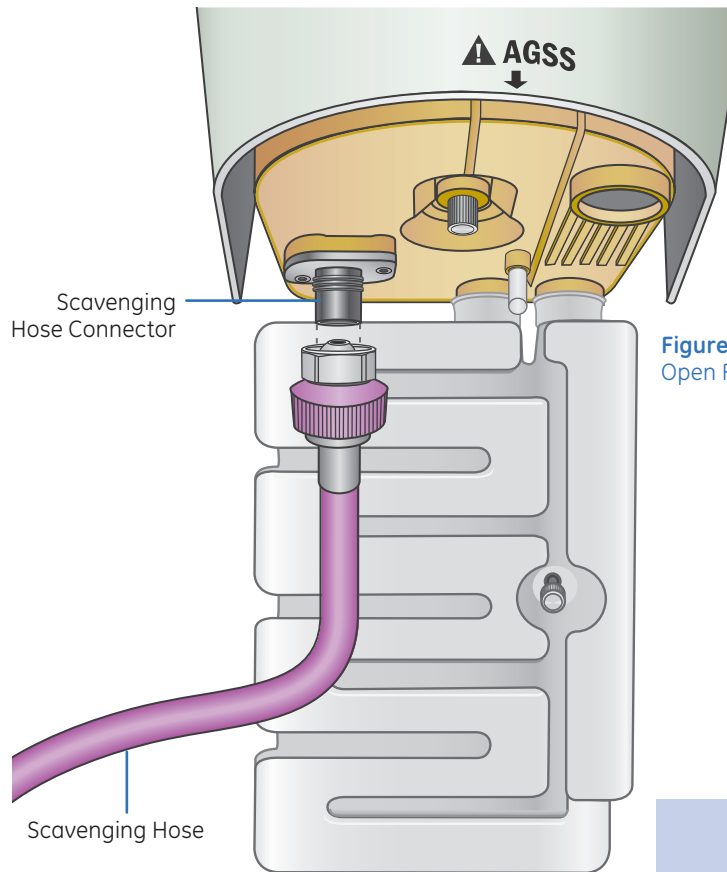
Scavenging Hose

Figure 2.13
Open Reservoir System

2 Overview
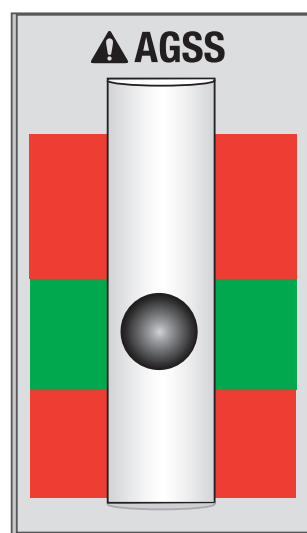
Figure 2.14
Flow Indicator

2.17
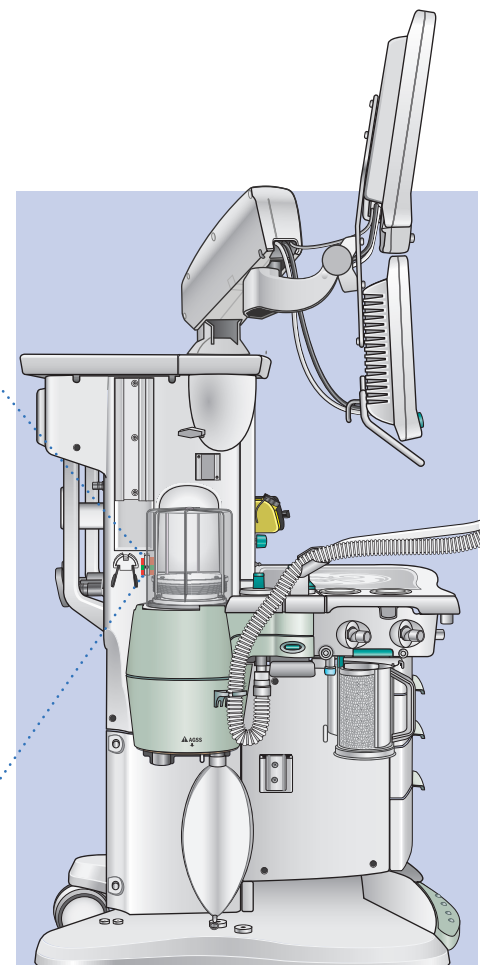
Passive AGSS (Anesthetic Gas Scavenging System)

The optional passive anesthesia gas scavenging system (AGSS) is for use in operating room environments that do not have an active gas extraction system for waste gas disposal. The passive AGSS contains both positive and negative pressure relief valves to protect the breathing system and the patient.

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

Connecting Passive AGSS

1. Connect a large diameter tube to the 30-mm tapered connector on the bottom of the AGSS receiver.

2. Route the large diameter tube from the passive AGSS to exterior of the building or to a non-recirculating ventilation system. The tube should be as large in diameter and as short as possible.
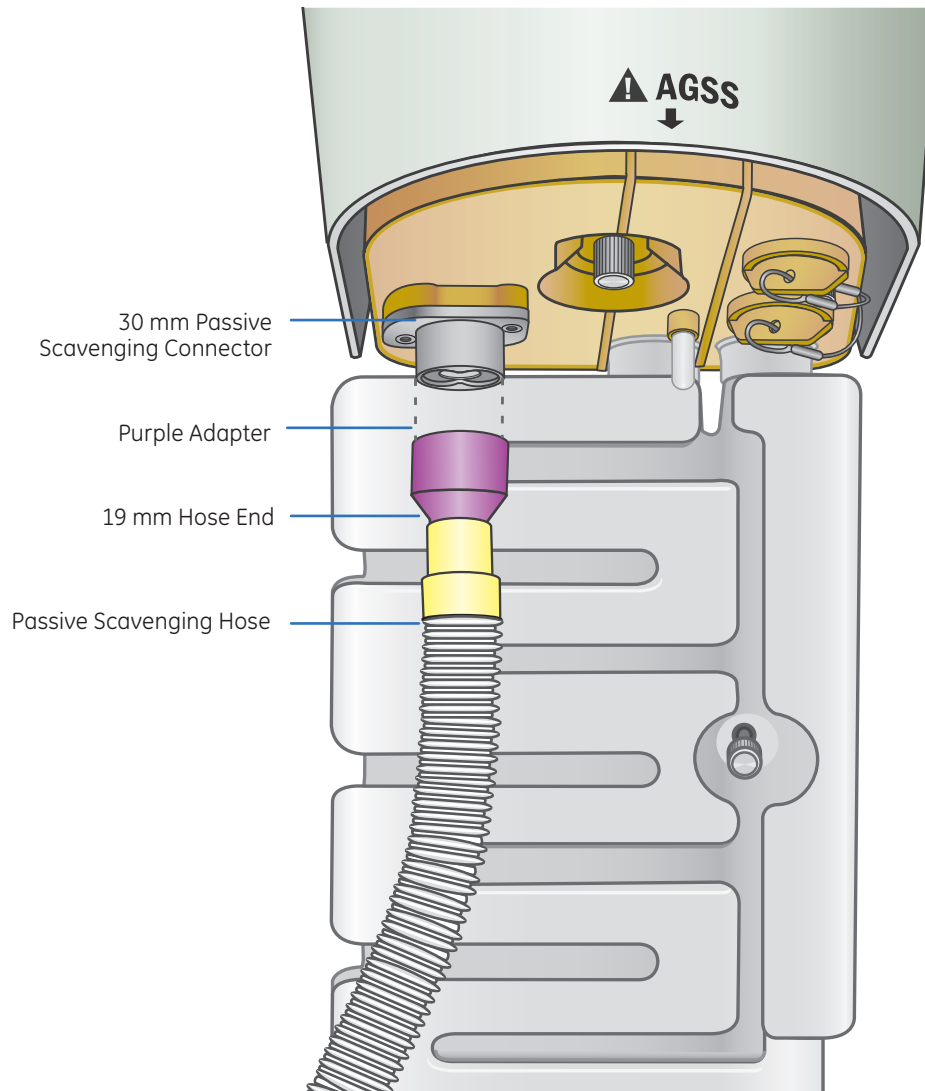
Figure 2.15   Passive Anesthetic Gas Scavenging System

3 Display Navigation

Aisys CS² Display Navigation Objectives

After completing this section, the participant will be able to:

- Position the display
- Describe the various areas of the display, such as waveform fields, digit fields and split screen.
- Navigate through a menu using the ComWheel
- Use a Quick Key to change a setting

Positioning the Display

The display can be moved for optimal viewing:

1. Unlock the display arm.

2. Raise or lower the display arm to adjust the height of the display.

3. Lock the display arm.

4. Rotate the display arm toward or away from the system to adjust the horizontal position of the display.

5. Tilt the display up or down to adjust the vertical angle of the display.

6. Tilt the display left or right to adjust the horizontal angle of the display.
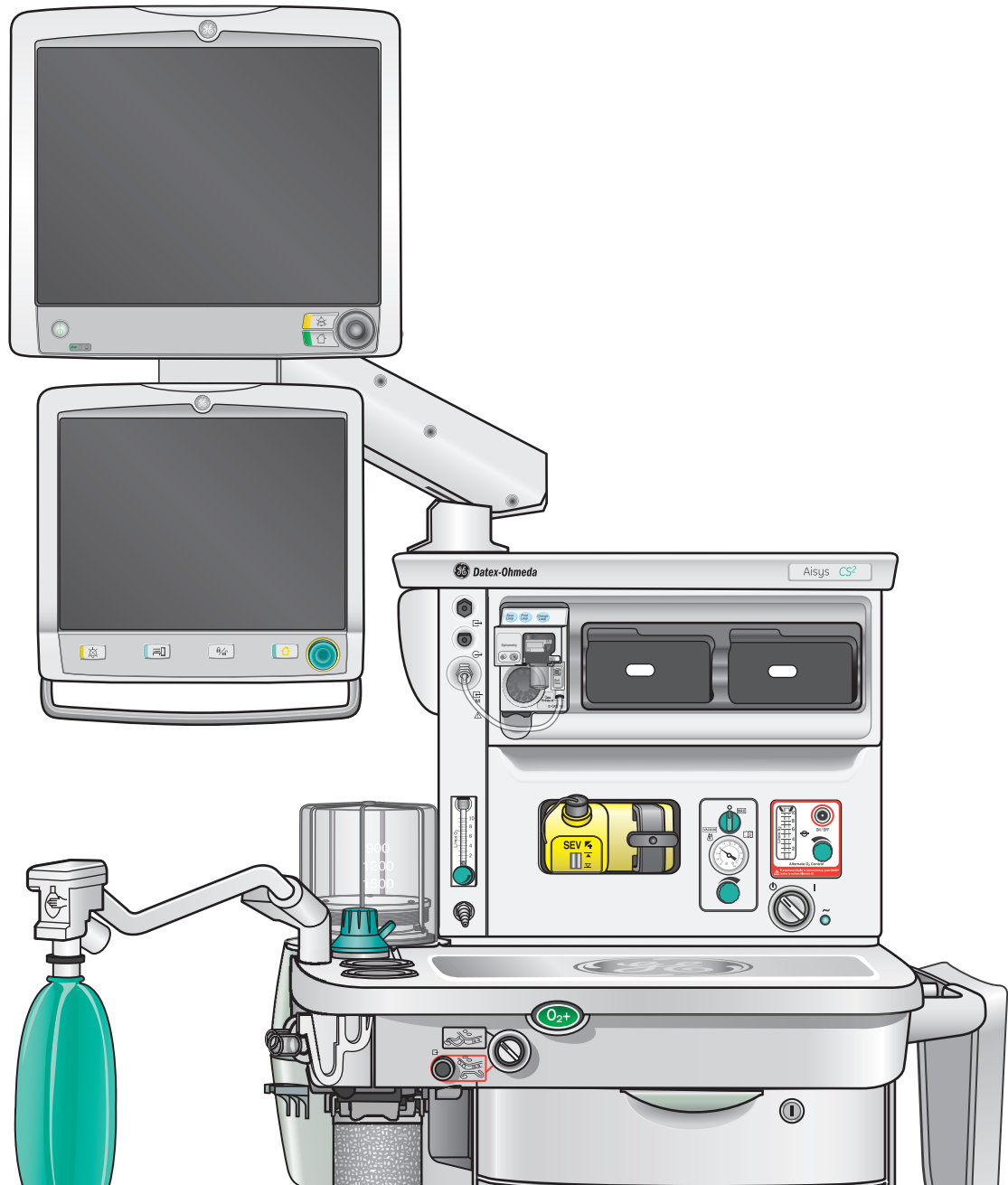
Figure 3.1 Display • front view

System Display Overview
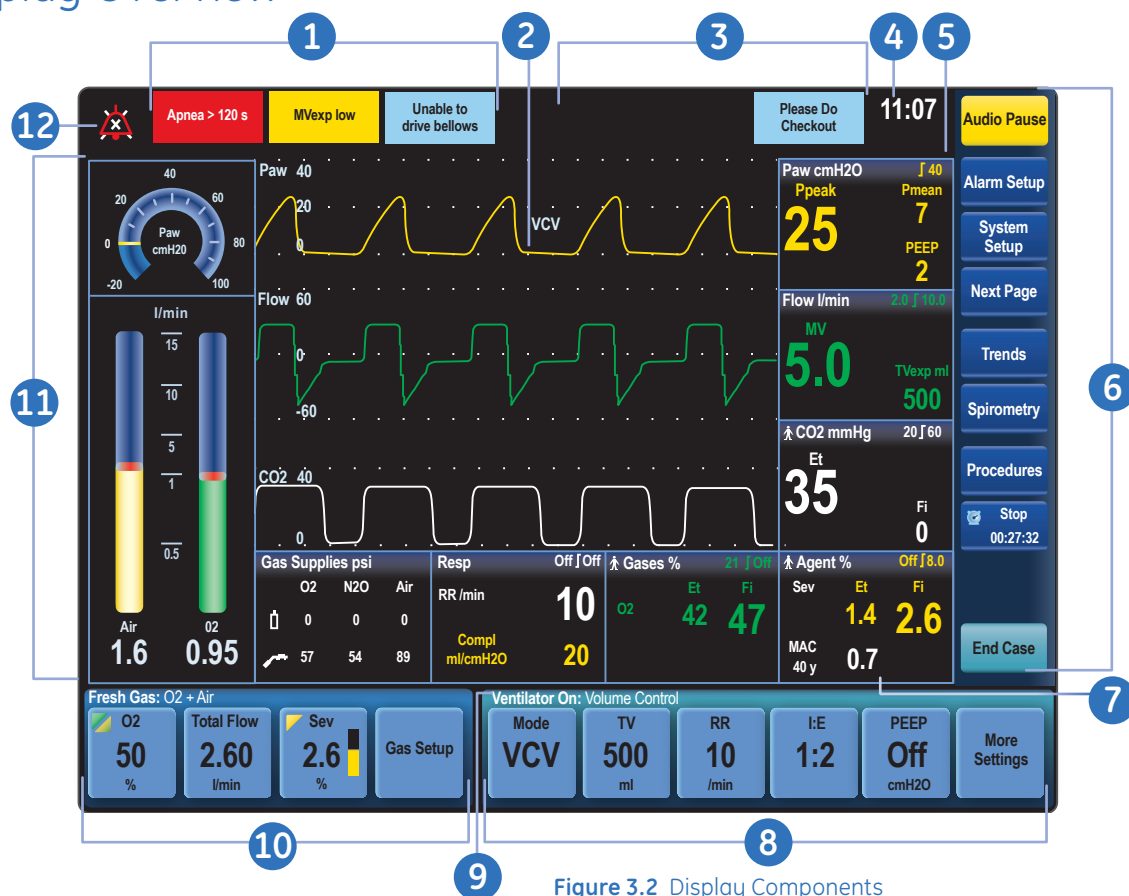
Figure 3.2 Display Components

1. **Alarm Message Fields:** Displays the active alarms.

2. **Waveform Fields**: Displays the waveforms of measured values. For example: Paw, Flow, and CO_2.

3. **General Message Fields or Lock Touchscreen Indicator:** Displays general messages and the touchscreen lock indicator.

4. **Clock:** Displays the current time.

5. **Measured Values Fields:** Displays the measured values. For example: Paw, Flow, and CO_2.

6. **Function Keys:** Functions available are Audio Pause, Alarm Setup, System Setup, Next Page, Trends, Spirometry, Procedures, Timer, Start, and End Case.

7. **Digit Fields:** Contains information for Spirometry, Resp, Agent, and Gases.

8. **Ventilator Quick Keys:** Displays mode, associated ventilation parameters, and more settings. For example: Mode, TV, RR, I:E, PEEP, and More Settings.

9. **Ventilation Mode:** Displays the selected ventilation mode. For example: Ventilator On, and Volume Control.

10. **Gas Quick Keys:** Displays O_2, Total Flow, and Gas Setup.

11. **Split Screen Field**: Contains airway pressure, gas flow values, compliance, trends, and optional ecoFLOW information.

12. **Audio Pause Symbol and Countdown Clock:** Indicates when alarm audio is paused and the countdown clock until audio is on.

Digit Fields

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

Paw, O_2, and either TVexp or CO_2 must show on the display during a case. If any of these parameters are not selected to show on the display, the right most digit field information is replaced with the missing parameter.
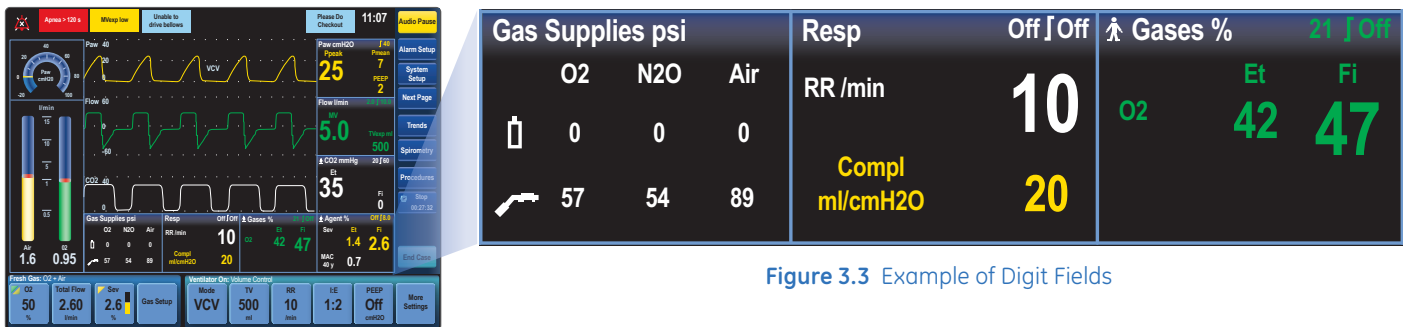
Figure 3.3 Example of Digit Fields

Waveform Fields

Up to three waveforms can be shown on the normal screen view. Each waveform can be set to show specific Paw, agent, flow, or CO_2 data. The corresponding numeric information shows in the measured values field to the right of the waveform. If the waveform is set to show the agent and no airway module is inserted, that waveform and numeric area is blank.

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

When in a case, touch the waveform field area to close the menu.
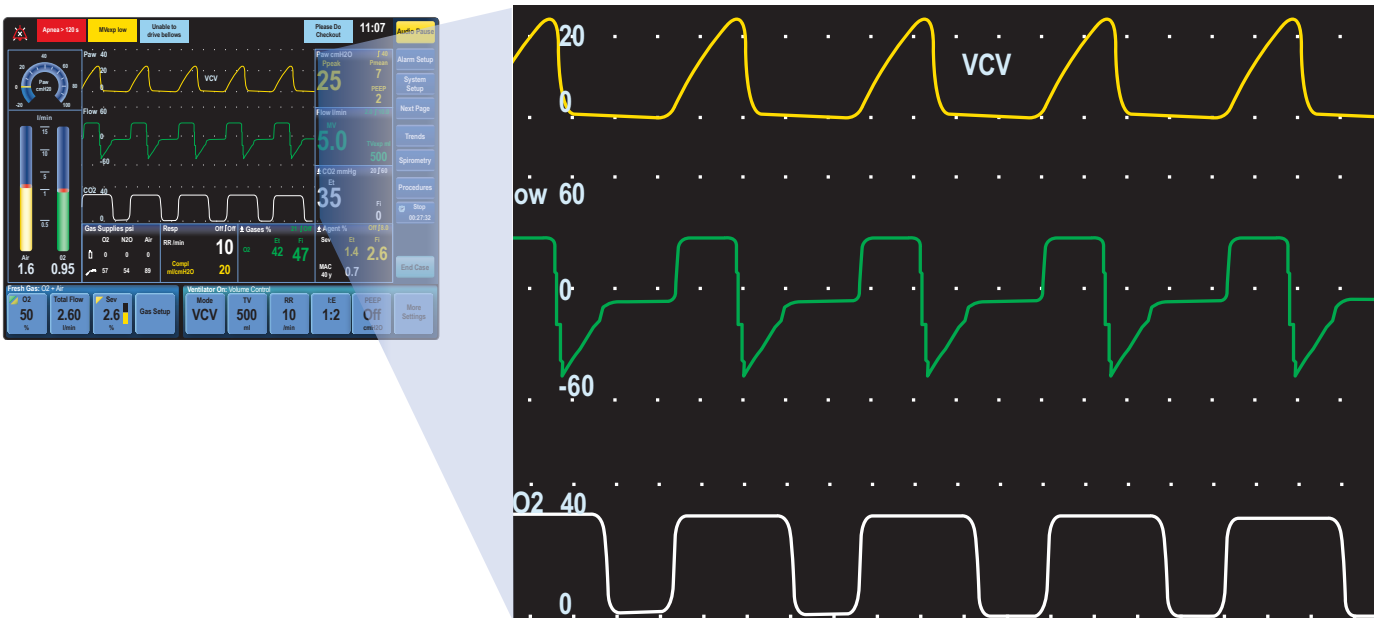
Figure 3.4 Example of Waveform Fields

Split Screen Field

The split screen field can be set to show gas delivery, trends, spirometry loops, Paw gauge, airway compliance, and optional ecoFLOW information. If **None** is selected, the split screen area will be blank.

Touch the spilt screen field to directly open the Screen Setup menu.

Figure 3.5 Example of Split Screen Field

Display Touch Points

CAUTION! **Do not apply excessive force to the touchscreen as damage may occur.**

The blue outlined areas indicates the touch points of the display.
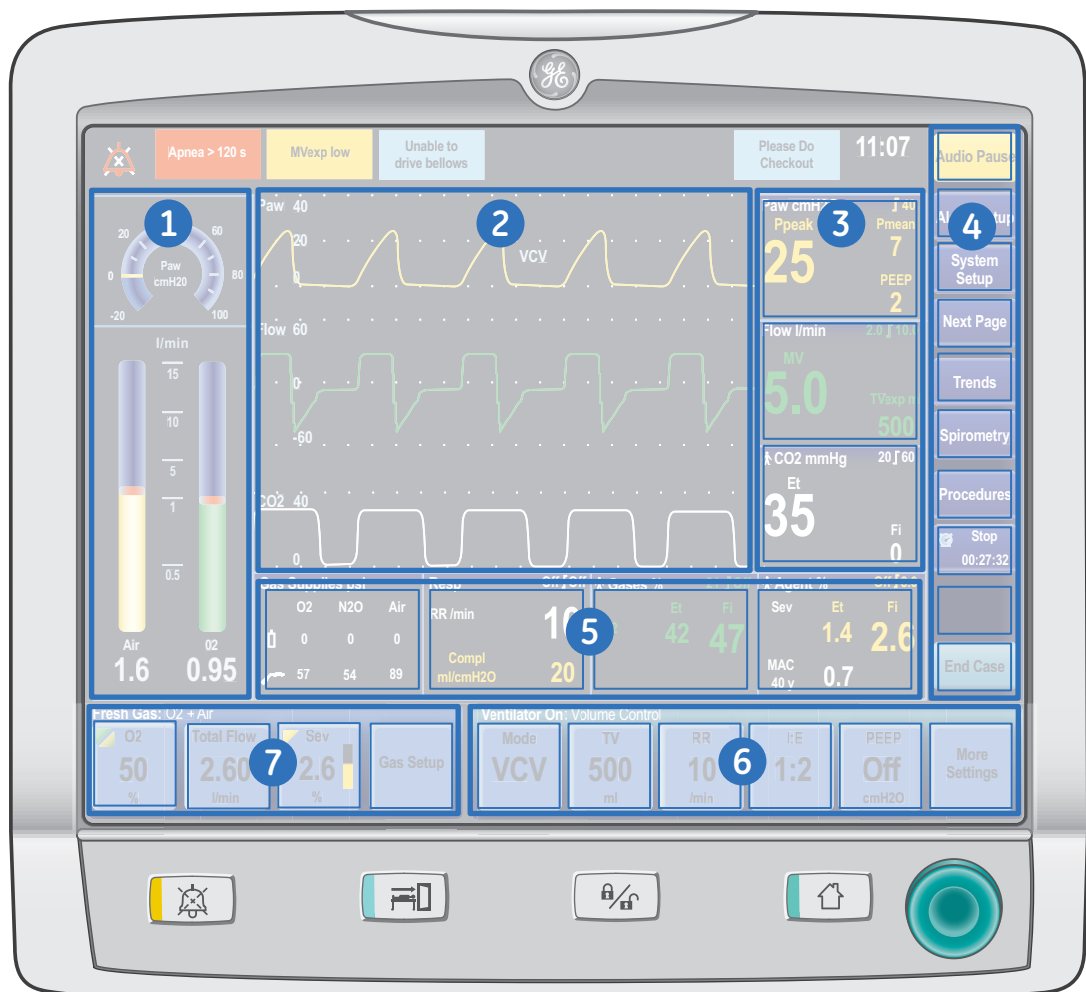
Figure 3.6 Display Touch Points

1. Split screen values

2. Wave fields

3. Measured values

4. Function keys

5. Digit fields

6. Ventilator quick keys

7. Gas quick keys

Measured Value Touch Points

Touching measured values provides access to the *Alarm Setup* menu and alarm limits.

1. Touch the measured value to access the *Alarm Setup* menu.

2. The *Alarm Setup* menu displays.

3. Select the alarm limit and set it to the correct value. Touch the value on the touchscreen or push the ComWheel to confirm the desired setting.

4. Push the *Home* key, touch the waveform area of the display, or select *Close* to close the menu.
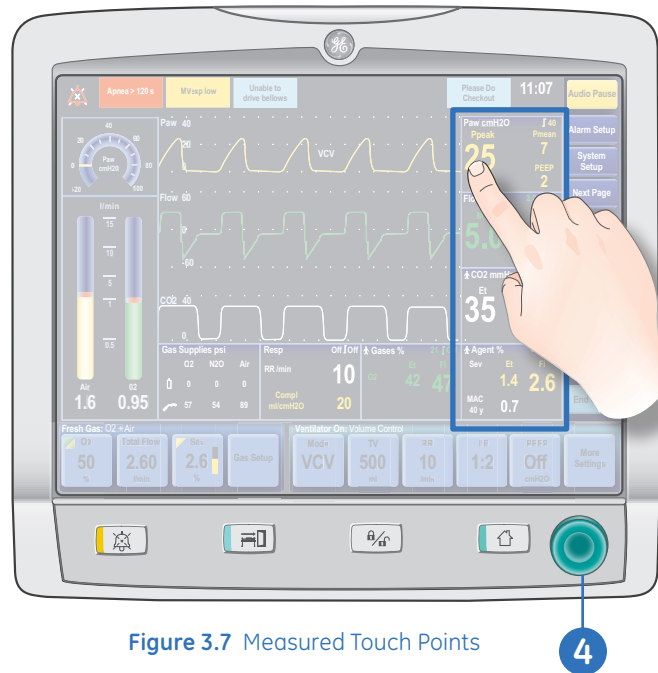
Figure 3.7 Measured Touch Points

Active Alarm Touch Points

When an alarm sounds the alarm message is displayed at the top of the screen and, if applicable, the alarming numeric field and digit field flashes. The Alarm messages at the top of the screen are message alerts only and not active touch points.

1. Touch the flashing numeric field to access the *Alarm Setup* menu and alarm limits for the active alarm.

2. The *Alarm Setup* menu displays with the active alarm limit highlighted.
   For example: If the *Ppeak high* alarm activates, the high alarm limit setting for Ppeak displays with the highlight.

3. Select the active alarm limit and change it to the desired setting.
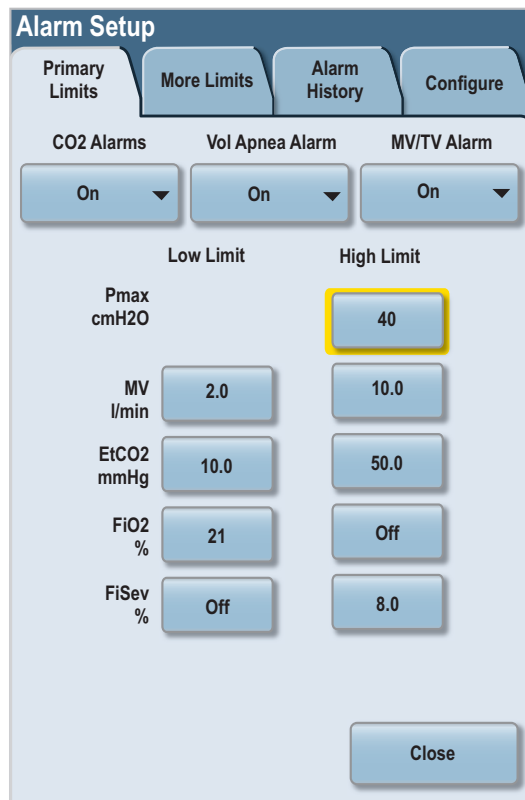
Figure 3.8 Alarm Setup Menu

Navigating the Display

Use the touchscreen and ComWheel to navigate the display.

Figure 3.9 Menu Overlaying - Normal View

Menu Components

1. **Menu Heading:** Displays the title of the open menu.

2. **Menu Items:** Contains the items to either adjust or select from a drop-down list.

3. **Instructions or Help Information:** This shows any additional instructions or help messages.

Using Menus

Use the function keys to access the corresponding menus. When a menu is selected, the menu field overlays the normal view and the waveform fields start at the right edge of the menu.

4. Select a function or quick key to access the corresponding menu.

5. Select a menu item to choose the item, or turn the ComWheel left or right to highlight a menu item and then push to confirm. If the menu item selected is an adjustment, turn the ComWheel left or right to make the setting and then push to confirm. If the menu item has a drop-down list, select the desired value from the list by touching the item.

6. Select **Close**, touch the waveform area, or push the **Home** key to exit the menu.

Using the ComWheel

Use the ComWheel to scroll through the quick key settings and function keys, make selections, change settings, and confirm settings.

1. Push the ComWheel to make a selection.

2. Turn the ComWheel to the right.
    *   For menu items, the highlight moves down.
    *   For quick keys, the highlight moves to the next key on the right.
    *   For settings, the value changes to the next available setting.
    *   For pull-down selections, the highlight moves to the next available selection.

3. Turn the ComWheel to the left.
    *   For menu items, the highlight moves up.
    *   For quick keys, the highlight moves to the next key on the left.
    *   For settings, the value changes to the previous available setting.
    *   For pull-down selections, the highlight moves to the previous available selection.

4. Push the ComWheel to confirm a setting.
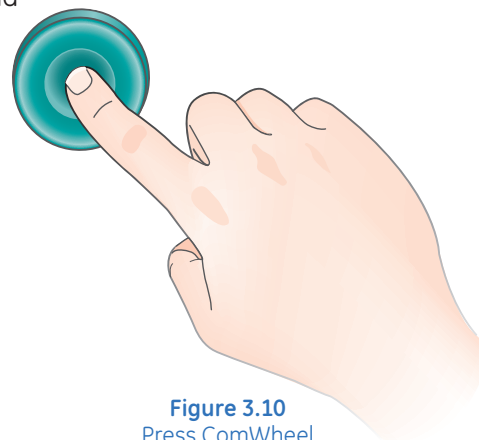
Figure 3.10
Press ComWheel
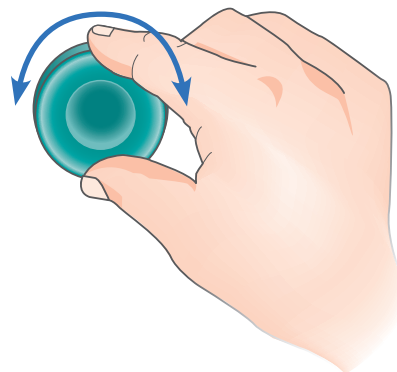
Figure 3.11 Turn ComWheel

Using Quick Keys

The gas settings and the main ventilator settings for each ventilation mode can be changed using the quick keys.

Fresh Gas: O2 + Air				Ventilator On: Volume Control					
O2	Total Flow	Sev	Gas Setup	Mode	TV	RR	I:E	PEEP	More Settings
50	2.60	2.6		VCV	500	10	1:2	Off	
%	l/min	%			ml	/min		cmH2O	
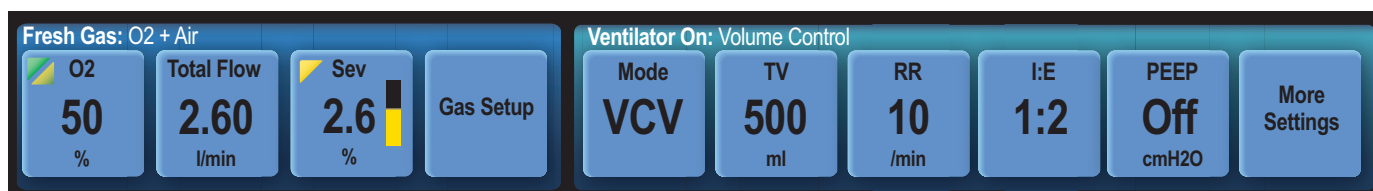
Figure 3.12 Quick Keys

1. Select a quick key to open the menu or select a parameter.

2. If Gas Setup, Mode, or More Settings is selected, a menu displays. Select the desired value on the menu by touching the value. If any other quick key is selected, the value displays with a highlight. Turn the ComWheel left or right to set the desired value.

3. Push the ComWheel or select the quick key to confirm the change.

 Note! *To cancel a quick key selection, push the **Home** key.*

4 Vaporization

Vaporization - Aladin2 Cassettes

Overview

The working principle behind the Aladin2 cassette is based on the free vaporizing of the liquid agent inside the cassette. Agent concentration is adjusted by electronically controlling gas flow through the cassette in order to achieve the set concentration. Output of agent concentration remains constant with changes in fresh gas flow, and the vaporizer is not out of commission if cassettes are tilted.

Aladin2 cassettes are agent specific and color coded. Each cassette is magnetically coded for its specific agent allowing the unit to automatically identify the cassette being used.

Scheduled maintenance or calibration is not needed for Aladin2 cassettes, as they contain an electronic self-diagnosis.

Note! *Desflurane is heated by the internal electronics of the system and is available immediately without a warm-up period.*
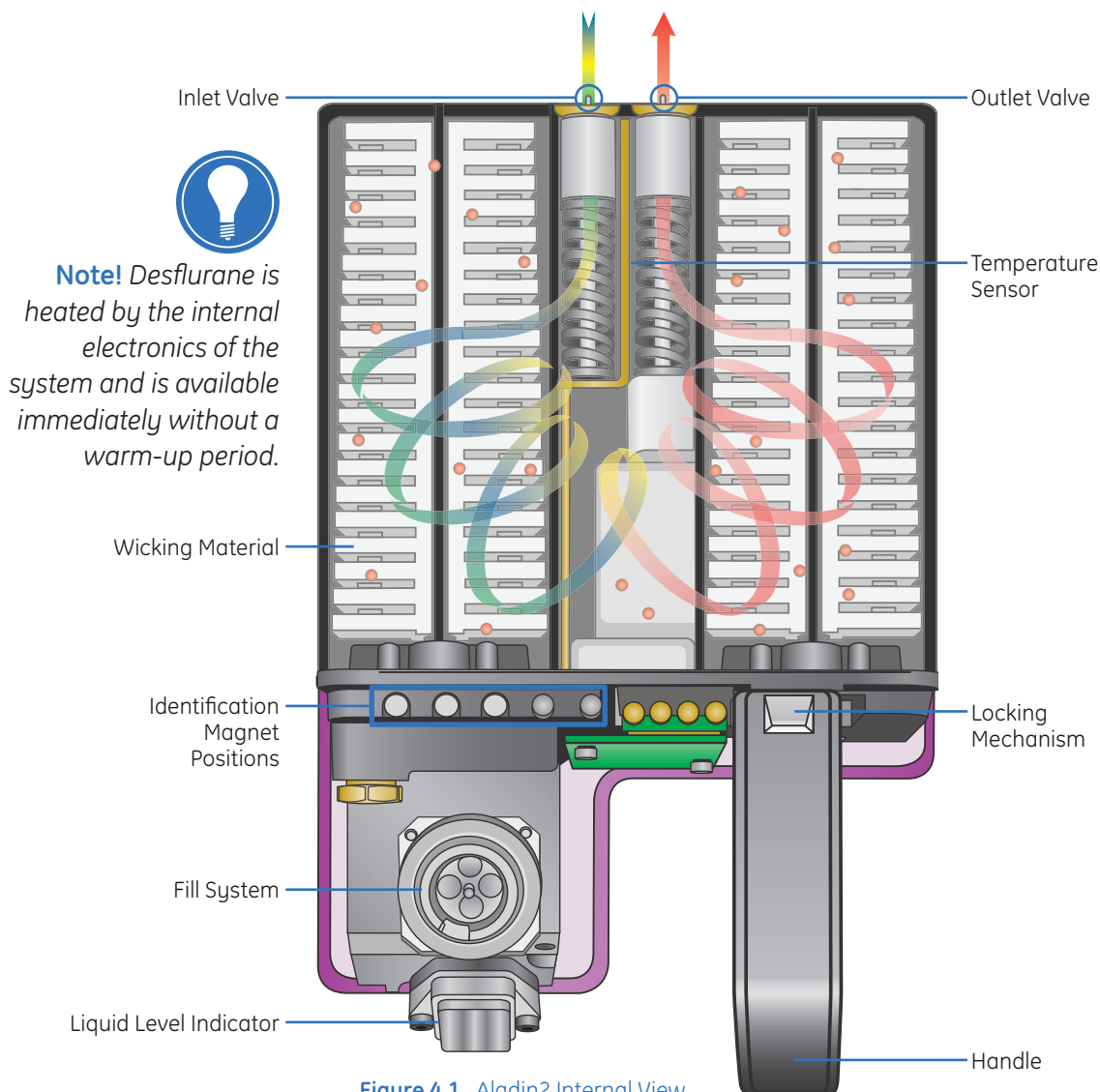
Figure 4.1 Aladin2 Internal View

Aladin2 Features

Below are the external features of the Aladin$_2$ vaporizer.

Note! *The Aladin2 is the newer version of the vaporizer cassette. Older units may have the original Aladin cassette. The Aladin2 cassette has a handle lock, a larger liquid level indicator and electronic agent level sensing.*

Electronic Bus

Agent Filling Port with Cap

Large Label

Liquid Level Indicator

Locking Mechanism

Handle

Lock

ISO
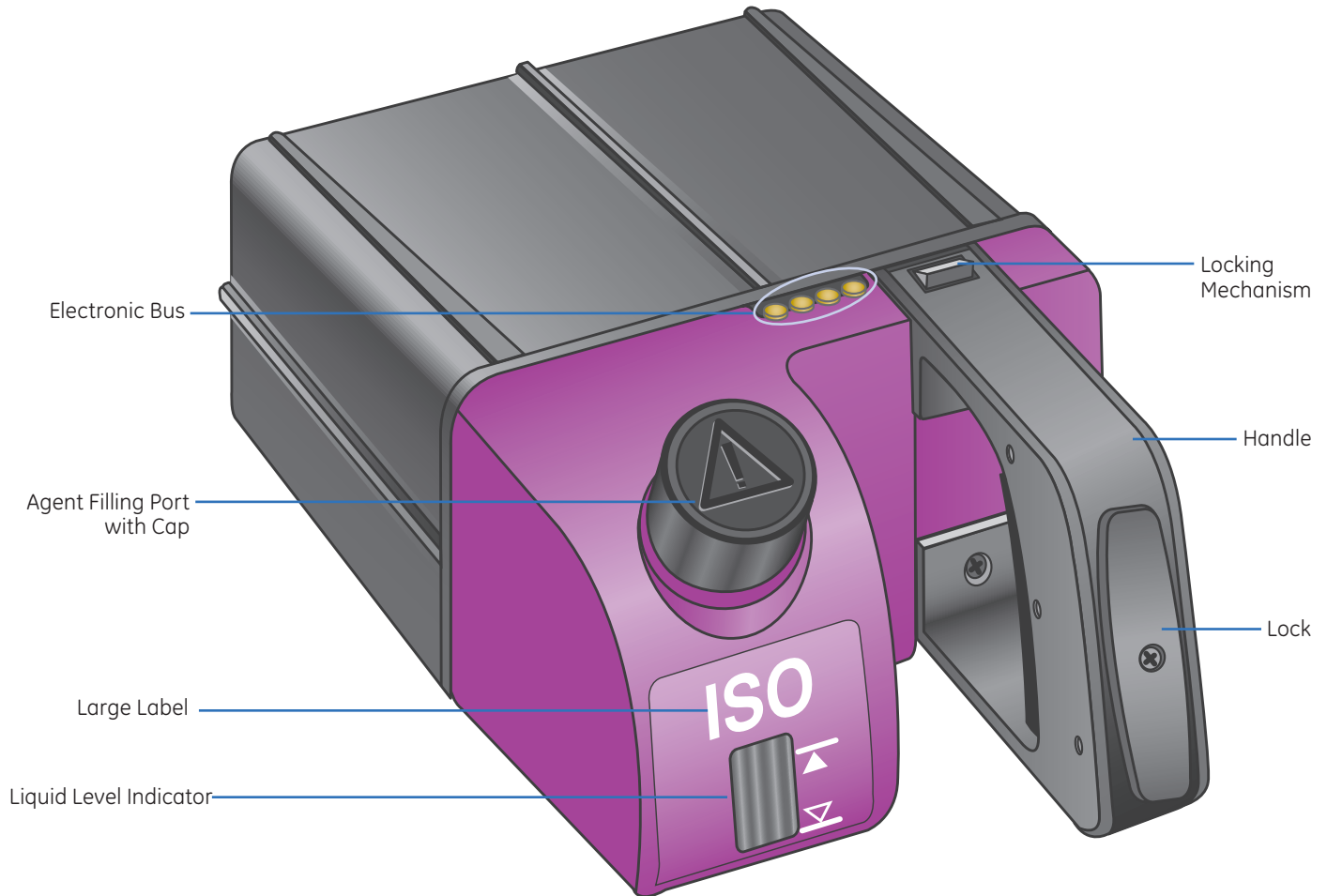
Figure 4.2   Aladin2 Front View

Outlet Valve

Inlet Valve

Temperature Sensor
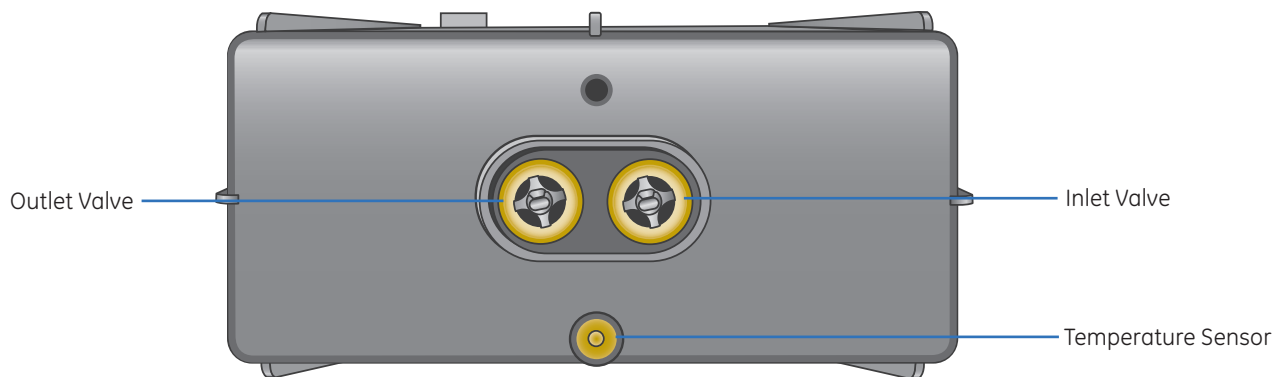
Figure 4.3   Aladin2 Back View

Turning On and Adjusting Agent Level Using Quick Keys

Before turning on the Aisys Carestation check to make sure the cassette is fully engaged. After turning the system on, check that there is adequate O_2 flow into the breathing system.

To turn on and adjust the agent:

1. Press the agent (third) Quick Key.

2. Adjust the level of agent using the ComWheel.

3. Confirm by pressing the ComWheel or the agent Quick Key again.

Figure 4.4 Turn on and adjust agent

Filling the Aladin2 Cassette

1. Remove the cassette from the cassette slot by turning the lock on the handle to the vertical position and then pulling on the release lever. Place it on a flat, horizontal surface.
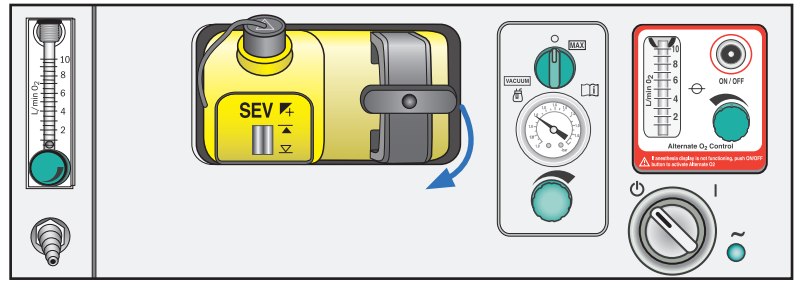
Figure 4.5 Remove the Aladin2 Cassette

Note! *Do not fill the cassette while it is fully or partially inserted in the cassette slot, as you risk spilling or leaking agent into the Aisys.*

2. Ensure that the pins at the rear of the cassette are free of any contact.

Pin
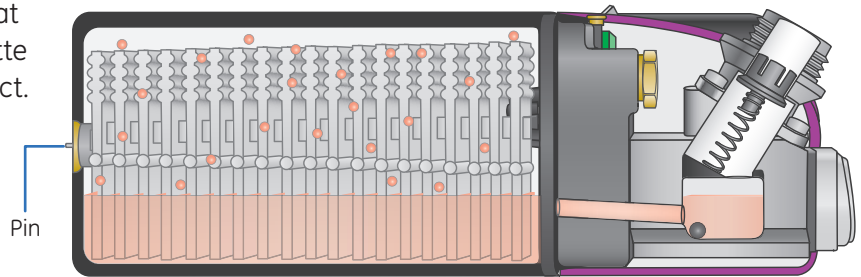
Figure 4.6 Check pins

3. Attach the EZ fill adapter to the bottle of agent.

EZ fil Adapter

Agent Bottle

Forane® (Isoflurane
Liquid for Inhalation
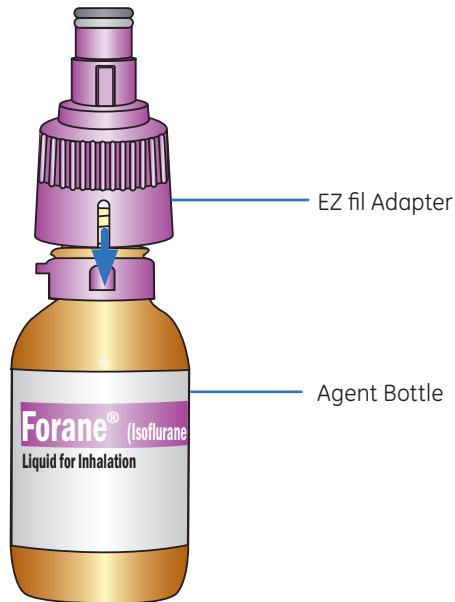
Figure 4.7 Attach adapter cap

Note! *Desflurane cassettes use the traditional Saf-T-Fil adapters and should also be completely removed before filling.*

4. Remove the filling port cap from the cassette.
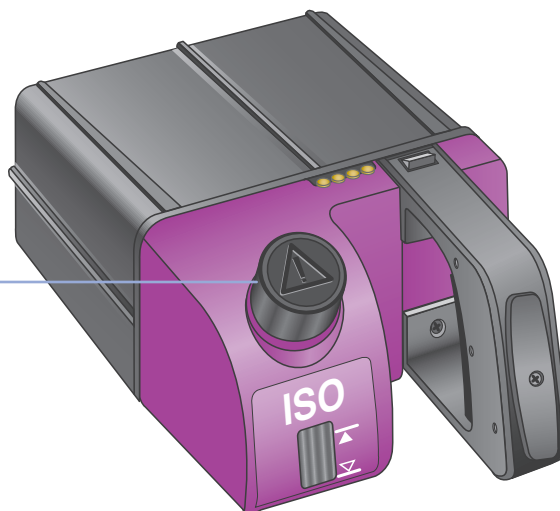
Figure 4.8 Remove Port Cap

5. Insert the attached EZ fill adapter and bottle into the cassette and push the bottle down to fill.

6. Watch the liquid level indicator and remove bottle when cassette is full.

Liquid level Indicator
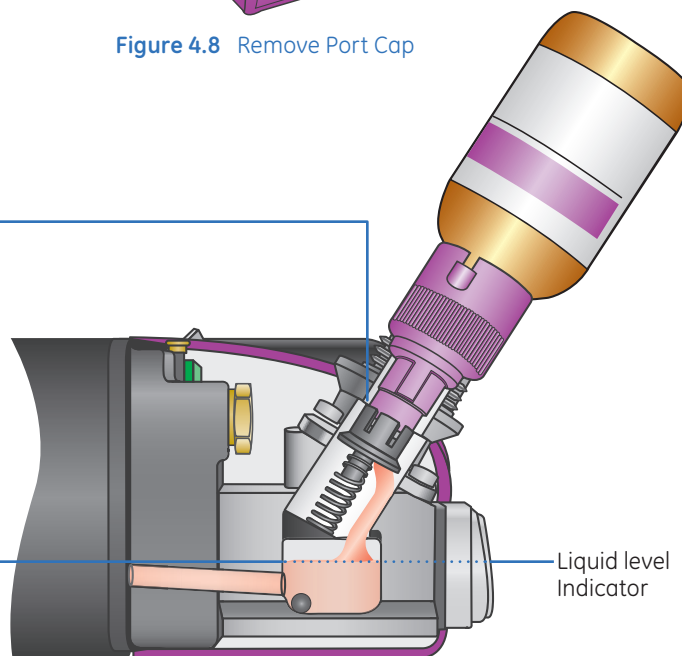
Figure 4.9 Insert bottle and fill cassette

7. Remove the EZ fill adapter from the bottle and replace with the original cap.

8. Replace cassette filling port cap.

Forane® (Isoflurane
Liquid for Inhalation
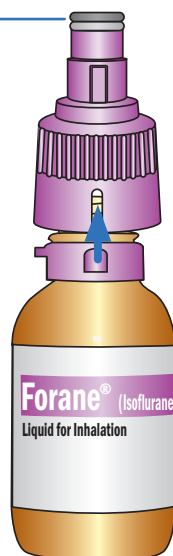
Note! *Agent flow is turned off when an agent cassette is removed. After filling and re-engaging the cassette, remember to turn agent flow back on if you are filling it during a case.*

4 Vaporization

4.5

Changing Aladin2 Cassettes

1. Push the Agent quick key and set agent delivery to *Off* using the ComWheel.

2. Turn the lock on the cassette handle to the vertical position (unlocked) and remove cassette from the active bay.

3. Store the cassette in the cassette bay.

4. Install a new cassette using the following procedure:

   • Ensure that the new cassette is filled to the appropriate level using the liquid level indicator

   • Turn the lock on the cassette to the vertical position (unlocked)

   • Insert the cassette into the active bay until a click is heard

   • Turn the lock on the cassette to the horizontal position (locked)

   • A tone will sound and the agent setting above the quick key will flash.

5. To set the new agent concentration, turn the ComWheel to the desired setting and push the ComWheel to confirm.

   Note! *If a cassette of the same type is removed and installed during a case, the last agent setting used is displayed above the Agent quick key. To confirm the agent setting, push the* ComWheel, *and then push the* Agent quick key. *If the setting is not confirmed within sixty seconds, the agent delivery is set to* **Off**.
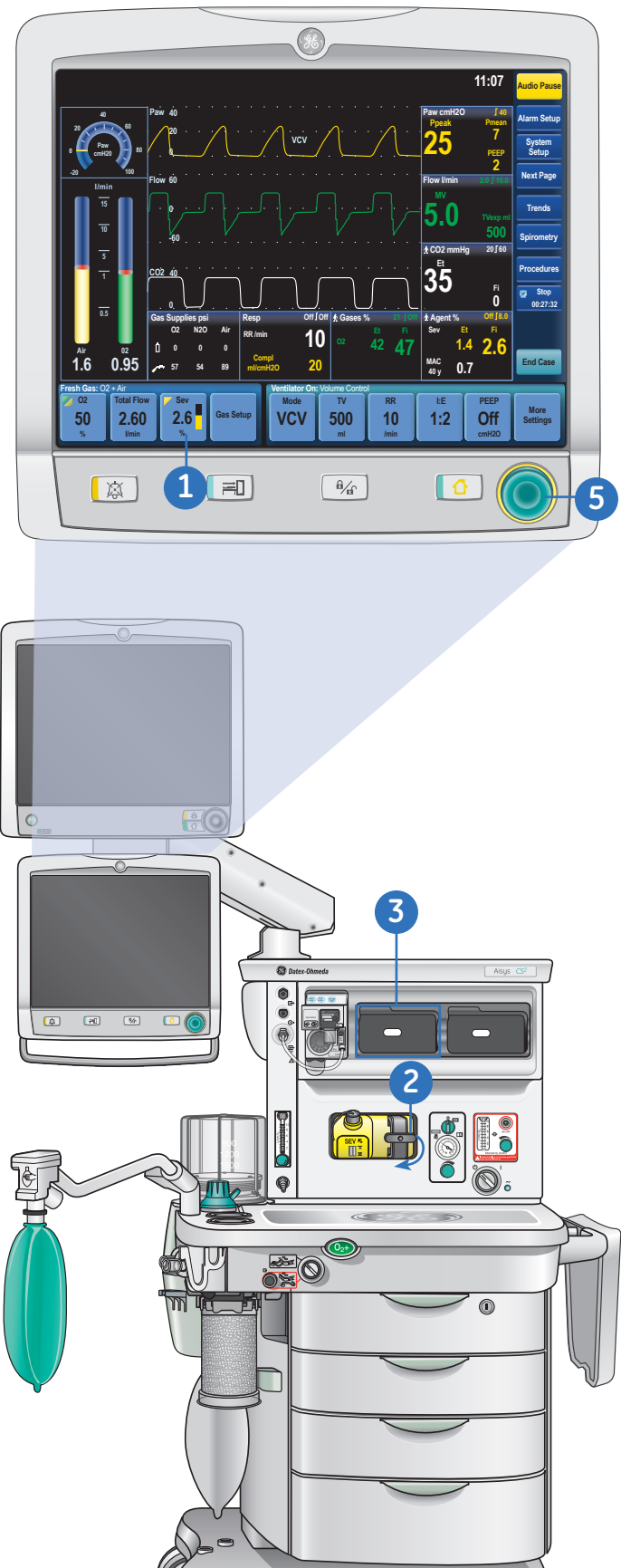
Figure 4.10 Changing the Aladin2 Cassette

5 Advanced Breathing System

Aisys CS² Advanced Breathing System Objectives

After completing this section, the participant will be able to:

- Utilize the Bag/Vent switch
- Utilize the APL valve
- Describe the purpose of the Bag Support Arm
- Remove and replace the CO_2 canister
- Drain the condenser, if applicable
- Zero the flow sensors
- Describe the various methods of preventing moisture buildup
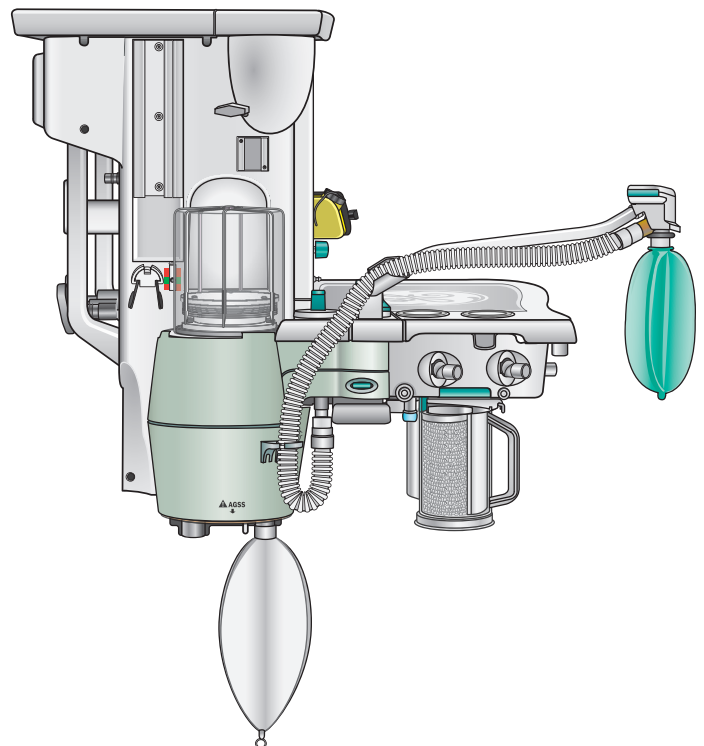
Overview

The Aisys CS² includes the Advanced Breathing System (ABS). The ABS is a small compact system with a 2.7L circuit vent volume designed for low flow anesthesia. It also allows for rapid control of fresh gas flows and concentrations. Changes to fresh gas concentration are applied at the next breath, which allows for the quick administration and removal of agent from the system.

Fresh gases are delivered just behind the inspiratory check valve and then immediately delivered into the inspiratory limb of the breathing circuit. Any changes to fresh gas concentration or flows are immediately delivered to the patient, which gives you rapid control of fresh gas flows and concentrations at the point where it matters, the patient. In addition, the ABS is autoclavable, allowing you to rapidly disassemble it, autoclave it, and reassemble the breathing system because it does not retain heat. You can assemble it quickly and return it to service -ready for the next case.

The ABS is not made with natural rubber latex. There are no cables and hoses, which minimizes improper connections or disconnects, and can integrate either passive or active scavenging systems.
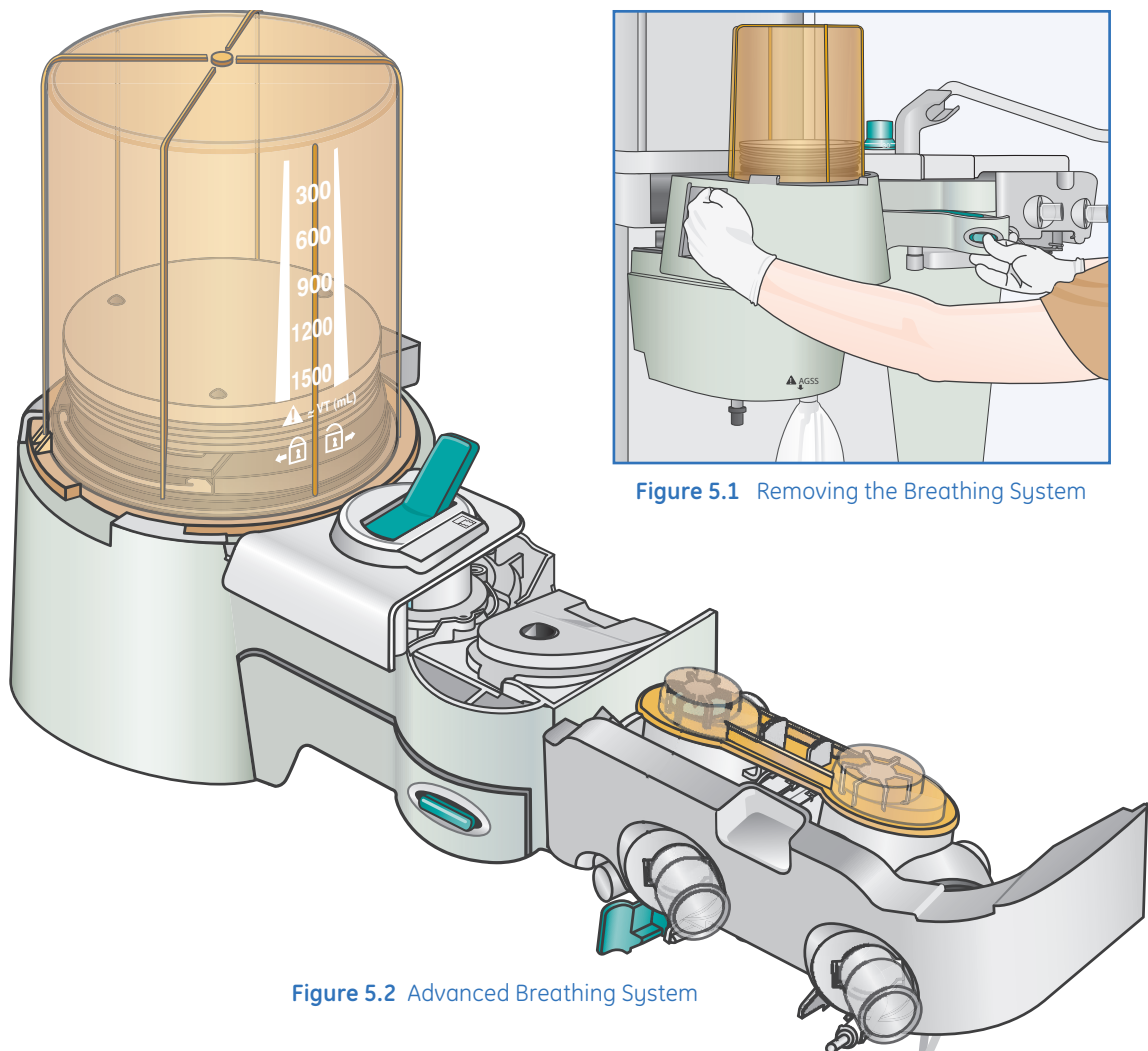
Figure 5.1 Removing the Breathing System

Figure 5.2 Advanced Breathing System

Bag/Vent Switch

The Bag/Vent Switch is a bi-stable mechanical switch that selects between manual ventilation (bag) and mechanical ventilation (vent). When the switch is changed from bag to vent mode, the ventilator is automatically switched on.

Be sure to check the ventilator parameters before changing from bag to vent mode.
Also keep in mind that the APL Valve is not in the circuit while the ventilator mode is active.
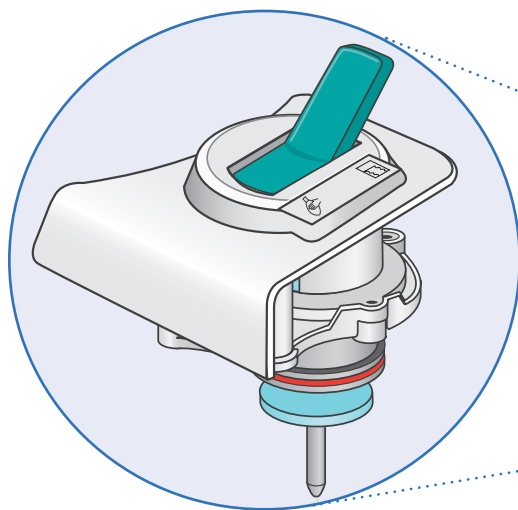
Figure 5.3 Bag/Vent Switch
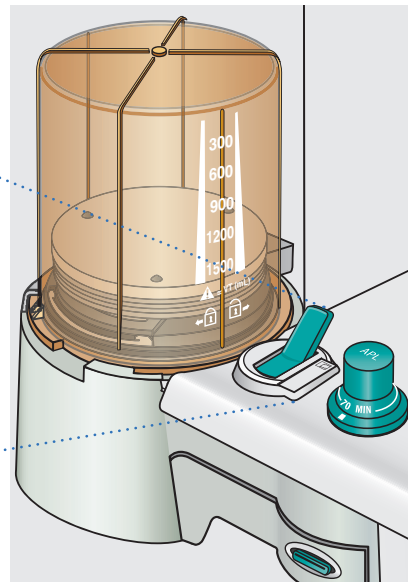
APL Valve

The APL Valve allows you to change the settings from minimum to **70 cmH2O**. When the APL is between **30** and **70 cmH2O**, you will notice that the valve becomes a tactile indicator, meaning that the knob clicks at each additional cmH$_2$O.

Note! *The APL can go from 70 cmH$_2$O to minimum with one turn.*
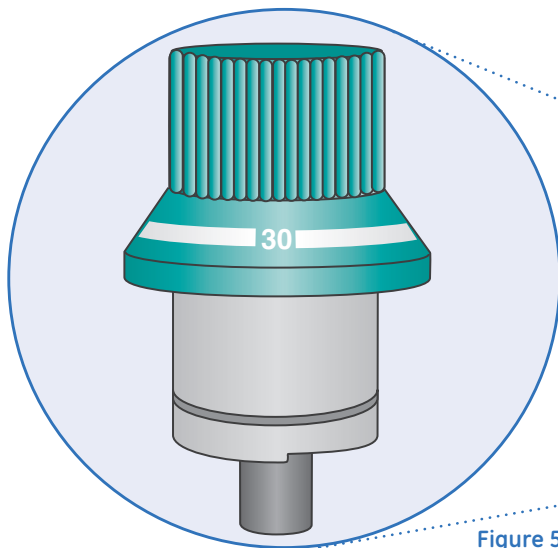
Figure 5.4 APL Valve
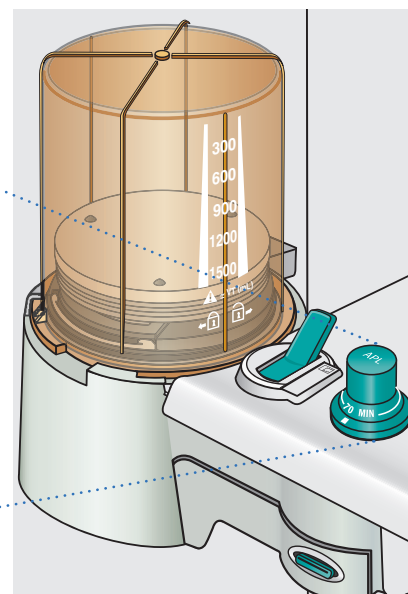
Bag Support Arm

The ABS also provides for the use of a Bag Support Arm. This bag arm is different than traditional anesthesia systems because it does not actually carry patient gas. Patient gas is carried through the bag arm hose from the ABS out to the bag. The bag can be used while attached to or detached from the bag support arm.
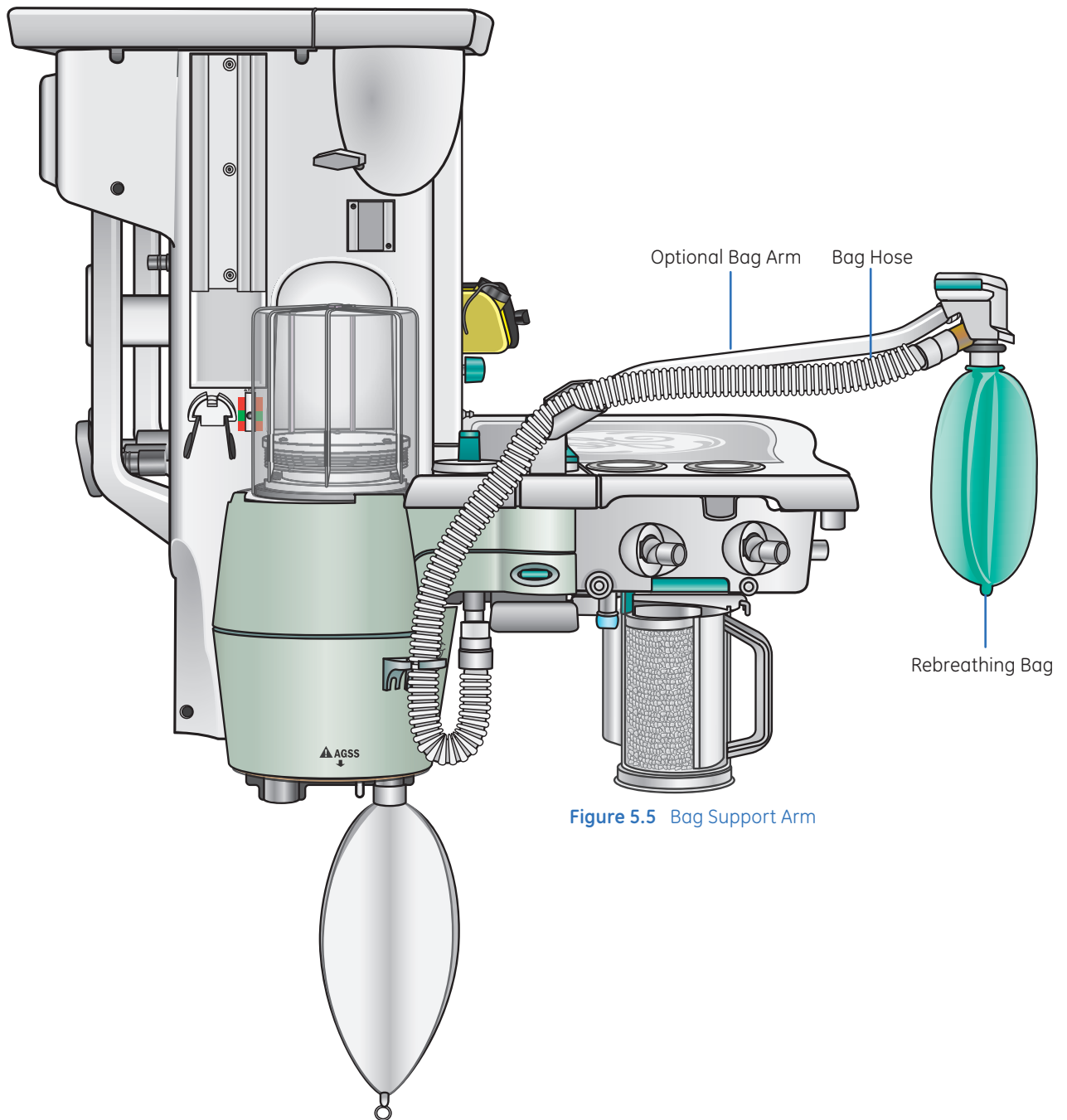
Figure 5.5 Bag Support Arm

Absorber Canister

The canisters hold 950 ml and are available as disposable or reusable. The reusable canister is autoclavable. The Advanced Breathing System also includes an EZChange mode for the canister. The EZChange canister mode seals the breathing circuit when the canister holder is down. While the absorber canister is out of the breathing circuit, the patient re-breaths exhaled gases without any gas passing through the absorbent. When the canister holder is down, the message *CO₂ Absorber Out of Circuit* shows in the waveform area on the anesthesia display. Systems with EZchange canister mode have a label on the canister holder. Both disposable and reusable canisters can be used with the EZChange option.

These canisters can be exchanged simply by pushing on the teal-colored release latch and disconnecting the canister, removing it for replacement.
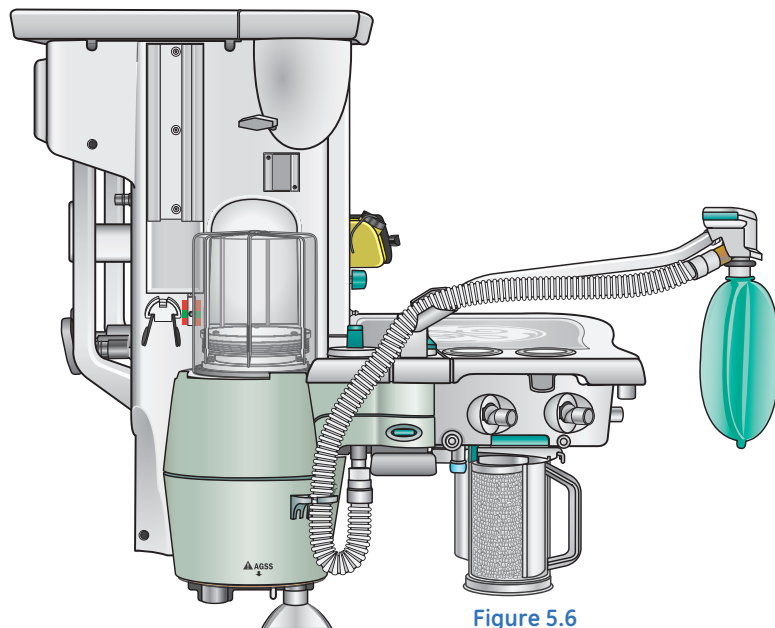
Figure 5.6
Canister on Standard Machine

EZChange Sealing Component
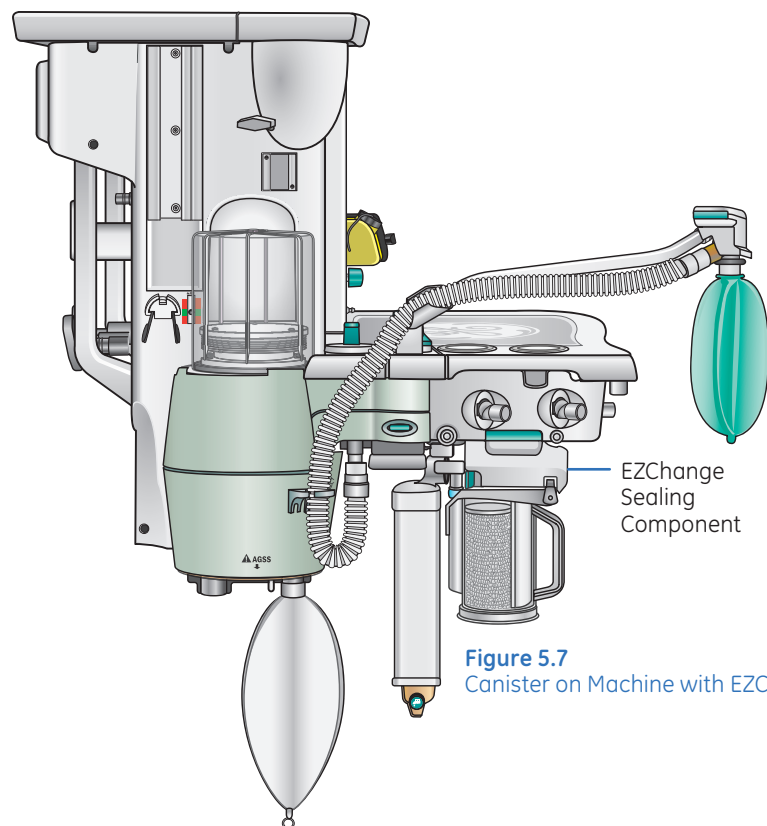
Figure 5.7
Canister on Machine with EZChange Mode

5.5

Canister Access on a Standard Machine

To remove a canister on a standard system:

1. Hold the canister by the handle.

2. Push the Absorber Canister Release.

3. Push it down and away from the attachment point/support pins to remove the canister.
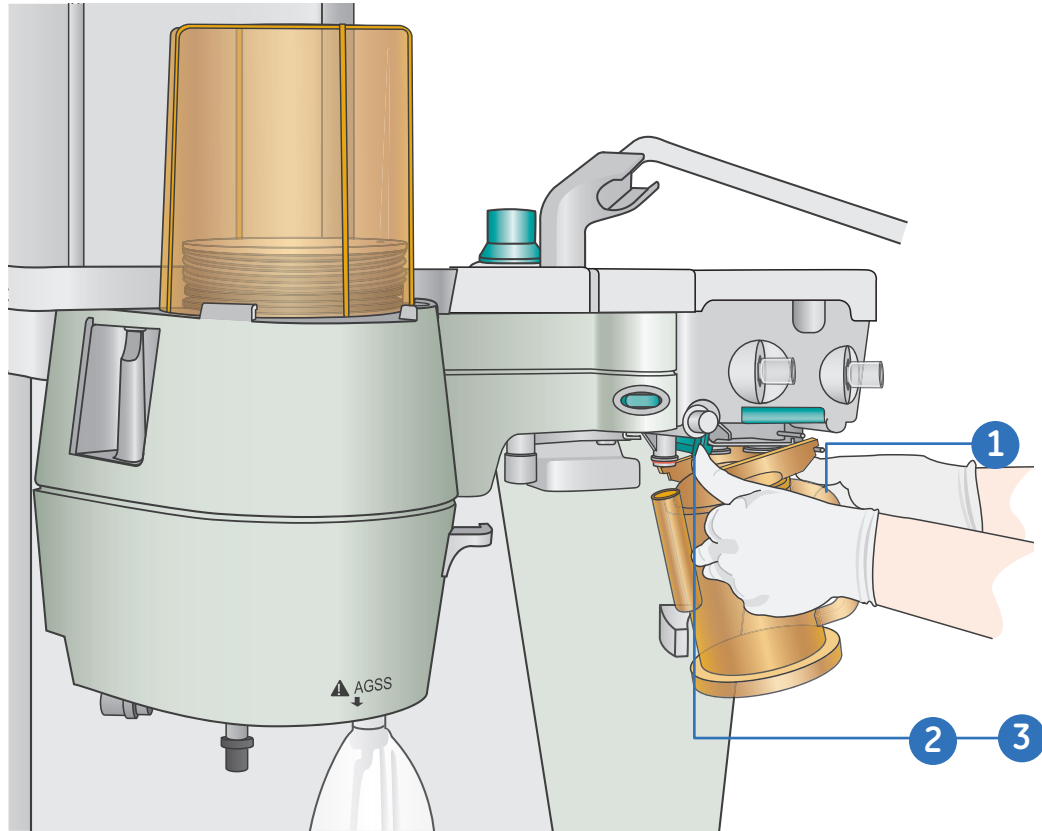
Figure 5.8 Removing the Canister

To replace a canister on a standard system:

1. Hold the canister by the handle.

2. Tilt the canister down and place the lip of the canister so that it catches at its attachment point/support pins.

3. Push the other side of the canister up until you hear it snap into place.

Note! *For standard systems (systems without the EZChange Mode), the breathing system is open to air and you will have a leak when the canister is out of the cradle.*

Canister Access on a Machine with the EZchange Mode

To remove a canister on a system with the EZChange Mode:

1. Hold the canister by the handle.

2. Push the Absorber Canister Release to unlock the canister cradle.

3. Tilt the cradle down, and slide the canister up and out of the cradle.
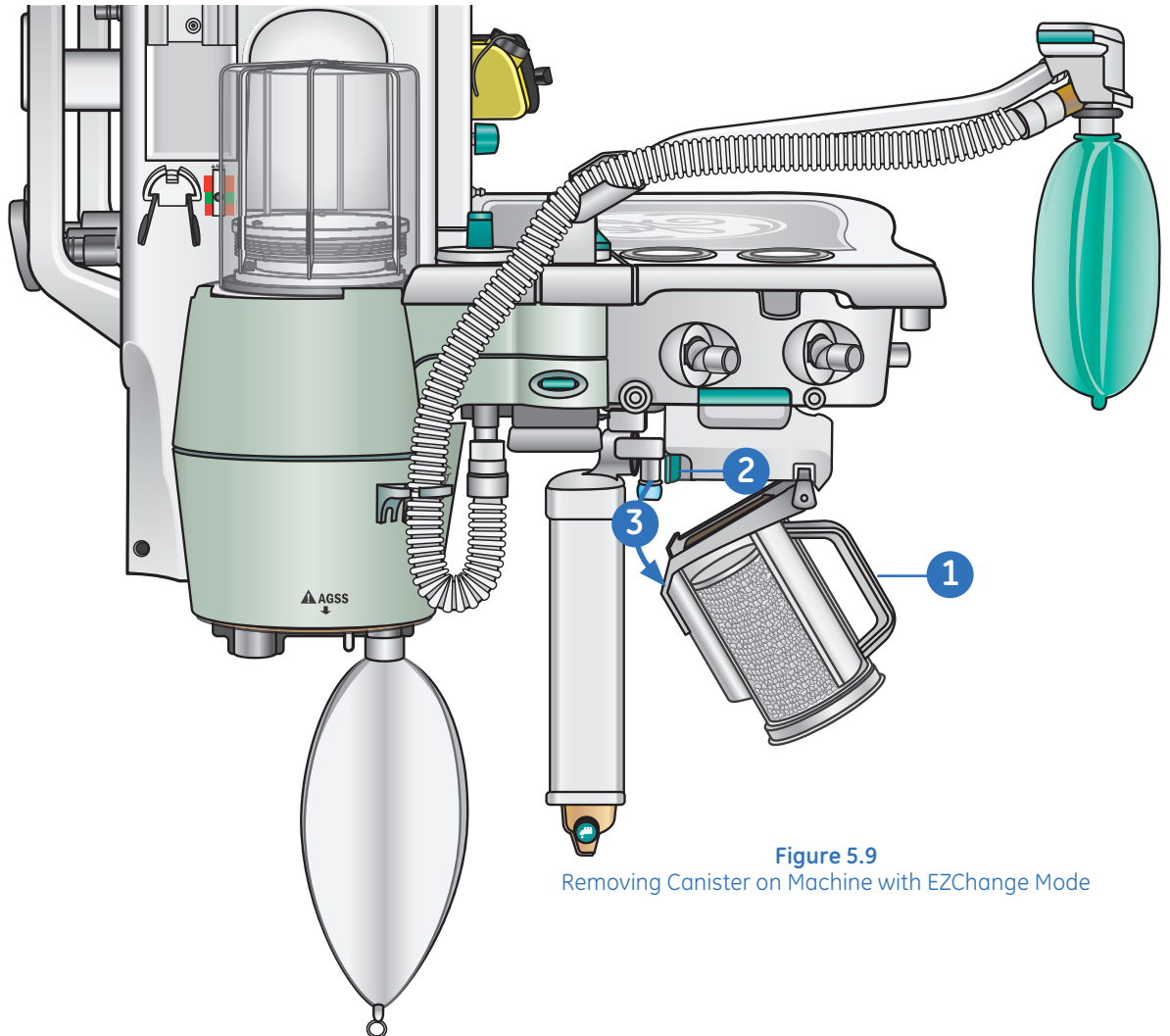
Figure 5.9
Removing Canister on Machine with EZChange Mode

To replace a canister on a system with the EZChange Mode:

1. Hold the canister by the handle.

2. Slide the canister into the cradle.

3. Tilt the cradle up to lock into place.

Condenser

Use the optional condenser to remove water in the system that is produced from the reaction of CO_2 gas with the absorbent. 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. The condenser adds 715 ml of volume to the breathing system.

Note! *Visually check the condenser reservoir daily, and drain if needed.*

Condenser

Figure 5.10
Optional Condenser

Drain Button
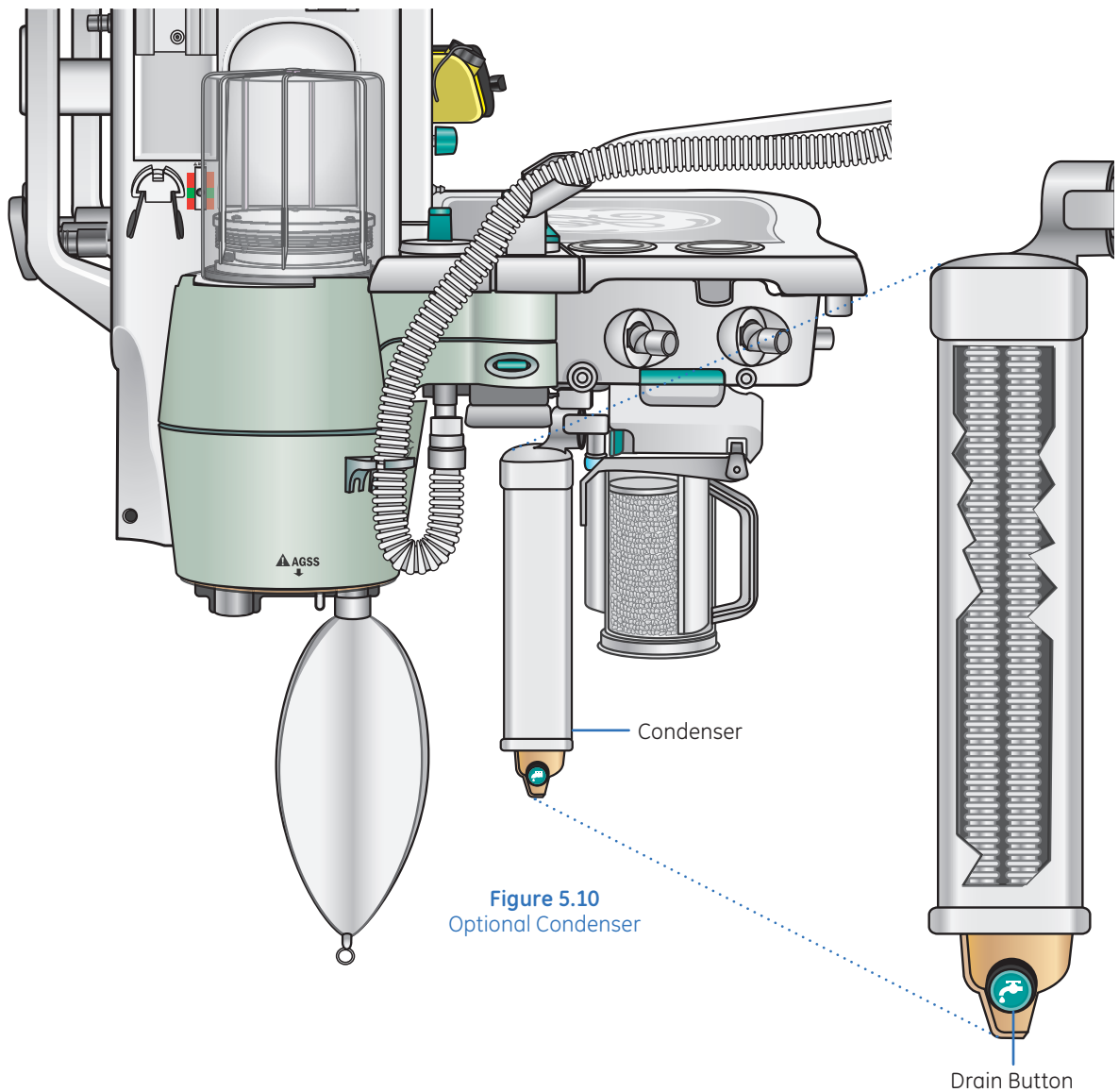
Flow Sensors

Flow Sensors are differential pressure pneumotachs that measure inspiratory pressures and both inspiratory and expiratory volumes.

The Flow Sensors are either plastic or metal. The plastic Flow Sensors may be sterilized using only liquid or gas methods. The metal Flow Sensors may be sterilized using liquid, gas or steam autoclave methods.
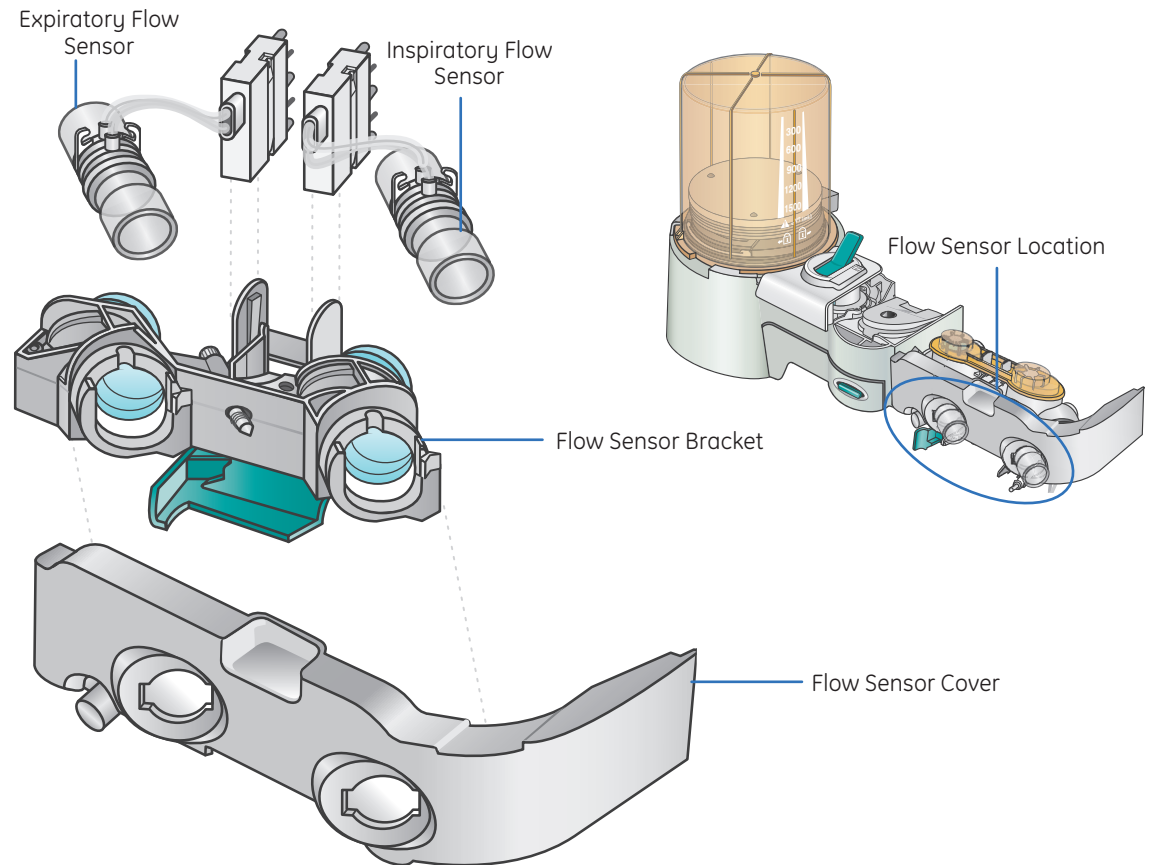
Figure 5.11 Flow Sensors

The flow sensors should be calibrated daily by removing them from the system. On-screen instructions are available through **System Setup > Calibration > Flow and Pressure**.

1. Set the Bag/Vent switch to Bag.

2. Remove the flow sensor module.

3. Wait for **No insp flow sensor** and **No exp flow sensor** alarms to occur.

4. Reinsert the flow sensor module. Make sure the flow sensors are securely latched when they are reinserted. Wait for alarms to clear.

5. Start mechanical ventilation when ready.

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

Preventing Moisture Buildup

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

Water results from exhaled gas and the chemical reaction between CO_2 and the absorbent that takes place within the absorber canister.

At lower fresh gas flows more water builds up because less gas is scavenged and more CO_2 stays in the absorber to react and produce water. Also, more moist and exhales gas stays in the patient circuit and the absorber.

To help prevent moisture buildup:

- Equip systems with the optional condenser
- Empty the water reservoir in the canister when changing the absorbent
- Ensure that water condensing in the breathing circuit tubes is kept lower than the flow sensors and is not allowed to drain back into the flow sensors
- Water condensation in the breathing circuit tubing might be lessened by using a Heat and Moisture Exchange (HME) filter at the airway connection
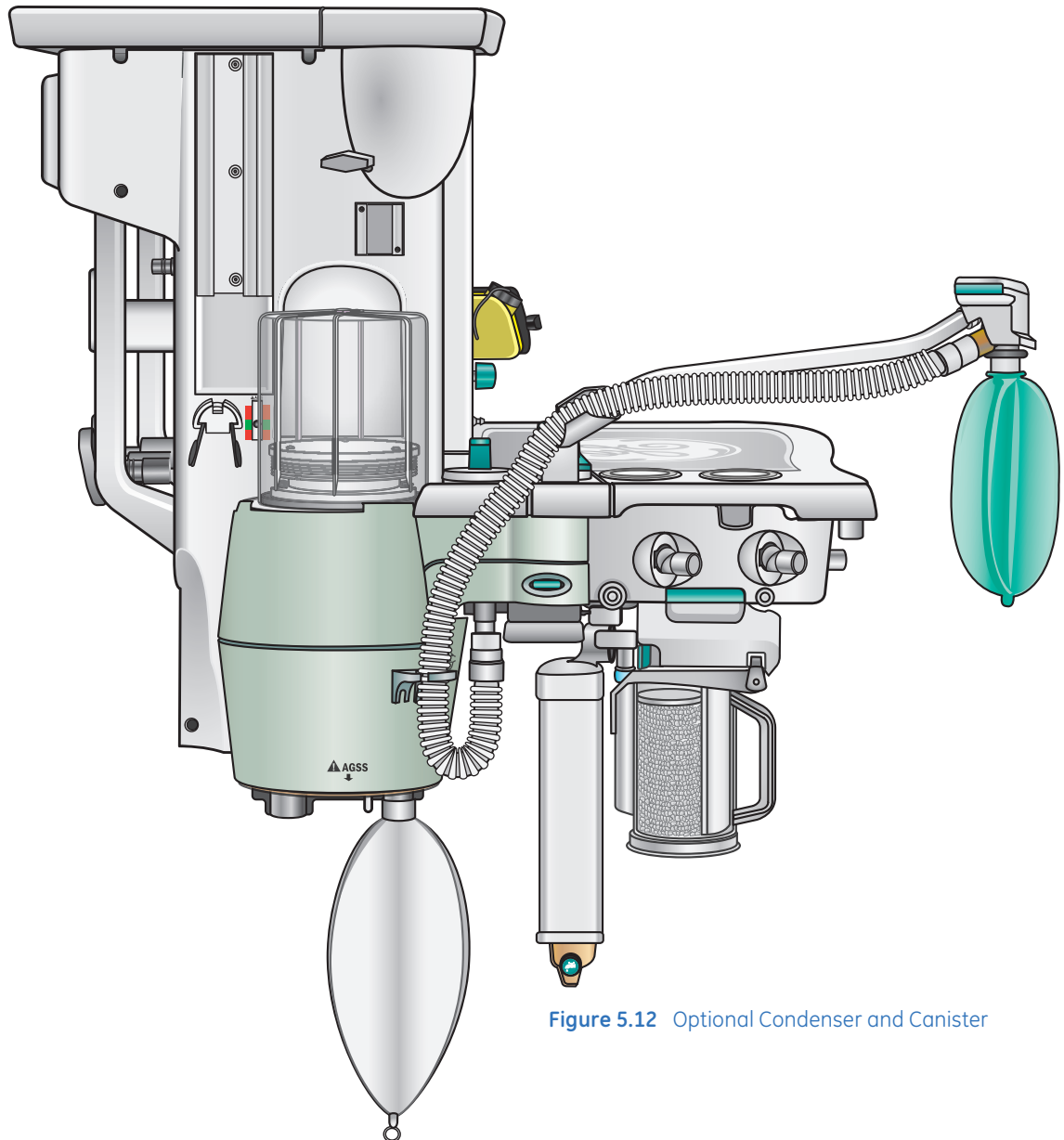
Figure 5.12 Optional Condenser and Canister

Auxiliary Common Gas Outlet (ACGO)

The optional Auxiliary Common Gas Outlet (ACGO) is not required for operation of the Aisys CS². A negative pressure leak test can be accomplished through the ACGO.

Set the switch to ACGO position to have fresh gas flow through the ACGO port. The ACGO may be used to provide fresh gas to an auxiliary manual breathing circuit, such as a Mapleson or Jackson-Reese circuit.

Note! *Mechanical ventilation is not available when operating an auxiliary manual breathing circuit with fresh gas from the ACGO. Volume and pressure monitoring are also not available.*

ACGO Selected

Breathing System Selected
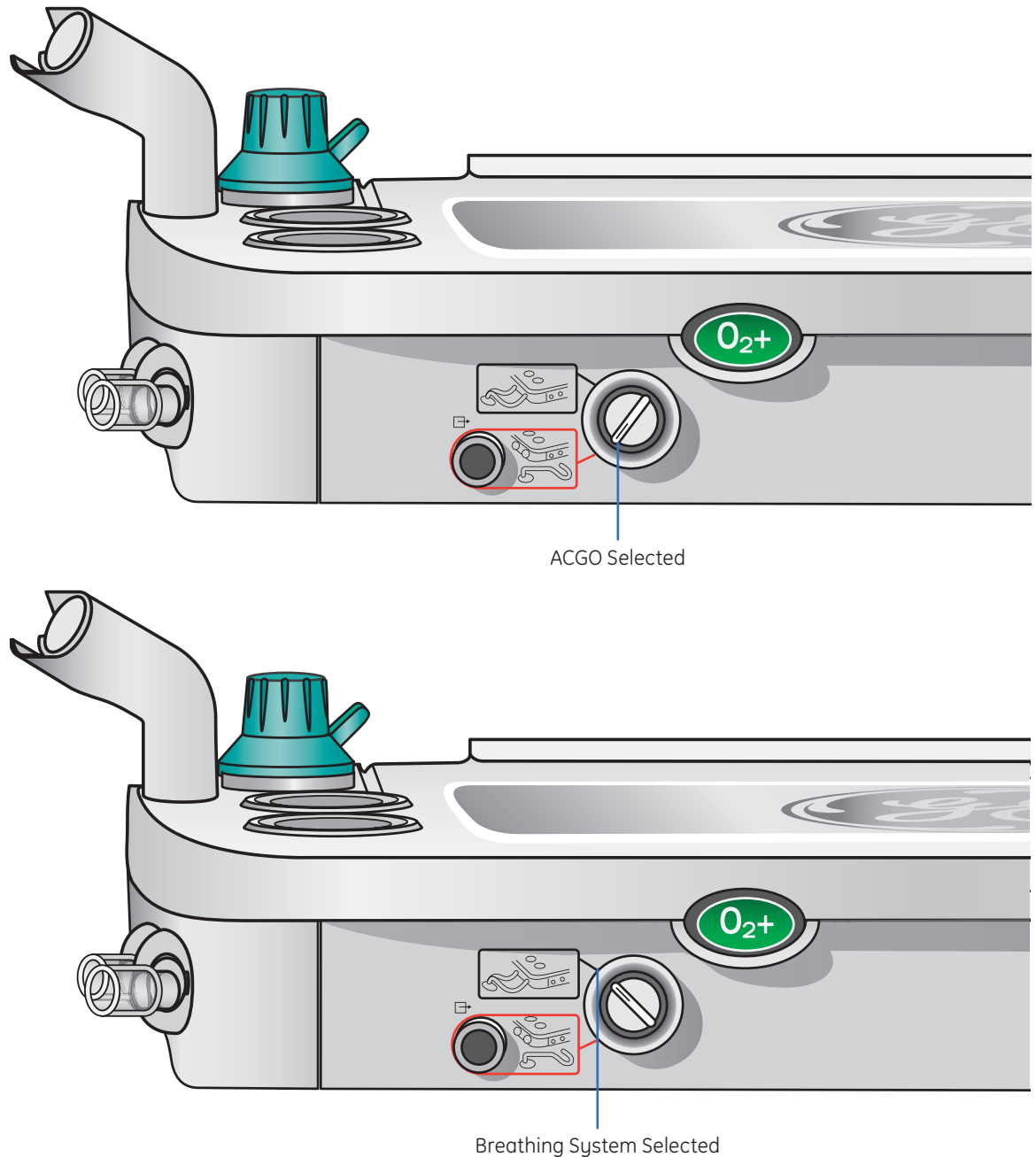
Figure 5.13 ACGO

6 Operation

Aisys CS² Operation Objectives

After completing this section, the participant will be able to:

- Start a case using the Start Case menu
- Enter a patient age and ideal weight
- End a case
- Turn off the system
- Change a ventilator mode
- Change a ventilator setting
- Change a gas setting
- Change the balance gas
- Change the circuit type
- Set a waveform field
- Set a digit field
- Set a split screen
- Set the time and date
- Set the data source
- Set the sweep speed
- Set the fresh gas controls
- View fresh gas usage
- Utilize ecoFLOW
- Describe the three alarm priorities
- Pause an alarm
- Set an alarm limit
- Set volume apnea and MV/TV alarms
- View alarm history
- Describe the settings on the Alarm Setup Configure Tab
- View trends

Starting a Case

Use the ***Start Case*** menu to set the case data and to start the gas flow.

A case can be started using default settings or using custom settings. The default settings are configured by the Super User.

Note! *A Super User is a person that has been given the authority to change default settings using a special password.*

Default Settings selection shows the first of five default case types when the Start Case menu is accessed. Four of the default case types are configured by the Super User. The fifth default case is Last Case.

The Ideal Weight, Age, and Volume Apnea Alarm values are set to the pre-selected settings defined by the Super User corresponding to the case type.

Figure 6.1 Start Case Menu

Minimum Alveolar Concentration (MAC)

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

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

The adjusted MAC value shows on several areas of the screen including in the mini-trend, agent waveform numeric information, agent digit field, and graphical trends page.

Starting a Case Using Default Settings

Start a case using the default settings by case type defined by the Super User.

Case Defaults contain five case type selections. Each case type has preset values for Ideal Weight, Age, and Volume Apnea Alarm. The first four default case types are configured and named by the Super User. The fifth default case is Last Case.

1. Set the Bag/Vent switch to Bag.

2. Select **Start Case** from the right side of the display. The Case Defaults selection shows the first preset case type. Ideal Weight, Age, CO_2 Alarms, and Volume Apnea Alarm show the default settings that correspond to the case type shown.

3. Verify or change the **Case Defaults** selected.

4. Verify the settings are clinically appropriate.

5. Select **Start Case Now**. Gas flow starts.

> **Start Case Now**

Starting a Case Using Custom Settings

Ideal Weight, Age, CO_2 Alarms, and Volume Apnea Alarm can be custom set on the Start Case menu before starting a case. Additional ventilator settings, ventilation mode, alarm settings, and gas settings can be custom set through the Vent Mode menu and other ventilation quick keys, Alarm Setup menu, Gas Setup menu.

1. Set the Bag/Vent switch to Bag.

2. Select **Start Case**. The Case Defaults selection shows the first preset case type. Ideal Weight, Age, CO_2 Alarms, and Volume Apnea Alarm show the default settings that correspond to the case type shown.

3. Change **Ideal Weight, Age**, or **Volume Apnea Alarm** settings on the menu. The Case Defaults changes from the case name to **Preset**. If the CO_2 Alarms setting on the menu is changed, the **Case Defaults** remains as previously selected.

4. To change ventilation mode, select **Mode**. Make the change. To change the ventilation settings, select a ventilator quick key or **More Settings**. Make the change.

5. To change alarm settings, select **Alarm Setup**. Make the change.

6. To change the gas settings or the circuit type, select **Gas Setup**. Make the change.

7. From the Start Case menu, select **Start Case Now**. Gas flow starts.

Ending a Case

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

1. Set the Bag/Vent switch to Bag.

2. Select **End Case** from the right side of the display.

3. Select **End Case Now** on the menu to put the system in standby (stops the gas flow and patient alarms). The End Case menu shows the gas and agent usage for the case.

End Case		
	End Case Now	
Gas Used	O2	57.761
	Air	0.00 l
	N2O	0.00 l
Agent Used	Des	0 ml
	Des	0 ml
	Enf	0 ml
	Hal	0 ml

Turn off mechanical ventilation or cardiac bypass. Then select End Case Now.

Close
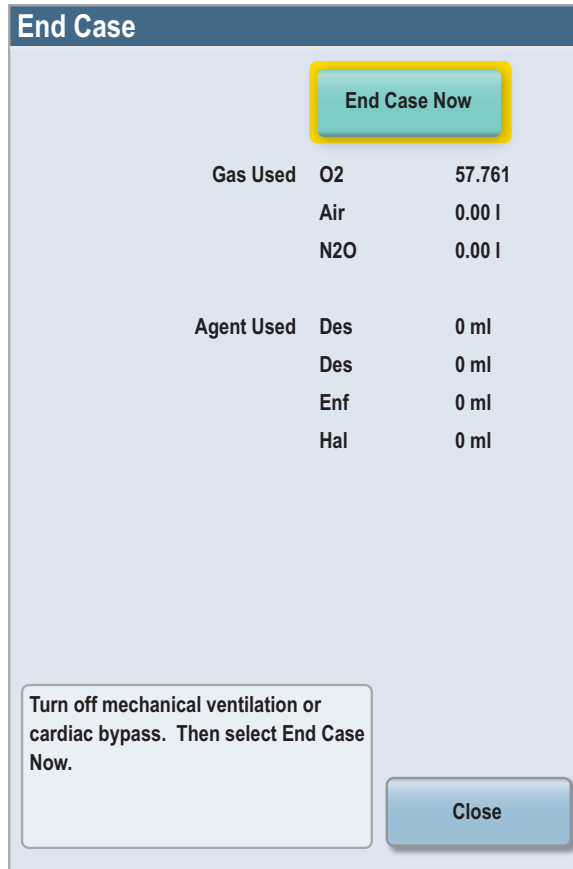
Figure 6.2 End Case Menu

Turning Off the System

1. Select **End Case Now** to put the system in standby, if appropriate.

2. Turn the System switch to **Standby**.

3. Turn the suction switch (optional) to the **off** position.

4. Rotate the Auxiliary O_2 knob fully clockwise to turn off the flow.

5. Disconnect or turn off any scavenging.

Ventilator Setup

Use the *Vent Mode* menu to set the ventilation mode. Use ventilator quick keys and *More Settings* to change ventilator settings.
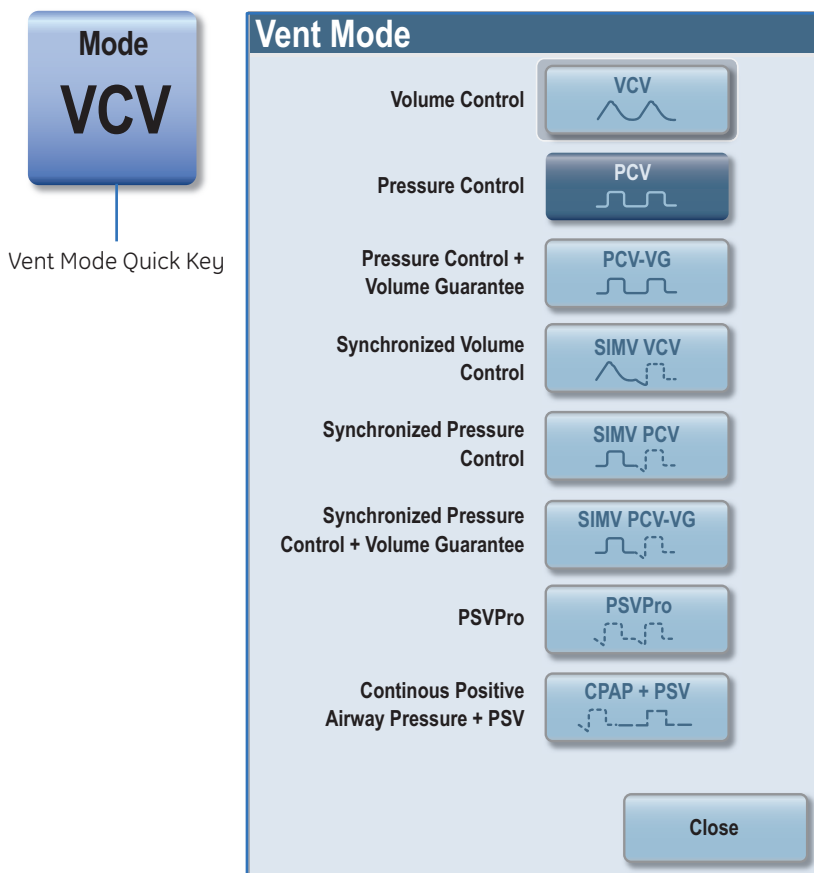
Figure 6.3 Vent Mode Menu

Changing Ventilator Mode

1. Select the *Mode* quick key from the bottom of the display. The Vent Mode menu shows.

2. Select the desired ventilation mode.

3. Set and confirm the primary ventilation setting to activate the ventilation mode. Controls that are frequently used in the ventilation mode can be adjusted with the ventilator quick keys and the *More Settings* quick key.

Changing Ventilator Settings

Change the ventilator settings for the ventilation mode when a case is running.

1. Select the ventilation setting to be adjusted. Set the desired value.

2. Push the ComWheel to activate the change.
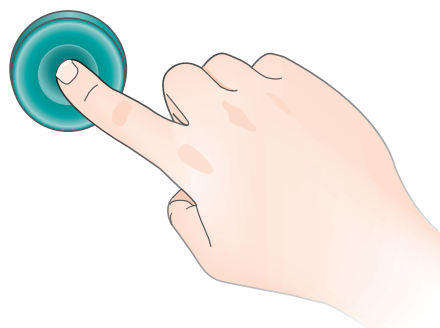
Gas Setup

Use the **Gas Setup** menu to adjust the Agent, O$_2$% and total flow, to change the balance gas, and to change the circuit type.

Gas Setup

Circuit	Circle ▼
Other Gas	Air ▼
O2 %	50
Total Flow l/min	2.6
AA %	Insert

Close
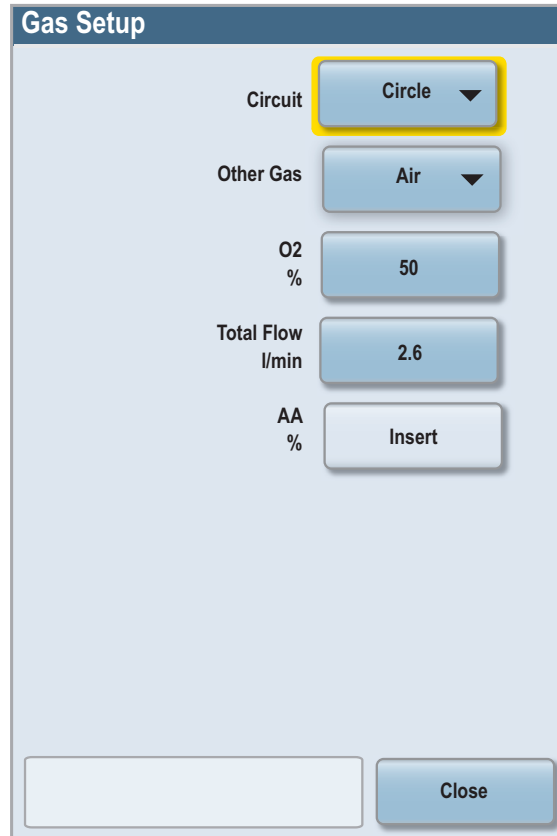
Figure 6.4 Gas Setup Menu

Gas Setup ── Gas Setup Quick Key

Changing Gas Settings

1. Select the **Gas Setup** quick key from the bottom of the display.

2. Select the setting to change from the **Gas Setup** menu.

3. Change the setting.

4. For **Circuit**, select the menu item and change using the dropdown menu. Select **Confirm**.

5. For **Other Gas**, select the menu item and change using the dropdown menu.

6. For **Agent, O$_2$%** and **Total Flow**, select the setting and make the change using the ComWheel and push to confirm the setting.

Changing Balance Gas

1. Select the **Gas Setup** quick key.

2. Select the **Other Gas** menu item.

3. Select the balance gas to use with O$_2$.

Changing Circuit Type

1. Select the **Gas Setup** quick key.

2. Select **Circle** or **Non-Circle**.

3. Select **Confirm**.

💡 **Note!** *Use the non-circle circuit mode to divert fresh gas around the inspiratory check valve and out through the inspiratory port. This fresh gas source may be used with circuits that do not have CO$_2$ absorbent capability (for example, Mapleson variants). Mechanical ventilation is not available when using the non-circle circuit. Tidal volume monitoring is not available when using the non-circle circuit.*

System Setup

Use **System Setup** to access menus and settings for Patient Demographics, Screen Setup, Fresh Gas Usage, System Status, Calibration, and Checkout. The System Setup key is located on the right side of the display.
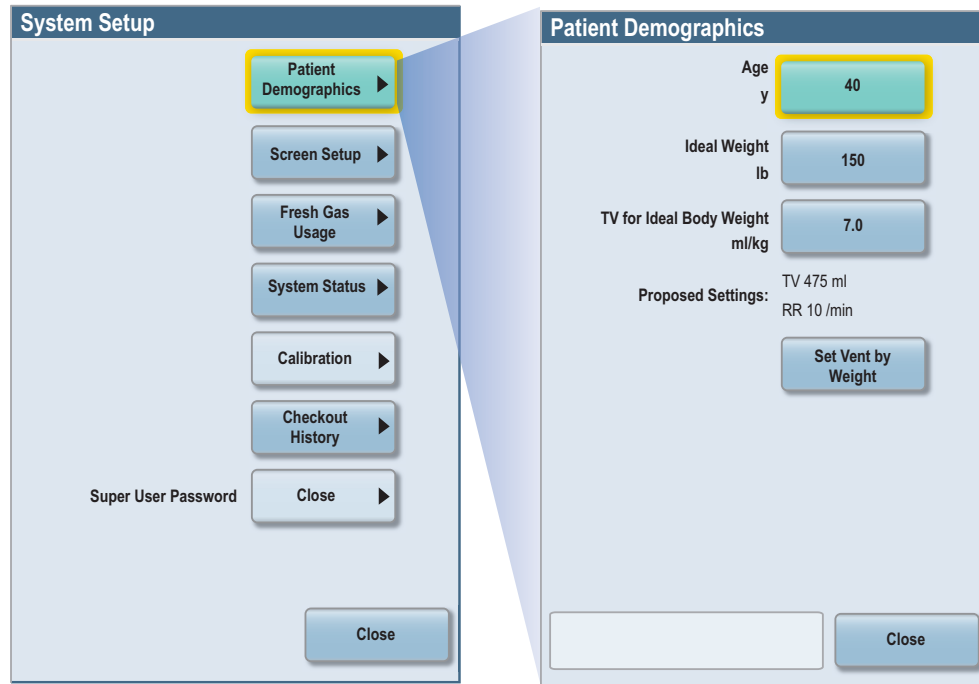
Figure 6.5 System Setup Menu

Patient Demographics

Use the **Patient Demographics** menu to access menus and settings for Age, Ideal Weight, TV for Ideal Body Weight, and Set Vent by Weight.

Screen Setup Menu

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

Note! *There are also four configurable screen views available that can be pre-programmed by the Super User. Select Next Page on the display to change to these configurable views.*

The Screen Setup menu contains the Layout, Scales, Time and Date, and More Settings submenus.

Figure 6.6 Screen Setup Menu

6 Operation

6.7
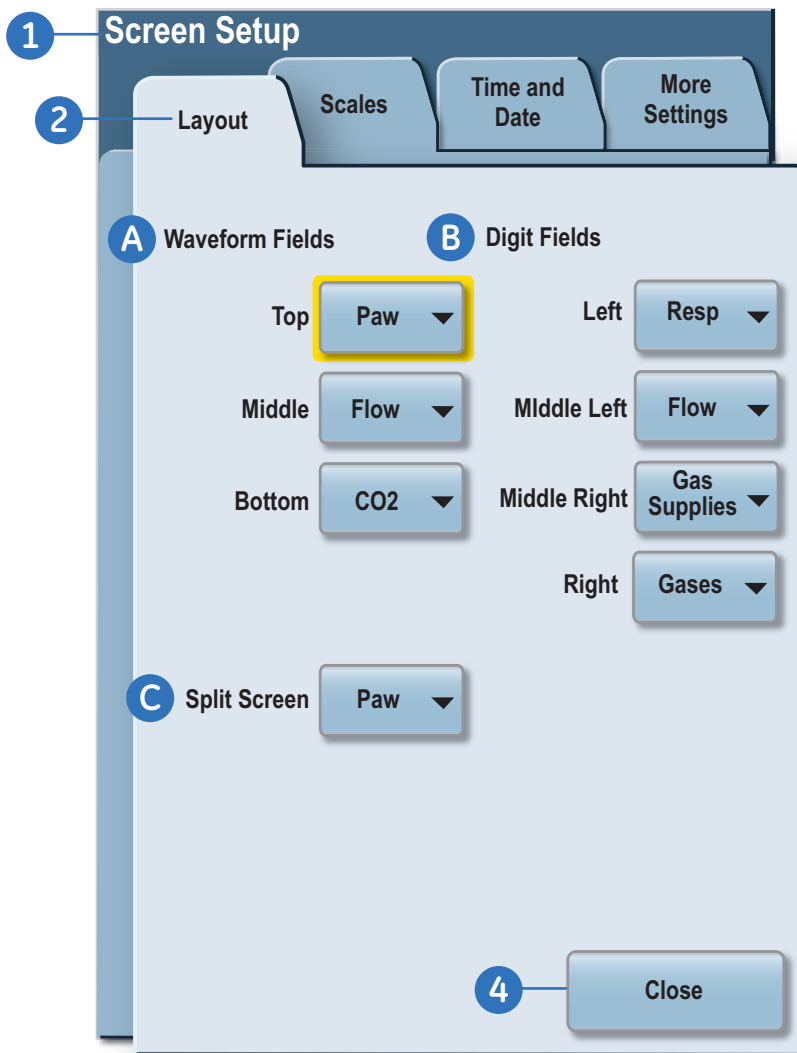
Figure 6.7 Screen Setup Layout Tab

A. Setting Waveform Fields

The waveforms can be set to show agent, CO_2, flow, Paw, or set to *Off*. If a waveform is set to the same value as another waveform, the previously set waveform changes to off and is removed from the screen.

1. Select *System Setup > Screen Setup* from the right side of the display.

2. Select the *Layout* tab.

3. Select the desired waveform button and select the value from the drop-down menu.

4. Select *Close*.

B. Setting Digit Fields

The digit field can be set to show gas supply, flow, spirometry loops, gases, respiration, or agent. If the digit field is set to show agent and no airway module is inserted, the digit field will be blank.

1. Select *System Setup > Screen Setup.*

2. Select the *Layout* tab.

3. Select the desired digit field button and select the value from the drop-down menu.

4. Select *Close.*

C. Setting the Split Screen

Use the Split Screen setting to show metabolics, trends, spirometry loops, Paw gauge, airway compliance, and optional ecoFLOW information.

1. Select *System Setup > Screen Setup*.

2. Select the *Layout* tab.

3. Select *Split Screen* and select the desired view from the dropdown menu.

4. Select *Close.*

Figure 6.8 Screen Time and Date Tab
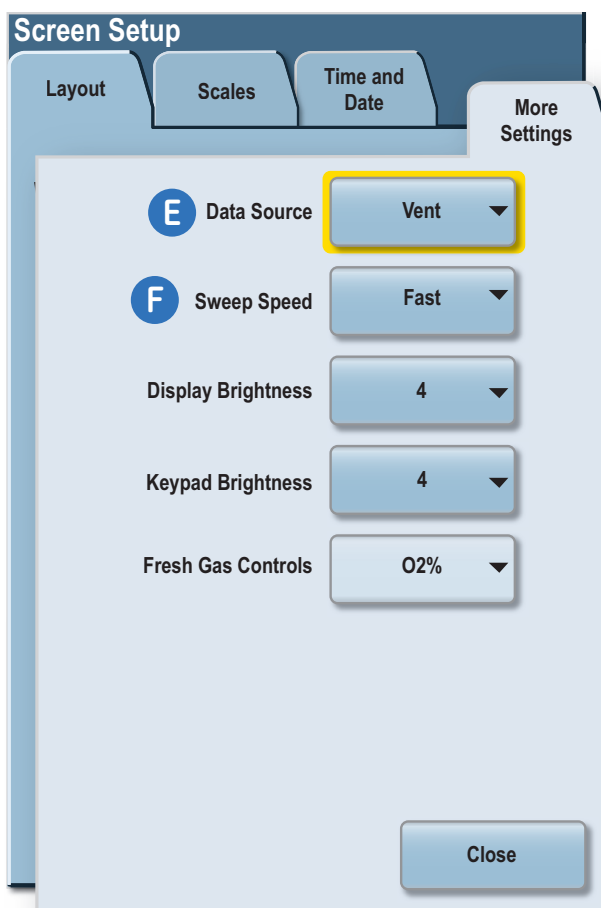
Figure 6.9 Screen More Settings Tab

D. Setting Time and Date

1. Select **System Setup > Screen Setup**.

2. Select the **Time and Date** tab.

3. Select the time or date item to change. Make the change.

4. Select **Close.**

E. Setting the Data Source

Use Data Source to specify the source of spirometry data. Spirometry is discussed in more detail in the **Spirometry** section.

1. Select **System Setup > Screen Setup > More Settings** or **Spirometry > Setup Loops**.

2. Select **Data Source**.

3. Select **Patient** to have spirometry data sourced from the airway module or **Vent** to have spirometry data sourced from the ventilator.

4. Select **Back** to view changes made and access other functions of the **Spirometry** menu.

F. Setting Sweep Speed

Use the Sweep Speed setting to set the waveform draw rate to fast (6.25 mm/s) or slow (0.625 mm/s).

1. Select **System Setup > Screen Setup**.

2. Select **More Settings**.

3. Select **Sweep Speed** and then select **Fast** or **Slow**.

4. Select **Close**.

6 Operation

6.9
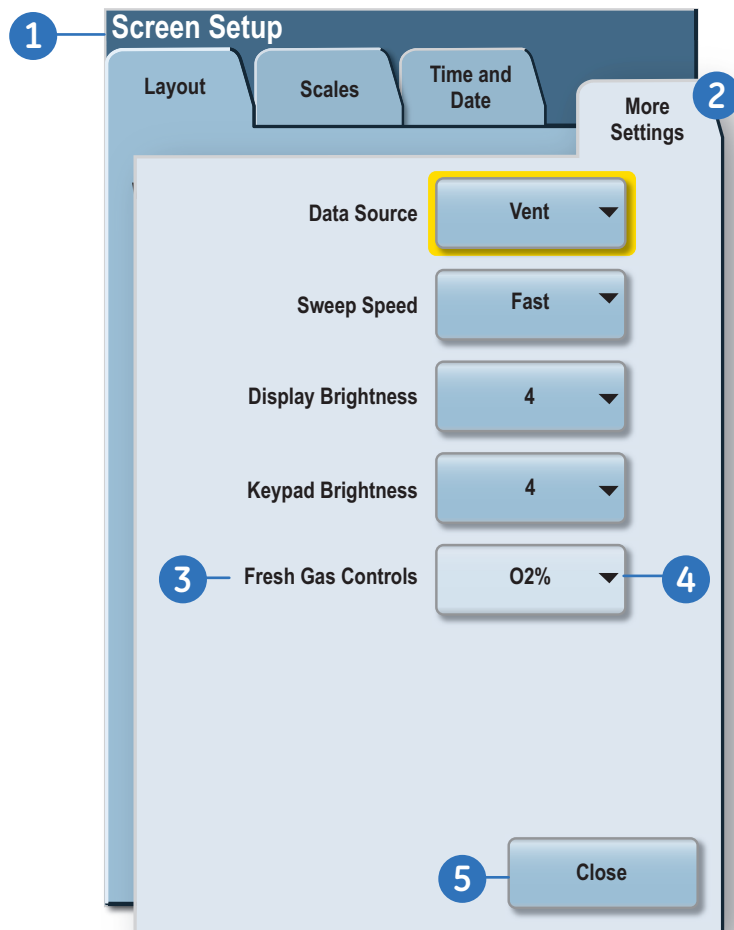
Figure 6.10 Screen More Settings Tab

Setting Fresh Gas Controls

Use the Fresh Gas Controls selection to set the gas control style to O2% with Total Flow or to individual gas flow. Selecting O2% shows O2% as the first quick key and Total Flow l/min as the second quick key. Selecting Flow shows balance gas l/min as one of the quick keys and O2 l/min as the other quick key.

Note! *The Fresh Gas Control setting may not be available if the system is configured to disable this ability. The Fresh Gas Controls cannot be accessed during a case.*

1. Select **System Setup > Screen Setup**.

2. Select **More Settings**.

3. Select **Fresh Gas Controls**.

4. Select **O2%** or **Flow** from the drop-down menu.

    - When set to O_2%, balance gas adjusts automatically when either the O_2% or the Total Flow is changed using the gas quick keys.

    - When set to Flow, balance gas and the O_2% are controlled individually using the gas quick keys.

5. Select **Close**.

Viewing Fresh Gas Usage

Use Fresh Gas Usage to view the volume of O_2, Air, N_2O, and agents used for the three most recent cases.

1. Select **System Setup > Fresh Gas Usage**.

2. Select **Case Start Time** to select the patient case to view.

3. Select **Close.**

ecoFLOW

The ecoFLOW option provides a split screen view that shows the approximate minimum O_2 flow to maintain a preset FiO_2 value. It also shows the approximate agent used per hour and the cost.

The split screen shows the Paw gauge in the upper area and the ecoFLOW gauge in the lower portion of the screen. The ecoFLOW gauge consists of a fresh gas flow tube, an agent flow indicator, and related parameters.

The fresh gas flow tube is a stacked flow tube showing the total O_2 flow on the bottom and the remaining gas (N_2 or N_2O) on top. Below the fresh gas flow tube is the measured total O_2 flow to the patient and the calculated FiO_2 flow value. The FiO_2 flow value is based on the FiO_2 setting specified in Super User mode. This is the minimum O2 flow needed to deliver a preset inspired O_2 concentration. The FiO_2 flow value is specific to each patient and case. It is calculated using the fresh gas settings, the patient O_2 uptake, the dilution effect of agent being delivered, and the effects of the circle breathing system.

The agent flow indicator shows the amount of liquid agent flow as related to the fresh gas setting. The calculated cost of the agent shows above this indicator. This cost is based on agent flow and the values entered in the **Agent Costs** menu set in **Super User** mode.

Figure 6.11 ecoFlow Display
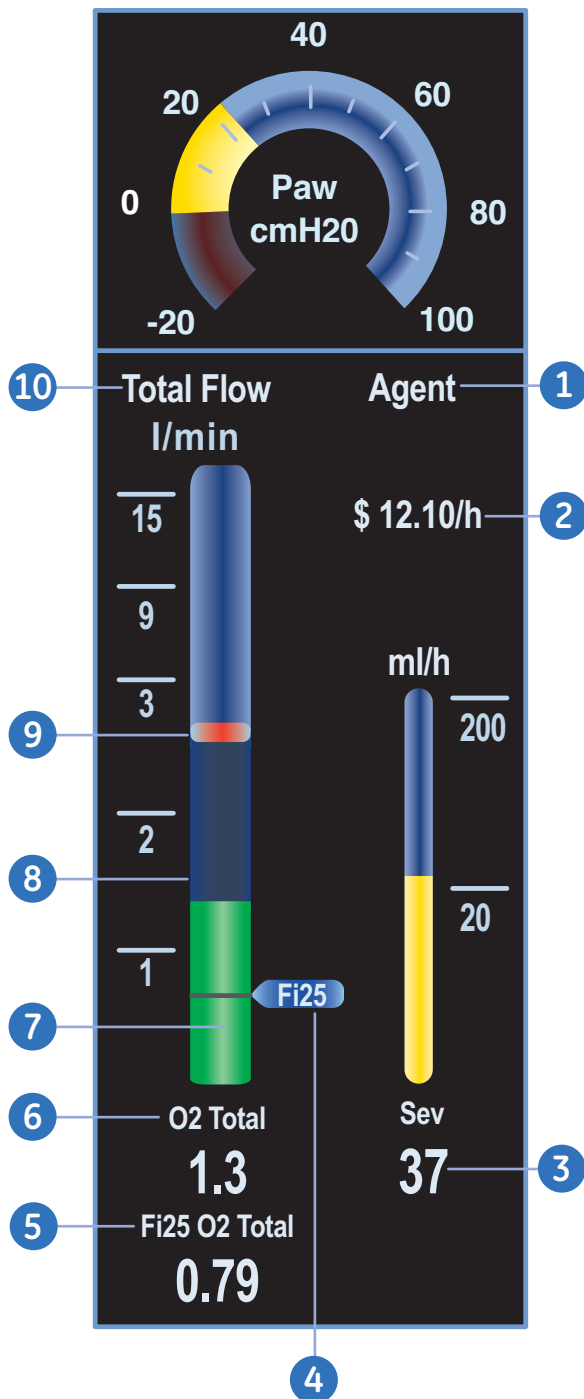
Figure 6.12 ecoFLOW Split Screen Components

ecoFLOW Split Screen Components

1. **Agent:** Shows Agent cost and flow information.

2. **Agent Cost:** The cost of the current agent flow. This value is determined by the agent flow multiplied by the agent cost set in Super user mode.

3. **Agent Flow:** The measured value of the liquid agent flow from the vaporizer. The agent flow may have a delayed response. For example: Sev.

4. **FiO_2 Flow Marker:** The graphical representation on the flow tube of the FiO2 flow value. This marker can be removed by disabling it in Super user mode.

5. **FiO_2 Flow:** The minimum O_2 flow needed to maintain the set inspired O_2 flow. This item can be disabled in Super user mode. For example: Fi25 O_2 flow.

6. **O_2 Total (numeric):** The numeric representation of the total O_2 flow. If N_2O is the balance gas, this equals the set O_2 flow. If Air is the balance gas, this is the set O_2 flow plus 21% of the Air flow.

7. **O_2 Total (graphical):** The graphical representation of the total O_2 flow. If N_2O is the balance gas, this equals the set O_2 flow. If Air is the balance gas, this is the set O_2 flow plus 21% of the Air flow.

8. *Remaining Gas Flow:* If N_2O is the balance gas, this equals the set N_2O flow. If Air is the balance gas, this N_2 is 79% of the Air flow.

9. **Flow Bobbin:** The height of this represents the total fresh gas flow delivered to the patient.

10. **Total Flow:** Shows Total Flow information.

Using ecoFLOW:
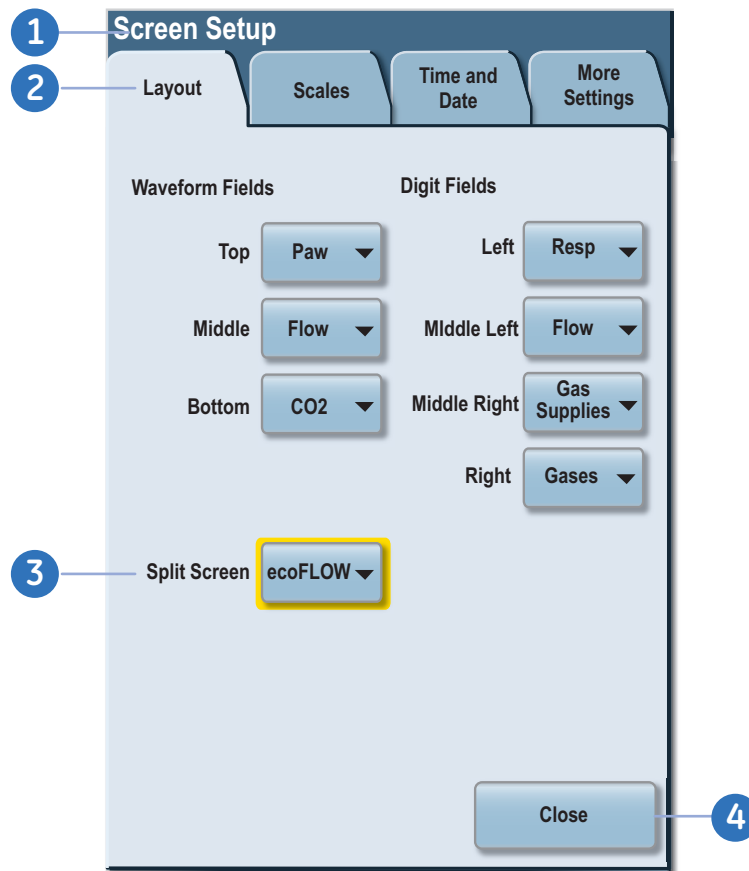
Figure 6.13 ecoFLOW Split Screen Selection

1. Select **System Setup > Screen Setup** from the right side of the display.
2. Select the **Layout** tab.
3. Select **Split Screen** and select **ecoFLOW** from the drop-down menu.
4. Select **Close**.

Alarm Management

Alarm Priorities

Alarms may be high priority, medium priority, or low. Alarm priority is indicated by the color of the alarm message and the audio sequence.
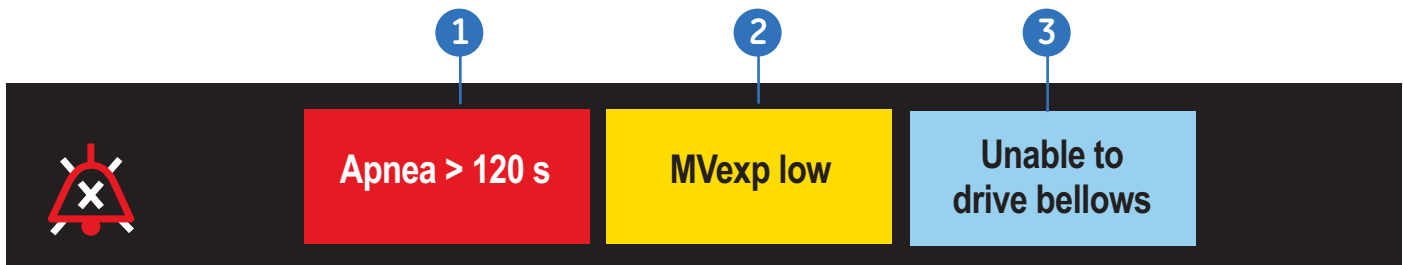
Figure 6.14 Priority Alarm Examples

1. **High-priority alarm** messages appear in white text on a red background.

2. **Medium-priority alarm** messages appear in black text on a yellow background.

3. **Low-priority alarms** appear in black text on a blue background.

Pausing Alarms

Selecting *Audio Pause* for an active alarm stops the audible tone for 120 seconds. The alarm message shows in the alarm message field. Selecting *Audio Pause* when no medium or high priority alarms are active prevents the audible alarm tones (audio off) for 90 seconds.

Figure 6.15 Audio Pause Key

Cancelling Audio Pause

Selecting and holding *Audio Pause* for 2 seconds will cancel the audio pause function.

De-escalating Alarms

Some device related alarms, such as *No insp flow* sensor will de-escalate priority when the alarm is acknowledged by selecting *Audio Pause*. The alarm message shows at the low-priority alarm level until the alarm condition is resolved and the alarm is cleared. If that alarm reoccurs after it has been resolved, the alarm occurs at its standard priority level.

Alarm Setup

| Primary Limits | More Limits | Alarm History | Configure |

A

CO2 Alarms	Vol Apnea Alarm	MV/TV Alarm
On ▼	On ▼	On ▼

B

	Low Limit	High Limit
C		
Pmax cmH2O		40
MV l/min	2.0	10.0
EtCO2 mmHg	10.0	50.0
FiO2 %	21	Off
FiSev %	Off	8.0

Close
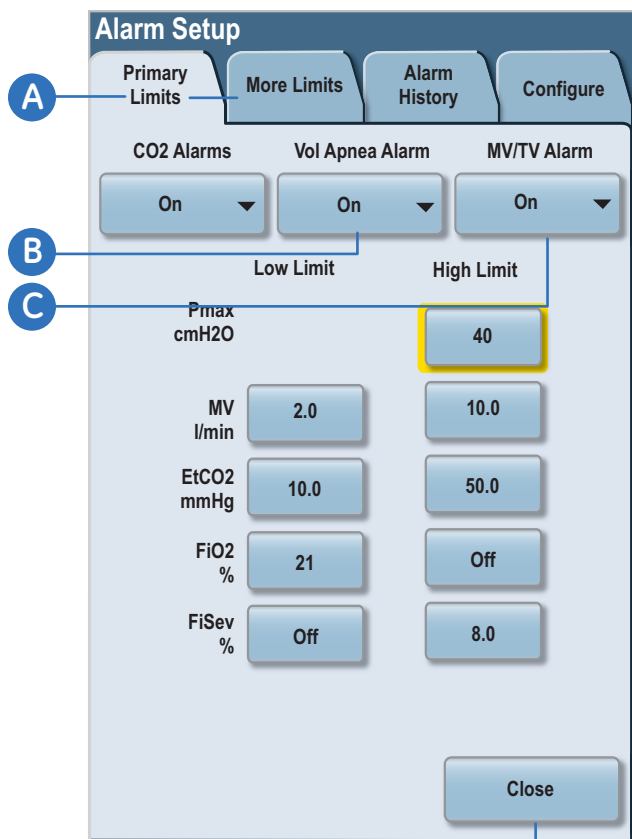
Figure 6.16
Alarm Setup - Primary Limits Tab

⌂
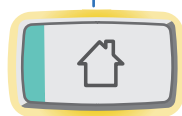
Home Key

A. Setting Alarm Limits

1. Select *Alarm Setup* from the right side of the display.

2. From the *Primary Limits* and *More Limits tabs*, select the alarm limit and make the change.

3. Push the *Home* key, touch the waveform area of the display, or select *Close* to close the menu.

B. Setting Volume Apnea Alarm

💡 **Note!** *The Volume Apnea Alarm setting may not be available if the system has been configured to disable this feature.*

Use the Vol Apnea Alarm setting to turn off the volume apnea alarm during manual ventilation. The volume apnea alarm remains off until the Bag/Vent switch is set to Vent or Vol Apnea Alarm is set to *On*.

1. Select *Alarm Setup.*

2. To turn the volume apnea alarms off, select *Vol Apnea Alarm* to *Off.*

3. *Volume Apnea Off* shows in the general message field.
   - If mechanical ventilation is started, the volume apnea alarms are active
   - If manual ventilation is restarted, a pop-up confirmation window appears to resume the Off setting

4. To turn the volume apnea alarms on, set *Vol Apnea Alarm* to *On*.

5. Select *Close*.

C. Setting MV/TV Alarms

Use the MV/TV Alarms setting to turn off the MV and TV alarms.

1. Select *Alarm Setup*.

2. To turn the volume alarms off, set *MV/TV Alarms* to *Off*.
   - *MV/TV Alarms Off* appears in the general message field
   - The volume alarm limits waveform numerics shows dashes during a case

3. To turn the volume alarms on, set *MV/TV Alarms* to *On*.

4. Select *Close*.

💡 **Note!** *Settings made during manual ventilation are not retained when mechanical ventilation starts. Settings made during mechanical ventilation are retained when manual ventilation starts.*

Viewing Alarm History

Use the *Alarm History* tab to view the list of the 12 most recent high and medium priority alarms that occurred since the start of the case. The alarm history clears at the start of a new case.

1. Select *Alarm Setup*.

2. Select the *Alarm History* tab. The list of alarms shows in the window.

3. Select *Close.*

Alarm Setup Configure Tab
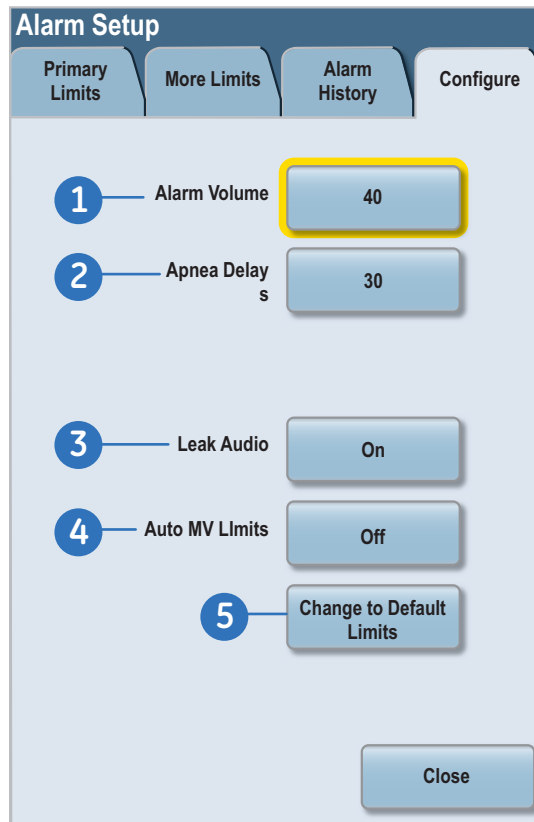
Figure 6.17 Alarm Setup Configure Tab

The following settings are available in the Alarm Setup Configure Tab:

1. **Alarm Volume:** Adjusts the alarm volume range from 1 to 5.

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

3. **Leak Audio:** Use the *Leak Audio* setting to silence audio alarms of small leaks. If the Low MV alarm limits are off or MV/TV Alarms is set to *Off, Leak Audio* is automatically set to *On* and cannot be changed.

4. **Auto MV Limits:** MV alarm limits can be calculated automatically for mechanical ventilation when in VCV or PCV-VG modes and volume compensation is enabled. Use the Auto MV Limits setting to turn on automatic calculations of the MV alarm limits.

5. **Change to Default Limits:** Sets the alarm limits to the values set by the Super User.

Trends

Use the **Trends** menu to view patient trends and set the time scale. There are three views for patient trends: measured (numerical), settings, and graphical. Trend information is saved every 15 seconds for the most recent 24 hours.
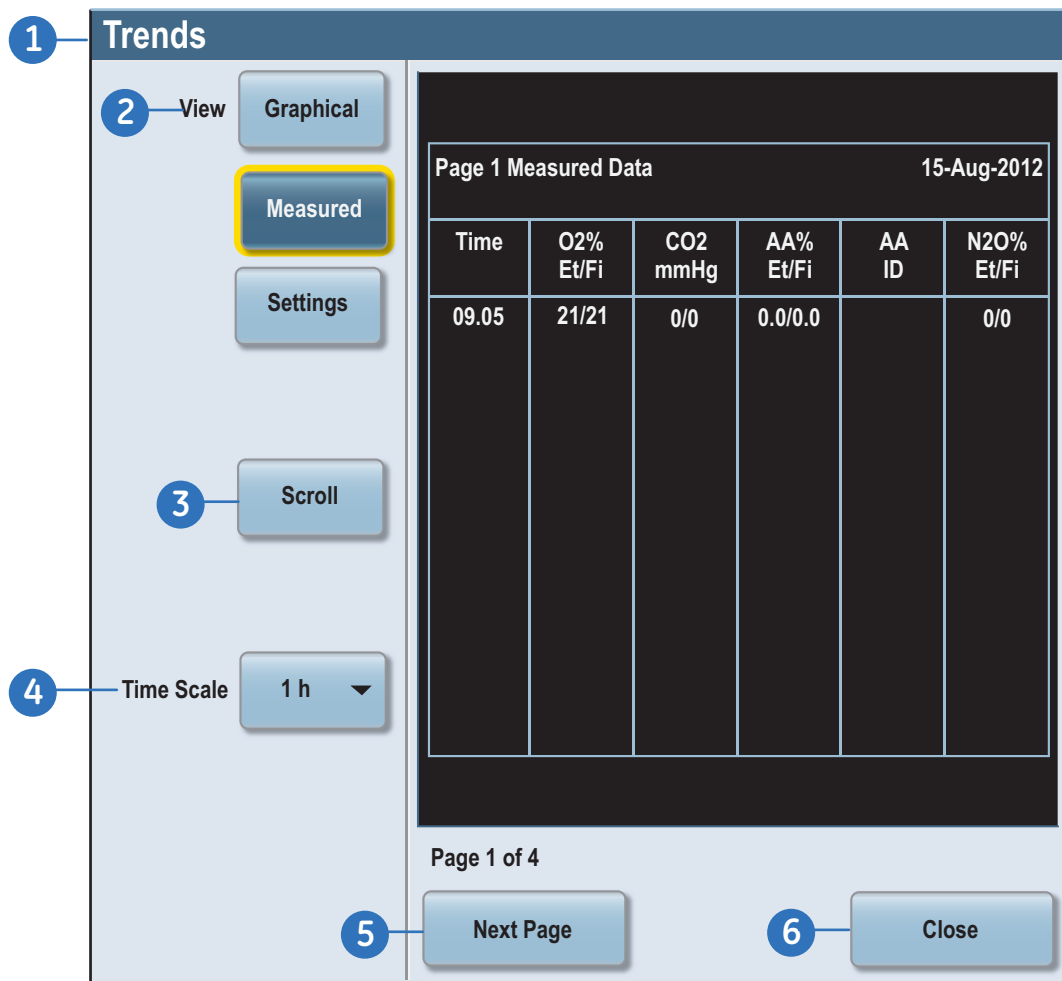
Figure 6.18 Trends Menu

1. Select **Trends** from the right side of the display.

2. Select the desired view.

3. Select **Scroll** to move through the current trend view.

4. Select **Time Scale** to select the desired scale from the drop-down menu.

5. Select **Next Page** to view additional parameters.

6. Select **Close.**

7 Ventilation

Aisys CS² Ventilation Modes Objectives

After completing this section, the participant will be able to describe the following modes of ventilation:

- Volume control ventilation (VCV)
- Pressure control ventilation (PCV)
- Pressure control ventilation - volume guaranteed (PCV-VG)
- Synchronized intermittent mandatory ventilation - volume control ventilation (SIMV VCV)
- Synchronized intermittent mandatory ventilation – pressure control ventilation (SIMV PCV)
- Synchronized intermittent mandatory ventilation – pressure control ventilation - volume guaranteed (SIMV PCV-VG)
- Pressure support ventilation with apnea backup (PSVPro)
- Continuous positive airway pressure + pressure support ventilation (CPAP + PSV)
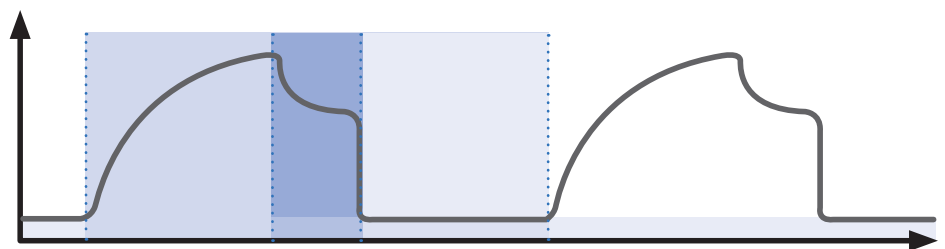
About Ventilator Modes

The system has the ***Volume control ventilation (VCV)*** as the standard mode of mechanical ventilation. The system offers the following optional modes of mechanical ventilation:

- Pressure control ventilation (PCV)
- Pressure control ventilation - volume guaranteed (PCV-VG)
- Synchronized intermittent mandatory ventilation - volume control ventilation (SIMV VCV)
- Synchronized intermittent mandatory ventilation – pressure control ventilation (SIMV PCV)
- Synchronized intermittent mandatory ventilation – pressure control ventilation - volume guaranteed (SIMV PCV-VG)
- Pressure support ventilation with apnea backup (PSVPro)
- Continuous positive airway pressure + pressure support ventilation (CPAP + PSV)

Volume Control Mode (VCV)

Volume control ventilation supplies a set tidal volume. The ventilator calculates a flow based on the set tidal volume and the length of the inspiratory time to deliver that tidal volume. It then adjusts that output by measuring delivered volumes at the flow sensors. Since the ventilator adjusts output, it can compensate for breathing system compliance, fresh gas flow, and moderate breathing system leaks. A typical volume-control pressure waveform increases throughout the entire inspiratory period, and rapidly decreases at the start of expiration. An inspiratory pause is available to improve gas distribution.

VCV mode settings:

- TV
- RR
- I:E
- Tpause
- PEEP
- Pmax
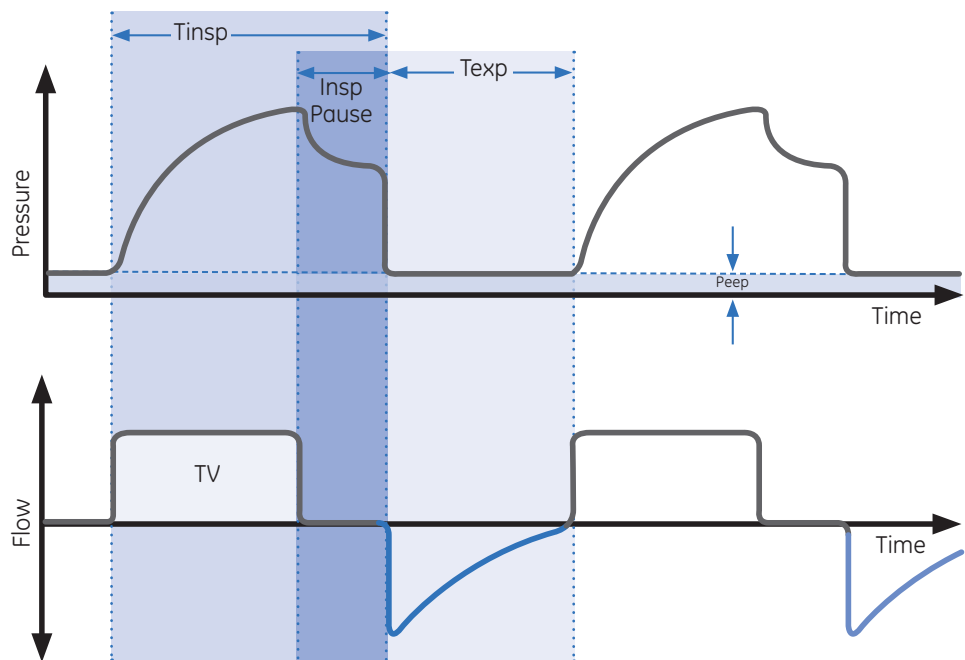
Figure 7.1   Example of Volume Control (VCV) Waveforms

Pressure Control Mode (PCV)

(PCV) Pressure control ventilation supplies a constant set pressure during inspiration. The ventilator calculates the inspiratory time from the frequency and I:E ratio settings. A high initial flow pressurizes the circuit to the set inspiratory pressure. The flow then decreases to maintain the set pressure (Pinsp). Pressure sensors in the ventilator measure patient airway pressure. The ventilator automatically adjusts the flow to maintain the set inspiratory pressure.

PCV mode settings:

- Pinsp
- RR
- I:E
- PEEP
- Pmax
- Rise Rate
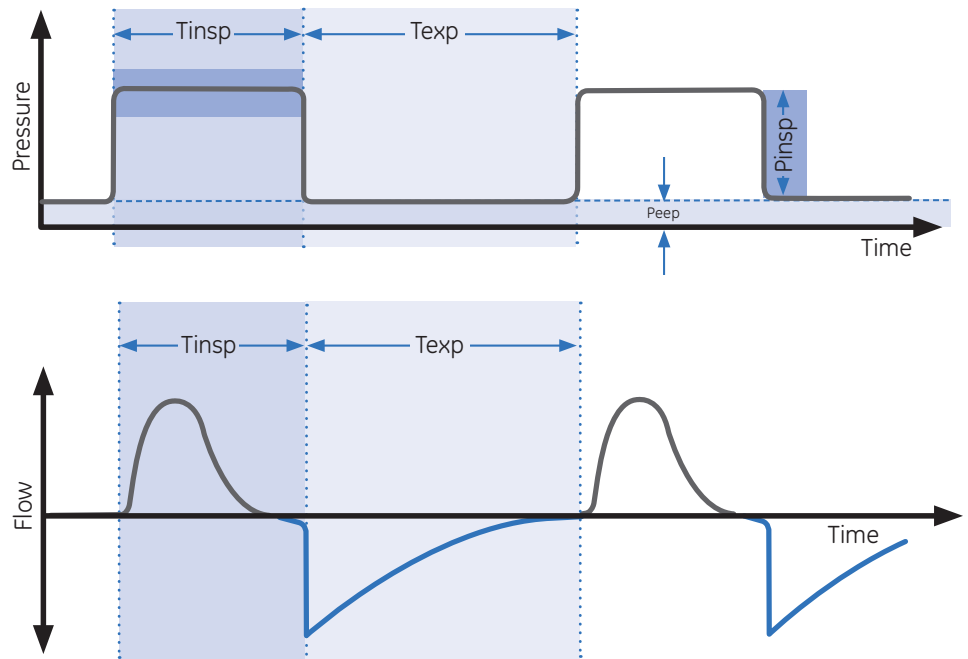
Figure 7.2 Example of PCV Waveforms

Pressure Control Ventilation with Volume Guarantee Mode (PCV-VG)

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 cmH2O level on the low end and 5 cmH2O below Pmax on the high end. The inspiratory pressure change between breaths is a maximum of +/- 3 cmH2O. If a high airway pressure alarm is active due to the current breath, the next breath's target will be 0.5 cmH2O less than the current breath's pressure target.

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

PCV-VG mode settings:

- TV
- RR
- I:E
- PEEP
- Pmax
- Rise Rate
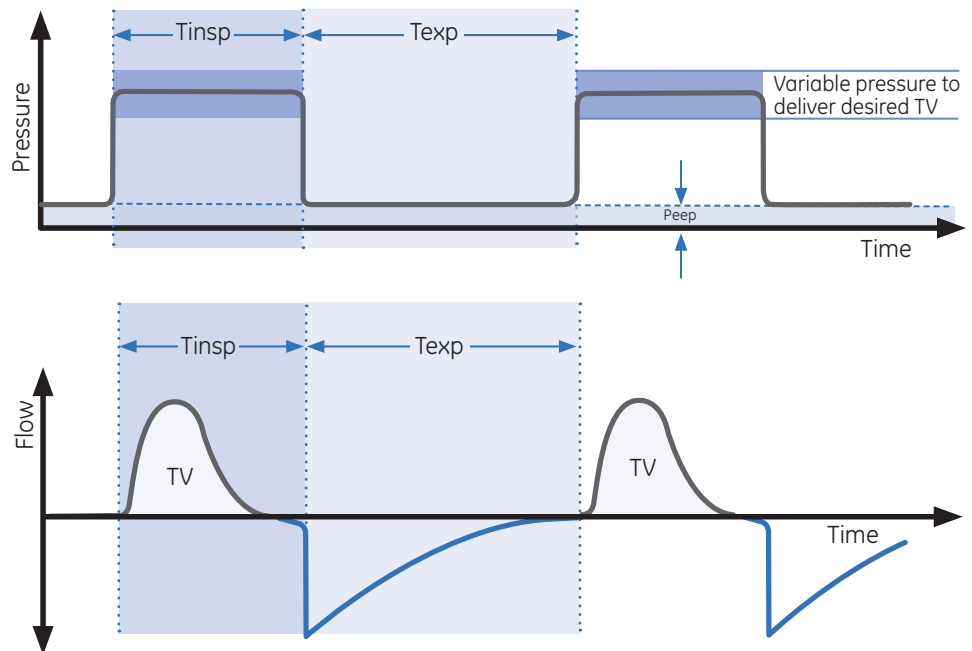
Figure 7.3 Example of PCV-VG Waveforms

Synchronized Intermittent Mandatory Ventilation - Volume Control Ventilation Mode (SIMV-VCV)

Synchronized intermittent mandatory ventilation with volume control 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 not 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 within the Trigger window it synchronously delivers a volume breath using the set tidal volume, and the inspiratory time (Tinsp) that is set on the ventilator. If the patient fails to make and 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 VCV, the spontaneous breaths can be pressure supported to assist the patient in overcoming the resistance of the patient circuit and artificial airway. When the Psupport level is set, the ventilator will deliver the pressure support level to the patient during inspiration. PEEP can also be used in combination with this mode. Spontaneous breaths that occur during this mode are indicated by a color change in the waveform.

SIMV-VCV mode settings:

- TV
- RR
- Tinsp
- Tpause
- Psupport
- PEEP
- Pmax
- Trig Window
- Flow Trigger
- End of Breath
- Rise Rate
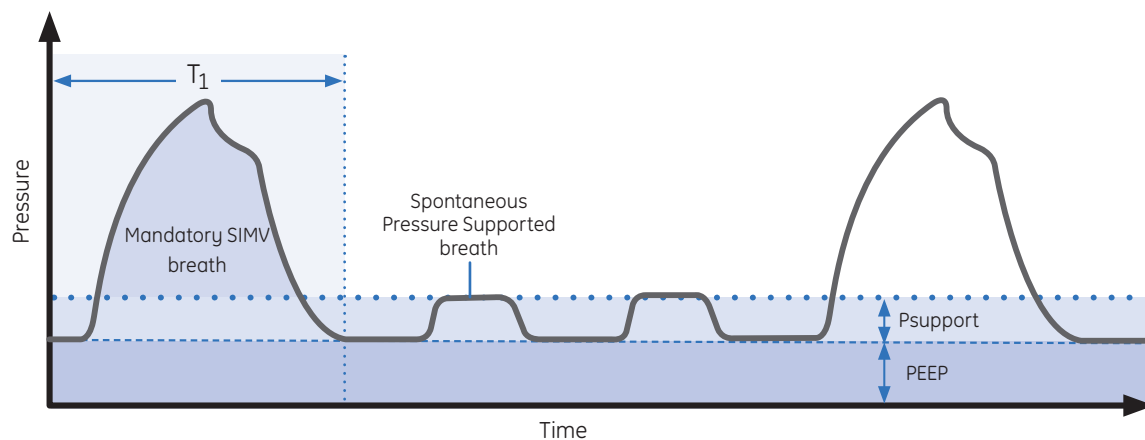
Figure 7.4 Example of SIMV-VCV Waveforms

Synchronized Intermittent Mandatory Ventilation – Pressure Control Ventilation Mode (SIMV-PCV)

Synchronized intermittent ventilation with pressure control ventilation (SIMV PCV) delivers a relatively slow breathing rate with pressure controlled breathing. This mode combines mandatory breaths with spontaneous breath support. If a trigger event occurs within the synchronized 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 PCV mode settings:

- Pinsp
- RR
- Tinsp
- Psupport
- PEEP
- Pmax
- Trig Window
- Flow Trigger
- End of Breath
- Rise Rate
- Exit Backup
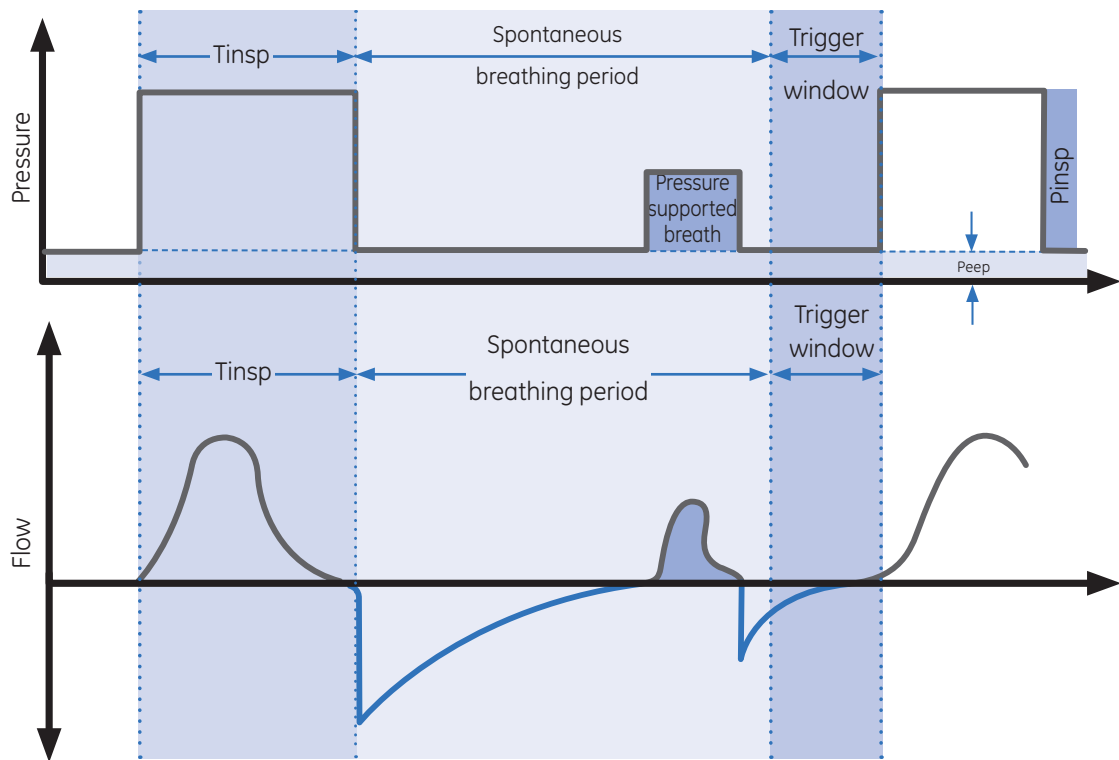
Figure 7.5 Example of SIMV-PCV Waveforms

Synchronized Intermittent Mandatory Ventilation – Pressure Control Ventilation - Volume Guaranteed Mode (SIMV PCV-VG)

Synchronized intermittent mandatory ventilation with pressure control volume guaranteed (SIMV PCV-VG) delivers a set rate of pressure controlled breaths with a guaranteed volume to the patient. The patient can breathe spontaneously between mandatory breaths. Pressure support can be used to support the spontaneous breaths.

The mandatory breaths will deliver the set tidal 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 cmH2O level on the low end and 5 cmH2O below Pmax on the high end. The inspiratory pressure change between breaths is a maximum of +/- 3 cmH2O. If a high airway pressure alarm is active due to the current breath, the next breath's target will be 0.5 cmH2O less than the current breath's pressure target.

SIMV PCV-VG begins by delivering a volume controlled breath. The patient's compliance is determined from the volume controlled ventilation breath and the inspiratory pressure level is then established for the next PCV-VG breath. The remaining mandatory breaths will be pressure controlled with a guaranteed volume at the inspiratory limb.

A portion of the exhalation phase is defined as the trigger window. If a spontaneous breath is detected in this window, a new mandatory PCV-VG breath is initiated. If a spontaneous breath is detected outside of this window, support for this breath is provided according to the set pressure support. The remainder of the trigger window is added to the next non-triggering phase.

The inspiratory phase of supported breaths will end if the set End of Breath is reached, if the airway pressure exceeds (PEEP + Psupport + 3 cmH2O). Supportive breaths have a maximum inspiratory time of 4 seconds.

SIMV PCV-VG mode settings:

- TV
- RR
- Flow Trigger
- Psupport
- PEEP
- Tinsp
- Pmax
- Trig Window
- End of Breath
- Rise Rate
- PSV Rise Rate
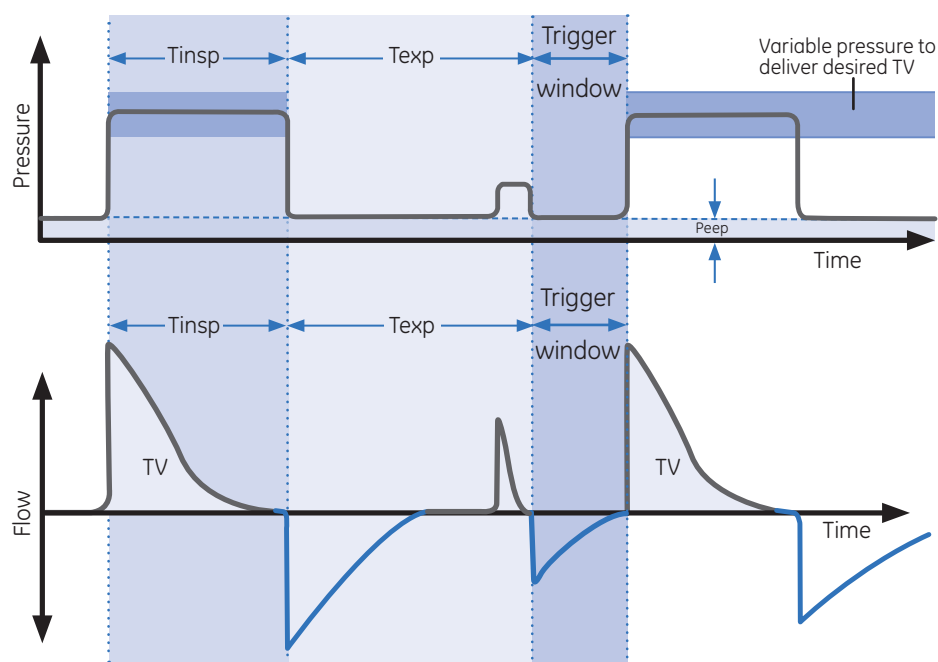
Figure 7.6 Example of SIMV-PCV-VG Waveforms

PSVPro Mode

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

PSVPro uses an inspiration termination level that establishes when the ventilator will stop the pressure-supported breath and cycle to the expiratory phase. The inspiration termination level is user adjustable from 5 to 75%. This parameter sets the percent of 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 shorter the inspiratory phase.

An apnea backup mode is provided if the patient stops breathing. When setting this mode the clinician adjusts the inspiratory pressure (Pinsp), respiratory rate (RR), and the inspiratory time (Tinsp). 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 PCV. Once in this mode the ventilator will begin delivering machine pressure controlled breaths at the inspiratory pressure level, inspiratory time, and rate that the user has set. If, during this time, the patient takes spontaneous breaths in between the machine breaths, the patient will receive pressure supported breaths.

PSVPro mode settings:

- Psupport
- Backup Time
- PEEP
- Pinsp
- Trig Window
- RR
- Flow Trigger
- Tinsp
- End of Breath
- Rise Rate
- Pmax
- Exit Backup
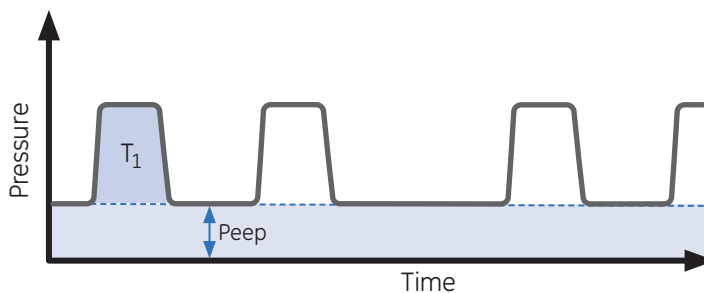
Figure 7.7 Example of PSVPro Waveforms

When the ventilator switches to the backup mode, the ***Backup Mode active*** alarm shows until PSVPro is reinstated or until another ventilation mode is selected. PSVPro mode automatically resumes when the ventilator registers the number of consecutive patient triggered breaths set for the Exit Backup setting. The factory default setting for Exit Backup is 2. When Exit Backup is set to Off, the user must reselect the PSVPro mode to reactivate PSVPro. Upon returning to PSVPro the ventilator immediately begins providing pressure supported breaths to the patient using the established settings. Spontaneous breaths that occur during this mode are indicated by a color change in the waveform.

CPAP + PSV Mode

Continuous positive airway pressure + pressure support ventilation mode is used on spontaneously breathing patients. This mode of ventilation provides a constant support pressure once the ventilator senses that the patient has made an inspiratory effort. In this mode, the clinician sets the Pressure support (Psupport) and PEEP levels. The patient establishes the rate, inspiratory flow, and inspiratory time. The tidal volume is determined by the pressure, lung characteristics, and patient effort.

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

If the spontaneous inspiratory effort does occur within the delay period, the ventilator delivers pressure controlled breaths with the preset inspiratory pressure to bring the breath rate up to the minimum rate. The delay period calculation is 60 s/minimum rate + ([60 s/ minimum rate] - previous measured breath period).

The inspiratory support pressure and the inspiratory pressure settings are linked at the start of each case. When the inspiratory support pressure setting is changed, the inspiratory pressure setting is automatically adjusted to match the inspiratory pressure setting. The link can be broken by changing the Pinsp setting through the Vent Mode menu during the case.

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

CPAP + PSV settings:

- Psupport
- PEEP
- Flow Trigger
- End of Breath
- Pmax
- Pinsp
- Minimum RR
- Tinsp
- Rise Rate
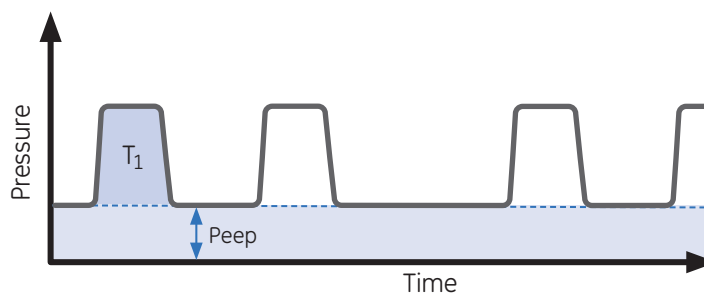
Figure 7.8 Example of CPAP + PSV Waveforms

8 Spirometry

Aisys CS² Spirometry Objectives

After completing this section, the participant will be able to:

- Set the spirometry loop type
- Set the loop graph scaling
- Set a patient type and sensor type
- Set the data source
- Set the spirometry volume type
- Save a spirometry loop
- View a spirometry loop
- Delete a spirometry loop

About the Spirometry Menu

Use the Spirometry menu to:

- Set the loop type
- Adjust the loop scaling
- Save a loop to memory
- Access the Setup Loops menu
- View a saved loop
- Delete a saved loop

Spirometry Loops

There are three types of spirometry loops: Pressure-Volume (Paw-Vol), Flow-Volume (Flow-Vol), and Pressure-Flow (Paw-Flow).

The spirometry loops show in the spirometry window and can be set to show alongside the waveforms as the split screen.
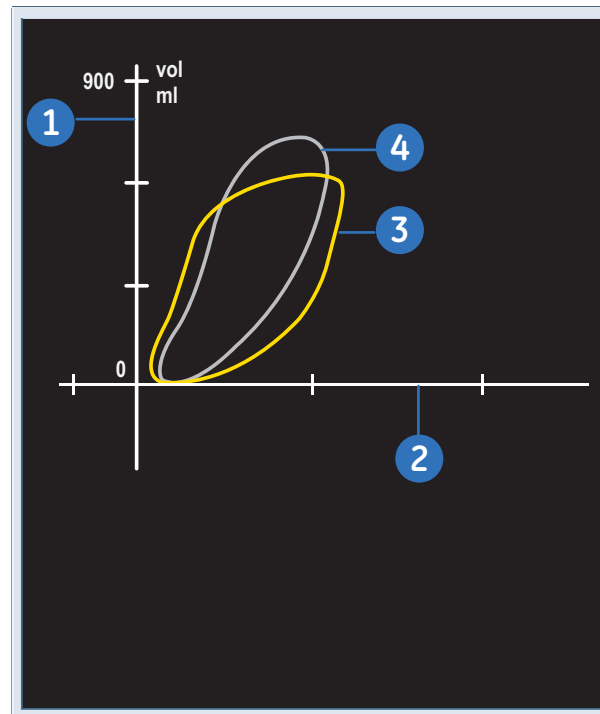
Figure 8.1   Example of Spirometry Window Loops on Split Screen

Spirometry loop components:

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

Using the Spirometry Loop Split Screen
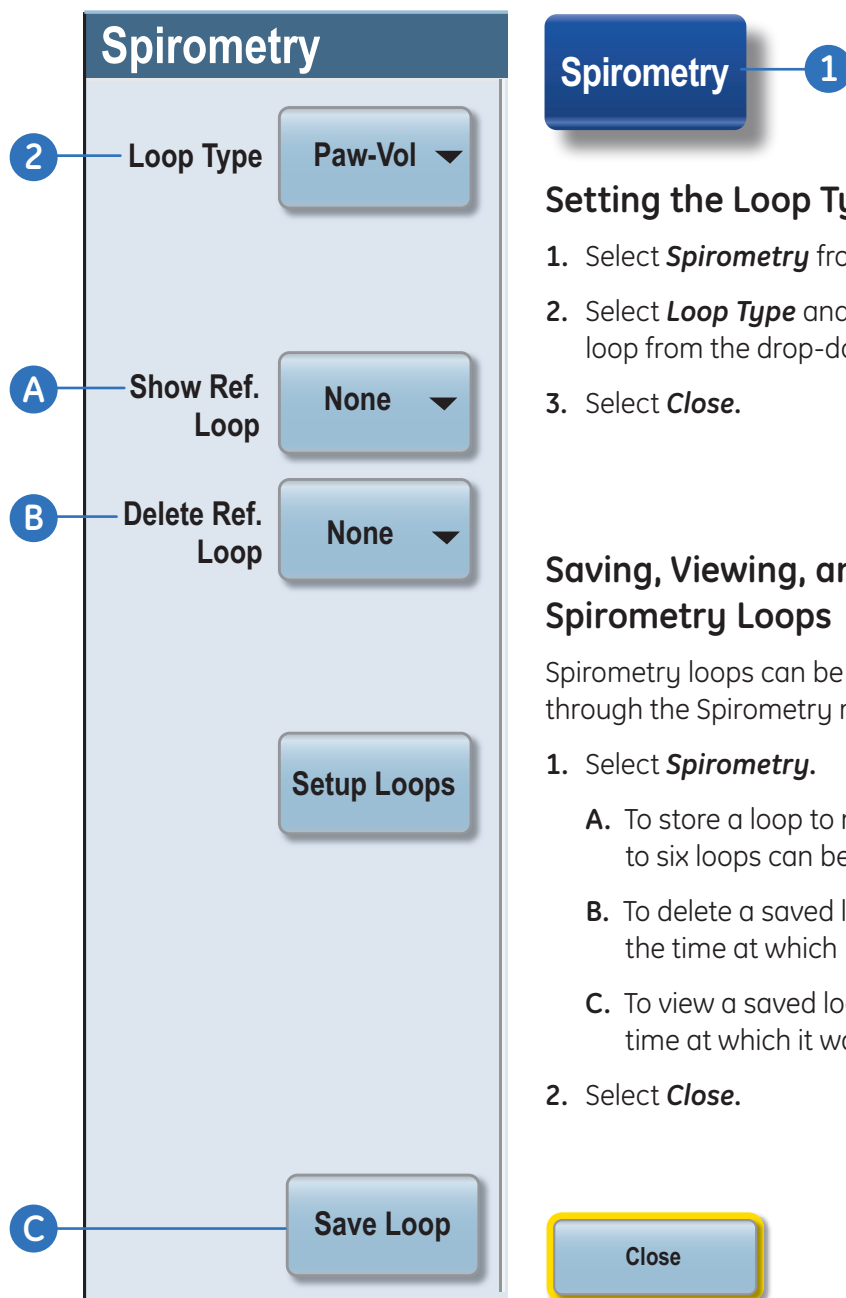
Figure 8.2 Spirometry Split Screen Menu

Setting the Loop Type

1. Select *Spirometry* from the right side of the display

2. Select *Loop Type* and select the loop from the drop-down list.

3. Select *Close.*

Saving, Viewing, and Deleting Spirometry Loops

Spirometry loops can be saved, viewed, and deleted through the Spirometry menu.

1. Select *Spirometry.*

   A. To store a loop to memory, select *Save Loop*. Up to six loops can be saved.

   B. To delete a saved loop, set *Delete Ref. Loop* to the time at which it was saved.

   C. To view a saved loop, set *Show Ref. Loop* to the time at which it was saved.

2. Select *Close.*

Spirometry Menu Setup
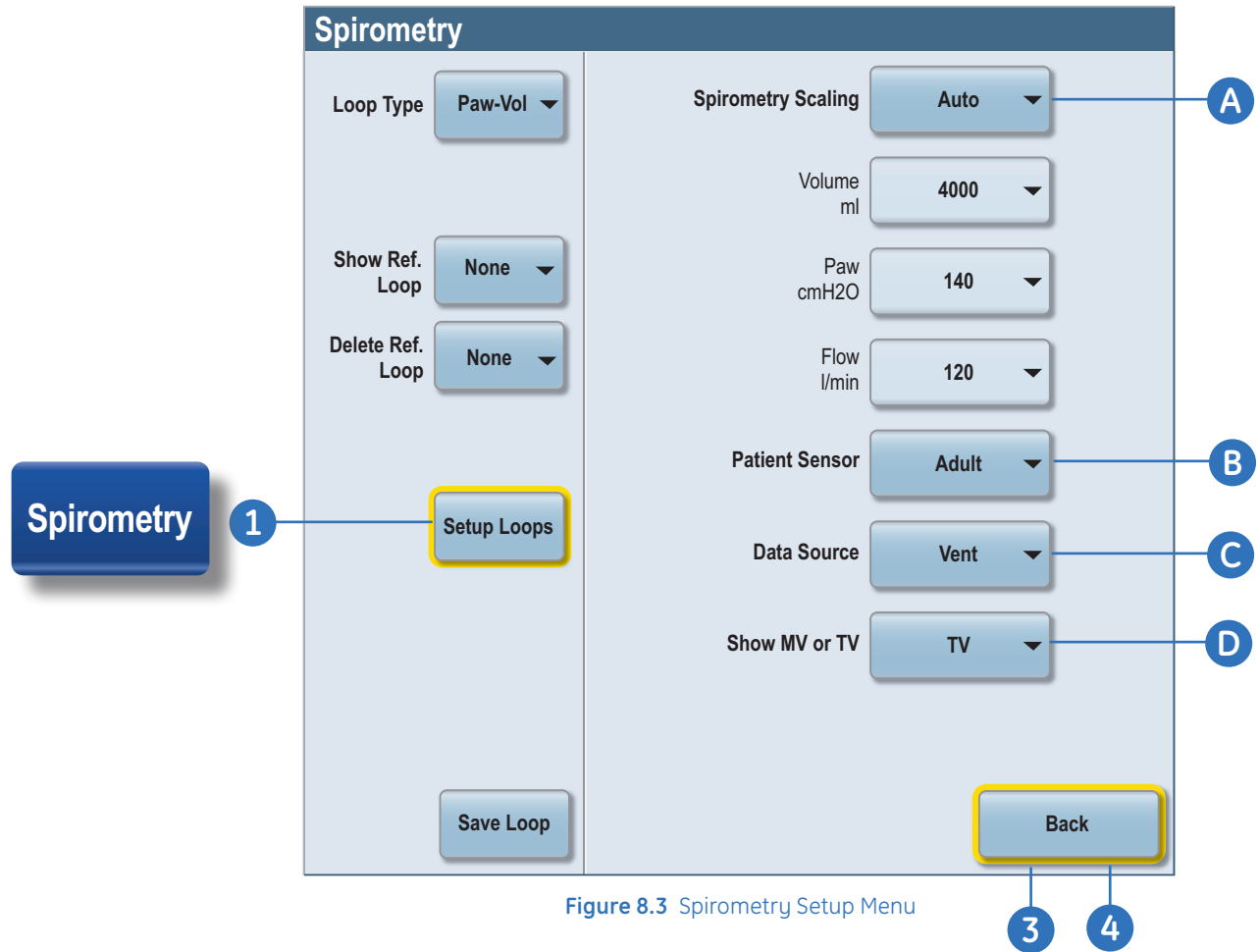
Figure 8.3 Spirometry Setup Menu

Setting Loop Graph Scaling

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

- **Auto:** Automatically adjusts the loop graph scaling based on the minimum and maximum breath reading.
- **Linked:** When you change one of the scales, the remaining two scales automatically change based on the one set scale.
- **Indep:** Allows the volume, Paw and flow axes of the loop graph to be changed separately.

A. To set the graph scaling:

1. Select **Spirometry > Setup Loops**.
2. Select **Spirometry Scaling** and set the scale type from the dropdown list.
3. Select **Back** to view changes made and access other functions of the Spirometry menu.

Setting Patient and Sensor Type

Patient and sensor type refer to the style of airway adapter used with the airway module. If spirometry data is obtained from the airway module, make sure that the sensor type matches the type of airway adapter used. Adult or pediatric patient types are available.

Note! *Make sure that the set sensor type corresponds to the type of airway adapter in use. If the sensor type is not set correctly, the information displayed may not be accurate.*

B. To set the Patient and Sensor Type:

1. Select *Spirometry > Setup Loops*.

2. Select *Patient Sensor* and then select *Adult* or *Pedi* depending on the sensor used.

3. Select *Back* to view changes made and access other functions of the Spirometry menu.

Setting the Data Source

Use Data Source to specify the source of spirometry data.

C. To set the Data Source:

1. Select *Spirometry > Setup Loops*.

2. Select *Data Source*.

3. Select *Patient* to have spirometry data sourced from the airway module or *Vent* to have spirometry data sourced from the ventilator.

4. Select *Back* to view changes made and access other functions of the Spirometry menu.

Setting Spirometry Volume Type

The volume shown on the spirometry split screen can be set to minute volume or tidal volume.

D. To set the Spirometry Volume Type:

1. Select *Spirometry > Setup Loops*.

2. Select *Show MV* or *TV* and select *MV* or *TV* from the drop-down list.

    *   Set to *TV* to show TVinsp and TVexp on the spirometry split screen.

    *   Set to *MV* to show MVexp and TVexp on the spirometry split screen.

3. Select *Back* to view changes made and access other functions of the Spirometry menu.

9 Procedures

Aisys CS² Procedures Objectives

After completing this section, the participant will be able to:

- Perform a Pause Gas Flow procedure
- Use manual and VCV cardiac bypass
- Perform a Vital Capacity procedure
- Change a Vital Capacity procedure setting
- Perform a Cycling procedure
- Change a Cycling procedure setting

The Procedure Menu
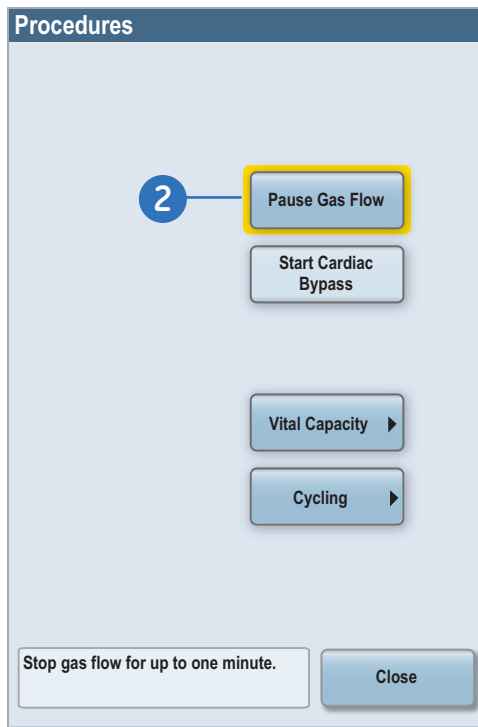
Figure 9.1   Procedures Menu

Use the Procedures menu to pause the gas flow, start cardiac bypass, perform or change settings for a vital capacity procedure, or perform or change the settings for a cycling procedure. The procedures key is located on the right side of the display.

The Vital Capacity and Cycling procedures may not be available if the system has been configured to disable these procedures. Vital Capacity and Cycling are only selectable during mechanical ventilation.

Pause Gas Flow
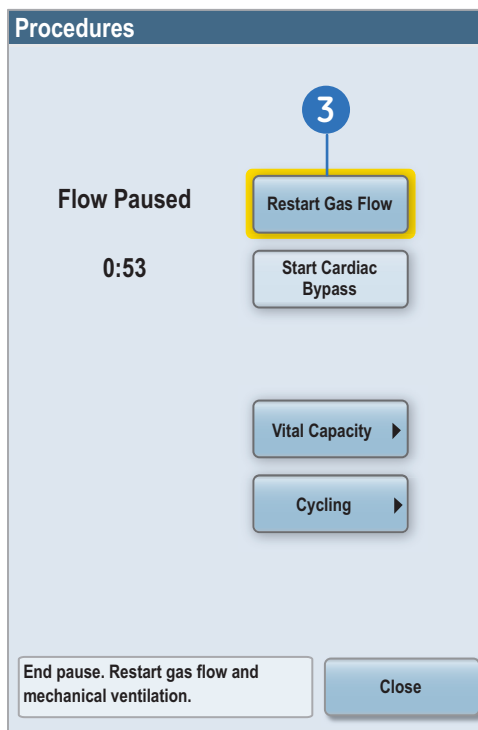
Figure 9.2   Pause Gas Flow Menu

Use Pause Gas Flow to temporarily suspend the flow of gas during a case. Using Pause Gas Flow while the breathing circuit is disconnected prevents the flow of gas into the room. Pause Gas Flow is available during both mechanical ventilation and manual ventilation.

1. Select *Procedures* from the right side of the display.

2. Select *Pause Gas Flow*.
    - The amount of time remaining in the gas flow pause shows in the window.
    - Gas flow stops for 1 minute and automatically resumes after 1 minute.
    - If mechanical ventilation is on, mechanical ventilation stops for 1 minute and then automatically resumes after 1 minute.

3. Resume the flow of gas at any time during the pause by selecting *Restart Gas Flow*.

Cardiac Bypass

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

Manual ventilation cardiac bypass suspends alarms for patients on cardiac bypass when the ventilator is not mechanically ventilating. The volume, apnea, low agent, CO2, and respiratory rate alarms are suspended. The alarms are enabled when cardiac bypass is turned off or mechanical ventilation is started.

Systems with the VCV cardiac bypass option enabled can mechanically ventilate while in VCV mode. The VCV mode is the only ventilation mode available while using VCV cardiac bypass. The volume, apnea, low agent, CO2, low Paw, and respiratory rate alarms are suspended. The alarms are enabled when VCV cardiac bypass is turned off or mechanical ventilation is stopped.

Using Manual Ventilation Cardiac Bypass
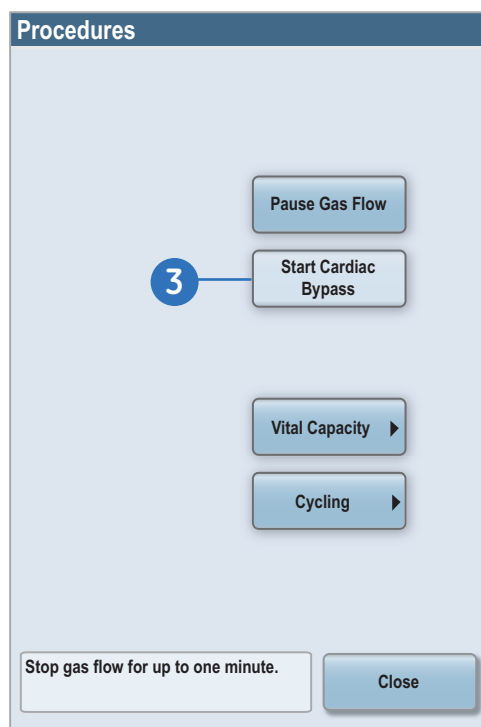
Figure 9.3 Cardiac Bypass Button

1. Set the Bag/Vent switch to Bag.

2. Select *Procedures*.

3. Select *Start Cardiac Bypass*. The *Cardiac Bypass* message shows in the waveforms and in the general message field when manual ventilation cardiac bypass is active.

4. Select *Close*.

Using VCV Cardiac Bypass

1. Start mechanical ventilation in *VCV* mode.

2. Select *Procedures*.

3. Select *Start Cardiac Bypass*.

- PEEP is set to 5 cmH2O
- TV settings of less than 170 ml prior to starting cardiac bypass remain at the set TV
- TV settings of more than 170 ml prior to starting cardiac bypass change to 170 ml
- The *VCV Cardiac Bypass* message shows in the waveforms and in the general message field when VCV cardiac bypass is active

4. Select *Close.*

> **Note!** *PEEP* and *TV* settings can be changed after entering cardiac bypass mode.

Vital Capacity

Use the Vital Capacity procedure to deliver a pressure breath for a set time. The Vital Capacity procedure provides a simple way to deliver one pressure breath during mechanical ventilation without making multiple ventilator setting changes. The PEEP on Exit setting provides a way to change the ventilation PEEP setting automatically at the end of the Vital Capacity procedure.

The Pressure Hold, Hold Time, and PEEP on Exit settings can be preset by the Super User. These settings can be changed by the user before starting the procedure.

Note! *PEEP on Exit shows if it has been enabled by the Super User.*
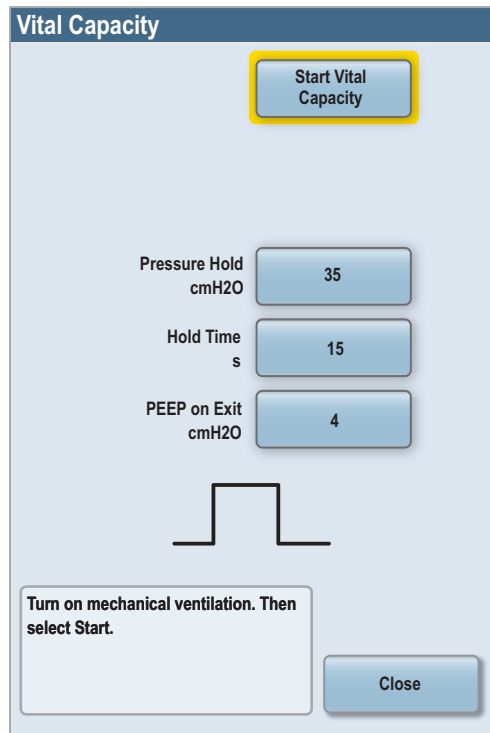
Figure 9.4   Vital Capacity Menu

Using Vital Capacity

Procedures

1. Select *Procedures.*

2. Select *Start Vital Capacity*.

   - One pressure breath is given at the set pressure
   - The pressure is held for the set time
   - PEEP is set to the PEEP on Exit setting

3. Select *Stop Vital Capacity* at any time to stop the procedure.

4. Select *Close.*

Note! *If the procedure is stopped before completion, the PEEP on Exit setting is not used.*

Changing Vital Capacity Settings

1. Select *Procedures.*

2. Select the setting to change and make the change.

   - Set *Pressure Hold* to between 20 and 60 cmH$_2$O.
   - Set *Hold Time* to between 10 and 40 seconds.
   - Set *PEEP on Exit* to *Off* or between 4 and 30 cmH$_2$O.

3. Select *Start Vital Capacity*.

4. Select *Close*.

Cycling

Use the Cycling procedure to deliver pressure breaths through a series of ventilation steps. The Cycling procedure provides a flexible way to deliver pressure breaths during ventilation without making multiple ventilator setting changes. Up to seven preset steps with multiple breaths are available.

Each procedure defaults steps and ventilation settings which can be preset by the Super User. The ventilation settings of each step can be changed by the user before starting a procedure.
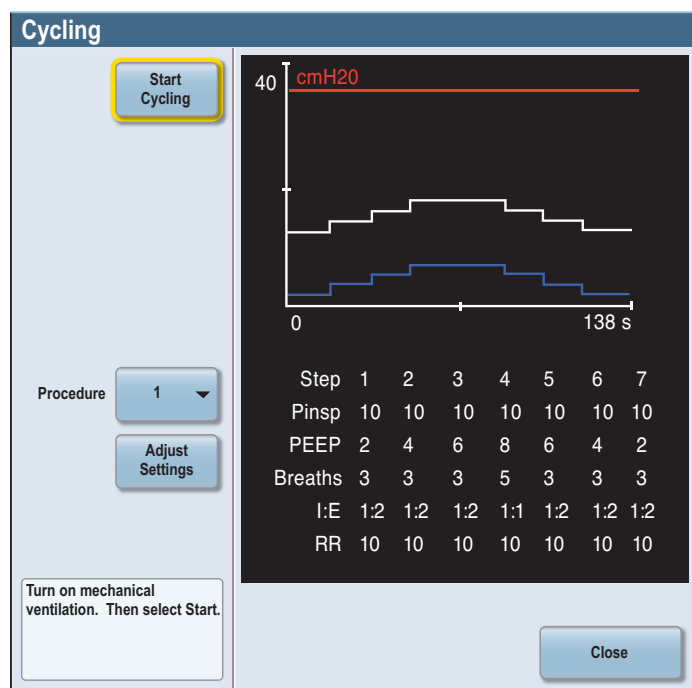
Figure 9.5 Cycling Menu

Using Cycling

1. Select **Procedures**.
2. Select **Cycling**.
3. Select a Procedure to perform.
4. Select **Start Cycling**.
   - The procedure begins
   - Procedure progress shows in the procedure window
5. Stop the procedure anytime by selecting **Stop Cycling**.
6. Select **Close**.

Changing Cycling Settings

1. Select **Procedures.**
2. Select **Cycling**.
3. Select a Procedure to perform.
4. Select **Adjust Settings**. The first setting of Step 1 in the procedure window is selected.
5. Push the ComWheel to enter the adjustment window.
6. Use the ComWheel to navigate the adjustment window and change a value.
7. Select **Start Cycling**.
8. Select **Close**.

10 Checkout

Aisys CS² Checkout Objectives

After completing this section, the participant will be able to:

- Access the Checkout menu
- Perform a Full Test
- Perform the Vent and Gas test
- Perform the Circuit Leak test
- Perform the Circuit O_2 Cell test (if applicable)
- Perform the Low P Leak Test

About the Checkout Menu

The Checkout menu shows on the display after turning on the system. To access the Checkout menu between cases, select **Checkout** from the right side of the display. Step-by-step instructions show in the Checkout menu during the tests. Use the Checkout menu to:

- Perform a Full Test
- Perform any of the individual tests
- View the Test Log
- Start a case

Full Test

The Full Test or the individual tests must be performed at least once within every 24-hour period. Perform the Full Test at the start of each day. The full test runs automatically and beeps to indicate when it is finished or if interaction is required.

The Full Test does the following tests: Vent and Gas, Circuit Leak, and Circuit O_2 Cell (if circuit O_2 cell is present). When one of the tests is completed, the next test begins.

Performing a Full Test

1. From the Checkout menu, select **Full Test** and follow the instructions.

2. If a test fails, follow the instructions to perform a retest or accept the results.

3. When the Full Test is completed, select **Start Case**

    Note! *In case of a patient emergency, the* Full Test *may be bypassed by selecting* **Start Case**. *The general message* **Please Do Checkout** *is displayed if a Full Test or all of the individual tests are not completed with passing results within 24 hours.*
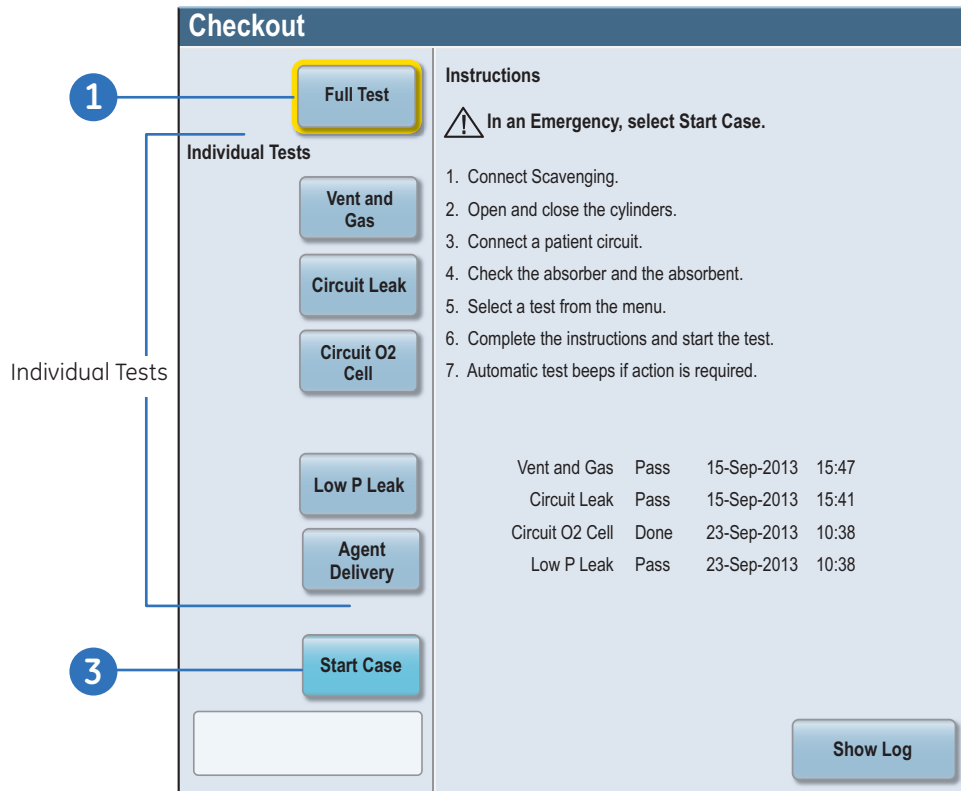
Figure 10.1 Checkout Menu

Tests Performed During a Full Test

- **Vent and Gas:** The Vent and Gas test checks the agent delivery, airway module, Bag/Vent switch, proper gas supply pressures, ventilation operation and leak, battery and electrical power, circuit compliance and flow control operation. This is a two-step test. To run this test, follow the on-screen instructions. When the test passes, the next test starts.
- **Circuit Leak:** The Circuit Leak test checks the Bag/Vent switch, proper gas supply pressures, airway pressure measurement transducer, APL valve, and manual circuit leak. To run this test, follow the on-screen instructions. When the test passes, the next test starts.
- **Circuit O_2 Cell:** If the circuit O_2 cell is present, the Circuit O_2 Cell test measures the O_2 percent. To run this test, follow the on-screen instructions. Do not select **Done** when 21 is first displayed. Allow the reading to stabilize, then select **Done**. Calibrate the O_2 cell if necessary.
- ***External Gas Monitor:*** When enabled by the Super User, the External Gas Monitor reminder occurs. This is not a test. This is a reminder to connect a respiratory gas monitor.

Individual Tests

Individual tests allow the user to perform any combination of single tests as opposed to performing a Full Test. These tests are helpful if there is a specific problem/alarm and the user wishes to test only that portion of the system. The Full Test or all of the individual tests must be completed with passing results at least once within every 24-hour period.

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

Low P Leak

The Low P Leak test is an individual test that is not performed as part of the Full Test. The positive pressure Low P Leak test measures machine leaks before the breathing system, between the common gas outlet and the high-pressure pneumatics and includes the gas mixer and vaporizer. It measures low-pressure pneumatic leaks with a pass or fail limit of 50 ml.

11 Assembly and Cleaning

Aisys CS² Assembly and Cleaning Objectives

After completing this section, the participant will be able to:

- Remove and replace the breathing system
- Remove and replace the flow sensor module
- Remove and replace the flow sensors
- Remove and replace the breathing circuit module
- Disassemble and assemble the bellows assembly
- Remove and replace the exhalation valve assembly
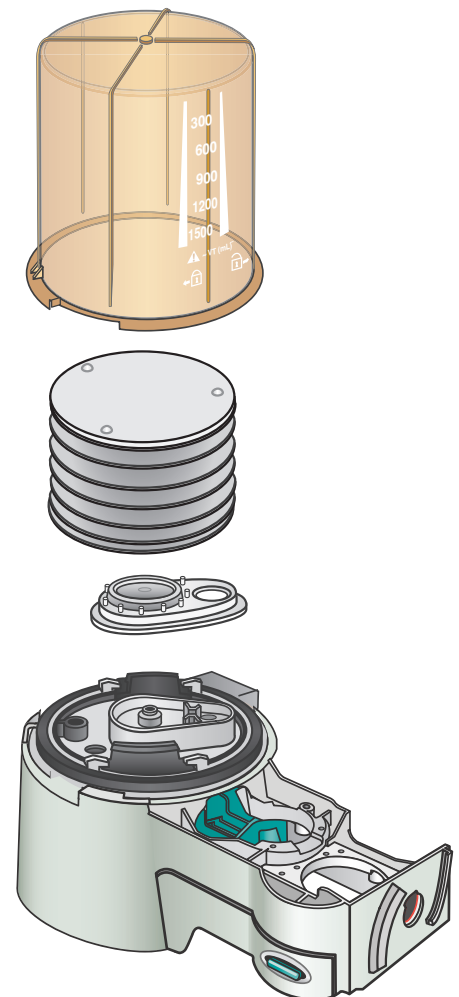
Advanced Breathing System

Assemble and disassemble the breathing system including the flow sensor module, breathing circuit module, bellows assembly, and exhalation valve assembly after removing the breathing system using the steps bellow.

Remove the Breathing System (page 12 of the *Advanced Breathing System Cleaning and Sterilization User's Reference Manual*)

1. Disconnect the bag hose from the bag hose connector.

2. Hold the absorber canister by the handle and push on the release latch to unlock the canister. Tilt the canister downward to remove it off of the two support pins. For EZchange canisters, slide the canister up and out of the cradle.

3. Push the release button and gently pull the latch handle toward you to release the system.

4. Grasp the rear handle to support the breathing system. Slide the breathing system away from the workstation by pulling it toward you using the latch handle.
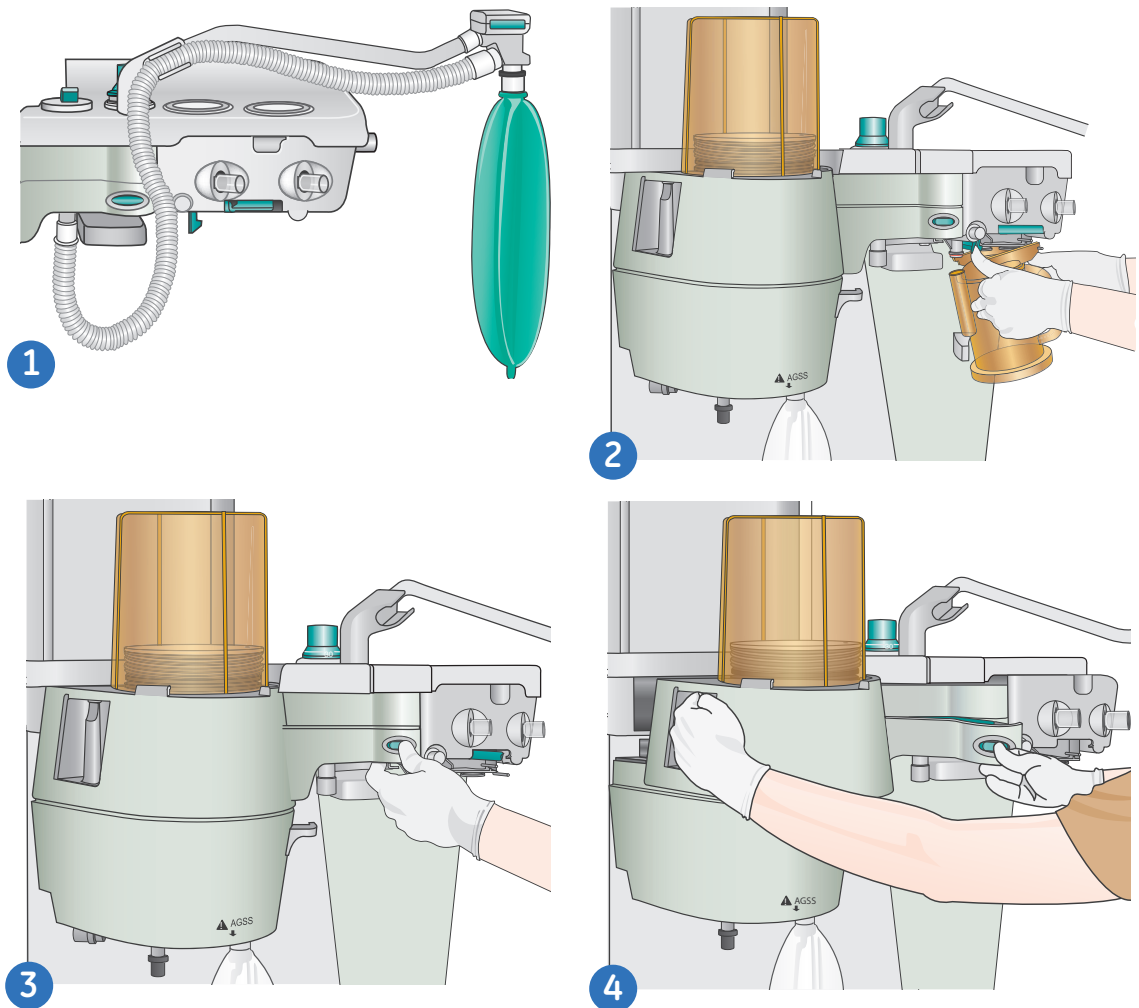
Figure 11.1 Removing the Breathing System

Replace the Breathing System

1. Align the pin openings with the guide pins.

2. Hold the rear handle and the latch handle and slide the breathing system onto the guide pins.

3. Use the grip under the latch handle to push the breathing system in fully until it latches firmly.

4. Install the absorber canister and bag hose.

5. Complete a full machine check to ensure that the breathing system is properly assembled.

> **Note!** *Please refer to the **Advanced Breathing System Cleaning and Sterilization User's Reference Manual** for more information on cleaning and sterilization. Any part labeled with 134 degree Celsius can be autoclaved.*

Guide pins on the bulkhead wall insert into the back of the breathing system
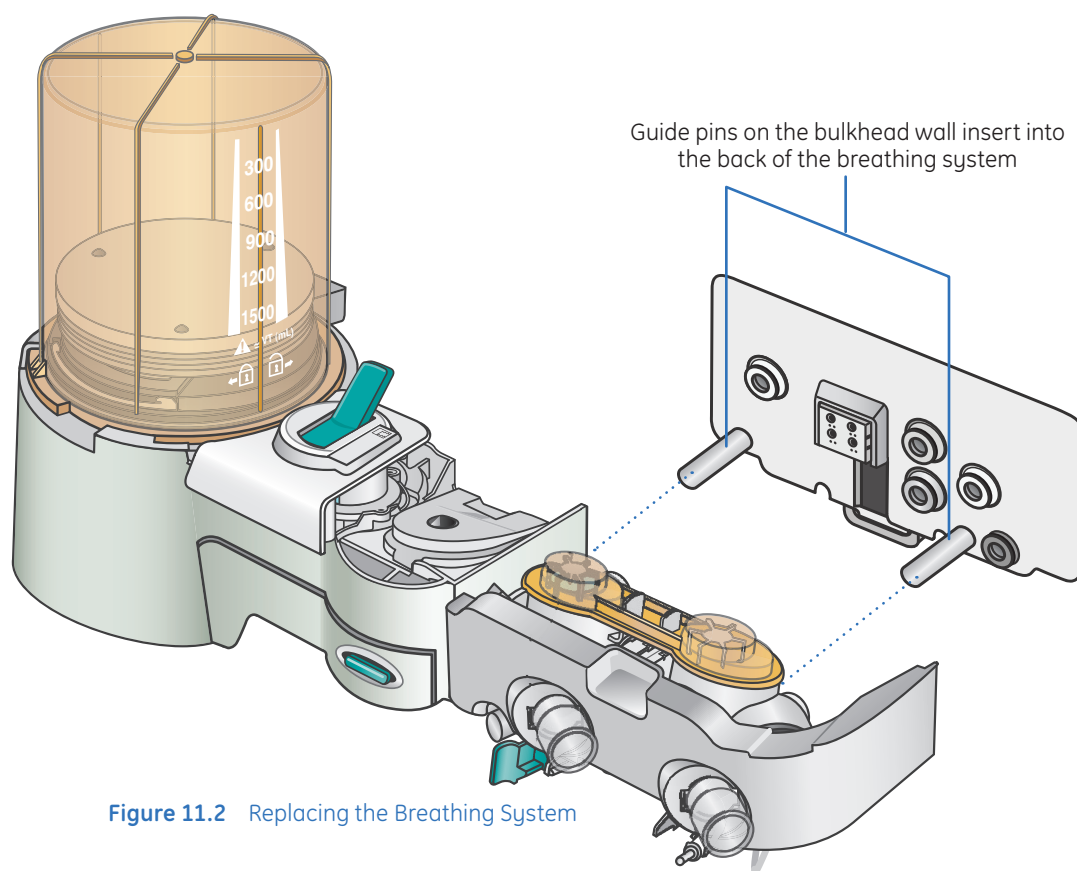
Figure 11.2 Replacing the Breathing System

Flow Sensor Module

Remove the Flow Sensor Module

1. Pull the latch to unlock the flow sensor module.
2. Pull the flow sensor module from the breathing system.
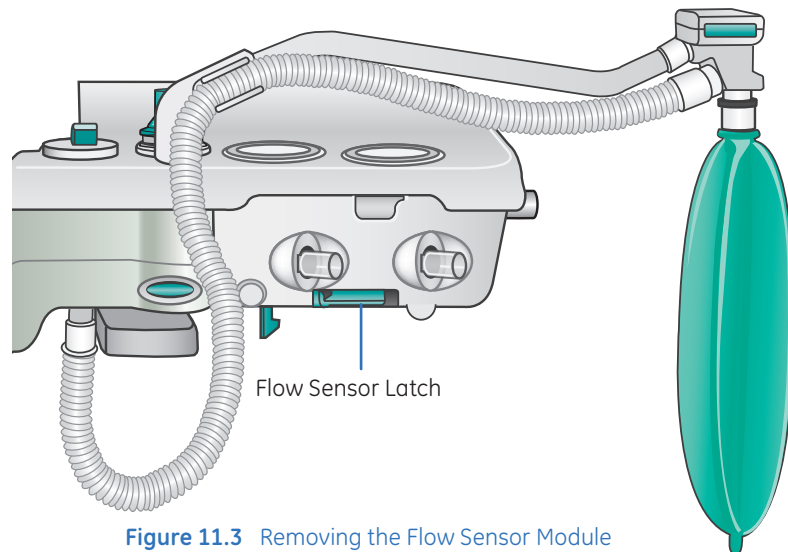
Figure 11.3 Removing the Flow Sensor Module

Remove the Flow Sensors

1. Loosen the thumb screw.
2. Pull off the flow sensor cover from the flow sensor holder.
3. Remove the flow sensor connectors from the flow sensor holder.
4. Pull the flow sensors from the flow sensor holder.
5. Plastic flow sensors cannot be autoclaved and should last a minimum of three months. Metal flow sensors can be autoclaved and should last a minimum of one year. Replace flow sensors as necessary.
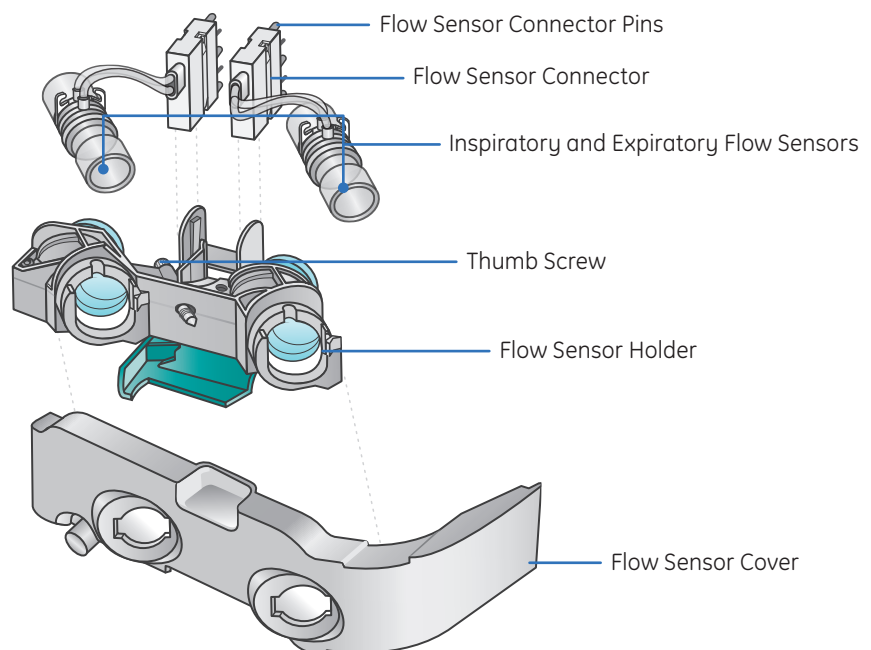
Figure 11.4 Flow Sensor Components

Replace the Flow Sensors

1. Insert the flow sensors into the flow sensor holder with the black-lined tube facing toward the flow sensor holder.

2. Attach the flow sensor connectors to the flow sensor holder.

3. Attach the cover to the flow sensor holder.

4. Tighten the thumbscrew to fasten the cover.

Replace the Flow Sensor Module

1. Attach the flow sensor module to the breathing system. Be sure to align the flow sensor tubes with the grooves in the flow sensor holder.

2. Push the latch closed to lock the flow sensor module into place on the breathing system.

Connector pins in the back of the flow sensor connector insert into the bulkhead wall

Breathing Circuit Module
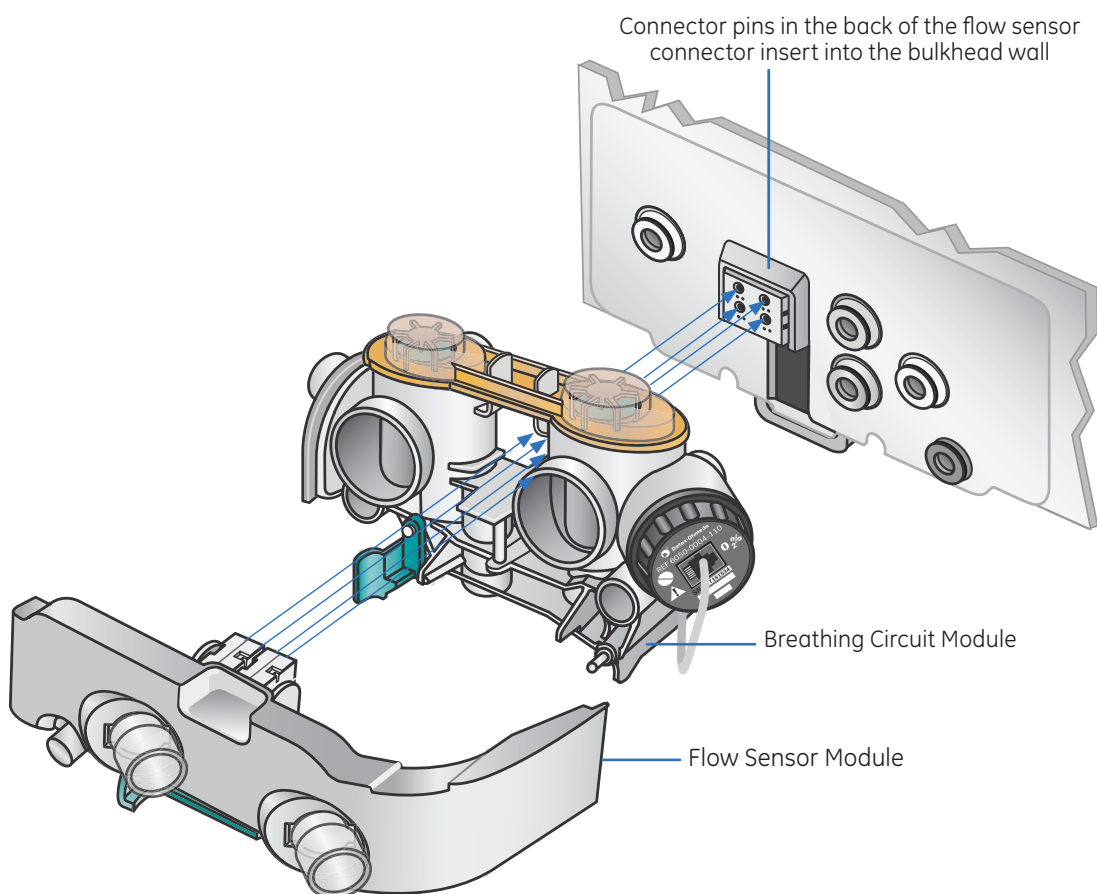
Flow Sensor Module

Figure 11.5   Replacing the Flow Sensors

Breathing Circuit Module

Remove the Breathing Circuit Module

1. If applicable - Remove the O_2 cell cable from the cell. Unscrew the O_2 cell counterclockwise and remove it. Remove the O_2 cell cable by pressing on the connector button while pulling the connector out.

2. Rotate the breathing circuit module counterclockwise. After rotating, pull the breathing circuit module apart from the bellows assembly by lifting up on the breathing circuit module.

3. On the breathing circuit module, remove the check valve lens by squeezing the latches together and pulling up on the lens. Lift out the check valve assemblies.
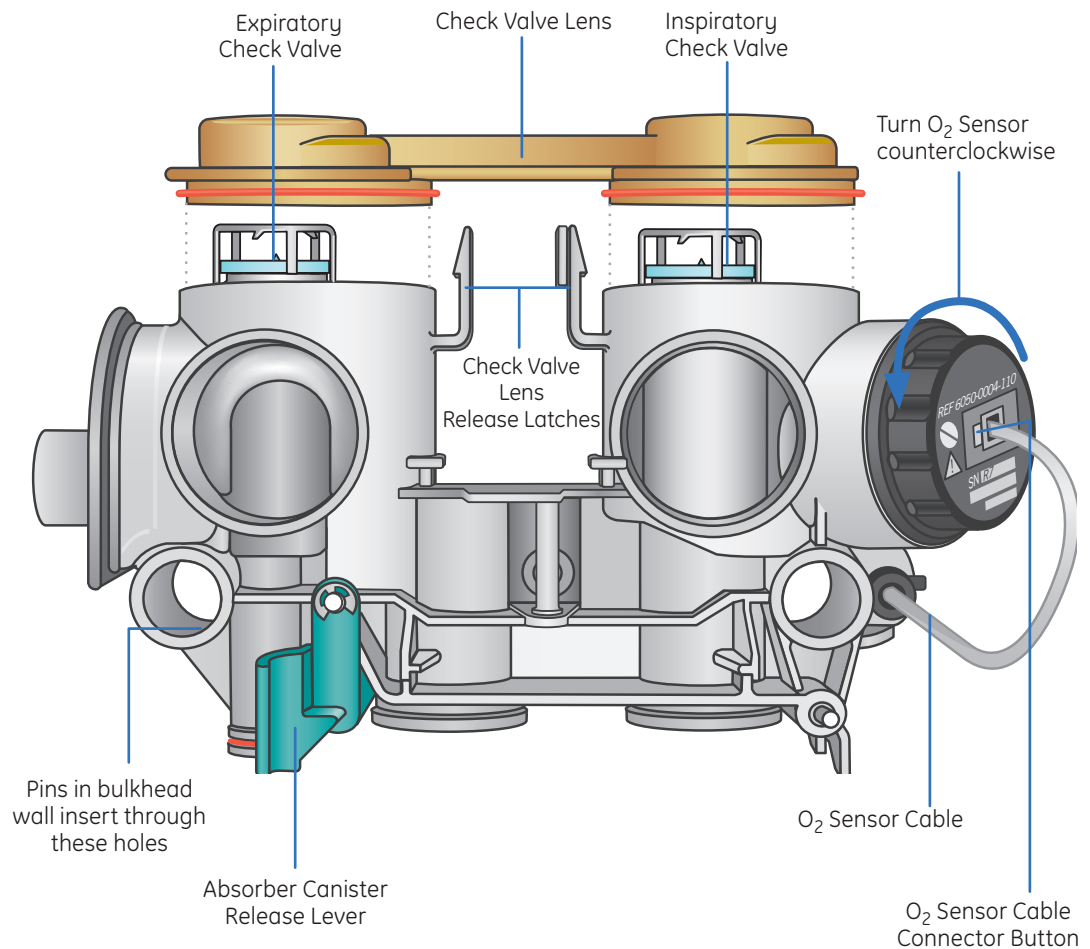
Figure 11.6 Removing the Breathing Circuit Module

Replace the Breathing Circuit Module

1. On the breathing circuit module, replace the check valve assemblies. Push the check valve circuit lens down onto the latches to lock the lens in place.

Check Valve Assembly
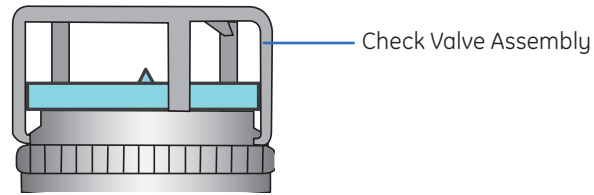
2. Insert the breathing circuit module into the bellows assembly aligned as shown.

3. Rotate the breathing circuit module clockwise at the point shown by the dotted line to attach it to the bellows assembly.

4. If applicable – Replace the cell by screwing it in clockwise. Reconnect the O_2 cell cable.

Pins in bulkhead wall insert through breathing circuit module

Bellows Assembly

Breathing Circuit Module
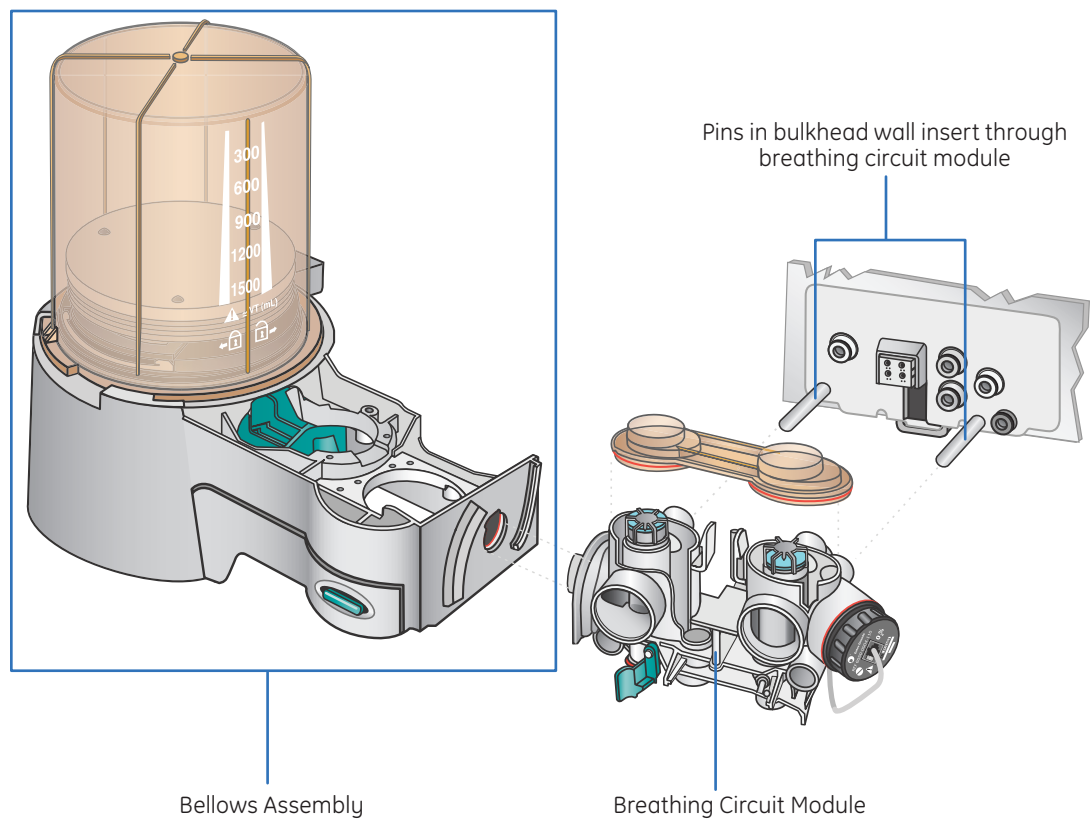
Figure 11.7   Replacing the Breathing Circuit

11 Assembly and Cleaning

Bellows Assembly

Disassemble the Bellows Assembly

1. Turn the bellows housing counterclockwise and lift.
2. Remove the bottom edge of the bellows and lift.
3. Push the two tabs toward the center and remove the rim.
4. Remove the pressure relief valve.
5. Push the latch toward the center and remove the locking tabs.
6. Remove the seal.
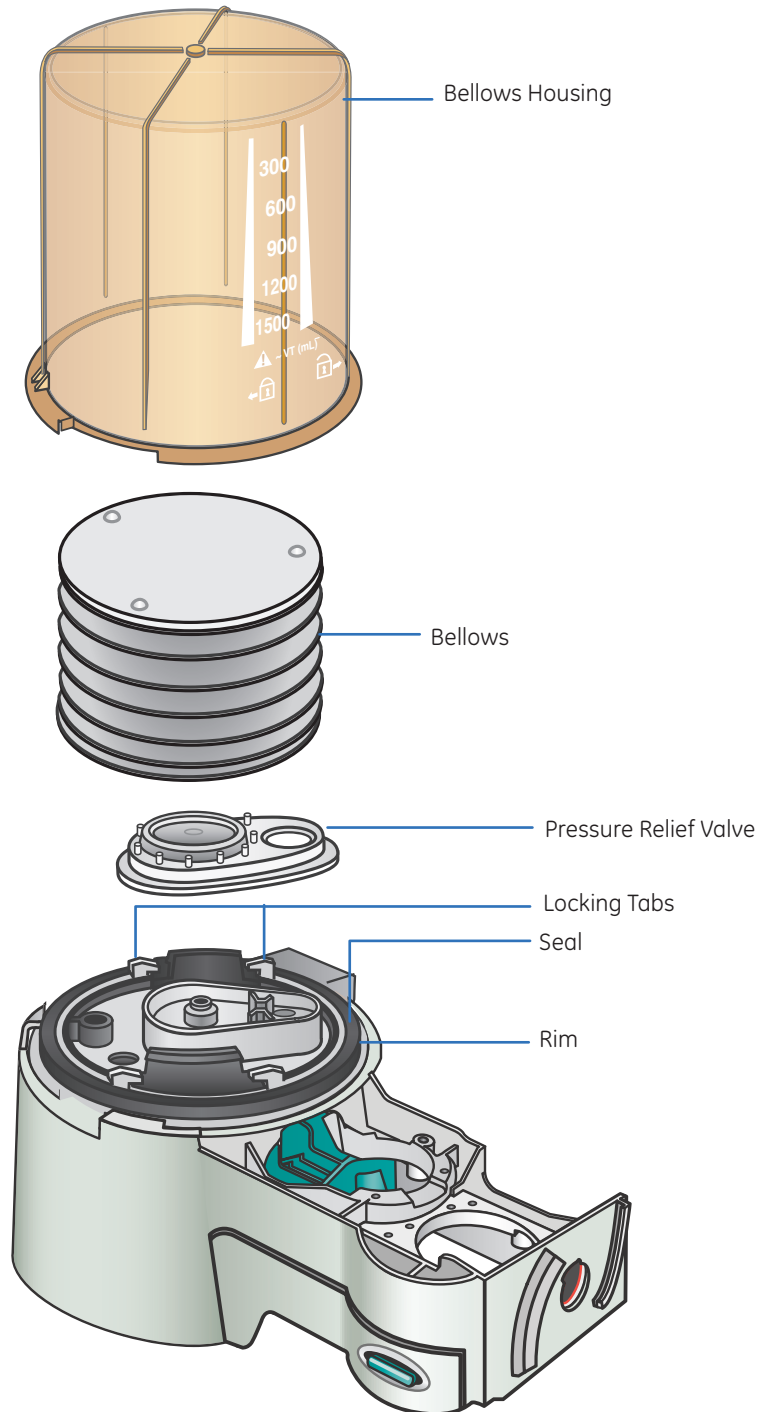
Figure 11.8 Bellows Assembly

Assemble the Bellows Assembly

1. Install the seal and verify the arrow and the groove on the seal point up.

2. Push the latch toward the center and attach the locking tabs.

3. Install the pressure relief valve.

4. Push the two tabs toward the center and install the rim. A click should be heard when the rim is installed.

5. Attach the bottom edge of the bellows to the rim. Verify that the bottom ring of the bellows is fitted over the rim.

6. Lower the bellows housing and turn it clockwise to lock. Verify housing is secure.
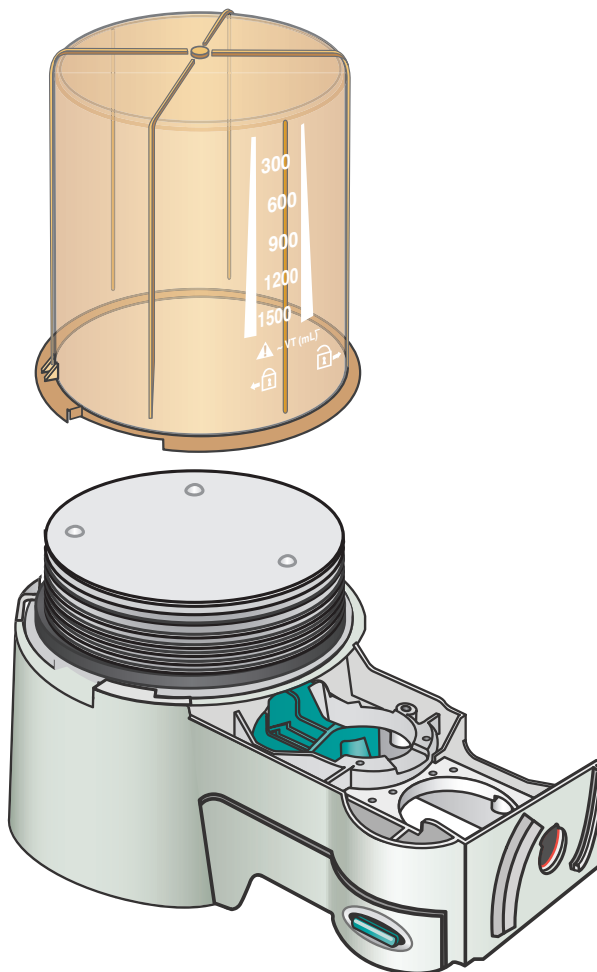
Figure 11.9 Bellows Assembly and Canister

Bellows assembly test (Verify the bellows is assembled correctly):

Your class instructor will demonstrate the proper method for testing the Bellows Assembly. You may also refer to the *Advanced Breathing System Cleaning and Sterilization User's Reference Manual, page 21*.

Exhalation Valve

Remove the Exhalation Valve Assembly

1. With the breathing system removed, the exhalation valve assembly can be removed.

2. Loosen the thumbscrews and lift the assembly off.

Replace the Exhalation Valve Assembly

1. Replace the exhalation valve assembly and tighten the thumbscrews.
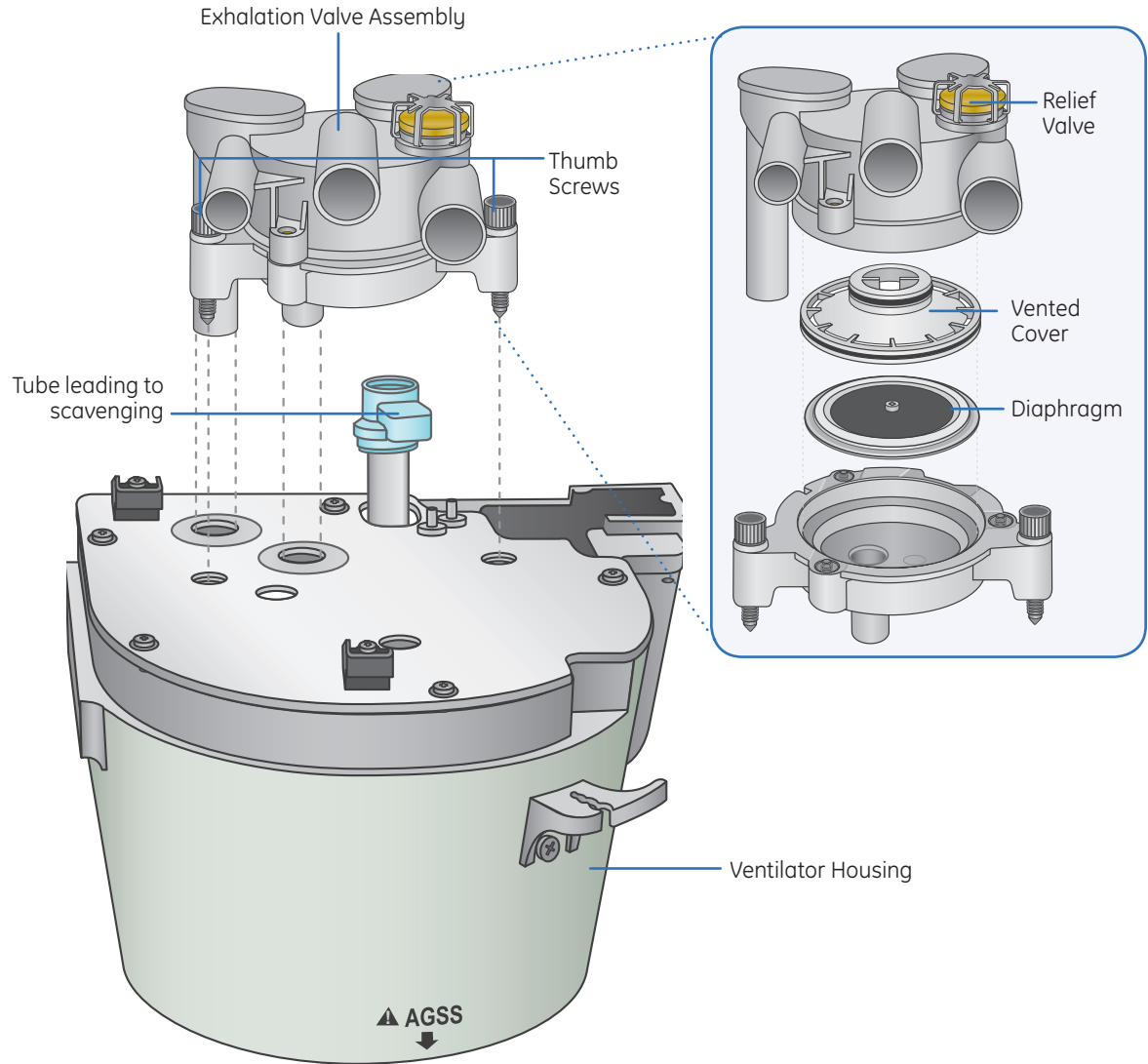
Figure 11.10 Exhalation Valve

12 Resources

Aisys CS² User Operational Maintenance Schedule

12.1

Activity	Frequency	User Manual Page
Full Anesthesia Machine Checkout	**Daily**	4-2
Flow Sensor Calibration	**Daily**	4-2
Flow Sensor Replacement	**PRN:** Lasts a minimum of 3 months	9-4
Inspect and Clean Fan Filters	**PRN:** Display and airway module	9-4
Suction Overflow Trap	**PRN**	9-4
Empty Condenser Reservoir	**Daily**	9-4
Change Absorbent Canister	**PRN:** Immediately if color has changed	8-6, 9-4
GE / Datex-Ohmeda Gas Module		
Gas Calibration	Every six months or every two months with heavy usage.	9-4
Black D-Fend	Replace the D-Fend water trap at least every two months or when a ***Sample line blocked*** or ***Replace D-Fend*** alarm persists.	7-10

Aisys CS² Anesthesia Supplies and Accessories

Part Number	Description
Flow Sensor Supplies	
1503-3858-000	Flow sensor, disposable (plastic)
1503-3244-000	Flow sensor, autoclavable (metal)
1407-7001-000	Flow sensor module (does not include flow sensors)
Absorber Canister Supplies	
1407-7004-000	Multi absorber, reusable (includes 40 pack of foam; does not include absorbent)
1009-8240-000	Cover assembly, CO_2 canister
1407-3201-000	Foam, CO_2 canister (pack of 40)
1407-3204-000	O-ring
1407-3200-000	Canister, CO_2 with handle
8003138	Multi absorber, disposable, white to violet (pack of 6)
Breathing System Supplies	
8004515	Reusable, hytrel patient tubing 36" (for use on bag arm)
8004459	ABS Bag arm connector elbow (for use on bag arm)
8004454	Manual 3L vent bag arm hose and elbow, disposable (pack of 20)
1503-3857-000	O_2 sensor plug
8004460	3L Scavenging Bag, Reusable
M1210946	Test plug (for low pressure leak test)
Vaporizer Supplies	
1100-3025-000	Easy Fill Bottle Adapter, Isoflurane
1100-3026-000	Easy Fill Bottle Adapter, Halothane
1100-3027-000	Easy Fill Bottle Adapter, Enflurane
1100-3028-000	Easy Fill Bottle Adapter, Sevoflurane
Airway Module Supplies	
876446	D-Fend Water Trap, black (pack of 10)
8004463	Gas Scavenger line-18cm with Colder fitting
73319	Sample lines (pack of 10)
755571	Calibration Gas (United States)
755583	Calibration Gas (Non-U.S.)
M1006864	Calibration Gas Regulator (United States)
755534	Calibration Gas Regulator (Non-U.S.)

Contact number for supplies issues, questions and orders will be supplied by the clinical trainer in the area below:

_____

Aisys CS² Quick Guide

To Start a Case:	• Ensure that the Bag/Vent switch is set to Bag • Select the **Start Case** function key on the right side of the display • The **Case Defaults** selection shows the first preset case type • Verify or change the **Case Defaults** selected • Verify or change the **Volume Apnea Alarm, CO2 Alarms, Age,** and **Ideal Weight** settings • To change ventilation mode, select the **Mode** quick key at the bottom of the display. Make the change. To change the ventilation settings, select a ventilator quick key or **More Settings**. Make the change. • To change alarm settings, select the **Alarm Setup** function key on the right side of the display. Make the change. • To change the gas settings or the circuit type, select the **Gas Setup** quick key at the bottom of the display. Make the change. • From the Start Case menu, select **Start Case Now** and gas flow will start.
To Change to Vent Modes:	• Select the **Mode** quick key at the bottom of the display • From the Vent Mode menu, select the desired ventilation mode • To change the ventilation settings, select **More Settings** from the Vent Mode menu or use the ventilator quick keys at the bottom of the display. • Set and confirm the primary ventilation setting to activate the ventilation mode
To switch between N_2O and Air during a Case:	• Select the **Gas Setup** quick key at the bottom of the display • Select **Other Gas** • Select the balance gas to use with O_2
To Turn CO_2 alarms off:	• Select the **Alarm Setup** function key on the right side of the display • Set CO_2 Alarms to **Off** • **CO_2 Alarms Off** appears in the general message field. The CO_2 alarm limit waveform numerics shows dashes during a case. • The alarms remain disabled until the Bag/Vent switch is set to Vent, the case is ended, or the CO_2 Alarms is set to **On**. • Select **Close**. **Note!** *The **CO_2 Alarms** selection is also available from the Start Case menu when starting a case.*
To turn off the Volume Apnea alarm during a MAC case:	• Select the **Alarm Setup** function key on the right side of the display • To turn the volume apnea alarms off, select **Vol Apnea Alarm** to **Off**. • **Volume Apnea Off** appears in the general message field. • If mechanical ventilation is started, the volume apnea alarms are active. • If manual ventilation is restarted, a pop-up confirmation window appears to resume the Off setting. **Note!** *The ability to turn off the Volume Apnea alarm is only available if it has been enabled for the facility by the Super User. The Vol Apnea selection is also available from the Start Case menu when starting a case.*

Quick Guide *Continued*

To Turn the MV/TV Alarms off:	• Select the ***Alarm Setup*** function key on the right side of the display • Under the Primary Limits tab, set ***MV/TV Alarms*** to ***Off*** • ***MV/TV Alarms Off*** appears in the general message field. The volume alarm limits waveform numerics shows dashes during a case. • Select ***Close***
To switch between Adult and Pedi sensor type when using the spirometry adapter:	• Select the ***Spirometry*** function key on the right side of the display • Select ***Setup Loops > Patient and Sensor*** and then select ***Adult*** or ***Pedi*** • Select ***Back*** to view changes made and access other functions of the Spirometry menu.
To change the data source when using the spirometry adapter:	• Select the ***Spirometry*** function key on the right side of the display • Select ***Data Source*** • Select ***Patient*** to have spirometry data sourced from the airway module or ***Vent*** to have spirometry data sourced from the ventilator • Select ***Back*** to view changes made and access other functions of the Spirometry menu
To switch between individual gas flow style and O₂% style:	• Select the ***System Setup*** function key on the right side of the display • Select ***Screen Setup > More Settings > Fresh Gas Controls*** • When ***Flow*** is selected, balance gas and the O_2% are controlled individually using the gas quick keys • When ***O₂%*** is selected, balance gas adjusts automatically when either the O_2% or the Total Flow is changed using the gas quick keys. • Select ***Close*** **Note:** *The ability to switch between the two styles is only available if it has been enabled for the facility by the Super User.*
To turn off gas flows and silence alarms at the end of the case:	• Set the Bag/Vent switch to Bag • Select the ***End Case*** function key on the right side of the display • Select ***End Case Now*** on the menu to put the system in standby. The End Case menu shows the gas and agent usage for the case.

Aisys CS² Troubleshooting Guide

Taken from: **pages 7-4 through 7-11 of the User's Reference Manual.**

Message	Cause	Action/Concern
Apnea >120 s	Apnea time exceeds 120 seconds.	Check for leaks or blockages in the breathing circuit. Ensure the Bag/Vent switch is in the Vent position. Check the patient.
Check D-Fend	Water trap not attached.	Check that the water trap is properly attached to the airway module.
Check flow sensors	System has detected an improper flow pattern in the breathing circuit.	Ensure the flow sensors are connected correctly.
Circuit leak	Vent TVexp is less than half of vent TVinsp for at least 30 seconds.	Check for leaks in the patient circuit. Calibrate flow sensors. If problem persists, replace flow sensors.
FiCO2 high. Absorbent OK?	High $FiCO_2$ is greater than alarm limit.	Check if absorbent needs to be changed.
No exp flow sensor No insp flow sensor	Electrical signals show the flow sensor is not connected.	Connect the flow sensor. Replace the flow sensor if necessary.
No fresh gas flow!	Possible patient detected while system is in checkout state.	Disconnect the patient or start the case.
PEEP high. Blockage?	High Paw greater than or equal to sustained limit for 15 seconds.	Check for blockages in the patient circuit.
Plug in power cable. On battery.	The mains supply is not connected or has failed and the system is using battery power.	Ventilate manually to save power. Make sure the power cable is plugged in and system breaker is on.
Replace D-Fend	Buildup in airway module sample line.	Replace D-Fend.
Replace exp flow sensor Replace insp flow sensor	EPROM calibration data read failure.	Replace the expiratory or inspiratory flow sensor.
Reverse exp flow. Check valves OK?	Flow toward the patient seen in the expiratory flow sensor during inspiration for six breaths in a row.	Calibrate the flow sensors.
Turn power Off and On for self tests	System has been operating for longer than 12 hours without a power-up self test.	Turn power off and back on between cases to perform a self test.
TV not achieved	Measured tidal volume is less than set tidal volume.	Check for leaks in the patient circuit. Check for leaks in the breathing system.
Unable to drive bellows	Bellows is collapsed.	Check the drive gas. Increase fresh gas flow (or push the O_2 flush button) to fill the bellows.
Vol vent only. No PEEP or PSV.	Manifold pressure error. Pressure Control unavailable. Medium priority alarm when Bag/Vent switch is in Vent and running PCV, PSVPro, SIMV-PC, CPAP/PSV, or PCV-VG mode.	Use volume control ventilation mode. Shut down the system as soon as possible and contact an authorized service representative

12 Resources

13   Clinical Training Documents

Aisys CS² Clinical Training Checklist

The following topics will be presented.

The purpose of this document is to verify that the following items are covered during your Aisys CS² training. You should be prepared to operate the Aisys CS² by the end of the training time. If you still believe that you are not prepared, please talk to your trainer or your manager. Please refer to the Aisys CS² User's Reference Manuals for complete instructions on the operation of the Aisys CS².

Introduction to the Aisys CS²

Place a checkmark next to topics discussed.

☐ Overview

- System and display components
- System power and battery back-up power
- O_2 information sources
- O_2 flush
- Alternate O_2 control
- Scavenging

☐ Screen Navigation

- Positioning the display
- Identifying display areas and touch points
- Using Menus, the ComWheel and Quick Keys

☐ Vaporization

- Filling the Aladin2 cassettes
- Removing and replacing the Aladin2 cassettes

☐ Advanced Breathing System

- Bag/Vent switch
- APL valve
- Changing CO_2 absorber canister
- Draining condenser
- Zeroing flow sensors and preventing moisture buildup

Continued

Clinical Training Checklist *Continued*

☐ Operation

- Start and End Case procedures
- Minimum Alveolar Concentration
- Changing vent modes and settings
- System Setup
- Fresh Gas Controls
- ecoFLOW
- Alarm management
- Trends

☐ Ventilation Modes

- VCV
- PCV
- PCV-VG
- SIMV VCV
- SIMV PCV
- SIMV PCV-VG
- PSV Pro
- CPAP + PSV

☐ Spirometry

- Setting loop type and scaling
- Spirometry setup
- Storing and erasing loops

☐ Procedures

- Pause Gas Flow
- Cardiac Bypass
- Vital Capacity
- Cycling

☐ System Checkout

- Checkout menu
- Complete full test

☐ Maintenance and troubleshooting

☐ Hands-on exercises

☐ Clinical skills checklist - see attached

☐ Training quiz

☐ Evaluation

Aisys CS² Clinical Skills Checklist

To help ensure safe operation of the Aisys CS², you must be able to perform the following functions:

Place a checkmark next to topics completed.

☐ Calibrate (remove and replace) the flow sensor module.

☐ Remove and replace the CO_2 absorber canister.

☐ Bypass the machine check out and start an emergency case.

☐ Perform a complete electronic machine check.
- Full test
- Circuit leak
- Low-pressure leak

☐ Start a case from the machine in Standby.

☐ Change gases between air and nitrous oxide.

☐ Fill and change a an Aladin2 cassette.

☐ Adjust agent concentration.

☐ Change ventilation modes.

☐ Change ventilation settings.

☐ Set and adjust alarm limits and alarm volume.

☐ End a case to stop gas flow and end the patient alarms.

☐ Remove and replace the D-fend and attached gas sample line.

☐ Manually activate the alternate O_2 source and regulate O_2 flow (the procedure used during an emergency or failure).

☐ Turn suction on to maximum, and then change to regulated suction and adjust suction pressure.

☐ Utilize Pause Gas Flow, Cardiac Bypass, Vital Capacity and Cycling from the Procedures menu.

☐ Save and view a loop from the Spirometry menu.

☐ **I have been trained and am able to complete all of the above named skills.**

Print Name:_____   Date:_____

Signature:_____

Aisys CS² Clinical Training Quiz

After completion of the test, compare your answers to the answer key. Ask the instructor to explain any answers you do not understand.

Circle the correct answer.

1. Which display component is used to select/change a menu item or to confirm a setting?
    a. Home Key
    b. ComWheel
    c. Start/End Case Key
    d. Audio Pause Key

2. Which feature of the system activates automatically in the case of certain failures or errors and can also be activated manually?
    a. Alternate O2 Control
    b. O2 Flush
    c. Galvanic Cell
    d. ACGO

3. Which type of scavenge system uses a visual indicator bag?
    a. Active AGSS with flow indicator
    b. Passive AGSS
    c. Active adjustable flow
    d. ACGO

4. What is the maximum number of waveform fields that can be shown on the normal screen view?
    a. 1
    b. 2
    c. 3
    d. 4

5. How many vaporizers can be turned on and operating at the same time?
    a. 1
    b. 2
    c. 3
    d. 4

6. Which component of the system would you use to change from manual ventilation mode to mechanical ventilation mode?
    a. APL valve
    b. ACGO switch
    c. EZchange lever
    d. Bag/Vent switch

7. Patient gas moves from the rebreathing bag to the breathing system through which component?
    a. Bag hose
    b. Bag arm
    c. AGSS
    d. Bellows assembly

8. What does the EZchange mode enable you to do?
   a. Switch from VCV to PCV with one key press
   b. Change from passive to active scavenging systems
   c. Change power input from 120 volts to 220 volts
   d. Seal the breathing system when changing absorber canisters

9. How often should the flow sensors be calibrated?
   a. Every day
   b. Every week
   c. Every month
   d. Every year

10. Which menu is used to set the case default, enter patient age and ideal weight and start the gas flow?
   a. Gas Setup
   b. System Setup
   c. Screen Setup
   d. Start Case

11. Which quick key would you press to change from Volume Control Ventilation to Pressure Control Ventilation?
   a. Mode
   b. System Setup
   c. Start Case
   d. Spirometry

12. Which quick key would you press to change from Air to N_2O as a balance gas?
   a. Mode
   b. System Setup
   c. Start Case
   d. Gas Setup

13. Which menu would you use to change a waveform field from airway pressure to flow?
   a. Start Case
   b. Gas Setup
   c. Screen Setup
   d. Scales

14. Which option provides a split screen view that shows the approximate minimum O_2 flow to maintain a preset FiO_2 value and also shows the approximate agent used per hour?
   a. ecoFLOW
   b. Alternate O_2 Control
   c. EZchange
   d. Fresh Gas Controls

15. To stop the audible tone of an active alarm for 120 seconds, you would press which function key?

    a. Alarm Setup

    b. System Setup

    c. Procedures

    d. Audio Pause

16. Which function key would you press to turn off the MV/TV alarm?

    a. Alarm Setup

    b. System Setup

    c. Procedures

    d. Audio Pause

17. In this mode of ventilation, a tidal volume is set and the ventilator will adjust the inspiratory pressure needed to deliver the set tidal volume breath-by-breath so that the lowest pressure is used.

    a. Pressure control

    b. Synchronized intermittent mandatory ventilation with volume control

    c. Synchronized intermittent mandatory ventilation with pressure control ventilation

    d. Pressure control ventilation with volume guaranteed

18. With this procedure, a pressure breath is delivered for a set time, which provides a simple way to deliver one pressure breathing during mechanical ventilation without making multiple ventilator settings changes.

    a. Pause Gas Flow

    b. Cardiac Bypass

    c. Vital Capacity

    d. Cycling

19. How often should a full test checkout be performed?

    a. At least once within every 24-hour period

    b. Once a week

    c. Once a month

    d. Every six months

20. If a condenser is in use, how often should it be drained?

    a. Every six months

    b. Once a month

    c. Once a week

    d. Daily

Clinical Training Quiz Answer Sheet

(A)

1. Which display component is used to select/change a menu item or to confirm a setting?
   b. ComWheel

2. Which feature of the system activates automatically in the case of certain failures or errors and can also be activated manually?
   a. Alternate O_2 Control

3. Which type of scavenge system uses a visual indicator bag?
   c. Active adjustable flow

4. What is the maximum number of waveform fields that can be shown on the normal screen view?
   c. 3

5. How many vaporizers can be turned on and operating at the same time?
   a. 1

6. Which component of the system would you use to change from manual ventilation mode to mechanical ventilation mode?
   d. Bag/Vent switch

7. Patient gas moves from the rebreathing bag to the breathing system through which component?
   a. Bag hose

8. What does the EZchange mode enable you to do?
   d. Seal the breathing system when changing absorber canisters

9. How often should the flow sensors be calibrated?
   a. Every day

10. Which menu is used to set the case default, enter patient age and ideal weight and start the gas flow?
    d. Start Case

11. Which quick key would you press to change from Volume Control Ventilation to Pressure Control Ventilation?
    a. Mode

12. Which quick key would you press to change from Air to N2O as a balance gas?
    d. Gas Setup

13. Which menu would you use to change a waveform field from airway pressure to flow?
    c. Screen Setup

14. Which option provides a split screen view that shows the approximate minimum O_2 flow to maintain a preset FiO_2 value and also shows the approximate agent used per hour?
    a. ecoFLOW

15. To stop the audible tone of an active alarm for 120 seconds, you would press which function key?

d. Audio Pause

16. Which function key would you press to turn off the MV/TV alarm?

a. Alarm Setup

17. In this mode of ventilation, a tidal volume is set and the ventilator will adjust the inspiratory pressure needed to deliver the set tidal volume breath-by-breath so that the lowest pressure is used.

d. Pressure control ventilation with volume guaranteed

18. With this procedure, a pressure breath is delivered for a set time, which provides a simple way to deliver one pressure breathing during mechanical ventilation without making multiple ventilator settings changes.

c. Vital Capacity

19. How often should a full test checkout be performed?

a. At least once within every 24-hour period

20. If a condenser is in use, how often should it be drained?

d. Daily

14 Non-clinical Training Documents

Aisys CS² Non-clinical Training Checklist

The following topics will be presented.

The purpose of this document is to verify that the following items are covered during your Aisys CS² training. You should be prepared to operate the Aisys CS² by the end of the training time. If you still believe that you are not prepared, please talk to your trainer or your manager. Please refer to the Aisys CS² User's Reference Manuals for complete instructions on the operation of the Aisys CS².

Introduction to the Aisys CS²

Place a check mark next to topics discussed.

☐ Overview

- System and display components
- System power and battery back-up power
- O_2 information sources
- O_2 flush
- Scavenging

☐ Screen Navigation

- Positioning the display
- Identifying display areas and touch points
- Using Menus, the ComWheel and Quick Keys

☐ Vaporization

- Filling the Aladin2 cassettes
- Removing and replacing the Aladin2 cassettes

☐ Advanced Breathing System

- Bag/Vent switch
- APL valve
- Changing CO_2 absorber canister
- Draining condenser
- Zeroing flow sensors and preventing moisture buildup

Non-clinical Training Checklist *Continued*

☐ Operation

- Start and End Case procedures

☐ System Checkout

- Checkout menu
- Complete full test

☐ Maintenance and troubleshooting

☐ Hands-on exercises

☐ Clinical skills checklist - see attached

☐ Training quiz

☐ Evaluation

Aisys CS² Non-clinical Skills Checklist

To help ensure safe operation of the Aisys CS², you must be able to perform the following functions:

Place a checkmark next to topics completed.

☐ Calibrate (remove and replace) the flow sensor module.

☐ Remove and replace the CO_2 absorber canister.

☐ Adjust the scavenging.

☐ Bypass the machine check out and start an emergency case.

☐ Perform a complete electronic machine check.

- Full test
- Circuit leak
- Low-pressure leak

☐ Start a case from the machine in Standby.

☐ Change gases between air and nitrous oxide.

☐ Fill and change a an Aladin2 cassette.

☐ End a case to stop gas flow and end the patient alarms.

☐ Remove and replace the D-fend and attached gas sample line.

☐ Manually activate the alternate O_2 source and regulate O_2 flow (the procedure used during an emergency or failure).

☐ Turn suction on to maximum, and then change to regulated suction and adjust suction pressure.

☐ **I have been trained and am able to complete all of the above named skills.**

Print Name:_____ Date:_____

Signature:_____

Aisys CS² Non-clinical Training Quiz

After completion of the test, compare your answers to the answer key. Ask the instructor to explain any answers you do not understand.

Circle the correct answer.

1. Which display component is used to select/change a menu item or to confirm a setting?
   a. Home Key
   b. ComWheel
   c. Start/End Case Key
   d. Audio Pause Key

2. Which feature of the system activates automatically in the case of certain failures or errors and can also be activated manually?
   a. Alternate O2 Control
   b. O2 Flush
   c. Galvanic Cell
   d. ACGO

3. Which type of scavenge system uses a visual indicator bag?
   a. Active AGSS with flow indicator
   b. Passive AGSS
   c. Active adjustable flow
   d. ACGO

4. How many vaporizers can be turned on and operating at the same time?
   a. 1
   b. 2
   c. 3
   d. 4

5. Which component of the system would you use to change from manual ventilation mode to mechanical ventilation mode?
   a. APL valve
   b. ACGO switch
   c. EZchange lever
   d. Bag/Vent switch

6. Patient gas moves from the rebreathing bag to the breathing system through which component?
   a. Bag hose
   b. Bag arm
   c. AGSS
   d. Bellows assembly

7. What does the EZchange mode enable you to do?
   a. Switch from VCV to PCV with one key press
   b. Change from passive to active scavenging systems
   c. Change power input from 120 volts to 220 volts
   d. Seal the breathing system when changing absorber canisters

Aisys CS² Non-clinical Training Quiz *Continued*

8. How often should the flow sensors be calibrated?
    a. Every day
    b. Every week
    c. Every month
    d. Every year

9. Which menu is used to set the case default, enter patient age and ideal weight and start the gas flow?
    a. Gas Setup
    b. System Setup
    c. Screen Setup
    d. Start Case

10. What color alarm is associated with a high priority alarm?
    a. Yellow
    b. Blue
    c. Green
    d. Red

11. To stop the audible tone of an active alarm for 120 seconds, you would press which function key?
    a. Alarm Setup
    b. System Setup
    c. Procedures
    d. Audio Pause

12. How often should a full test checkout be performed?
    a. At least once within every 24-hour period
    b. Once a week
    c. Once a month
    d. Every six months

13. If a condenser is in use, how often should it be drained?
    a. Every six months
    b. Once a month
    c. Once a week
    d. Daily

14. Which menu would you use to stop gas flow and end the patient alarms?
    a. End Case
    b. System Setup
    c. Procedures
    d. Alarm Setup

15. At a minimum, how often should the D-Fend water trap be replaced?
    a. Every two years
    b. Every year
    c. Every six months
    d. Every two months

Aisys CS² Non-clinical Training Quiz Answers

A

1. Which display component is used to select/change a menu item or to confirm a setting?
   b. ComWheel

2. Which feature of the system activates automatically in the case of certain failures or errors and can also be activated manually?
   a. Alternate O$_2$ Control

3. Which type of scavenge system uses a visual indicator bag?
   c. Active adjustable flow

4. How many vaporizers can be turned on and operating at the same time?
   a. 1

5. Which component of the system would you use to change from manual ventilation mode to mechanical ventilation mode?
   d. Bag/Vent switch

6. Patient gas moves from the rebreathing bag to the breathing system through which component?
   a. Bag hose

7. What does the EZchange mode enable you to do?
   d. Seal the breathing system when changing absorber canisters

8. How often should the flow sensors be calibrated?
   a. Every day

9. Which menu is used to set the case default, enter patient age and ideal weight and start the gas flow?
   d. Start Case

10. What color alarm is associated with a high priority alarm?
    d. Red

11. To stop the audible tone of an active alarm for 120 seconds, you would press which function key?
    d. Audio Pause

12. How often should a full test checkout be performed?
    a. At least once within every 24-hour period

13. If a condenser is in use, how often should it be drained?
    d. Daily

14. Which menu would you use to stop gas flow and end the patient alarms?
    a. End Case

15. At a minimum, how often should the D-Fend water trap be replaced?
    d. Every two months

Course Evaluation
Aisys CS²

Course Name:_____Date: _____

Location:_____Instructor:_____

Please complete the following survey. The information you provide will help us to improve the course for future learners.

Rate the training by circling the appropriate number.

Instructor Delivery 10 = Strongly agree 1 = Strongly disagree NA = Not applicable											
The instructor was knowledgeable about the course content.	10	9	8	7	6	5	4	3	2	1	NA
The instructor was able to transfer their knowledge to you.	10	9	8	7	6	5	4	3	2	1	NA
The instructor was prepared for the training session.	10	9	8	7	6	5	4	3	2	1	NA
The instructor was able to effectively present content and respond to questions.	10	9	8	7	6	5	4	3	2	1	NA
Rate the overall effectiveness of the instructor.	10	9	8	7	6	5	4	3	2	1	NA
Comments about instructor delivery:											

Course Content 10 = Strongly agree 1 = Strongly disagree NA = Not applicable											
The relevance of the course content enables you to do your job.	10	9	8	7	6	5	4	3	2	1	NA
The content covered the topics adequately and clearly.	10	9	8	7	6	5	4	3	2	1	NA
The activities/exercises helped you to learn the content presented.	10	9	8	7	6	5	4	3	2	1	NA
The content was easy to follow.	10	9	8	7	6	5	4	3	2	1	NA
The knowledge checks and/or assessments in this course were effective in helping you to validate your existing or acquired knowledge.	10	9	8	7	6	5	4	3	2	1	NA
Rate the overall effectiveness of the course content.											
Comments about course content:											

Course Experience 10 = Strongly agree 1 = Strongly disagree NA = Not applicable											
I would recommend GE Healthcare to a friend or colleague.	10	9	8	7	6	5	4	3	2	1	NA
It is easy to do business with GE Healthcare Services.	10	9	8	7	6	5	4	3	2	1	NA
The on-line course registration process was clear and easy to use.	10	9	8	7	6	5	4	3	2	1	NA
If applicable, Is there anything you would change about the course registration process?											

Any additional comments?

Would you like to be contacted in the future for further inputs on our training development, delivery, and operations processes?

☐ **No**   ☐ **Yes** If yes, please provide your name and email ID here:_____

Healthcare Re-imagined

GE is dedicated to helping you transform healthcare delivery by driving critical breakthroughs in biology and technology. Our expertise in medical imaging and information technologies, medical diagnostics, patient monitoring systems, drug discovery, and biopharmaceutical manufacturing technologies is enabling healthcare professionals around the world to discover new ways to predict, diagnose and treat disease earlier. We call this model of care "Early Health." The goal: to help clinicians detect disease earlier, access more information and intervene earlier with more targeted treatments, so they can help their patients live their lives to the fullest. Re-think, Re-discover, Re-invent, Re-imagine.

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imagination at work