GE Healthcare

iVent201®

Participant Guide

Education Services
Clinical Development

iVent$_{201}$®

Participant Guide

Education Services

Clinical Development

Notice

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.

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

This course is intended for iVent$_{201}$ and iVent$_{201HS}$. The material contained in this course is intended for educational purposes only. Always refer to the official written materials provided with the iVent$_{201}$ 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 ventilation 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

The iVent$_{201}$ training session is designed to give the clinical staff a fundamental knowledge of the clinical aspects and operation of the iVent$_{201}$ ventilator. Using this guide will help ensure that all the essential objectives will be discussed during the training session. Combined with the use of hands on activities, this Participant Guide will also ensure that the end-user has the sufficient knowledge and skills to safely operate the iVent$_{201}$ ventilator.

- **iVent$_{201}$ Overview:** Overview of main components, connecting high and low pressure oxygen sources, connecting a breathing circuit, navigating the menus and using dedicated keys.
- **Preparing for Clinical Use:** Powering up, setting patient weight, performing an OVT, changing a ventilation mode, changing ventilation parameters, and starting the ventilator.
- **Ventilation Modes:** Descriptions for SIMV-Volume Control, Assist-Control Volume Control, SIMV-Pressure Control, Assist-Control Pressure Control, Adaptive Bi-level and CPAP/PSV modes. Pressure alarms, Adaptive Peak Flow and Adaptive I-Time, tidal volume limit and breath type icons.
- **Alarms:** Accessing Alarm Settings window, changing alarm settings, using Auto Settings, changing alarm options, clearing alarms, restoring modes after back-up ventilation is activated, trouble-shooting sensor disconnect alarms and restoring a previous mode after open loop mode is activated.
- **Advanced Settings:** Accessing Advanced Settings window, changing the Sigh Breath setting, enabling and disabling Easy Exhale, changing Oxygen Supply settings, changing Adaptive Peak Flow settings, enabling and disabling the pulse oximetry function, connecting and activating a nebulizer, setting the time and date and restoring default settings.
- **Graphics and Trends**: Displaying and browsing waveforms, changing waveform range, viewing and changing trends, browsing trends, accessing default views, displaying loops, freezing and unfreezing loops, displaying Mechanics, showing the Log Book and accessing the multiple displays.
- **Maintenance:** Calibrating the O_2 system, performing a battery full recharge procedure, performing a VVT, changing the default startup weight and start screen, changing the default FiO_2 settings, accessing the maintenance and accessories chart.
- **MRI:** Properly set up the iVent$_{201}$ for use in the MRI environment, and learn the important reminders when using the iVent$_{201}$ with MRI.

Icons Used in This Manual

Lesson Objective: Appears at the beginning of each chapter, and includes a list of lesson objectives for the subject matter.

Check Your Knowledge: Appears at the end of each chapter, and includes a list of questions regarding the chapter subject matter.

Hands on Activity: Appears at the end of each chapter. Asks the participant to perform specific tasks that pertain to the subject matter of the chapter.

Define: Definitions of terms to you should know appear through out the book.

Answers: Appears at the end of each chapters, and provides answers to Check Your Knowledge.

Note! Represents information which is additive in terms of helping the participant better understand specific tasks, activities and processes.

2 iVent$_{201}$ Overview

Objectives: iVent$_{201}$ Overview

By the end of this chapter you should be able to:

- Describe components on the front of the machine
- Describe components on the rear of the machine
- Describe the purpose of the air inlet filter, the CBRN filter and the bacterial filter, as well as any maintenance requirements
- Properly connect a High Pressure Oxygen source
- Properly connect a Low Pressure Oxygen source
- Properly connect a patient breathing circuit, including an HME if applicable
- Navigate the menus using the control knob
- Activate the silence key and describe its function
- Activate the 100% O_2 key and describe its function
- Activate the manual breath key and describe its function
- Activate the hold key and describe its function
- Activate the clear key and describe its function
- Describe the function of the Alarm, Charge and On LED indicators

iVent$_{201}$ Introduction

The iVent$_{201}$ is a compact, portable, fully-featured, microprocessor-controlled ventilator offering the versatility and capability of larger and costlier ventilators. The iVent$_{201}$ features include:

- A turbine-powered air source and a rechargeable internal battery provide freedom from wall air and power outlets.
- An intuitive turn and click control knob
- Five dedicated quick-choice keys
- The bright, well organized, easy to read screen allow rapid control and continuous real-time monitoring of patient ventilation
- Alarm settings are fully adjustable
- Optional Waveform and Diagnostic Software package displays pressure and flow waveform data, loops, trends, and logged totals in a full array of graphical and numerical modes

The iVent$_{201}$ supports the following modes:

- SIMV–Volume Control
- Assist /Control - Volume Control
- SIMV-Pressure Control
- Assist /Control – Pressure Control
- Adaptive Bi-level
- Continuous Positive Airway Pressure with Pressure Support Ventilation (CPAP/PSV)

In addition, the iVent$_{201}$ has these advanced features:

- Rise time is adjustable
- Preset Parameters by Patient Weight enables quick setup
- Adaptive Peak Flow™ can determine and deliver Inspiratory Peak Flow Rate according to a target mandatory tidal volume, maintaining a 1:2 I:E ratio
- Adaptive I-Time™ allows the ventilator to determine and deliver a respiratory cycle time to sustain a 1:2 I:E ratio
- Easy Exhale™ is an advanced PEEP mode designed to reduce expiratory work of breathing
- Firmware is upgradeable via a PC connection
- The iVent$_{201}$ is designed to operate according to specifications in any physical orientation – such as during transport use

Note! *Certain modes are optional features and may not be operational in some iVent$_{201}$ models.*

Intended Use

The iVent$_{201}$ MR (Magnetic Resonance) Conditional is a portable, computer controlled, electrically powered intensive care ventilator intended to provide continuous or intermittent ventilatory support for the care of individuals who require mechanical ventilation. Specifically, the ventilator is applicable for use with adult through pediatric patients, who require invasive or non-invasive assistance via the following general modes of ventilatory support, as prescribed by an attending physician:

- Assist/Control (Pressure Controlled or Volume Controlled)
- SIMV (Pressure Controlled or Volume Controlled)
- CPAP/PSV

The iVent201 MR Conditional ventilator is suitable for use in the ICU and all other hospital areas, including Magnetic Resonance environment, not to exceed a 3.0 Tesla static magnetic field, in all hospital-type facilities, alternate care sites, transport, emergency and in the home environment. The iVent$_{201}$ MR Conditional ventilator is MR conditional.

The optional non-invasive Pulse Oximeter is intended for non-invasive monitoring of oxygen saturation and pulse rate and is suitable for use in all above mentioned areas, excluding MR environments.

The iVent$_{201}$ MR Conditional ventilator is a restricted medical device intended for use by qualified, trained personnel under the direct supervision of a physician.

iVent$_{201}$ and iVent$_{201HS}$ Front View

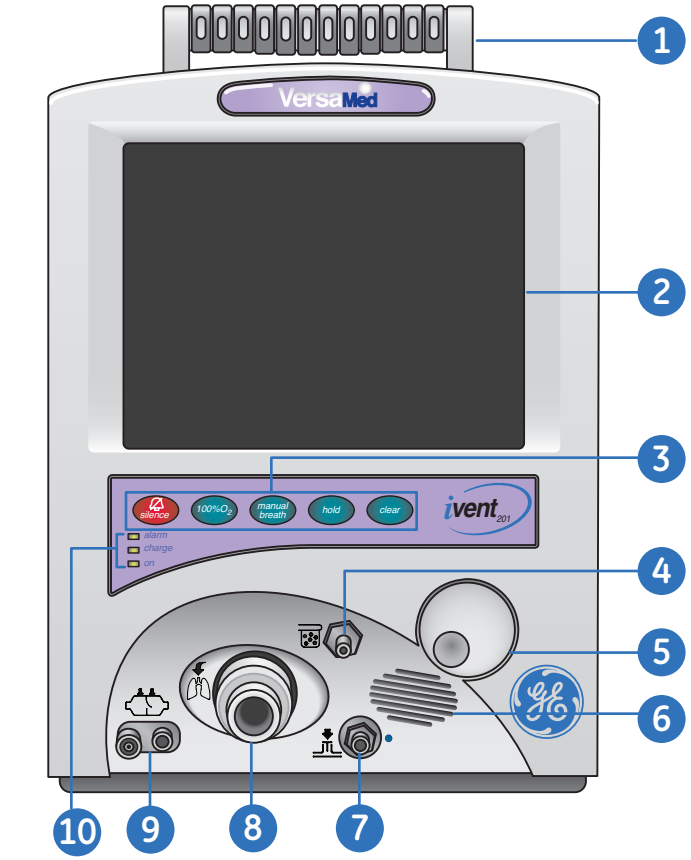


Figure 2.1 iVent$_{201}$ front view

Figure 2.2 iVent$_{201HS}$ front view

Front Components

1. Carrying handle
2. Display
3. Keypad
4. Nebulizer outlet
5. Control knob
6. Speaker
7. Exhalation valve luer inlet
8. Ventilator outlet
9. Sensor line luer inlets
10. LED Indicators

iVent201 and iVent201HS Back View

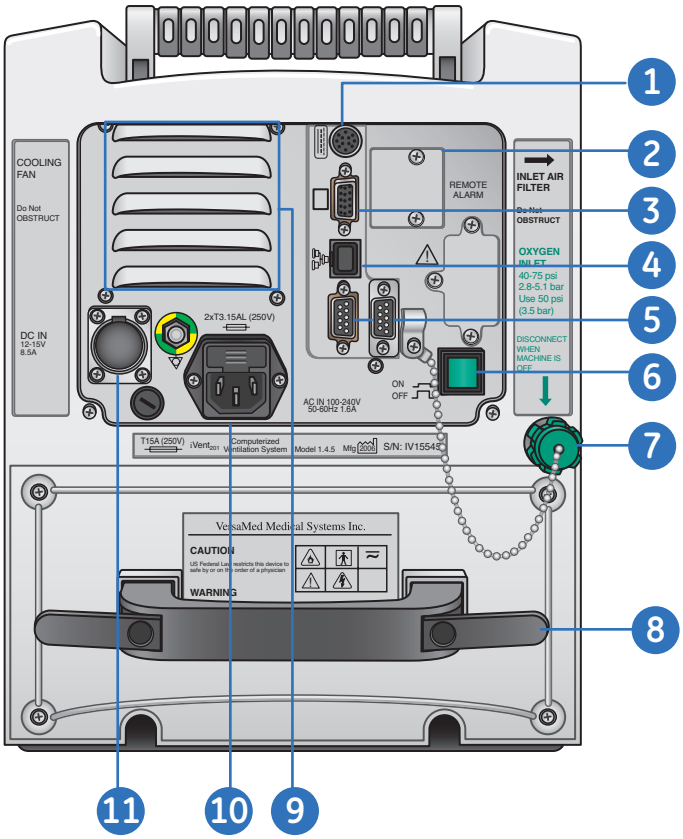


Figure 2.3 iVent201HS Back view

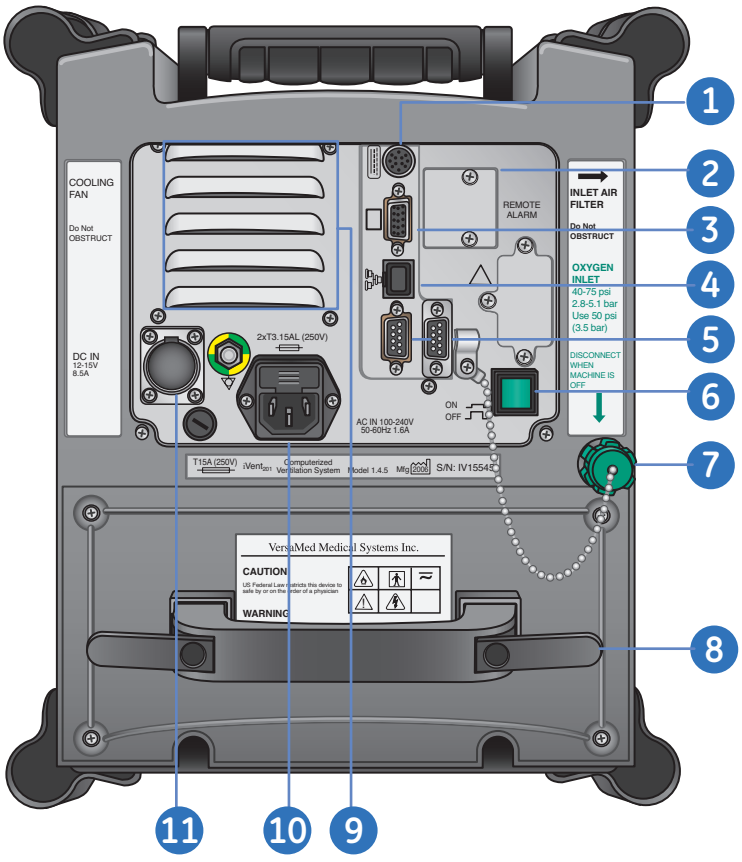


Figure 2.4 iVent201HS Back view

Back Components

1. Keyboard connector
2. Remote alarm connector
3. External screen connector
4. LAN connector
5. RS 232 connectors (COM1 and COM2)
6. On/off switch
7. High pressure oxygen inlet connector
8. Internal battery handle/power cord storage
9. Cooling fan
10. AC cord connector
11. DC cord connector

Filters

The iVent$_{201}$ has a turbine-powered air source that pulls in room air through the air inlet filter, eliminating the need for an external air source. The air inlet filter screens out particulate matter and must be replaced every 500 hours or every thirty days of operating.

An optional configuration enables air to be drawn in through a Chemical, Biological, Radiological, and Nuclear (CBRN) filter.

A user-supplied bacterial filter is recommended on the inspiratory gas outlet to prevent contamination of the patient circuit components. This also prevents bacteria, excessive humidity and liquids from entering the iVent$_{201}$.

Note! *Failure to use an adequate bacterial filter may cause severe damage to internal pressure and flow sensors, which may result in ventilator failure.*

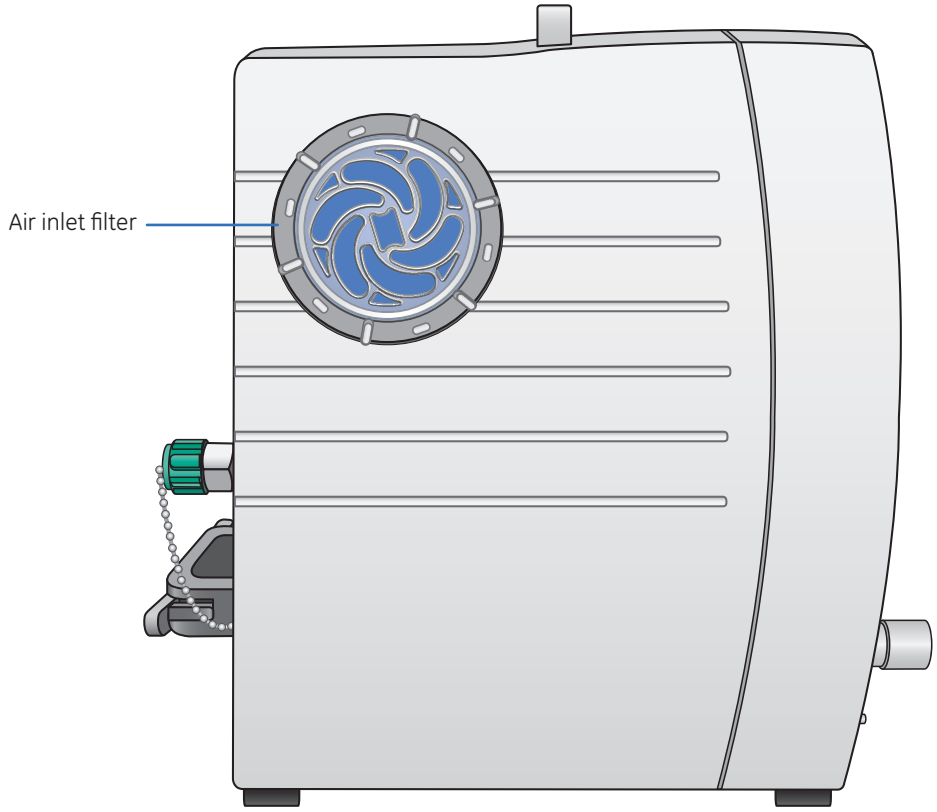


Figure 2.5 Air Inlet Filter

High Pressure Oxygen Supply

If using pressurized oxygen, connect the oxygen supply to the oxygen DISS inlet connector at the back of the ventilator. When the unit is ventilating the measured concentration of delivered oxygen may be viewed on the Alarm Settings window.

When connecting the iVent$_{201}$ to any oxygen supply, you must ensure that the correct type of oxygen source is selected in Advanced Settings. This is covered in detail in the Advanced Settings chapter.

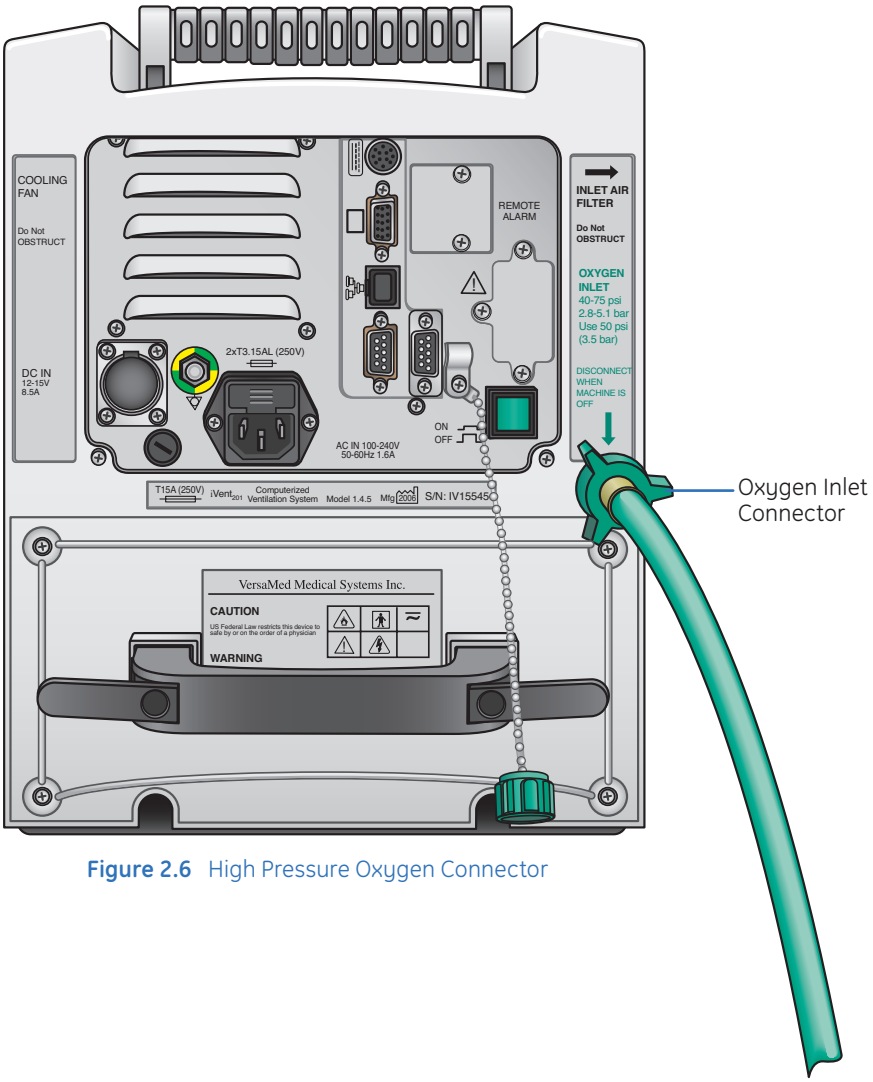


Figure 2.6 High Pressure Oxygen Connector

Low Pressure Oxygen Supply

The iVent$_{201}$ can use medical-grade oxygen from a low-pressure oxygen source such as an oxygen concentrator or flow meter device using the optional Low Pressure Oxygen Enrichment System.

When connecting the iVent$_{201}$ to any oxygen supply, you must ensure that the correct type of oxygen source is selected in Advanced Settings. This is covered in detail in the Advanced Settings chapter.

Connecting a Low Pressure Oxygen Supply

1. The low pressure O_2 supply Adapter requires a low pressure O_2 filter/adapter, fitted with a 22mm female port. Remove the air inlet filter by turning it counterclockwise. Then install the low pressure O_2 filter/adapter with a clockwise turn.
2. You are now ready to connect the Low Pressure O_2 Supply Adapter to the air inlet port of the ventilator.
3. Be sure that Low +M or Low is selected under Oxygen Supply (Pressure) in the Advanced Settings window.

Note! *Do not attempt to use the FiO_2 option above 60% when using a low pressure oxygen supply.*

*When not using a low pressure O_2 supply, the Low Pressure O_2 Filter must **NOT** be used, as the 22mm port could easily be blocked.*

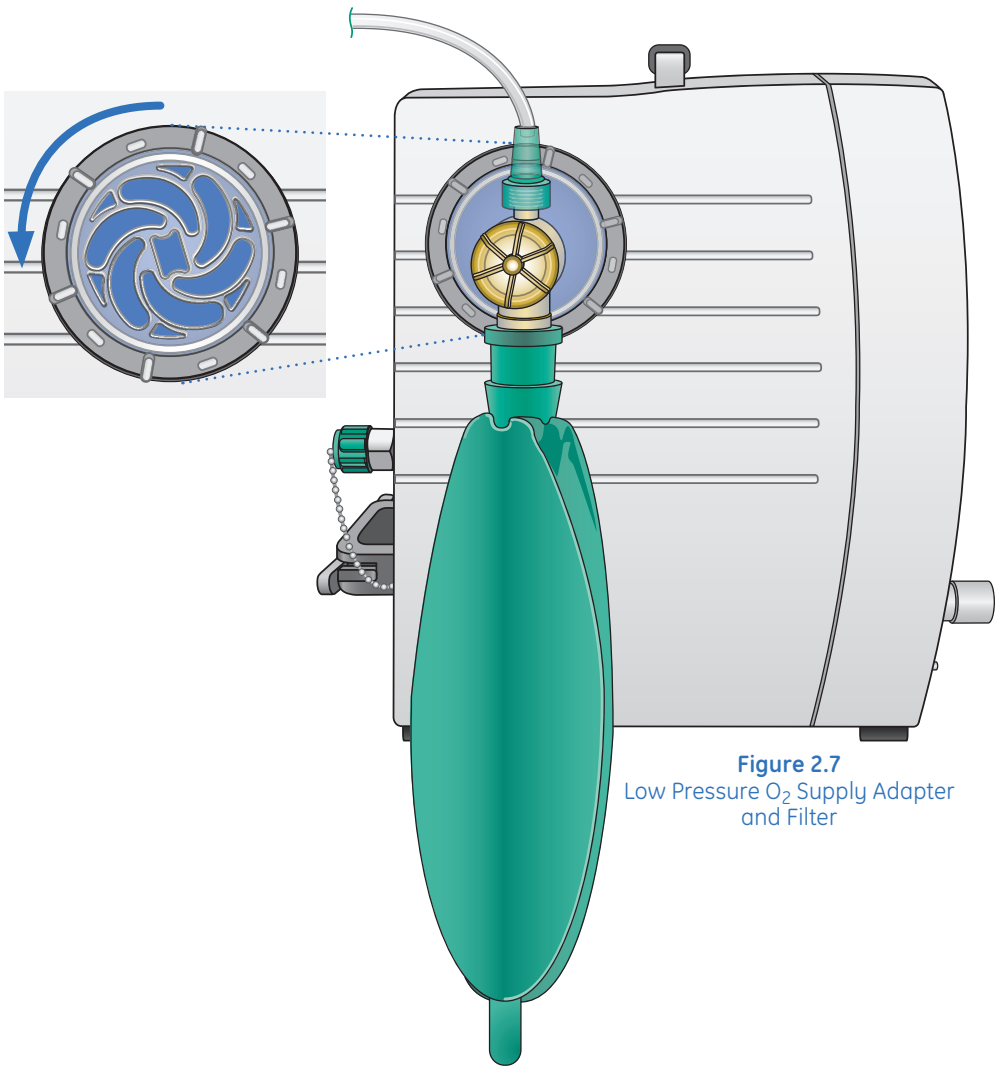


Figure 2.7
Low Pressure O_2 Supply Adapter and Filter

Disposable Breathing Circuit

The disposable breathing circuit consists of an inspiratory limb with a connector at one end of corrugated tubing, and a one-way valve connected to the Patient Wye at the other end.

The Patient Wye contains a flow sensor which is connected by two sensor tubes to the luer connectors on front of the ventilator. The Expiratory Limb fastens to the Patient Wye, and leads to the Exhalation Valve, which connects to a blue tube (the Control Line) and leads back to the ventilator front panel.

To connect a Disposable Breathing Circuit:

1. Twist the connector on the machine end of the breathing circuit tubing onto the ventilator outlet. The connector should fit snugly.
2. Connect the flow sensor (the clear tube) to the patient wye.
3. Connect the patient wye to the oneway valve and breathing circuit tubing which includes the exhalation valve.
4. Connect the flow sensor lines with the Male and female luer connectors to the sensor line inlets on the machine. Ensure correct connection.
5. Connect the external Exhalation Valve control line (the blue tube) to the exhalation valve luer inlet (marked with a blue dot).
6. Ensure that all connections are secure and airtight.
7. Perform an Operation Verification Test (OVT), as described in the ***Operational Verification Test (O.V.T.) section on page 3.3.***

If an HME is used for humidification place the HME between the flow sensor and the patient. If active humidification is used it is recommended to move the one-way valve to the inlet side of the humidifier.

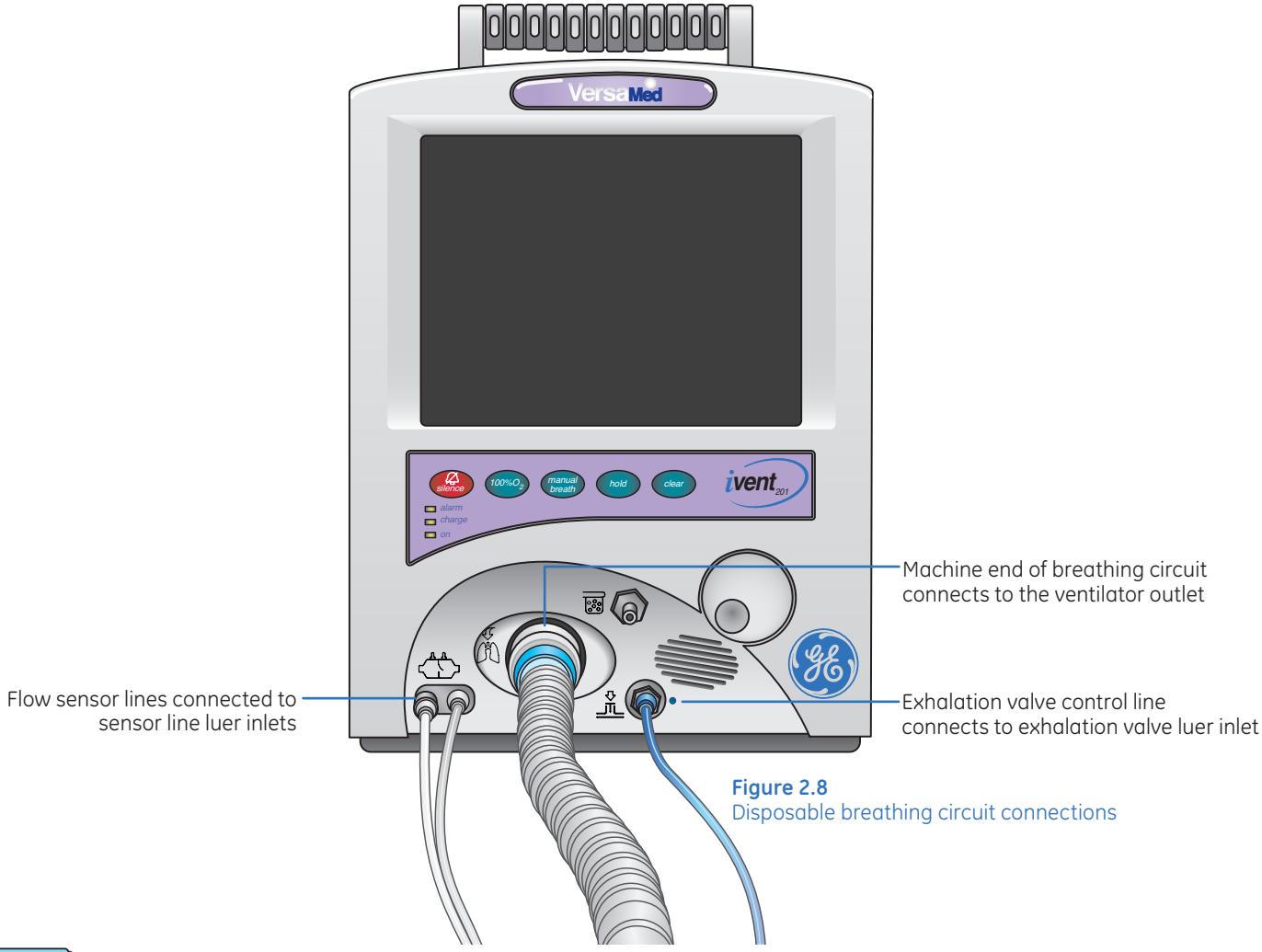


Figure 2.8
Disposable breathing circuit connections

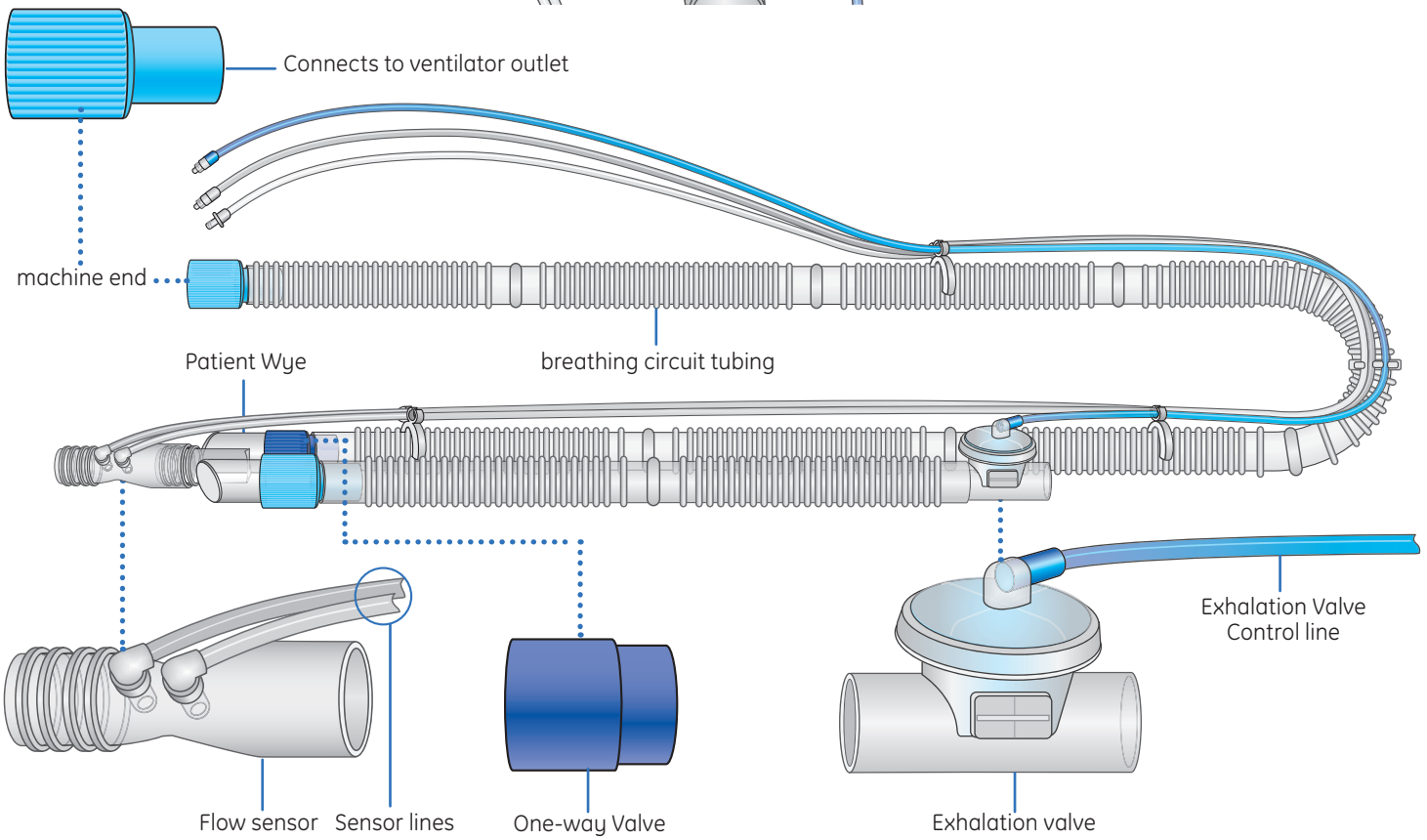


Figure 2.9 Disposable breathing circuit assembly

The Control Knob

The control knob allows control of and access to all the ventilator functions for the display. Use the control knob to perform the following tasks:

- **To change a value:** rotate the knob through a menu or list of choices.
- **To select a numeric value:** rotate the knob through a virtual slider bar, spin buttons or counter, calibrated in precise increments along a full range of values.
- **To Confirm or save a setting**: Press the control knob. You will hear a ***click*** and get an audible feedback.

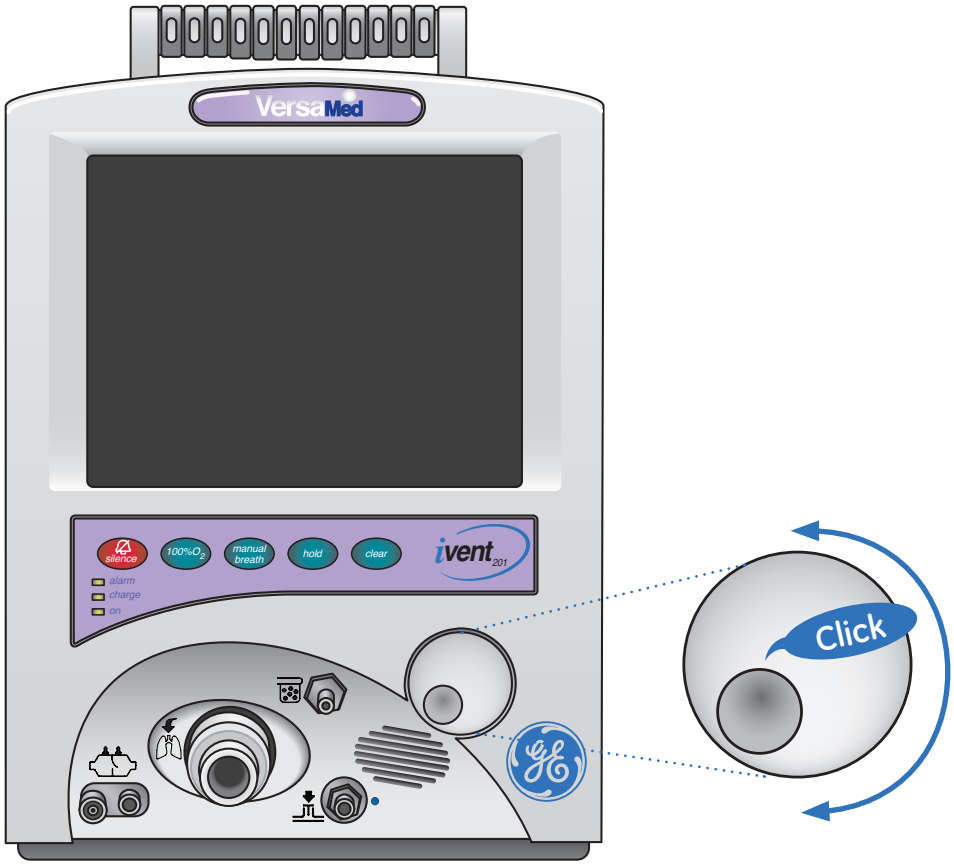


Figure 2.10 Rotational knob

The Keypad

There are five dedicated keys located below the display, and three LED (light-emitting diode) indicators provide a quick indication of power and alarm status.

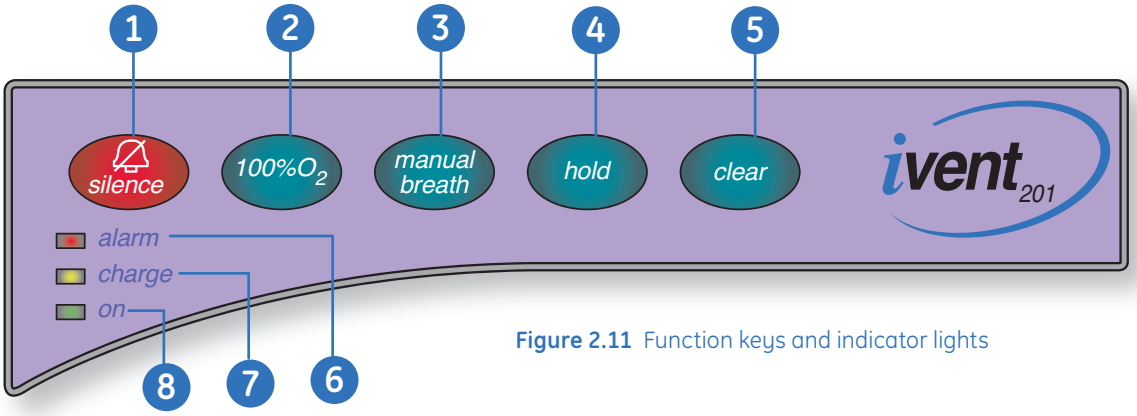


Figure 2.11 Function keys and indicator lights

1. **Silence:** Used to immediately mute the audible alarm and minimize the corresponding red alarm message. A two-minute timer is activated and displayed in the lower right corner of the display instead of the time-date field, alongside the Silenced alarm icon.

   One short press on the ***Silence*** key resets the time to two minutes. Press the ***Silence*** key for one second and it will re-activate the pending alarms.

Figure 2.12 Status window after alarm has been silenced

2. **100% O_2:** When activated, provides three minutes of 100% oxygen and two minutes of alarm silence.
3. **Manual Breath**: Delivers a single breath at the set tidal volume or pressure. In CPAP/PSV ventilation mode, where there is no definition for machine breath, the Manual Breath will be set according to the default volume control for the specified patient weight chosen at startup.
4. **Hold**: Activates and/or cancels the Hold maneuver. Pressing the key once initiates an inspiratory hold maneuver, which will allow the calculation of static compliance. Pressing it twice will initiate an end expiratory hold maneuver, which will allow the calculation of intrinsic PEEP.
5. **Clear:** Has several functions. Pressing it will:
   - Clear the screen of its current selection and return the user to the previous screen or menu selection – just like the Escape key on a computer keyboard.
   - Minimize any red alarm-warning window and mute the alarm sound for thirty seconds. If ***clear*** is pressed again within thirty seconds, an alarm warning window appears.
   - When ***clear*** is pressed and held, all corrected alarm messages (displayed in green) are cleared.
6. **Alarm:** Red blinks rapidly when the $iVent_{201}$ detects an alarm condition.
7. **Charge**: Amber indicates the $iVent_{201}$ is connected to external power.
8. **On:** Green indicates the power is switched on.

Check Your Knowledge: iVent$_{201}$ Overview

Circle the correct answer.

1. What does the iVent$_{201}$ use as an air source?
   - a. An air inlet connected to a high pressure (50 psi) air source.
   - b. A turbine-powered air source that pulls in room air through the air inlet filter.
   - c. An external air cylinder
   - d. The iVent$_{201}$ does not use air, only O_2.

2. A user-supply bacterial filter is not recommended as it may interfere with ventilator readings.
   - a. True
   - b. False

3. Where does the High Pressure Oxygen Supply connect to on the iVent$_{201}$?
   - a. The oxygen inlet connector on the rear of the unit.
   - b. There is no high pressure oxygen inlet for the iVent$_{201}$, only low pressure oxygen.
   - c. To the air inlet port on the side of the unit, where the air inlet filter is located.

4. Where do the flow sensor tubing connectors from the flow sensor attach to on the iVent$_{201}$?
   - a. The male and female luer connectors on the bottom left of the front of the unit.
   - b. The oxygen inlet connectors on the rear of the unit.
   - c. The exhalation valve luer inlet on the front of the unit.
   - d. The RS-232 connectors on the rear of the unit.

5. Which of the following keys is ***NOT*** one of the five dedicated keys?
   - a. Silence
   - b. Manual Breath
   - c. Hold
   - d. On

6. The red LED indicator blinking rapidly indicates:
   - a. The iVent201 is connected to external power.
   - b. An alarm condition.
   - c. The power switch is on.
   - d. The battery is fully charged.

Hands on Activity: iVent$_{201}$ Overview

Place a check mark next to each task that is verified by the instructor.

- ☐ Remove and replace the air inlet filter.
- ☐ Either connect a high pressure or low pressure oxygen supply, whichever is applicable.
- ☐ Properly connect a disposable breathing circuit, including the flow sensor tubing connectors and the exhalation valve control tube, and a bacterial filter.
- ☐ Activate each of the five dedicated keys.

Answers: Check Your Knowledge iVent$_{201}$ Overview

1. What does the iVent$_{201}$ use as an air source?
   b. A turbine-powered air source that pulls in room air through the air inlet filter.

2. A user-supply bacterial filter is not recommended as it may interfere with ventilator readings.
   b. False

3. Where does the High Pressure Oxygen Supply connect to on the iVent$_{201}$?
   a. The oxygen inlet connector on the rear of the unit.

4. Where do the flow sensor tubing connectors from the flow sensor attach to on the iVent$_{201}$?
   a. The male and female luer connectors on the bottom left of the front of the unit.

5. Which of the following keys is ***NOT*** one of the five dedicated keys?
   d. On

6. The red LED indicator blinking rapidly indicates:
   b. An alarm condition.

3 Preparing for Clinical Use

Objectives: Preparing for Clinical Use

By the end of this chapter you should be able to:

- Power up the iVent$_{201}$
- Set a Patient Weight via the patient weight selection window
- Perform an Operational Verification Test (O.V.T.)
- Change a ventilation mode
- Change a ventilation parameter through the main screen and through the mode parameter window
- Describe the purpose of the dark blue, green and red color indicators on the selection interface
- Start the iVent$_{201}$ ventilator

Power Up and Weight Selection

If you have installed a patient circuit you are ready to begin operating the iVent$_{201}$.

To turn on the power:

1. Press the green ***ON/OFF*** button on the back of the machine.
2. After the power is turned on, the software performs a self-test. Once the boot up process completes (after approximately thirty seconds) you will hear a beep.

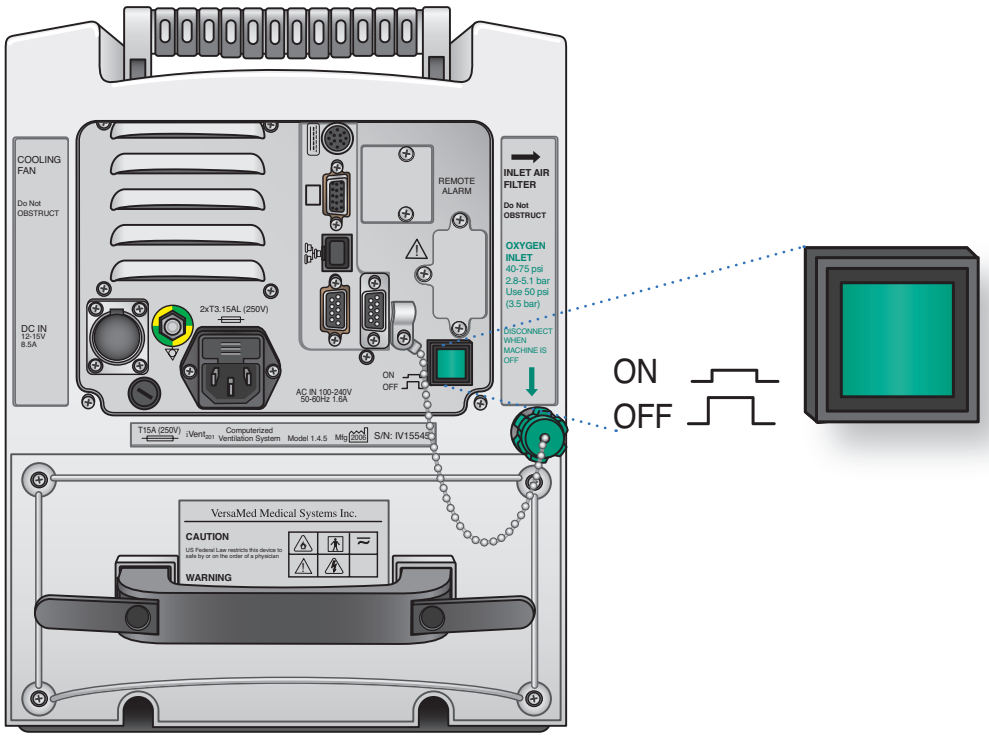


Figure 3.1 On/Off button

To select a body weight:

1. The window will ask you to select the patient's ideal body weight. The selected body weight sets the default ventilation parameters such as ***rate, tidal volume, Plimit*** and ***alarm*** settings.
2. Rotate the control knob to highlight the ideal body weight of the patient, and then press the control knob to confirm the weight selection.
3. The ***Standby/Start*** screen appears and the Operational Verification Test (O.V.T.) must be performed.

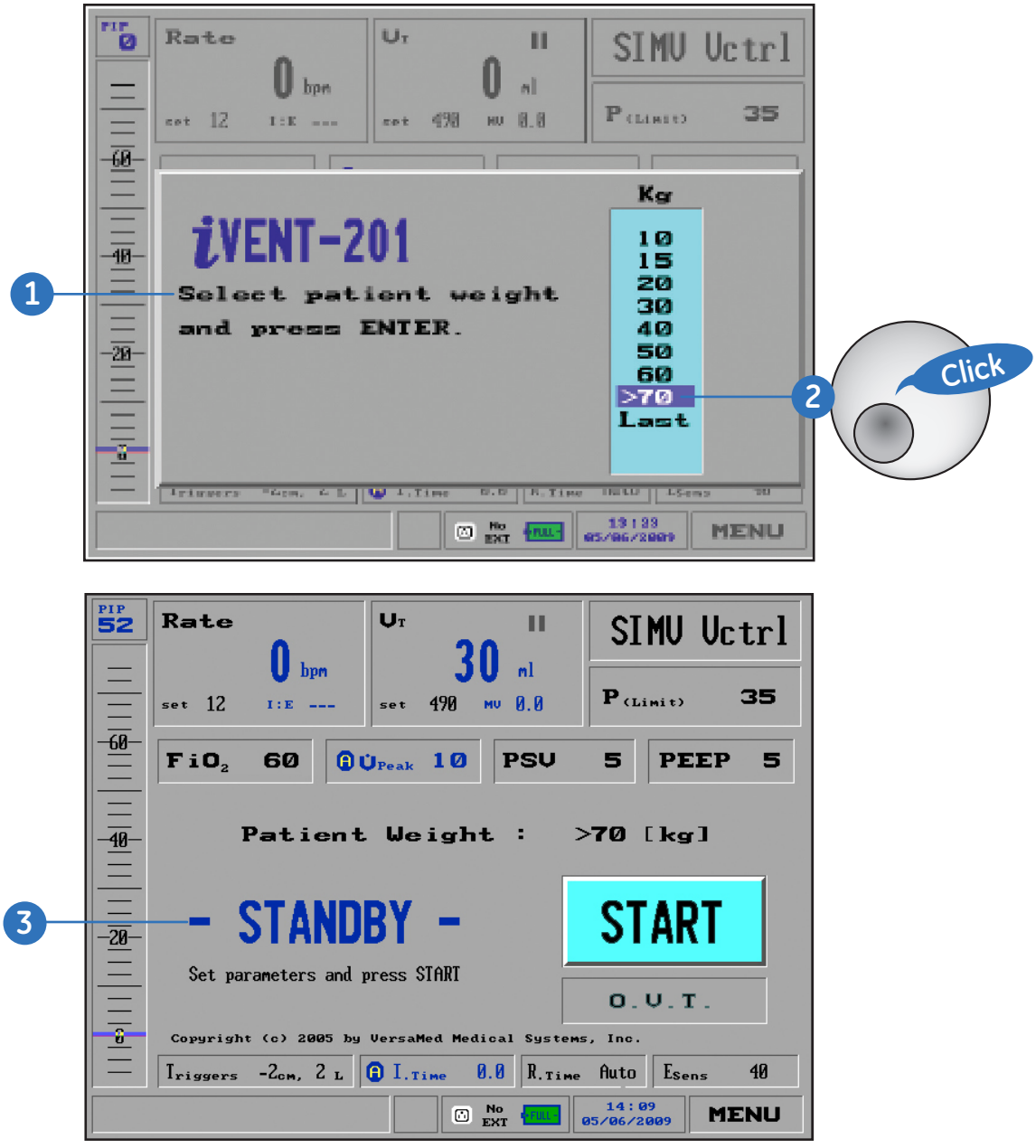


Figure 3.2 Patient weight selection

Operational Verification Test • O.V.T.

The patient circuit must be tested each time it is connected, so if you are reconnecting a patient circuit or using a new one, you must perform the Operational Verification Test (O.V.T.). This test, which takes less than one minute, checks the integrity of the breathing circuit and audible alarm functionality.

Two plastic caps for covering the ends of the patient circuit are required for the O.V.T. They are included with all patient circuits offered by Versamed.

To Perform an O.V.T.:

1. Rotate the knob until the ***O.V.T.*** field is highlighted in bright blue.

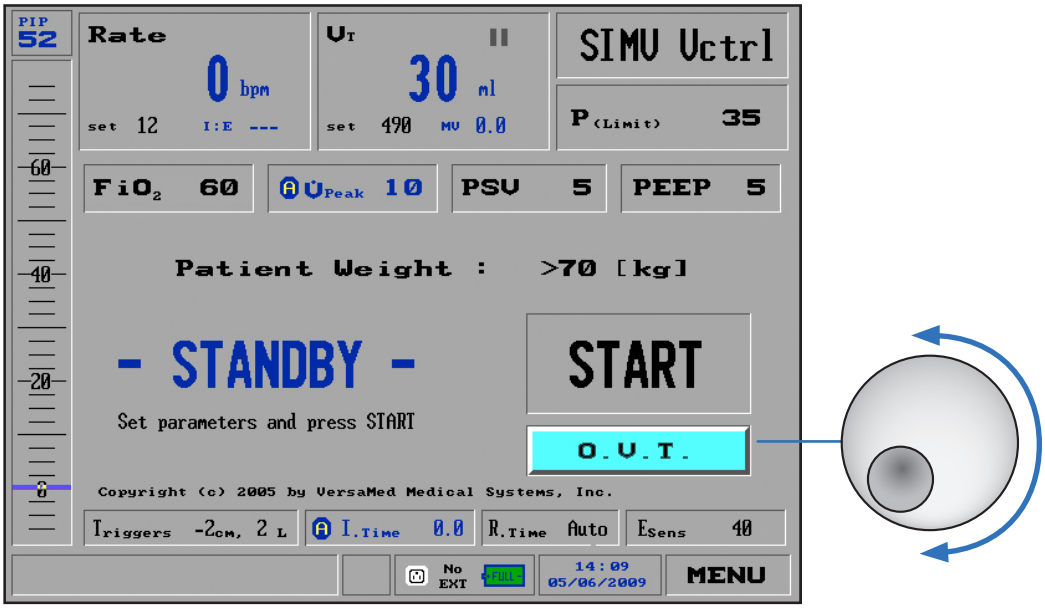


Figure 3.3 O.V.T. box highlighted

2. Press the control knob until you hear a ***click***. The O.V.T. Instructions window will appear.

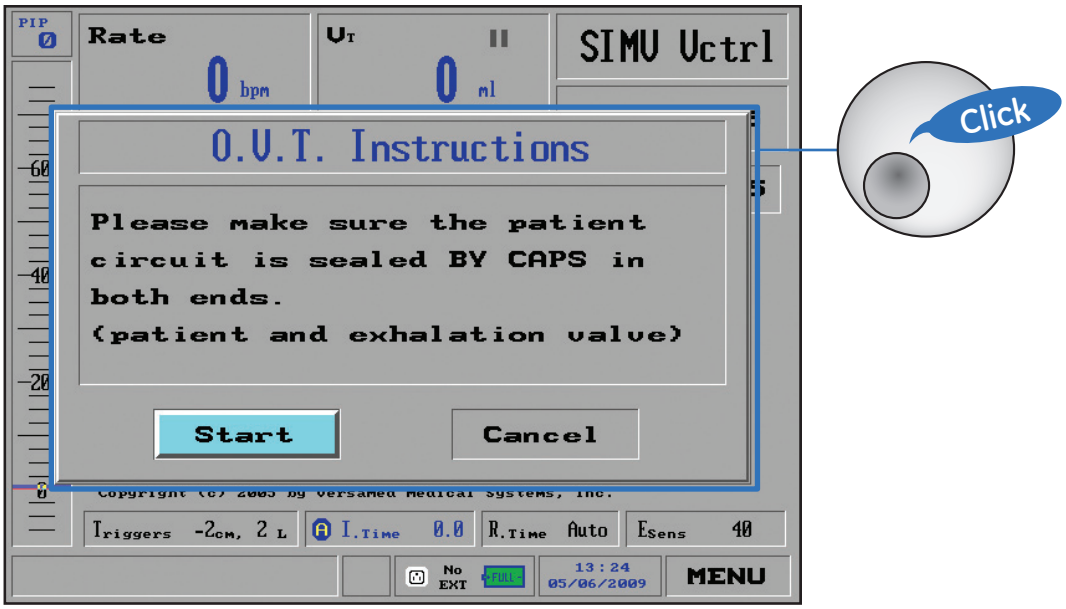


Figure 3.4 O.V.T. instructions

3. Follow the instructions in the window. Use the plastic caps to seal off:
    - the patient Wye sensor
    - the exhalation valve.
4. Press the knob to begin the test. A window appears, indicating the test has begun.
5. After several seconds, another message window directs you to remove the cap on the exhalation valve, leaving the cap on the Wye outlet.
6. After the ventilator performs further testing, it will sound an alarm. After the alarm sounds, press the control knob to complete the O.V.T.

If the O.V.T. fails to complete successfully:

1. Verify that both Flow Sensor tubes are properly and snugly connected to the correct luer ports on the front of the iVent$_{201}$. (Remember: two lines go to the patient Wye connectors, and the blue line goes to the Expiratory Valve Control connector.) Repeat the test.
2. If the O.V.T. fails once again, replace the patient circuit.
3. If after replacing the patient circuit, the O.V.T. still fails, try recalibrating the ventilator. If calibration fails to correct the O.V.T. failure, immediately remove the ventilator from service and contact a Versamed-approved technician.

Once the iVent$_{201}$ has successfully completed the O.V.T., the patient circuit and ventilator are ready for use. By default the iVent$_{201}$ starts up in SIMV-Volume Control. Before attaching the patient to the circuit, review all the settings and ensure that they are appropriate.

Ventilator Adjustments

Note! *Only a fully qualified professional should adjust ventilator settings.*

Changing Ventilation Mode

The Mode Selection field is on the top right side of the display. To change the mode, simply turn the control knob to highlight the ***Mode Selection*** field, then press the control knob. A window will appear offering six mode choices, plus Standby.

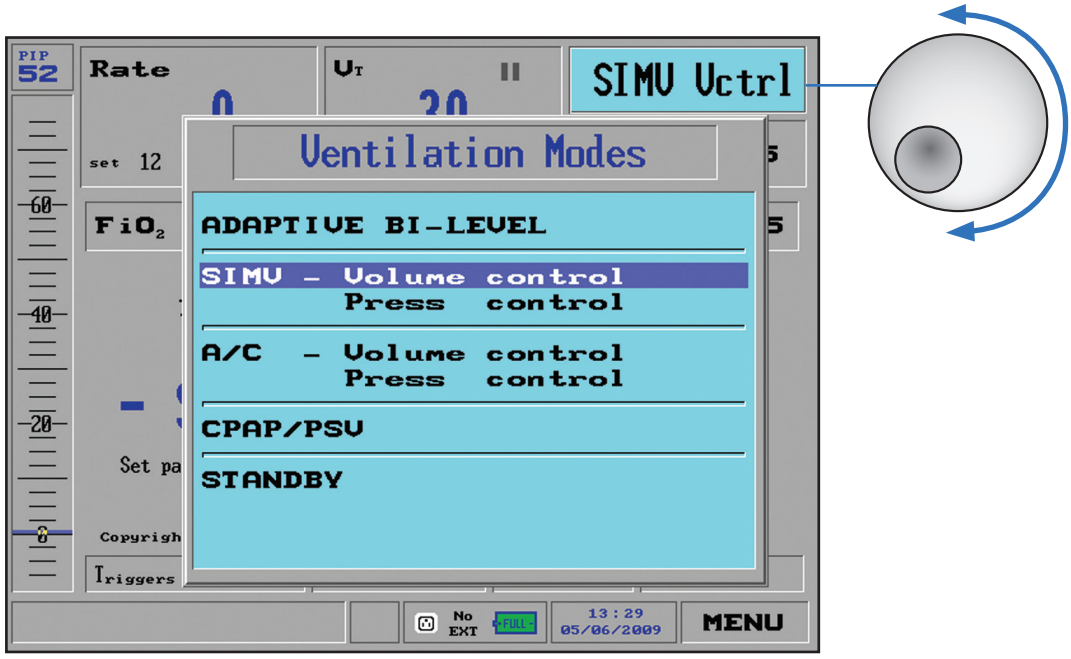


Figure 3.5 Ventilation modes selection window

Note! *Depending on which iVent$_{201}$ model you have purchased, not every mode may be available.*

Turning the control knob moves the highlight bar through the choices. When the desired mode is highlighted, press the knob to accept it. This will bring up a parameter window where you can either accept the default ventilation parameters or change any of them.

For example, to change to SIMV-Pressure Control mode from SIMV-Volume Control control mode:

1. Make sure you are in the Main screen. To return to the Main screen, press the ***clear*** key on the keypad below the display. This will cycle you back through all previous screens until you return to the Main screen.
2. From the Main screen, turn the control knob until you highlight the Mode Selection field. By default, the iVent$_{201}$ starts in SIMV-Volume Control, abbreviated ***SIMV Vctrl***.

3. Press the control knob, the Ventilation Mode window appears. Turn the knob to highlight ***Pressure Control.***

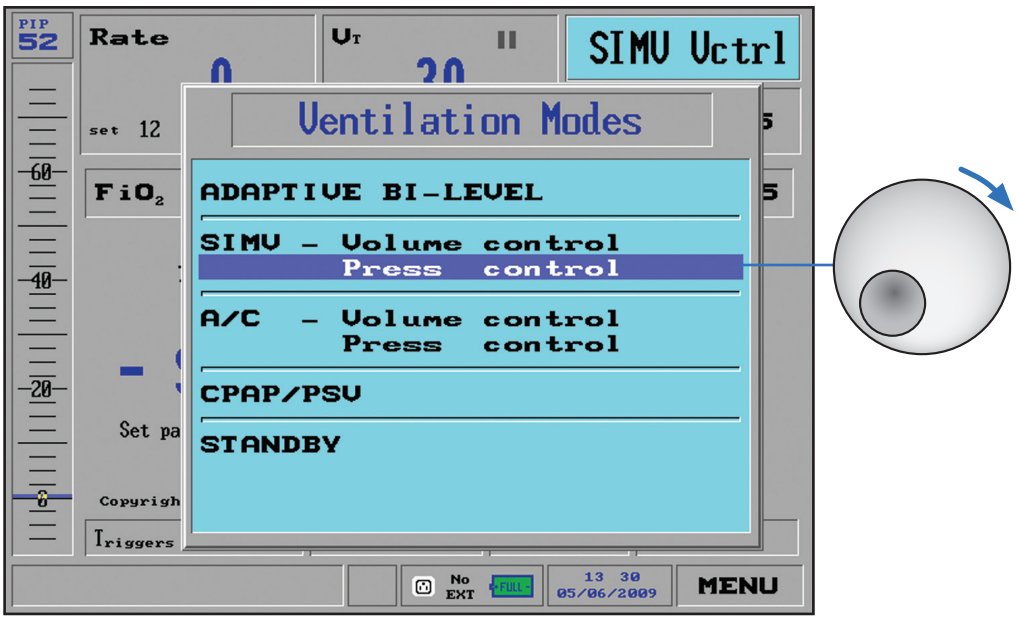


Figure 3.6 Pressure control highlighted

4. Press the control knob. The SIMV-Pressure Control window will appear.

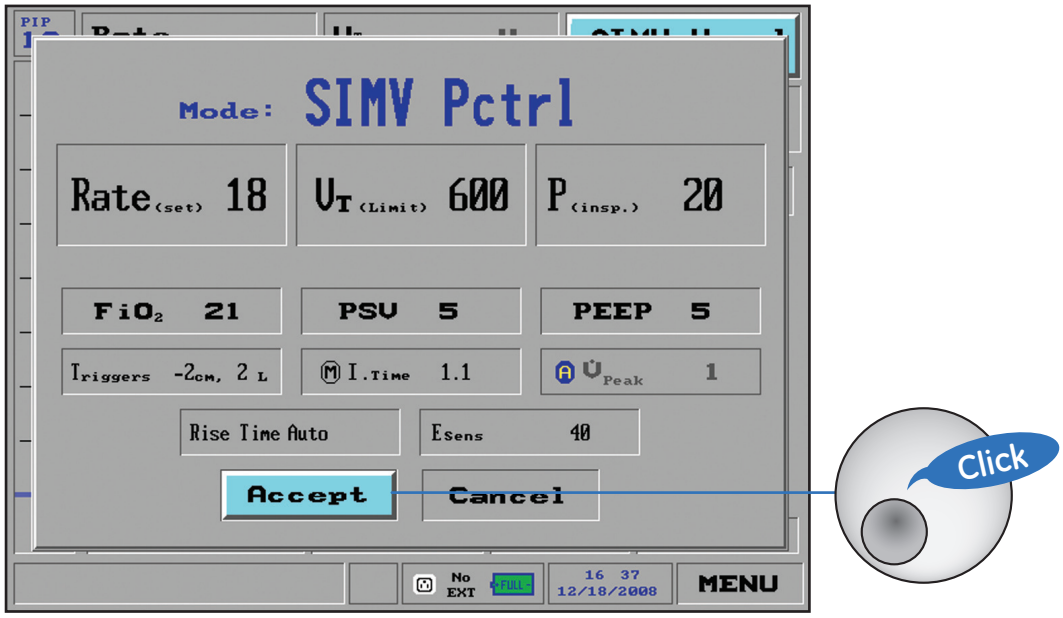


Figure 3.7 SIMV-Pressure Control window

5. Notice that the ***Accept*** field is automatically highlighted, making it possible to accept the default parameters immediately. Always verify that the settings are correct for the patient before selecting ***Accept***. If ventilation has not been initiated you will return to the Standby/ Start screen after selecting ***Accept***. Select ***Start*** to begin ventilation at the chosen settings.

   If ventilation has already been initiated, the iVent$_{201}$ will continue ventilating with the new settings after selecting ***Accept***.

Note! *The mode is not changed, and changed parameters are not accepted, until the user presses* ***Accept.***

Changing Ventilation Parameters

The iVent$_{201}$ provides two different ways to change ventilation parameters: through the Main screen and through the Mode Parameters window.

If you wish to quickly change one parameter setting, the fastest way is through the Main screen. If you need to adjust several settings at once, access the Mode Parameters window. and make each required adjustment. When you have set each parameter, you can accept all of them at once.

To change ventilation parameters through the Main screen:

1. Make sure you are in the Main window. To return to the Main window, press the ***clear*** key on the keypad below the display. This will cycle you back through all previous screens until you return to the Main screen.
2. Turn the control knob to select the parameter you want to adjust.
3. Press the control knob.
4. Adjust the setting to the desired value.
5. Press the control knob again to confirm your changes and return to the Main screen.

Below are three examples of parameter adjustments:

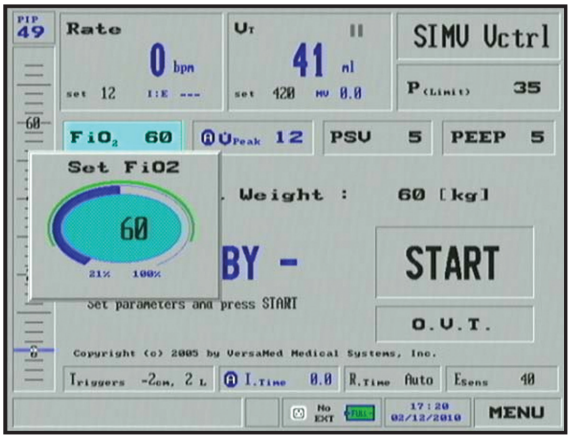


Figure 3.8 FiO2 parameter is being adjusted

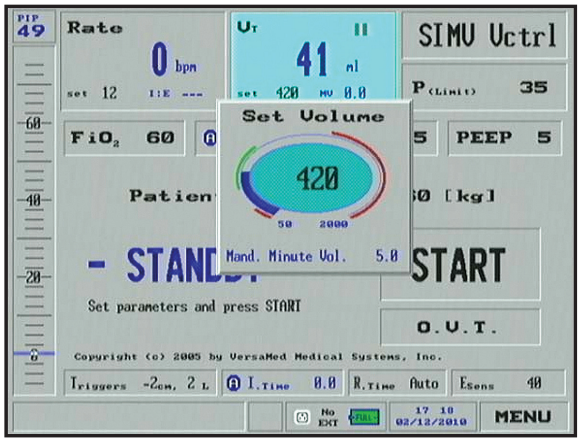


Figure 3.9 Set tidal volume is being adjusted

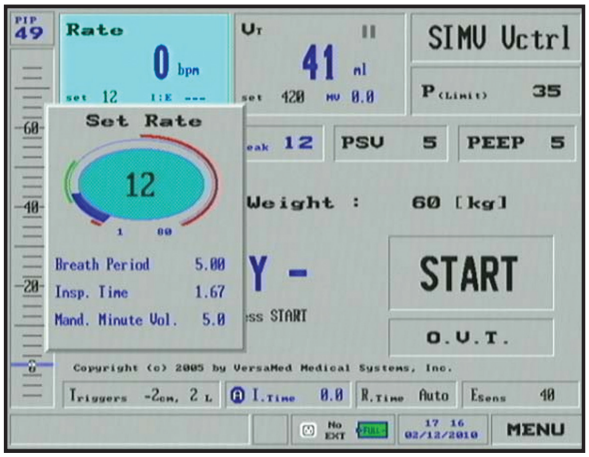


Figure 3.10 Rate is being adjusted

To change ventilation parameters through the Mode Parameter window:

1. From the Main screen, choose the ***Mode Selection*** box and select the desired ventilation mode. The Parameters window appears.
2. Turn the control knob to select the particular setting you wish to change.
3. Press the control knob to call up the setting's control window.
4. Turn the control knob until the parameter has been changed to the desired level or value.
5. Press the control knob again to save the setting. You will return to the Parameters window.
6. Continue through the other parameter options, choosing and changing until you have set all the values you want. Once you have finished highlight the ***Accept*** on the bottom of the window. Press the control knob and your new selections will be saved.

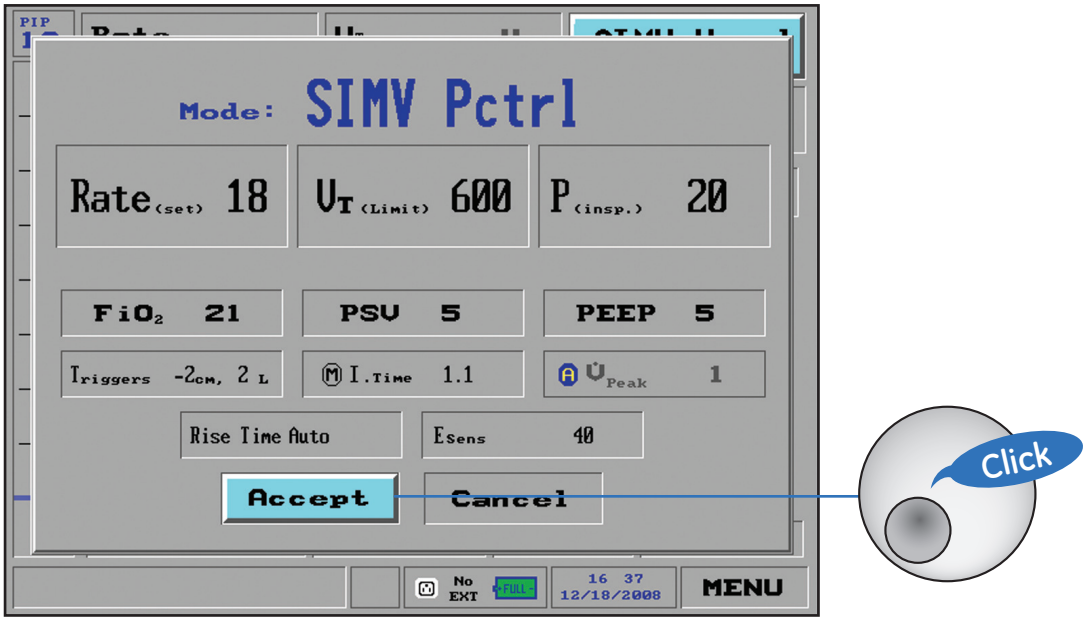


Figure 3.11 Mode Parameter window

Note! *To abort the selection process and return the parameter to the previously chosen value, press the clear key.*

The Selection Interface

Most of the quantitative parameters are presented in the form of a solid teal oval dial featuring black numerals. Black numbers represent set values. Turning the control knob increases or decreases the selected value as indicated by the black numerals inside the oval. A dark blue ribbon indicator moves around the periphery of the oval to show the scale of the selected value.

Recommended ranges are outlined in green, while values outside recommended ranges are outlined in red. As a precaution, if a setting you are inserting exceeds or fails to meet recommended settings for the patient weight, a bright yellow caution flag appears.
Other parameter settings are adjusted on a slider gauge.

The chosen values are not operational until you confirm your selection by pressing the control knob, which will take you back to the Main screen. The new value(s) you have selected will now be shown in black.

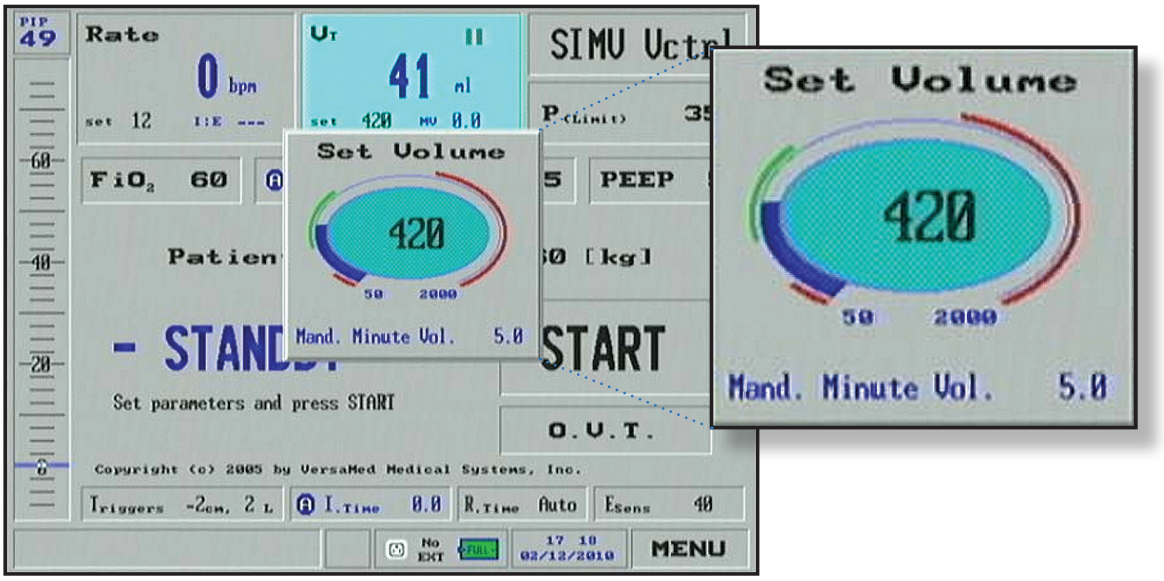


Figure 3.12 Selection interface

Starting Ventilation

After all the settings have been reviewed and adjusted as necessary, ensure that the breathing circuit is properly attached to the ventilator and the patient.

To start ventilation:

1. Make sure you are in the ***Main*** window. To return to the Main window, press the ***clear*** key on the keypad below the display. This will cycle you back through all previous screens until you return to the Main screen.
2. Turn the control knob to highlight ***Start***.
3. Press the control knob.

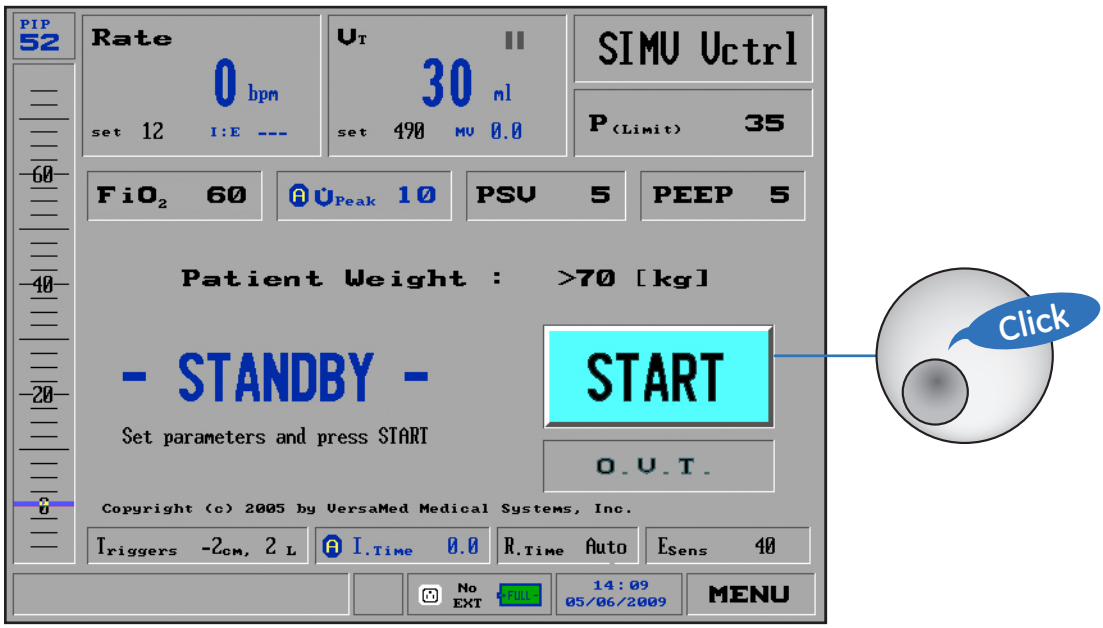


Figure 3.13 Start ventilation

Note! The iVent$_{201}$ can be configured to automatically start ventilating under certain conditions. For more information on auto-start, consult chapter 3 of the user's manual - "Operating the iVent$_{201}$".

Check Your Knowledge: Preparing for Clinical Use

Circle the correct answer.

1. How does selecting a patient weight affect the iVent$_{201}$ settings?
   - a. The selected patient weight has no effect on the iVent$_{201}$ settings.
   - b. The selected patient weight sets the default alarm settings only.
   - c. The selected patient weight sets the default ventilation parameters such as rate, tidal volume and alarm settings.

2. What must be performed each time a patient circuit is connected to the iVent$_{201}$?
   - a. An Operational Verification Test (O.V.T.).
   - b. Nothing, the iVent$_{201}$'s automatic self test is sufficient for new circuits.
   - c. An O_2 calibration
   - d. Replace the air inlet filter

3. You can only change a mode when the ventilator is in Standby
   - a. True
   - b. False

4. Which of the methods below is ***NOT*** a method for changing a ventilation parameter?
   - a. From the main window, scroll to the parameter, press the control knob and adjust the setting.
   - b. Press the Parameters dedicated key, select a parameter and adjust the slider bar.
   - c. Select a mode, and then change a setting from the mode parameter window.

5. On the selection interface window, what does the red line represent?
   - a. Recommended range
   - b. The scale of the selected value
   - c. The set value
   - d. Values outside recommended ranges

6. How do you start ventilation on the iVent$_{201}$?
   - a. From the main window, scroll to Start and press the control knob.
   - b. Press the Start dedicated key
   - c. Press the Ventilation dedicated key, scroll to start and press the control knob.
   - d. Ventilation starts automatically as soon as the O.V.T. is completed.

Hands on Activity: Preparing for Clinical Use

Place a check mark next to each task that is verified by the instructor.

- ☐ Select a patient weight.
- ☐ Perform an Operational Verification Test (O.V.T).
- ☐ Change a ventilation mode.
- ☐ Change a ventilation parameter setting through the main screen.
- ☐ Change a ventilation parameter setting through the ventilation mode parameter window.
- ☐ Start ventilation.

Answers: Check Your Knowledge - Preparing for Clinical Use

1. How does selecting a patient weight affect the iVent$_{201}$ settings?
   - **c.** The selected patient weight sets the default ventilation parameters such as rate, tidal volume and alarm settings.

2. What must be performed each time a patient circuit is connected to the iVent$_{201}$?
   - **a.** An Operational Verification Test (O.V.T).

3. You can only change a mode when the ventilator is in Standby
   - **b.** False

4. Which of the methods below is ***NOT*** a method for changing a ventilation parameter?
   - **b.** Press the Parameters dedicated key, select a parameter and adjust the slider bar.

5. On the selection interface window, what does the red line represent?
   - **d.** Values outside recommended ranges

6. How do you start ventilation on the iVent$_{201}$?
   - **a.** From the main window, scroll to Start and press the control knob.

4 Ventilation Modes

Objectives: Ventilation Modes

By the end of this chapter you should be able to:

- Describe the modes of ventilation available on the iVent$_{201}$
- Activate SIMV-Volume Control mode and change a setting
- Activate Assist-Control Volume mode and change a setting
- Describe the functionality of the Plimit and High Pressure alarms and change a setting
- Describe the functionality of Adaptive Peak Flow and Adaptive I-Time
- Activate SIMV-Pressure Control mode and change a setting
- Activate Assist-Control Pressure mode and change a setting.
- Describe the functionality of tidal volume limit in Pressure Control and change the setting
- Set up the ventilator for Adaptive Bi-Level mode
- Activate Adaptive Bi-Level mode and change a setting
- Activate CPAP/PSV and adjust a setting
- Identify the seven breath type icons

Ventilation Modes Overview

Note!

Depending on which iVent$_{201}$ model you have purchased, not every mode may be available.

The iVent$_{201}$ supports the following modes:

- SIMV–Volume Control
- Assist /Control - Volume Control
- SIMV-Pressure Control
- Assist /Control – Pressure Control
- Adaptive Bi-level
- Continuous Positive Airway Pressure with Pressure Support Ventilation (CPAP/PSV)

In addition, the iVent$_{201}$ has these advanced features:

- Rise time is adjustable
- Adaptive Peak Flow can determine and deliver Inspiratory Peak Flow Rate according to a target mandatory tidal volume, maintaining a 1:2 I:E ratio
- Adaptive I-Time allows the ventilator to determine and deliver a respiratory cycle time to sustain a 1:2 I:E ratio
- Easy Exhale is an advanced PEEP mode designed to reduce expiratory work of breathing

SIMV – Volume Control

Synchronized Intermittent Mandatory Ventilation - Volume Control: A mode of ventilation in which all breath types (ventilator, assisted, and spontaneous) are allowed. Mandatory breaths are volume controlled and synchronized with patient efforts, while spontaneous breaths can be pressure supported. On the iVent$_{201}$, this mode is displayed as SIMV Vctrl.

The SIMV-Volume Control Parameter Window

If the SIMV-Volume Control option is selected the parameter window for that mode appears. When the settings have been acknowledged as appropriate, select ***Accept*** to begin ventilation. Select ***Cancel*** to return to the previous display.

1. **Triggers:** Are adjustable in all modes. The triggers shown below are set to ***–2 cm*** of water pressure and ***2 L/m*** flow.
2. **I-time and Peak Flow:** These boxes each have a blue circle surrounding an ***A.*** This icon indicates that the setting is ***Adaptive***, as opposed to Manual. Adaptive I-time and Peak Flow are discussed further in this chapter.
3. **Rise Time**: The rise time setting refers to the speed of the flow engine acceleration during the inspiratory phase. The default setting is ***Auto***, other selections include ***High, Max*** and ***Mid.***
4. **Esens:** The iVent$_{201}$ terminates the pressure support breath delivery after flow drop detection to an adjustable percentage of the peak flow. The flow termination (exhale sensitivity) can be set between ***10*** to ***90*** percentages of the peak flow. The Esens is used to adjust flow termination of pressure support breaths for patient comfort.

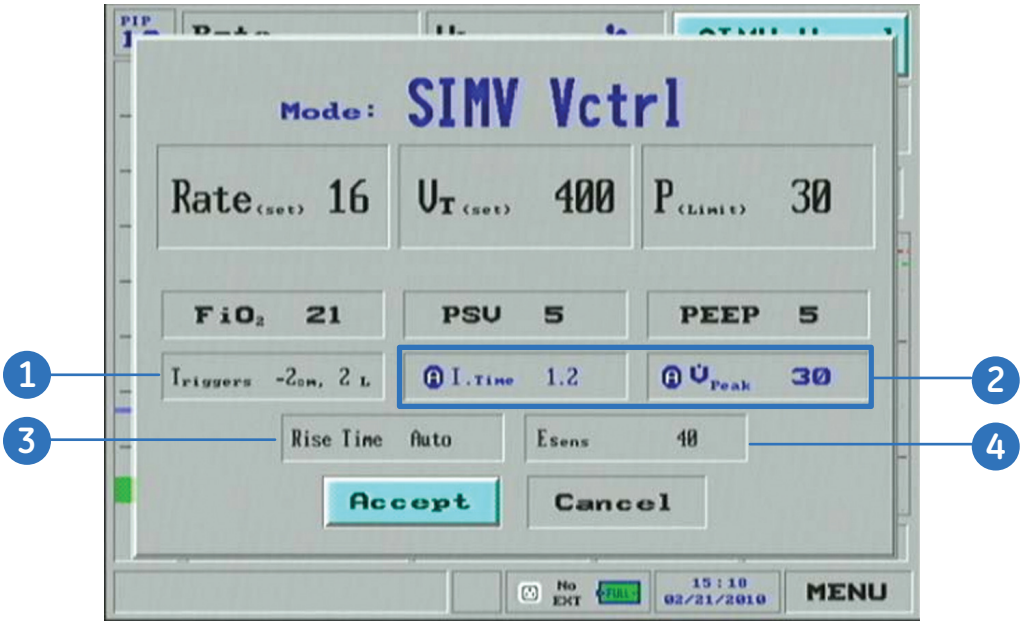


Figure 4.1 SIMV Vctrl parameter window

Assist / Control – Volume Control

Assist /Control Volume Control: A mode of ventilation in which the patient receives a set rate of mandatory volume controlled breaths. The patient may trigger some or all of the breaths. The total measured respiratory rate may be greater than the set rate. On the iVent$_{201}$, this mode is displayed as A/C Vctrl.

The Assist/Control – Volume Control Parameter Window

If the Assist /Control – Volume Control option is selected the parameter window for that mode appears. When the settings have been acknowledged as appropriate:

1. Select ***Accept*** to begin ventilation.
2. Select ***Cancel*** to return to the previous display.

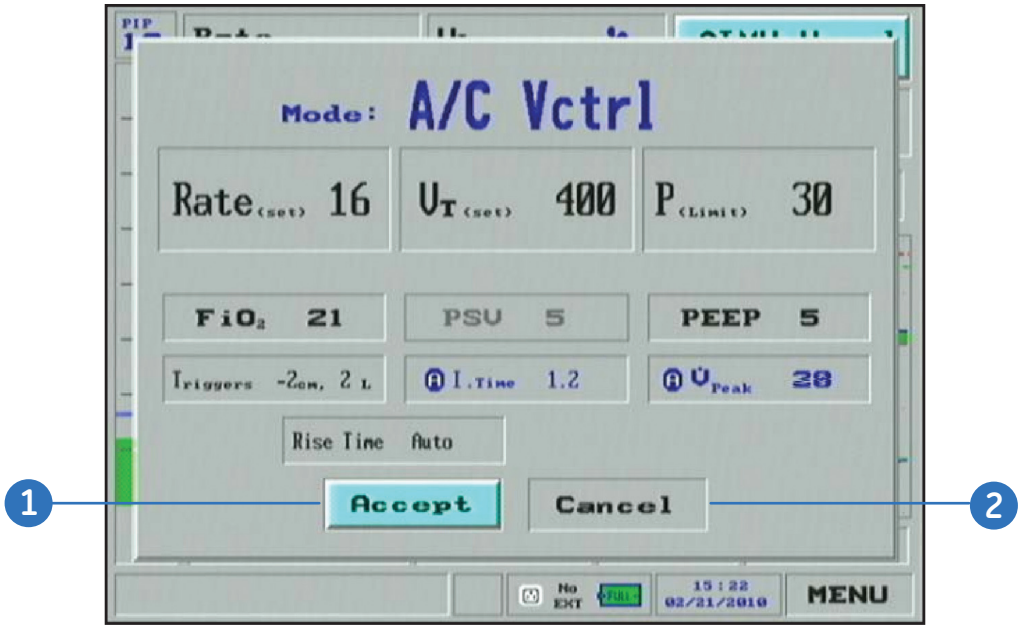


Figure 4.2 A/C Vctrl Parameter window

Note! *The Assist/Control-Volume Control Parameter Window is very similar to the SIMV – Volume Control window except that it does not include the PSV or Esens selection.*

Plimit and High Pressure Alarm in Volume Control

Plimit

When in a Volume Control ventilation mode you can adjust the maximum acceptable pressure, known as Plimit.

If the airway pressure reaches the Plimit value, the Plimit flashes and inspiration continues but at the Plimit value. Depending upon setting and patient conditions the Plimit may trigger a low tidal volume alarm.

High Pressure Alarm

All modes have a high pressure alarm. The high pressure alarm is adjusted automatically to the value Plimit + 5 cmH_2O, although it can also be set to any desired value using the Alarm window.

Adaptive Flow and Adaptive I-Time

Adaptive Flow and Adaptive I-Time are automated ventilator controls to determine peak inspiratory flow and inspiratory time during breath delivery. Adaptive Flow and Adaptive I-Time work together only in volume control modes and seek to achieve an I:E ratio of 1:2 in passively breathing patients. When active, the I-time and Peak Flow fields each have a blue circle surrounding an ***A***. This icon indicates that the setting is Adaptive.

Adaptive Flow and Adaptive I-Time are both active by default in either volume control mode, and can be disabled by manually setting the flow and I-time.

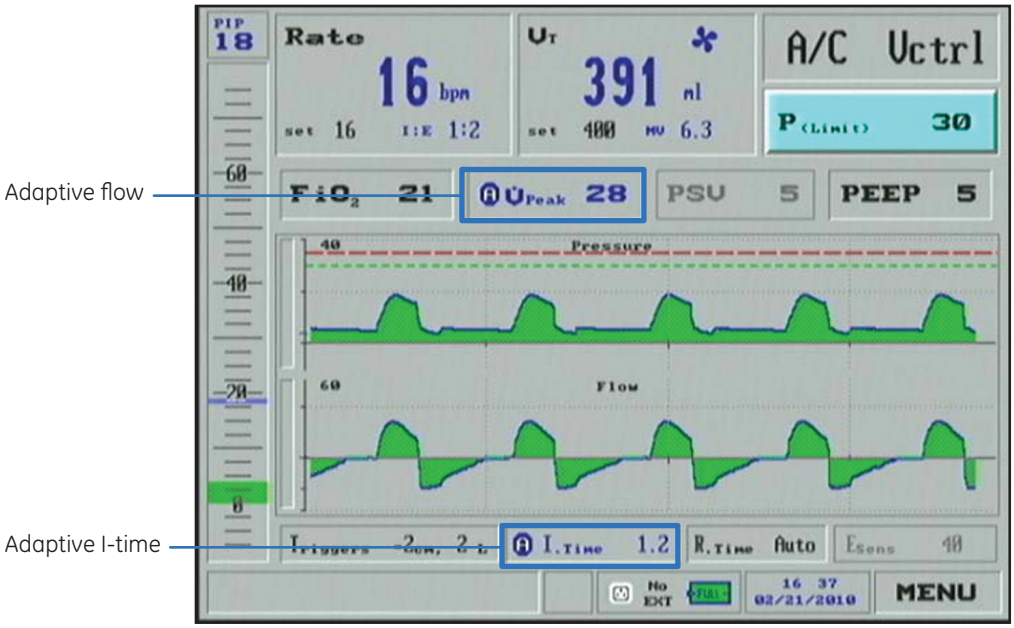


Figure 4.3 Adaptive Flow and Adaptive I-Time boxes

If the patient requires a higher inspiratory flow the iVent$_{201}$ will monitor that patient's flow demands and automatically increase the flow to match the patient's needs, while simultaneously reduce the I-time. If the patient returns to breathing at the set rate, the iVent$_{201}$ will slowly reduce the flow and increase the I-time and ventilate the patient at a low peak airway pressure.

The Adaptive Flow algorithm will accommodate changes in the I-time and automatically adjust the peak flow in actively breathing patients so that the delivery of the set tidal volume for the I-time determined by the Adaptive I-Time algorithm is assured.

In summary:

- The Adaptive I-time changes inspiratory time as required to achieve a 1:2 I:E ratio
- If respiratory rate increases, the inspiratory time will decrease and the mandatory peak inspiratory flow will increase to deliver the set tidal volume
- If respiratory rate decreases, the inspiratory time will increase and the mandatory peak inspiratory flow will decrease to deliver the set tidal volume
- Adaptive Flow and Adaptive I-Time can be disabled by manually setting the flow and I-time

Pressure Control Ventilation Modes

SIMV – Pressure Control

Synchronized Intermittent Mandatory Ventilation – Pressure Control: A mode of ventilation in which all breath types (ventilator, assisted, and spontaneous) are allowed. Mandatory breaths are pressure controlled and synchronized with patient efforts, while spontaneous breaths can be pressure supported. On the iVent$_{201}$ this mode is displayed as SIMV Pctrl.

The SIMV-Pressure Control Parameter Window

If the SIMV-Pressure Control option is selected the parameter window for that mode appears. Verify that the settings are appropriate, and then select ***Accept*** to begin ventilation. Select ***Cancel*** to return to the previous display.

1. **I-Time:** The I-Time is set manually.
2. **Triggers:** Are adjustable in all modes. The triggers shown below are set to ***–2 cm*** of water pressure and ***2 L/m*** flow.
3. **Rise Time:** Setting refers to the speed of the flow engine acceleration during the inspiratory phase. The default setting is ***Auto***, other selections include ***High, Max*** and ***Mid.***
4. **Peak Flow:** This parameter has a blue circle surrounding an ***A***. The icon indicates that the setting is ***Adaptive***, as opposed to Manual.
5. **Esens**: The iVent$_{201}$ terminates the pressure support breath delivery after flow drop detection to an adjustable percentage of the peak flow. The flow termination (exhale sensitivity) can be set between 10 to 90 percent of the peak flow. The Esens is used to adjust flow termination of pressure support breaths for patient comfort.

Figure 4.4 SIMV Pctrl window

Assist/Control – Pressure Control

Assist / Control Pressure Control: is a mode of ventilation in which the patient receives a set rate of mandatory pressure controlled breaths. The patient may trigger some or all of the breaths. The total measured respiratory rate may be greater than the set rate. On the iVent201, this mode is displayed as A/C Pctrl.

The Assist /Control – Pressure Control Parameter Window

If the Assist/Control –Pressure Control option is selected the parameter window for that mode appears. Verify that the settings are appropriate, then:

1. Select ***Accept*** to begin ventilation.
2. Select ***Cancel*** to return to the previous display.

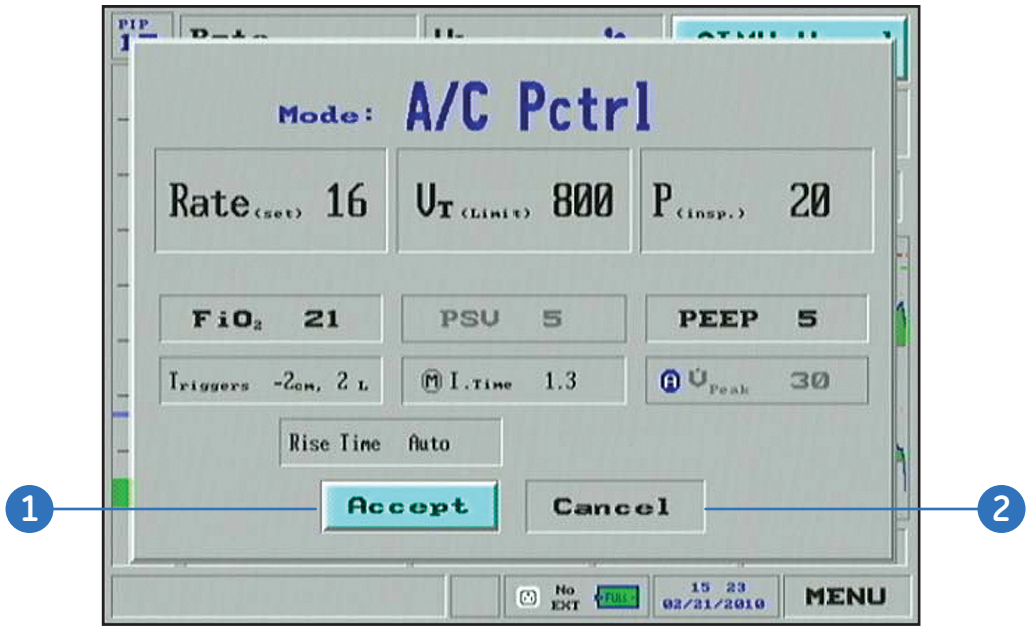


Figure 4.5 A/C Pctrl window

Note! *The Assist/Control-Pressure Control Parameter Window is very similar to the SIMV – Pressure Control window except that it does not include the PSV or Esens selection. As in SIMV – Pressure Control mode the peak flow is always* ***Adaptive*** *and the I-time is set manually.*

Default high pressure alarm for both SIMV – Pressure Control and Assist /Control Pressure Control is always ***10 cm H20*** *above Pinsp.*

Tidal Volume Limit in Pressure Control

The tidal volume limit can be adjusted from the tidal volume window on the main screen in either pressure control mode. This setting limits the tidal volume for machine breaths. If this limit is reached, the alarm message ***Volume Limit Reached*** is shown on the display.
The machine breath is terminated by the ventilator when the set limit for tidal volume is delivered prior to the end of the inspiratory phase.

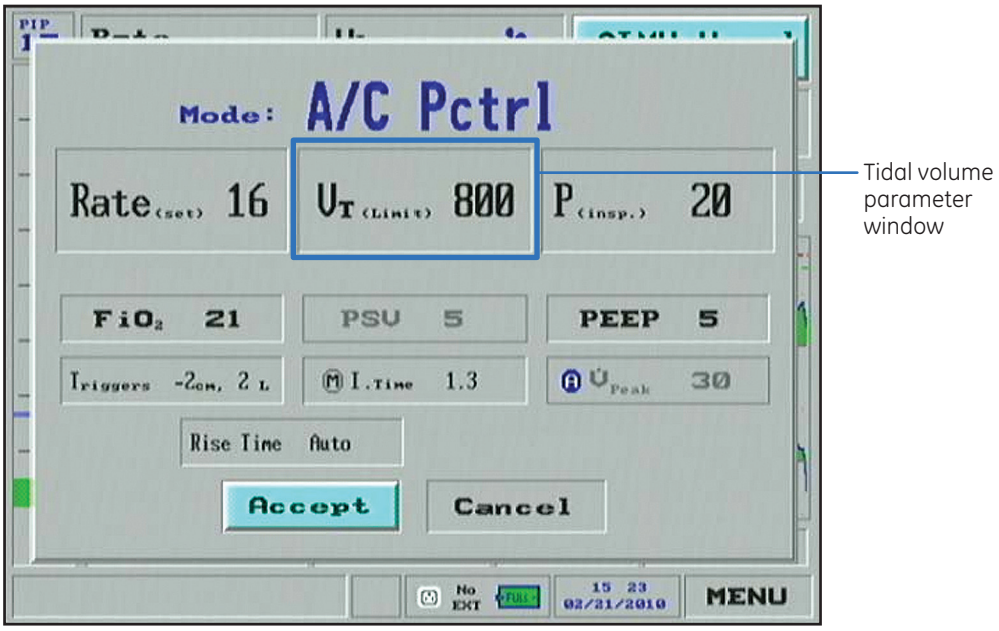


Figure 4.6 Tidal Volume box

Adaptive Bi-level Mode

Adaptive Bi-level: Is a combination of two standard modes of ventilation: Pressure Control, where the Inspiratory and end expiratory pressures, I-Time, and Breath Rate are specified; and Pressure Support Ventilation where breath termination can be controlled by the patient.

In Adaptive Bi-level mode the iVent$_{201}$ can accommodate high leak situations - for instance when using a facemask (sometimes referred to as non-invasive ventilation) or pressure support for high leak ET tube ventilation.

It is an important component in the arsenal of therapies that can be applied to patients presenting with respiratory insufficiency.

Adaptive Bi Level is a support mode of ventilation, where spontaneous breathing efforts are pressure supported at a high (inspiratory) and low (expiratory) pressure. In the absence of spontaneous breathing efforts, the ventilator will provide mandatory breaths at a rate indicated by the ***respiratory rate*** setting. The default setting should be lower than the spontaneous breathing rate to reduce dysynchrony with patient breathing efforts.

Breaths can be terminated by a reduction in peak flow to a preselected percentage. In high leak situations, cycling to exhalation by reduced flow will be easier for the patient if the %flow termination value is high. A low percent peak flow termination value will mean that the mandatory I-time will dominate the inspiratory cycle. Therefore, if the % peak flow parameter is set at a low level, the I-time setting must be appropriate to avoid breath stacking.

Either Nasal CPAP masks or full facemasks may be used with Adaptive Bi-level. Patients who breathe with their mouths should use a full facemask or if not available, a nasal mask with suitable chinstrap support. When using higher inspiratory pressures it is also recommended to use a full facemask to prevent the escape of inflationary pressure via the oral cavity. Recommended full face masks are the Respironics Image 3 SE disposable version and the Resmed Mirage 2 reusable version (no vent holes). All types of nasal masks may be used, although a chin strap may be required for mouth breathers.

Figure 4.7 Adaptive Bi-level parameter window

Indications

Adaptive Bi-level is indicated for patients who exhibit clinically appropriate conditions for facemask ventilation. Such patients include those with acute or chronic respiratory insufficiency secondary to acute exacerbation of COPD; hypercapnic acute respiratory failure, or decompensated heart failure.

Setup

Note! *Patients exhibiting an altered level of consciousness requiring intubation for mechanical ventilation, inability to tolerate facemask ventilation (injury, burn etc.), or severe decompensated respiratory failure requiring intubation should not be treated with a face mask.*

1. Power up the ventilator.
2. Select patient weight based on ideal body weight.
3. Select the ***Adaptive Bi-level*** mode, by opening the ***Ventilation Modes*** window and using the control knob to choose ***Adaptive Bi-level.***
4. Accept or adjust the parameters on the Adaptive BiLevel parameter window.
5. If facemask ventilation is desired, apply a facemask to the patient. Connect the ventilator breathing circuit to the facemask.
6. Adjust the ventilator parameters for optimal ventilator patient synchrony and adequate ventilation.
7. Select suitable patient alarms by accessing the Main Menu and highlighting and entering the Alarm Settings window. Enter the appropriate alarms according to facility protocol.

Note! *Adaptive Bi-level is an SIMV mode and will provide a backup respiratory rate if spontaneous patient breathing efforts are not detected.*

In cases where a severe leak is present, the Patient Disconnect alarm may be disabled. This may be done via the Alarm Settings window.

Adaptive Bi-level Parameters

Use the Mode window to set parameters for Adaptive Bi-level Ventilation. Set the ranges for Adaptive Bi-level parameters as follows

1. **Rate:** 1 to 80 bpm
2. **IPAP:** 7 to 60 cmH_2O; with CAUTION indication at 41 cmH_2O. IPAP cannot be set below P-Low +2.
3. **Rise Time:** 0.1 to 1.5 seconds. Rise time cannot exceed inspiration time.
4. **Triggers:** -2cm H2O, 2 L/m
5. **FiO2:** 21% to 100%
6. **EPAP:** 0 to IPAP minus 2 or Maximum 30 cmH_2O
7. **Esens**: 10% to 90%
8. **I-Time:** 0.2 to 3 seconds; with CAUTION indication at 2.0 seconds or when rate setting I:E ratio reaches 1:4. If I-Time flashes, inspiration was terminated by the set I-Time being reached. When breath termination occurs due to decreased flow, the I-Time display is steady.

Figure 4.8 Adaptive Bi-level window

Adaptive Bi-level Screen

The Vte display shows the estimated Tidal Volume delivered to the patient calculated using the measured flow leak during EPAP. An estimated Leak is shown below the VT/Exhale field of the display.

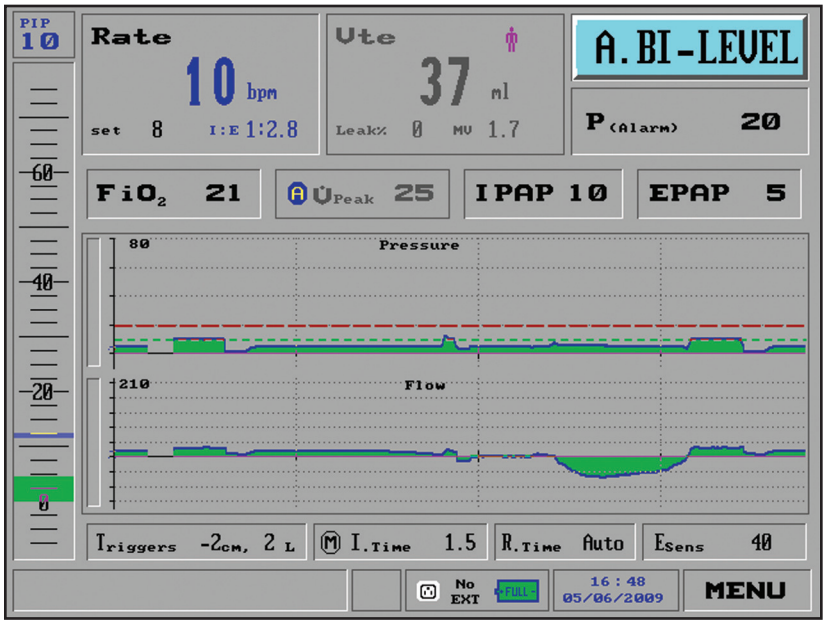


Figure 4.9 Adaptive Bi-level screen

CPAP with Pressure Support Ventilation

Continuous Positive Airway Pressure (CPAP): is a mode of ventilation in which the patient is breathing spontaneously from a positive pressure baseline as continuous positive pressure is applied throughout the breath cycle. Pressure support breaths can also be delivered in this mode. CPAP is a mode intended for patients who are breathing spontaneously at a rate sufficient to meet their ventilation requirements.

In CPAP mode, the following parameters can be set:

1. O_2%
2. Triggering type and sensitivity
3. Support pressure for pressure support breaths.

Breath Type Icons

The upper right corner of the Tidal Volume field indicates the type of breath delivered by displaying one of several icons besides the exhale volume.

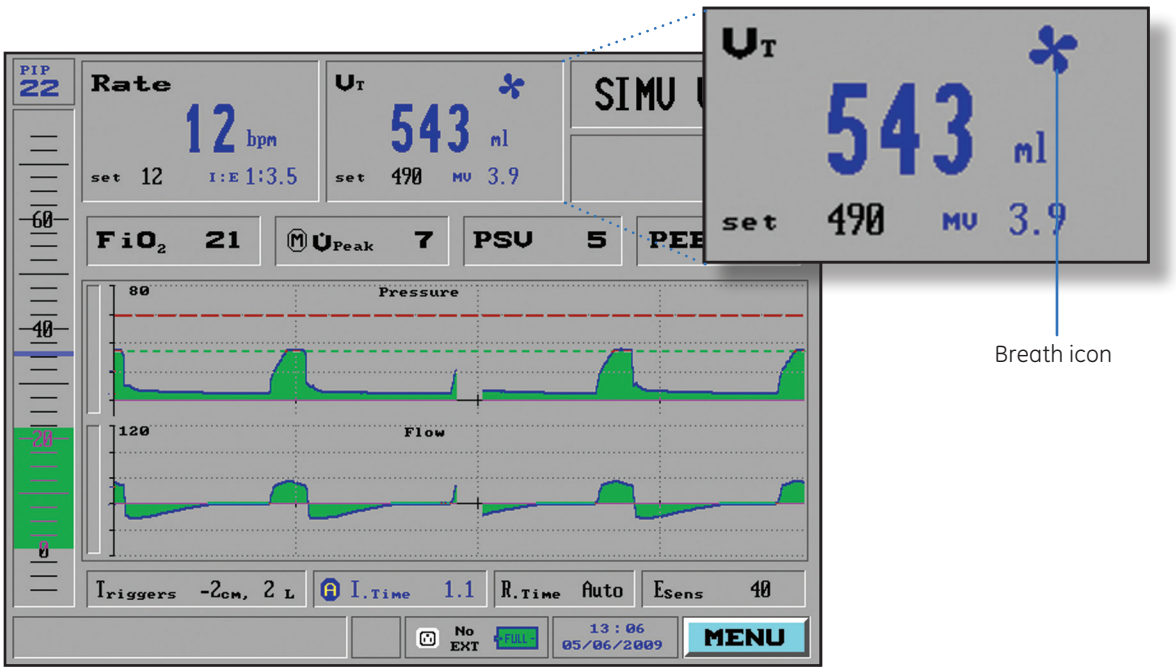


Figure 4.10 Adaptive Bi-level Screen

Breath Type Icon Examples

Double Bar: No measurement

Pink Fan: Mandatory Assist Breath (patient initiated): The iVent$_{201}$ has responded to patient initiation by delivering a breath.

Blue Fan: Mandatory Ventilator Breath (ventilator initiated): The iVent$_{201}$ has delivered a breath without patient initiation.

Green Sigh: Sigh Breath

Pink Man: Pressure Support Breath: In SIMV and CPAP/PSV modes, the ventilator has delivered a patient breath that has elevated the inspiratory pressure above PEEP.

Green Z: Automatic Zeroing of Sensors: The iVent$_{201}$ has calibrated itself to ensure that the sensors are measuring accurately.

Blue P: Purge sensor lines function is activated. To help prevent moisture build up when a humidifier is connected, the iVent$_{201}$ will send a puff of high pressure air through the sensor lines to clean them.

Figure 4.11 Breath type icons

Check Your Knowledge: Ventilation Modes

Circle the correct answer.

1. Which mode is best described by the following: A mode of ventilation in which all breath types (ventilator, assisted, and spontaneous) are allowed. Mandatory breaths are volume controlled and synchronized with patient efforts, while spontaneous breaths can be pressure supported.
    a. SIMV – Volume Control
    b. SIMV – Pressure Control
    c. Assist / Control – Pressure Control
    d. Adaptive Bi-level

2. What does the letter ***A*** within a blue circle indicate in the I-Time and Peak Flow boxes?
    a. Assist / Control
    b. Apnea
    c. Adaptive
    d. Airway Pressure

3. You can adjust the maximum acceptable pressure (Plimit) in which type of mode?
    a. CPAP/PSV
    b. Pressure Control
    c. Volume Control

4. Adaptive I-Time changes inspiratory time to achieve which I:E ratio?
    a. 2:1
    b. 1:2
    c. 1:3
    d. 1:1.5

5. Which mode is best described by the following: A mode of ventilation in which the patient receives a set rate of mandatory pressure controlled breaths. The patient may trigger some or all of the breaths. The total measured respiratory rate may be greater than the set rate.
    a. SIMV – Volume Control
    b. Assist / Control – Pressure Control
    c. Assist / Control – Volume Control
    d. Adaptive Bi-level

6. You can adjust the Tidal Volume Limit in which type of mode?
    a. CPAP/PSV
    b. Pressure Control
    c. Volume Control

7. Which mode would be best for high leak situations such as non-invasive ventilation (using a face mask)?
    a. SIMV – Volume Control
    b. Assist / Control – Pressure Control
    c. Assist / Control – Volume Control
    d. Adaptive Bi-level

Hands on Activity: Ventilation Modes

Place a check mark next to each task that is verified by the instructor.

- ☐ Activate SIMV - Volume Control and change a setting
- ☐ Activate Assist /Control - Volume Control and change a setting
- ☐ Change the Plimit setting in a Volume Control mode
- ☐ Deactivate Adaptive Flow and Adaptive I-Time in a volume control mode
- ☐ Activate SIMV - Pressure Control and change a setting
- ☐ Activate Assist /Control - Pressure Control and change a setting
- ☐ Change the Tidal Volume Limit setting in a Pressure Control mode
- ☐ Setup the ventilator for Adaptive Bi-Level mode
- ☐ Activate Adaptive Bi-level mode and change a setting
- ☐ Activate CPAP/PSV mode and change a setting

Answers: Check Your Knowledge - Ventilation Modes

1. Which mode is best described by the following: A mode of ventilation in which all breath types (ventilator, assist, and patient) are allowed. Mandatory breaths are volume controlled and synchronized with patient efforts.
   a. SIMV – Volume Control

2. What does the letter ***A*** within a blue circle indicate in the I-Time and Peak Flow boxes?
   c. Adaptive

3. You can adjust the maximum acceptable pressure (Plimit) in which type of mode?
   c. Volume Control

4. Adaptive I-Time changes inspiratory time to achieve which I:E ratio?
   b. 1:2

5. Which mode is best described by the following: A mode of ventilation in which the patient receives a set rate of mandatory pressure controlled breaths. The patient may trigger some or all of the breaths. The total measured respiratory rate may be greater than the set rate.
   b. Assist / Control – Pressure Control

6. You can adjust the Tidal Volume Limit in which type of mode?
   b. Pressure Control

7. Which mode would be best for high leak situations such as non-invasive ventilation (using a face mask)?
   d. Adaptive Bi-level

5 Alarms

Objectives: Alarms

By the end of this chapter you should be able to:

- Access the Alarms Settings window
- Change an alarm setting
- Select Auto Settings for alarms
- Access the Alarms Options window, describe each selection and adjust a setting.
- Clear an apnea alarm message.
- Restore the previous mode after apnea back-up ventilation is activated.
- Troubleshoot a sensor disconnect alarm
- Restore the previous mode after open loop mode is activated

Access the Alarms Settings Window

To access the alarm settings window:

1. Access the Main Menu from the ***Main*** screen by turning the control knob until the ***Menu*** field in the lower right corner is highlighted in bright blue.
2. Press the control knob, the ***Main Menu*** will appear.
3. Highlight ***Alarm Settings,*** and press the control knob.

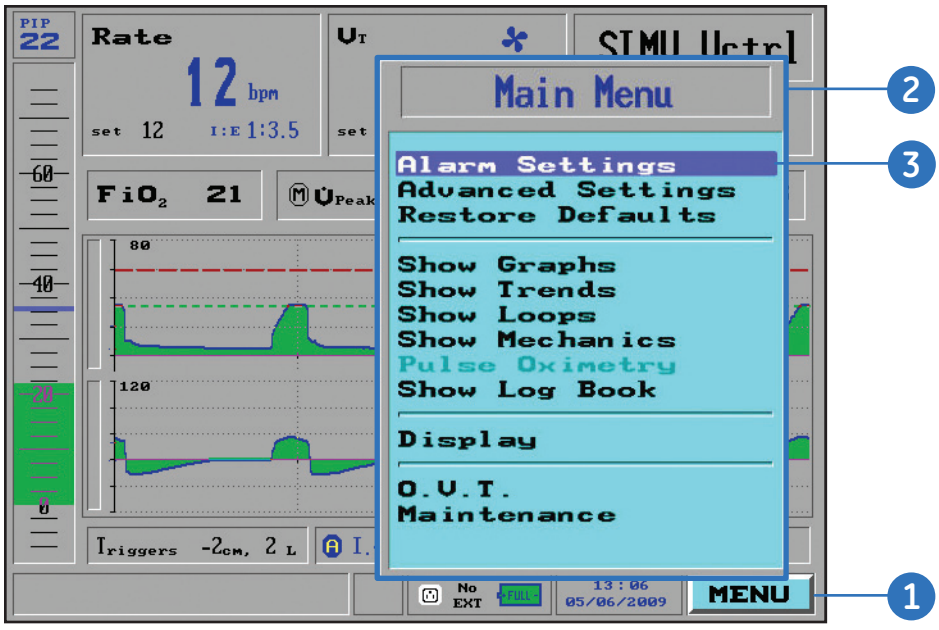


Figure 5.1 Main menu

Changing Alarm Settings

The first Alarm Settings window includes six ***slide indicators*** that control the range of values for triggering alarms. Some of these Alarm Conditions have a high and a low value (Rate, Minute Value, Pressure, FiO_2), while Apnea accepts only a time value, and Leak accepts a percentage.

The slide indicator components include:

1. **Small black numbers:** Located to the left of each gauge show the absolute maximum or minimum allowable alarm setting.
2. **Bright blue bar:** Indicates the scale of an active alarm threshold within the entire possible range of values.
3. **Large blue numbers:** Located to the left of each gauge are displayed only during ventilation showing each parameter's current operative value.
4. **Red number(s):** Located to the right of each indicator show the currently selected alarm value(s).

Note! *To save any alarm change, the Accept box must be highlighted and selected. Exiting the Alarms Settings window by any other means will cancel all changes that have been made.*

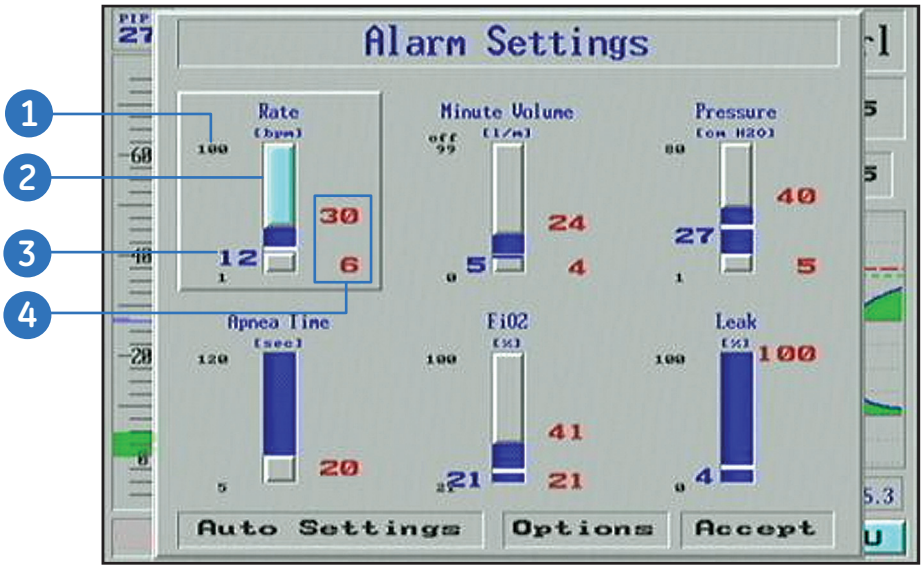
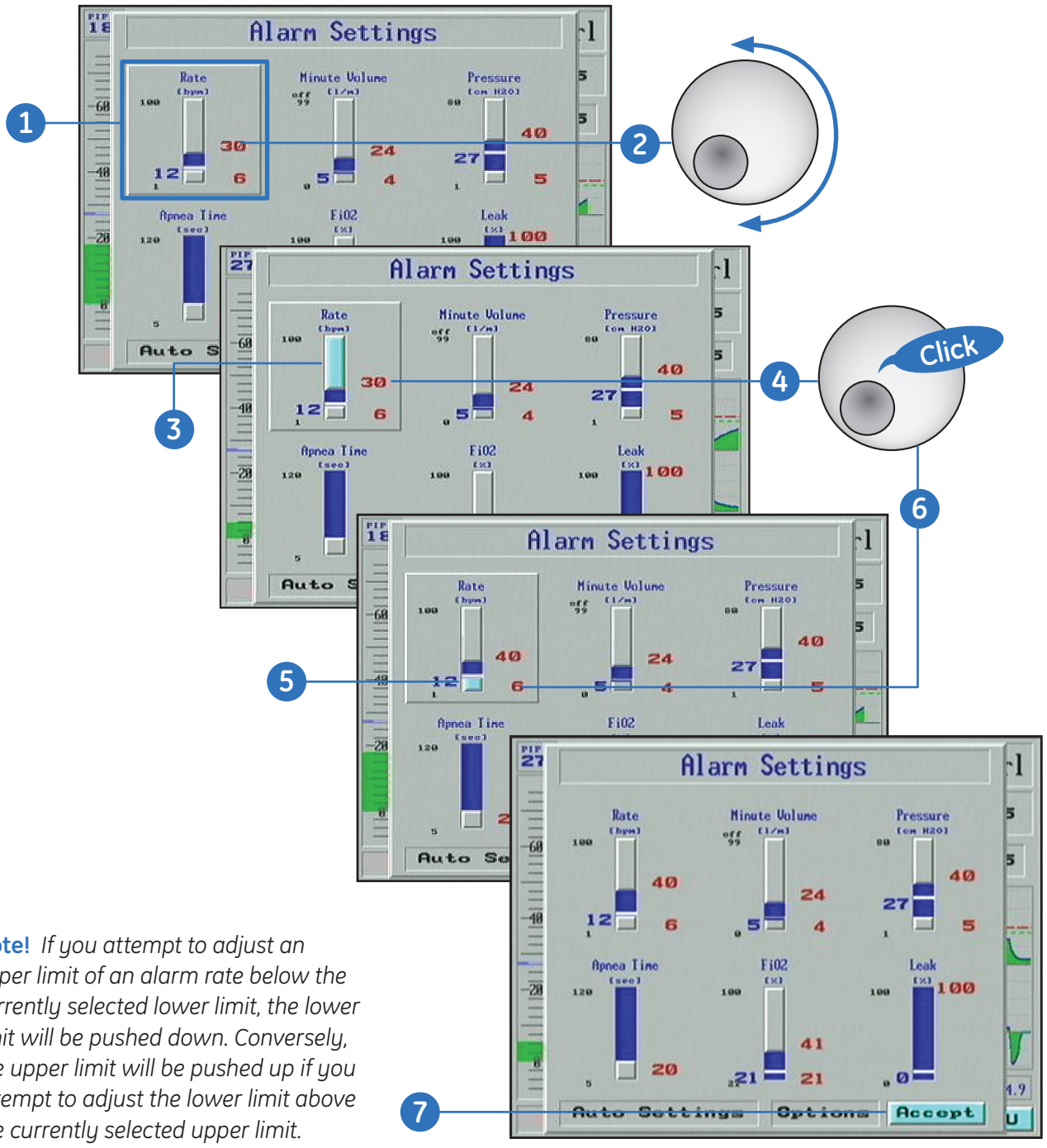


Figure 5.2 Alarm Settings slide indicator

To Change an Alarm Setting for Respiratory Rate

1. From the ***Alarm Settings*** window, turn the control knob until ***Rate*** field is highlighted.
2. Turn the control knob to the desired alarm setting for ***Respiratory Rate***.
3. The top of the slider is highlighted in bright blue. Turn the knob to adjust the alarm rate for the upper limit in Breaths per Minute.
4. Press the control knob to confirm your selection.
5. The bottom of the slider is now highlighted in bright blue. Turn the knob to adjust the alarm rate for the lower limit in Breaths per Minute.
6. Press the control knob to confirm the alarm settings.
7. Continue to set the remaining alarm slide indicators by following steps 1-6 listed above. When you have finished setting all of the alarm indicators press ***Accept***.



Note! *If you attempt to adjust an upper limit of an alarm rate below the currently selected lower limit, the lower limit will be pushed down. Conversely, the upper limit will be pushed up if you attempt to adjust the lower limit above the currently selected upper limit.*

Figure 5.3 Setting alarm indicators

Auto Settings

The Auto Settings feature sets all the alarms in the Alarm Settings window to suit the currently measured ventilation parameters for the patient. Selecting Auto Settings will bracket the measured values for each parameter in the Alarm Settings window with appropriate limits for those parameters. The Auto settings option is available only when the iVent$_{201}$ is ventilating.

Note! *The user should carefully review and assess the automatic alarm settings. Confirm that the alarm settings are compatible with specific patient needs, or facility policy.*
The factory default setting for Leak Alarm is set to OFF. You must manually set the leak alarm to enable it.

To Select Auto Settings

1. From the ***Alarm Settings*** window, turn the control knob until ***Auto Settings*** is selected.
2. Press the control knob. The Alarm Settings are now reset in accordance with current ventilation parameters.
3. Turn the control knob and select ***Accept*** to accept the Auto Settings and return to the Main screen.

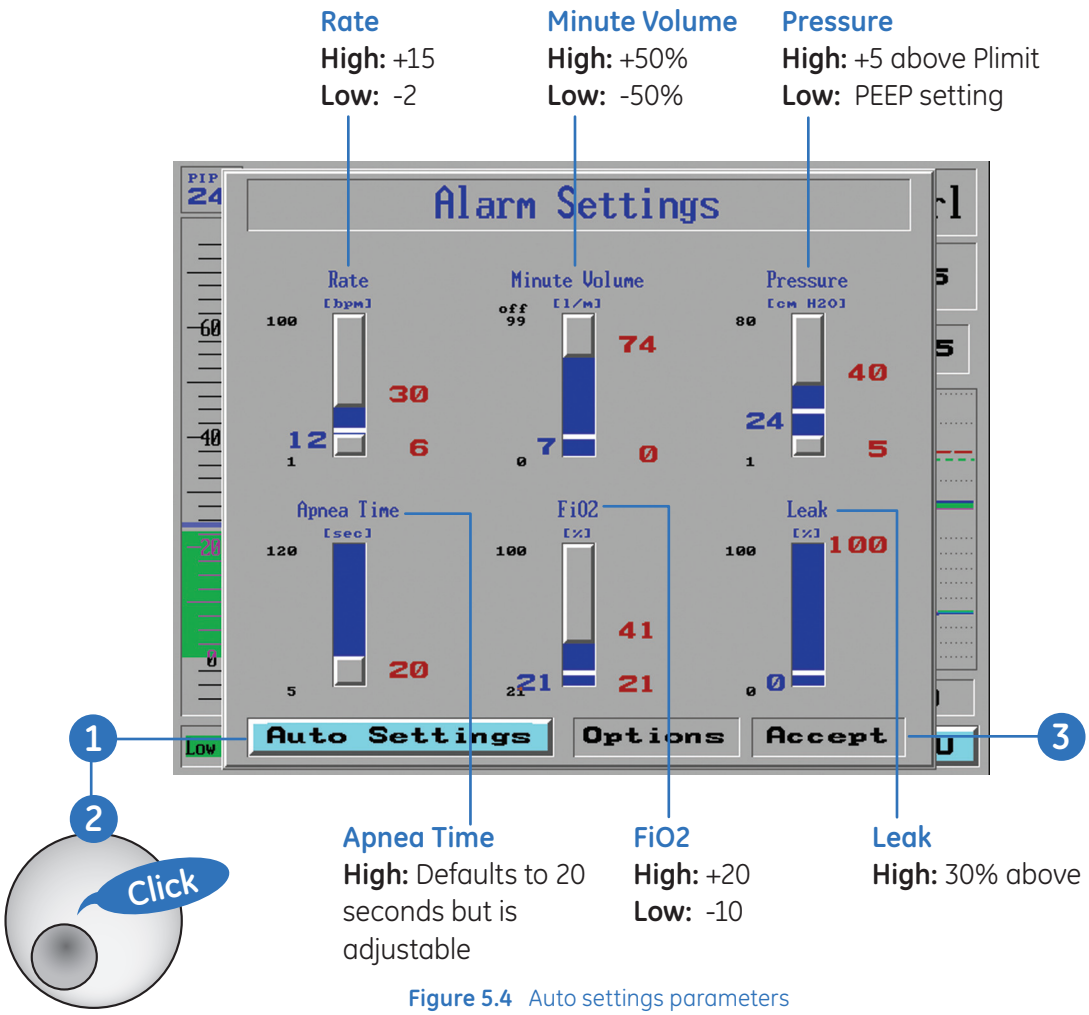


Figure 5.4 Auto settings parameters

Alarm Options

Accessing the Alarm Options Window

1. Access the Main Menu window from the Main screen by turning the control knob until the ***MENU*** field on the lower right corner is highlighted in bright blue.
2. Press the control knob and the ***Main Menu*** window appears.
3. Highlight ***Alarm Settings***, and press the control knob. The Alarm setting window appears.
4. Turn the control knob until ***Options*** is highlighted, and press the control knob.
5. The ***Alarm Options*** window appears

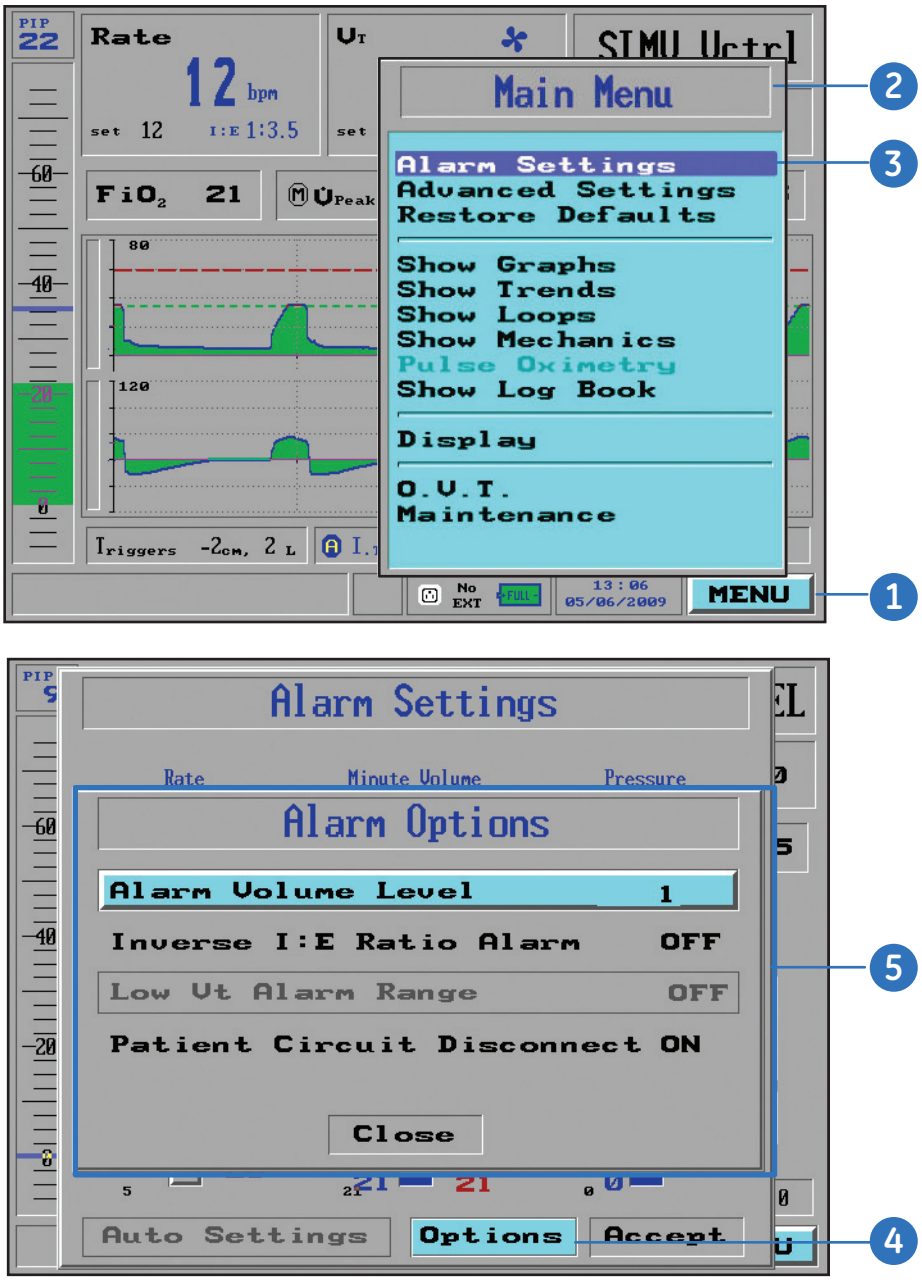


Figure 5.5 Accessing the alarm options window

Alarm Options Settings

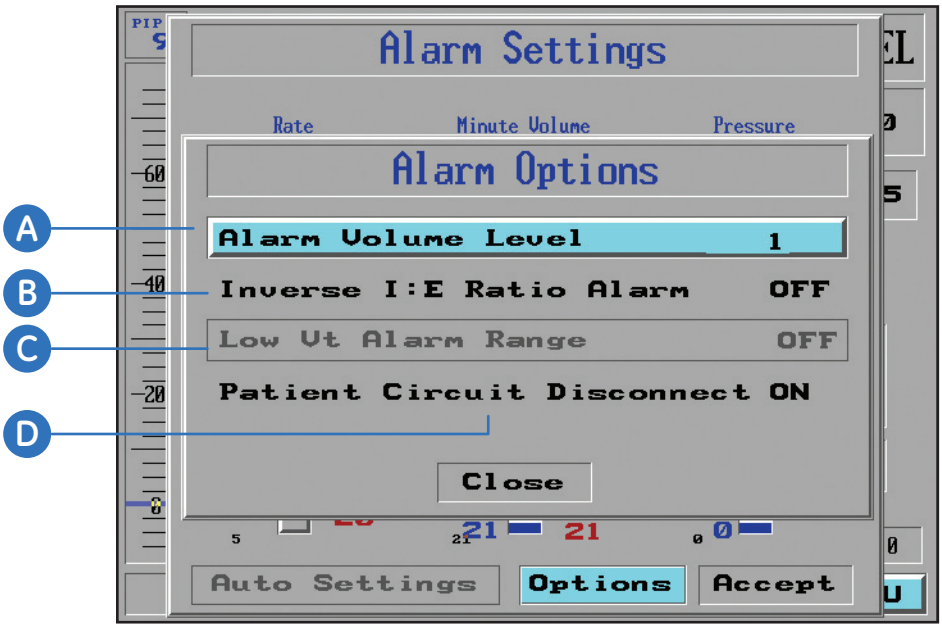


Figure 5.6 Alarm options window

Starting from the ***Alarm Options*** window adjust the following fields:

A. Alarm Volume

1. Turn the control knob until ***Alarm Volume Level*** is highlighted, and press the control knob.
2. Turn the control knob to adjust the alarm volume from ***1*** to ***10***, and press the control knob to confirm the setting. Select ***Close*** to return to the Alarm Settings window.
3. Turn the control knob until ***Accept*** is highlighted, and press the control knob to accept the Alarm Volume Level setting.

Note! *The default volume for alarm volume is 8. It is not recommended to set the alarm volume below 5.*

B. Inverse I:E Ratio Alarm

1. Turn the control knob until ***Inverse I:E Ratio Alarm*** is highlighted, and press the control knob.
2. Turn the control knob to select ***On*** or ***Off***, and press the control knob to confirm the setting. Select ***Close*** to return to the Alarm Settings window.
3. Turn the control knob until ***Accept*** is highlighted, and press the control knob to accept the Inverse I:E Ratio Alarm setting.

Note! *The default setting for Inverse I:E Ratio Alarm is ON. Before disabling any alarms, be sure that you are in accord with facility policy and patient needs.*

C. Low Tidal Volume Alarm Range

1. Turn the control knob until ***Low Vt Alarm Range*** is highlighted, and press the control knob.
2. Turn the control knob to adjust the percentage between ***0% (Off)*** and ***85%,*** and press the control knob to confirm the setting. Select ***Close*** to return to the Alarm Settings window.
3. Turn the control knob until ***Accept*** is highlighted, press the control knob to accept the Low Tidal Volume Alarm Range setting.

Note! *The default setting for Tidal Volume Not Delivered Alarm is 85%. Before disabling or adjusting any alarms, be sure that you are in accord with facility policy and patient needs. This option is not available in Adaptive Bi-Level ventilation mode.*

D. Patient Circuit Disconnect Alarm

When ventilating with Adaptive Bi-Level, under some circumstances it may be desirable to turn off the Patient Circuit Disconnect Alarm.

When the Patient Disconnect Alarm is turned Off, the warning ***Disc OFF*** is displayed in the bottom left corner of the Main Screen.

1. Turn the control knob until ***Patient Circuit Disconnect*** is highlighted, press the control knob.
2. Turn the control knob to select ***On*** and ***Off,*** press the control knob to confirm the setting. If you select ***Off***, a warning will appear as shown in figure 5.7.
3. Press the control knob to select ***Yes,*** and to confirm. Select ***Close*** to return to the Alarm Settings window.
4. Turn the control knob until ***Accept*** is highlighted, then press the control knob to accept the Patient Circuit Disconnect Alarm setting.

Figure 5.7 Patient circuit disconnect off warning

Apnea Alarm and Apnea Backup Ventilation

Apnea Alarm

If breathing has ceased for a period of time determined in the Alarm Settings window (the default value is 20 seconds), the Apnea Alarm will activate, as shown below. This message can be minimized by doing one of the following:

- Pressing ***Close*** in the Apnea window.
- Pressing the ***silence*** key on the keypad.
- Pressing the ***clear*** key on the keypad.

Figure 5.8 Apnea Alarm

Apnea Backup Ventilation

Apnea back up ventilation can be activated from all breathing modes. When apnea is detected the patient will be ventilated in the current ventilation mode except for CPAP. Rate is determined according to the set tidal volume for volume control, for all other modes the rate is based on an average of the twelve previous tidal volumes prior to the apnea event. The twelve breaths can be either spontaneous or mandatory breaths.

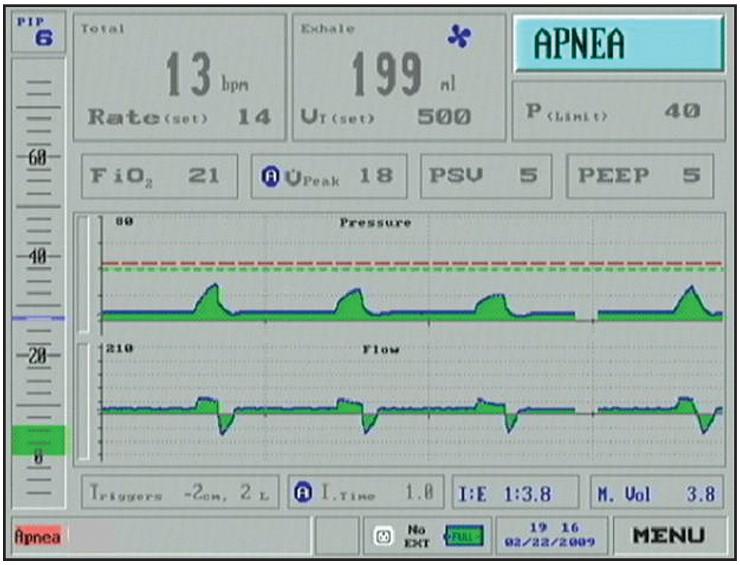


Figure 5.9 Apnea Back-up Ventilation Screen

In CPAP the unit switches to SIMV – Volume Control mode and the rate is based on the average of the twelve previous tidal volumes and the volume is determined from the weight setting. If there were no previous breaths in CPAP then both the tidal volume and rate are determined from the weight setting.

Restoring Previous Mode

The ventilator will remain in apnea backup ventilation until the patient initiates 3 consecutive breaths within a 1 minute time period and will then return to the previous mode automatically (although the ventilator will not exit from apnea ventilation during the first minute).

The user may restore previous ventilation parameters or make appropriate adjustments at any time. During apnea ventilation, all parameters appear in gray so all adjustments must be made only after restoring the previous ventilation mode.

To restore the previous mode:

1. Turn the control knob until ***Apnea*** is highlighted in the upper right of the main screen. Press the control knob.
2. Turn the control knob until ***Yes*** is highlight, and press the control knob.

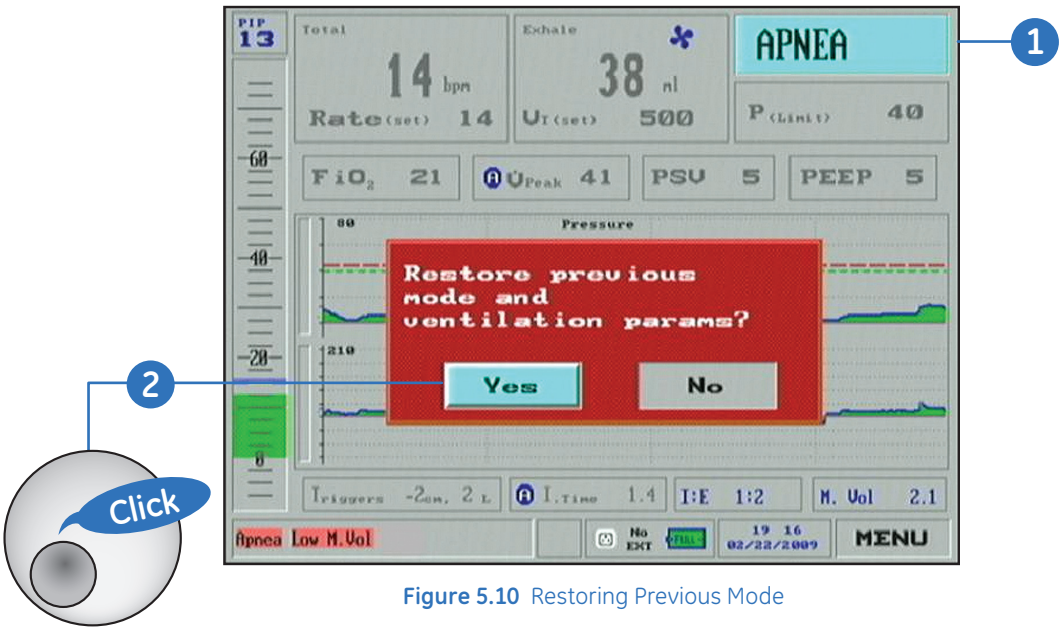


Figure 5.10 Restoring Previous Mode

The Sensor Failure Alarm

When the iVent$_{201}$ detects a Sensor Disconnect alarm or Check Sensor condition it will enter Open Loop ventilation backup mode. During Open Loop, ventilation is provided based on an average of the previous inhaled tidal volumes (see Open Loop Mode in the next section for more information).

If the Sensor Disconnect alarm triggers the following alarm window will appear:

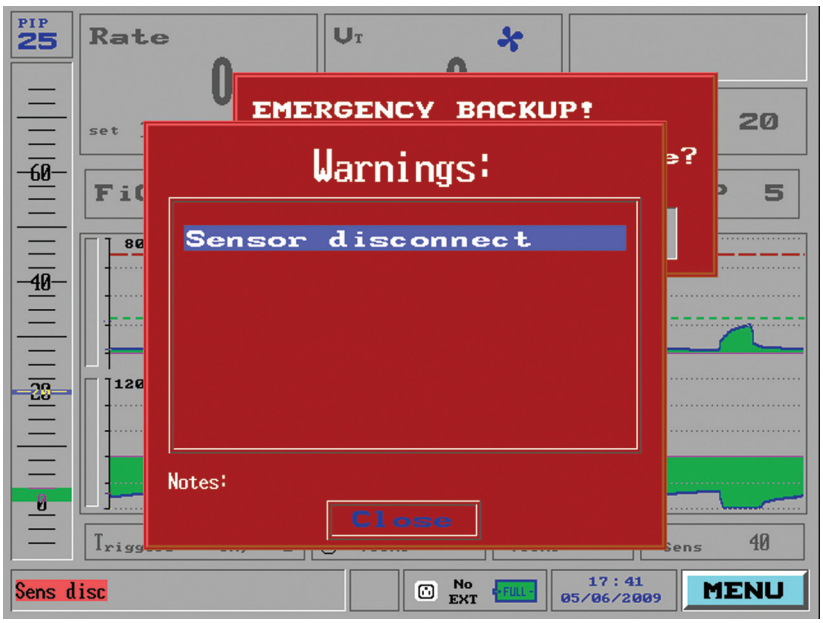


Figure 5.11 Sensor Disconnect Alarm Window

If the sensor disconnect alarm is triggered:

1. Press the ***clear*** key on the keypad.
2. Check the connection of flow transducer tubing to the ventilator.
3. Check for excessive amounts of water or secretions, which can set off the sensor alarm, in the tubing and flow transducer.
4. If no water or secretions are visible, wait approximately 10 breaths – sometimes coughing can cause **Check Sensor** or ***Sensor Disconnect*** alarms.
5. If the ventilator does not automatically return to the previous mode and setup, press the ***Restore*** option in the ***Backup Mode Activated*** window and check the setting values: PEEP, Rise-Time (auto).

Note! *If the Check Sensor alarm persists repeatedly, provide an alternative source of ventilation. Then replace the patient circuit and run the O.V.T. test.*

If the Patient Disconnect alarm is available and switched off, the Sensor Failure alarm and backup mode will not be activated.

If the Sensor Disconnect alarm is detected three times within a minute, the ventilator will not restore to the previous mode automatically, but will remain in Open Loop instead. Press the Restore option in the Backup Mode Activated window to restore the ventilator to the previous mode.

Open Loop Mode

The Open Loop mode is an emergency backup mode designed for short-term ventilation. Open Loop is used as a safety mode in the event of ventilator circuit or sensors failures. While in Open Loop mode, the $iVent_{201}$ ventilates without reference to the flow sensor data.

When the open Loop mode is activated a Warning message is displayed allowing you to restore to the last ventilation mode or to go to Standby mode, as shown.

Figure 5.12 Open loop warning message

If Standby is selected, the standby confirmation message is displayed.

Figure 5.13 Standby confirmation message

The Open Loop ventilation is an approximation of the Volume Controlled ventilation with pressure limit. Ventilation is based on the average measured inhaled volume similar to apnea ventilation. Pressure is measured via an internal pressure sensor.

Check Your Knowledge: Alarms

Circle the correct answer.

1. How do you access the Alarms Settings window?
   a. Press the Alarms Settings dedicated key on the front of the unit.
   b. Access the Main Menu, and then select Alarm Settings.
   c. Press the Alarm key on the front of the keypad, then select Alarm Settings

2. Which of the following alarm settings can ***not*** be adjusted from the Alarm Settings window?
   a. Rate
   b. Minute Volume
   c. Pressure
   d. Low O_2 Pressure

3. Which feature is best described by the following: A feature that sets all the alarms in the Alarm Settings window to suit the currently measured ventilation parameters for the patient.
   a. Alarm Settings
   b. Auto Settings
   c. Apnea Back-up Ventilation
   d. Open Loop Ventilation

4. From which window would you adjust the alarm volume?
   a. Alarm Options
   b. Auto Settings
   c. Advanced Settings

5. The iVent$_{201}$ cannot return to the previous mode automatically after apnea backup ventilation has been activated, it must be returned manually.
   a. True
   b. False

6. When the iVent$_{201}$ detects a Sensor Disconnect alarm or Check Sensor condition, it will enter which mode of ventilation?
   a. None, it will continue in the existing mode.
   b. CPAP
   c. Open Loop mode

Hands on Activity: Alarms

Place a check mark next to each task that is verified by the instructor.

- ☐ Access the Alarm Settings window and adjust a setting
- ☐ Activate Auto Settings
- ☐ Access the Alarm Options window and adjust a setting
- ☐ Restore a previous mode from apnea backup ventilation

Answers: Check Your Knowledge - Alarms

1. How do you access the Alarms Settings window?
   b. Access the Main Menu, and then select Alarm Settings.

2. Which of the following alarm settings can ***not*** be adjusted from the Alarm Settings window?
   d. Low O_2 Pressure

3. Which feature is best described by the following: A feature that sets all the alarms in the Alarm Settings window to suit the currently measured ventilation parameters for the patient.
   b. Auto Settings

4. From which window would you adjust the alarm volume?
   a. Alarm Options

5. The iVent$_{201}$ cannot return to the previous mode automatically after apnea backup ventilation has been activated, it must be returned manually.
   b. False

6. When the iVent$_{201}$ detects a Sensor Disconnect alarm or Check Sensor condition, it will enter which mode of ventilation?
   c. Open Loop mode

6 Advanced Settings

Objectives: Advanced Settings

By the end of this chapter you should be able to:

- Access the Advanced Settings window
- Change the Sigh Breath setting
- Enable and disable Easy Exhale
- Describe each of the four Oxygen Supply settings and change a setting
- Change the Adaptive Peak Flow setting
- Change the Humidifier setting
- Enable and disable the pulse oximetry function
- Connect a synchronized nebulizer device
- Set and activate a synchronized nebulizer device
- Set the time and date
- Restore Default settings

Advanced Settings Overview

The Advanced Settings window allows you to switch or adjust several patient and ventilator parameters, including:

- Sigh breath
- Easy Exhale™
- Oxygen supply
- Adaptive Peak Flow
- Humidifier Settings
- SpO_2 enabled
- Nebulizer
- Time and date

Accessing the Advanced Settings Window

To access the Advanced Settings window:

1. Turn the control knob until the ***MENU*** field on the lower right corner of the display is highlighted in bright blue.
2. Press the control knob and the ***Main Menu*** will appear.
3. Turn the control knob to highlight ***Advanced Settings***.
4. Press the control knob and the ***Advanced Settings*** window will appear.

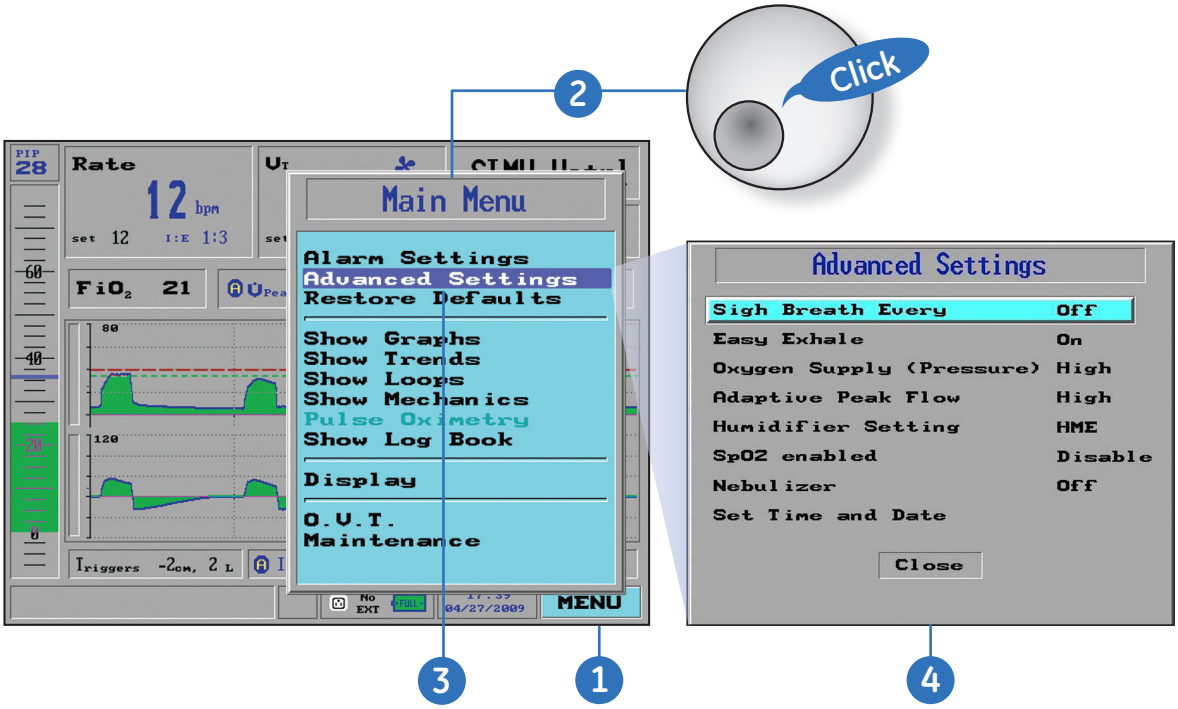


Figure 6.1 Acessing the advanced settings window

To exit from the Advanced Setting window:

1. Turn the control knob to highlight ***Close*** on the Advanced Settings window ,
2. Press the control knob.

Sigh Breath

In Volume Control modes, the iVent$_{201}$ supports sigh breaths. . You can use the Sigh Breath entry of the Advanced Settings window to turn Sigh Breaths off or enable it by adjusting its intervals. The Sigh Breath volume is 1.5 times the set tidal volume, and the default setting is ***Off.***

To change the Sigh Breath setting:

1. From the Advanced Settings window, turn the control knob to highlight ***Sigh Breath Every***. The current setting is shown to the right of the selection.
2. Press the control knob. A window appears with the values ***25, 50, 75, 100, 125, 150***, and ***Off.***
3. Turn the control knob to the desired value.
4. Press the control knob to confirm the settings.

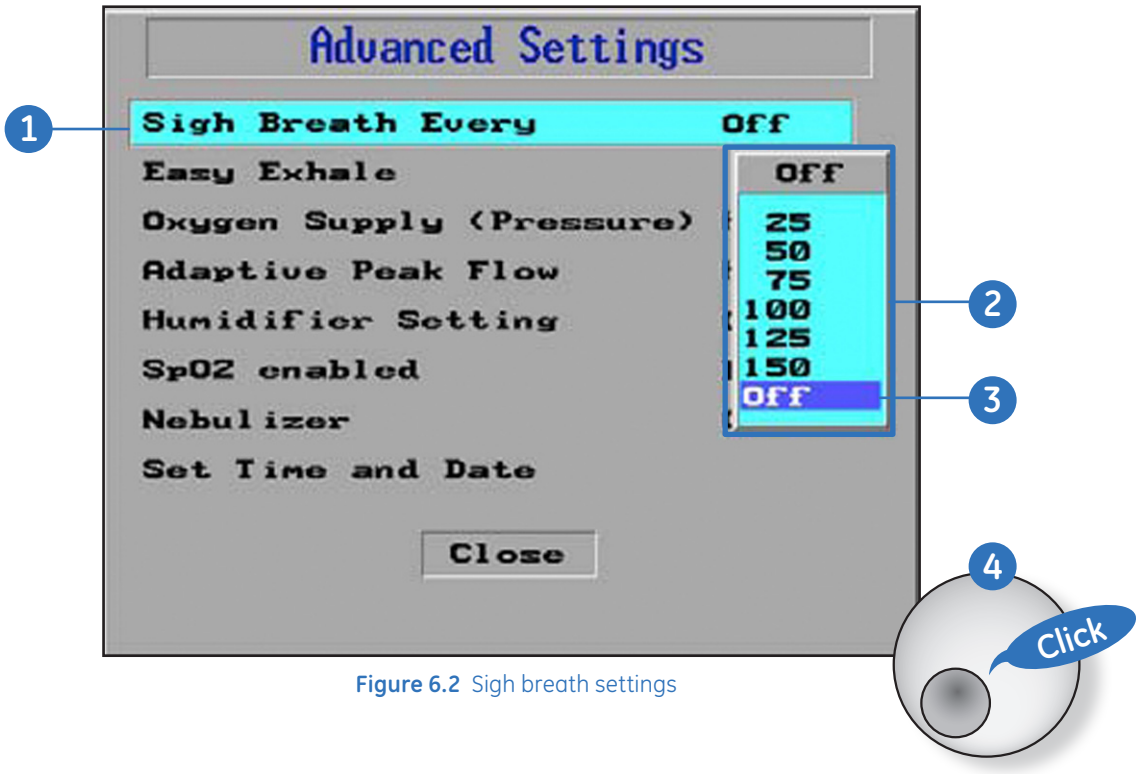


Figure 6.2 Sigh breath settings

Easy Exhale

Easy Exhale is an advanced PEEP mode designed for use with severe obstructive airway flow. It introduces PEEP late in expiration in order to prevent airway pressure from falling below alveolar pressure in situations where critical airway closure tends to create intrinsic PEEP.

The default setting for Easy Exhale is ***On***. Use the Advanced Settings window to turn Easy Exhale Off or On.

To enable or disable Easy Exhale:

1. From the Advanced Settings window, turn the control knob to highlight ***Easy Exhale***. The current setting is shown to the right of the selection.
2. Press the control knob. A window appears with the values ***On*** and ***Off***.
3. Turn the control knob to select the desired value.
4. Press the control knob to confirm the settings.

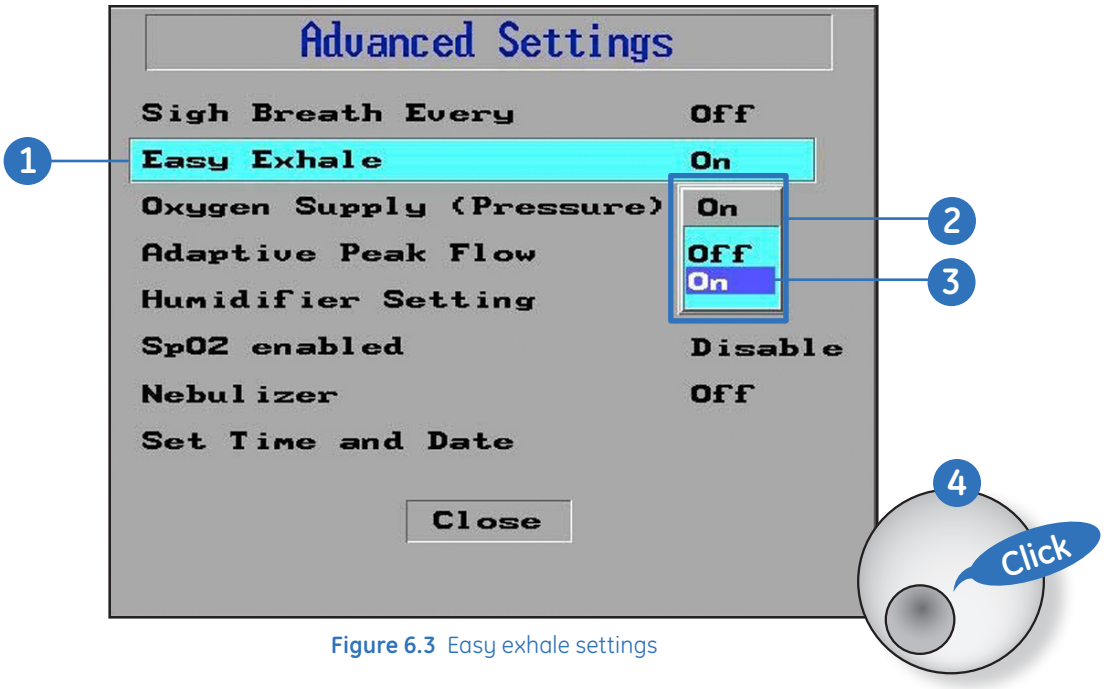


Figure 6.3 Easy exhale settings

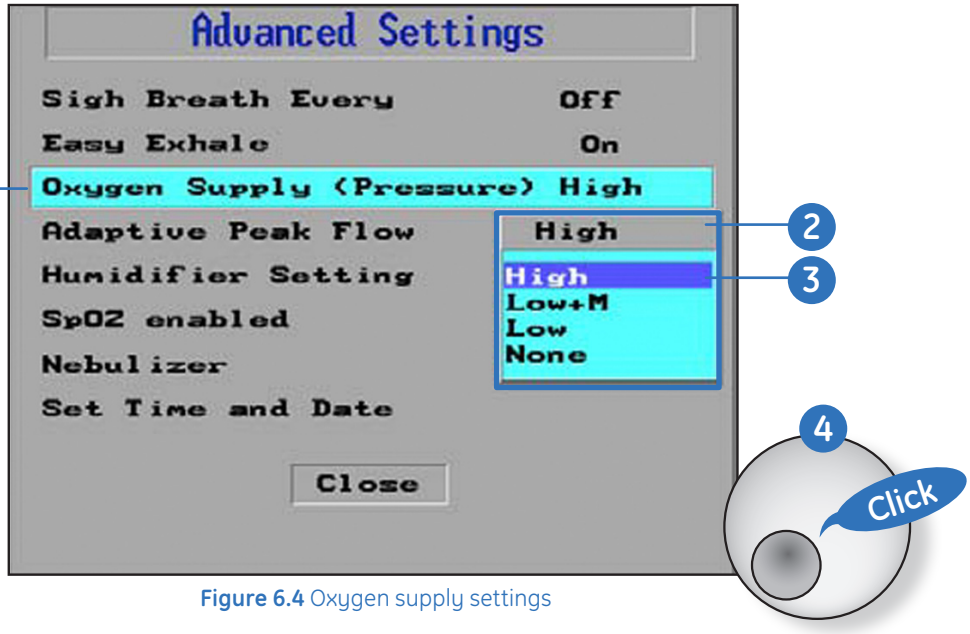
Oxygen Supply

There are four available options for Oxygen Supply. These options will be described in detail.

- High
- Low + Monitoring
- Low
- None

To change the Oxygen Supply setting:

1. From the Advanced Settings window, turn the control knob to highlight ***Oxygen Supply (Pressure)***. The current setting is shown to the right of the selection.
2. Press the control knob. A window appears with the values ***High***, ***Low + M***, ***Low***, and ***None***.
3. Turn the control knob to select the desired value.
4. Press the control knob to confirm the settings.



Note!
The nebulizer can be activated only when the Oxygen Supply High option is selected.

Figure 6.4 Oxygen supply settings

Oxygen Supply: High

This option is used for a high-pressure supply, either from a wall outlet or an oxygen cylinder, both of which use the internal O_2 mixer. If using a high pressure oxygen supply, connect the oxygen supply to the oxygen inlet connector at the back of the ventilator. The High option is the factory default setting for the oxygen supply type.

When the High option is selected, the set value is displayed in the FiO_2 field on the main screen. All O_2 related alarms are enabled, such as Low O_2, High O_2, and O_2 sensor fail.

To view the measured O_2 concentration with a high pressure oxygen supply, navigate to the ***Alarm*** window from the ***Main Menu***. The blue number next to the FiO_2 alarm slider indicates the measured O_2 level.

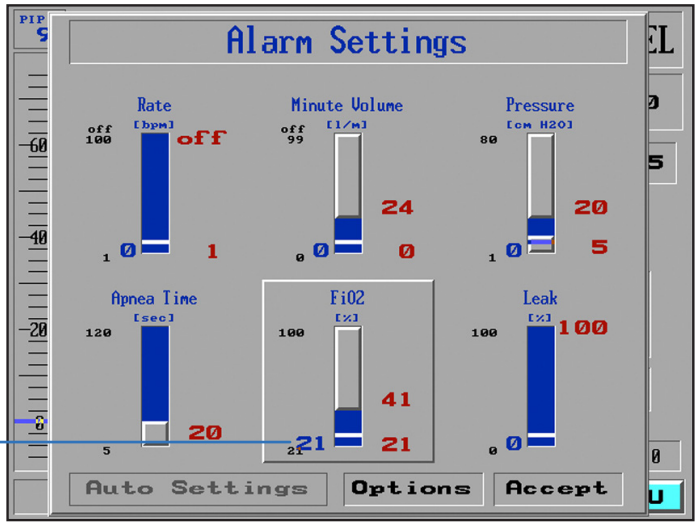


Figure 6.5 Measured FiO_2 concentration

Oxygen Supply: Low + Monitoring

The Oxygen Supply Low + Monitoring option is used for a low pressure oxygen supply in combination with the iVent$_{201}$'s low-pressure adapter. If Low+ Monitoring is selected, the FiO_2 field on the main screen will be grayed out, and the O_2 settings cannot be changed. The display in the main screen will show the measured FiO_2 (the FiO_2 delivered to the patient), as in the Alarm window. All O_2 related alarms are enabled.

Oxygen Supply: Low

The Oxygen Supply Low option is used for a low-pressure supply in combination with iVent$_{201}$'s low-pressure adapter. When this option is selected, all the O_2 related alarms are disabled, such as Low O_2, High O_2, and O_2 sensor failed. After selecting the Low option, the following warning message is displayed:

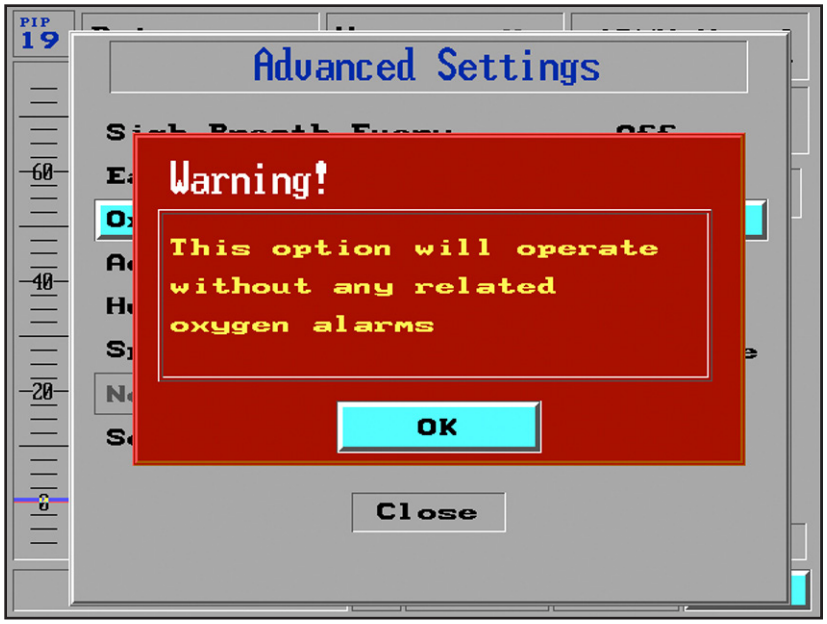


Figure 6.6 Oxygen supply low warning

The alarm settings and readings are disabled, and the FiO_2 field on the main screen will display two dashes (--). If the O_2 sensor fails, no alarm will be displayed.

Oxygen Supply: None

The Oxygen Supply None option is used when no O_2 Supply is connected to the iVent$_{201}$. When this option is selected all the O_2 related alarms are disabled. The alarm settings and readings are also disabled, and the FiO_2 field on the main screen will display two dashes (--). If the O_2 sensor fails, no alarm will be displayed.

Adaptive Peak Flow

The rate for Adaptive Peak Flow can be adjusted from the Advanced Settings window. For more information about Adaptive Peak Flow, see ***Chapter 4, Ventilation, Adaptive Flow and Adaptive I-Time on page 4.4.***

To change the Adaptive Peak Flow setting:

1. From the ***Advanced Settings*** window, turn the control knob to highlight ***Adaptive Peak Flow***. The current setting is shown to the right of the selection.
2. Press the control knob. A window appears with the values ***Off, Low, Mid*** and ***High.***
3. Turn the control knob to select the desired value.
4. Press the control knob to confirm the settings.

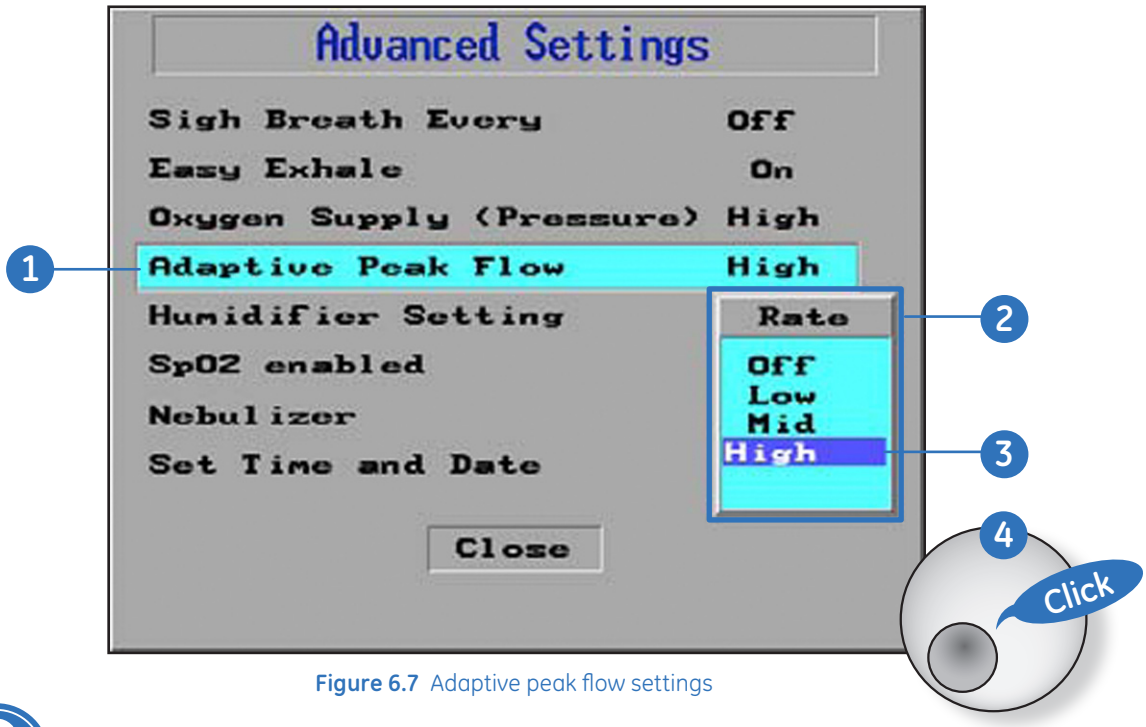


Figure 6.7 Adaptive peak flow settings

Note! *The recommended setting (and the default setting) for Adaptive Peak Flow is High.*

Humidifier Setting

When a Humidifier is connected, moisture tends to cluster at the sensor tubes. To prevent this excess moisture, the iVent$_{201}$ periodically sends a burst of air through the sensor tubes. The Humidifier setting enables the user to determine the frequency of the automated sensor purging.

Note! *This is an optional feature not available in all units.*

There are no default settings for the Humidifier. The iVent$_{201}$ will keep the last settings every time, even if a new patient is selected. The factory settings are used only when new software is installed or the memory data is corrupted.

To change the Humidifier setting:

1. From the Advanced Settings window, turn the control knob to highlight ***Humidifier Setting***. The current setting is shown to the right of the selection.
2. Press the control knob. A window appears with the values ***Heated*** (1 minute purge frequency), ***HME*** (10 minute purge frequency), and ***Off.***
3. Turn the control knob to select the desired value.
4. Press the control knob to confirm the settings.

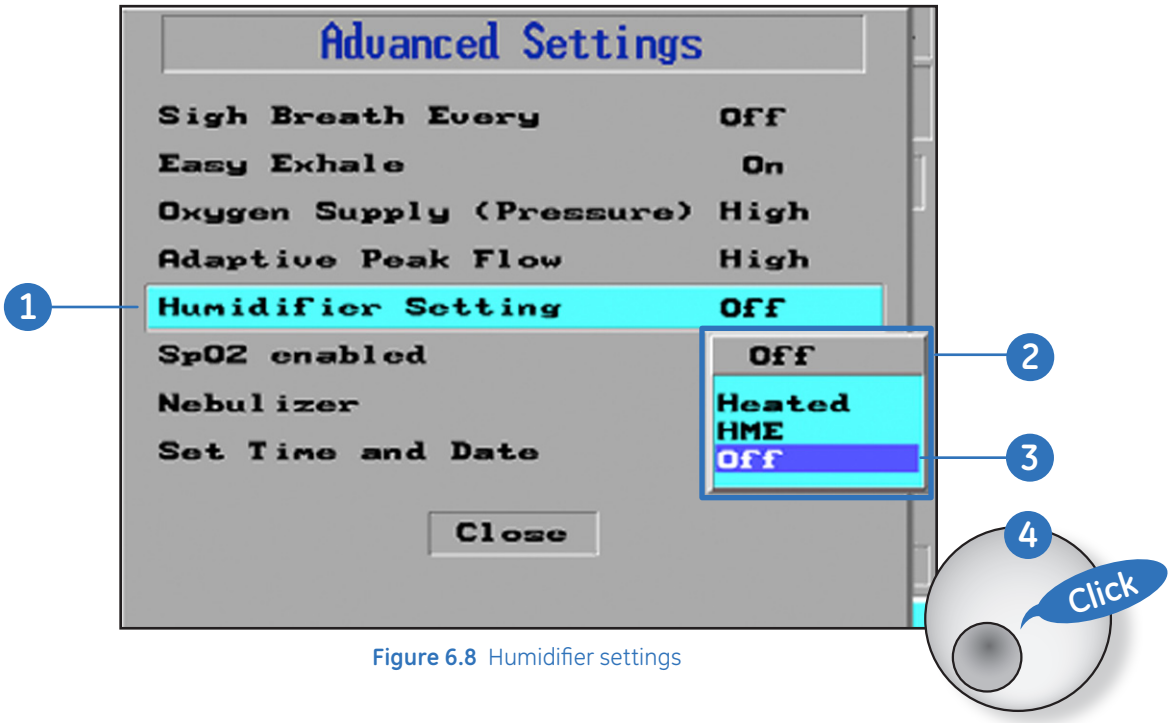


Figure 6.8 Humidifier settings

Note! *The automated sensor purge frequency is always 1 minute when the Nebulizer is activated.*

Pulse Oximetry

A pulse oximeter can be connected to the iVent$_{201}$ ventilator allowing the user to continuously monitor patient's oxygenation saturation on the iVent$_{201}$ display.

To enable/disable the Pulse Oximetry function:

1. From the ***Advanced Settings*** window, turn the control knob to highlight the **SpO$_2$ enabled**.
2. Press the control knob. A window appears with the values ***Enable*** and ***Disable.***
3. Turn the control knob to the desired selection.
4. Press the control knob to confirm the settings.

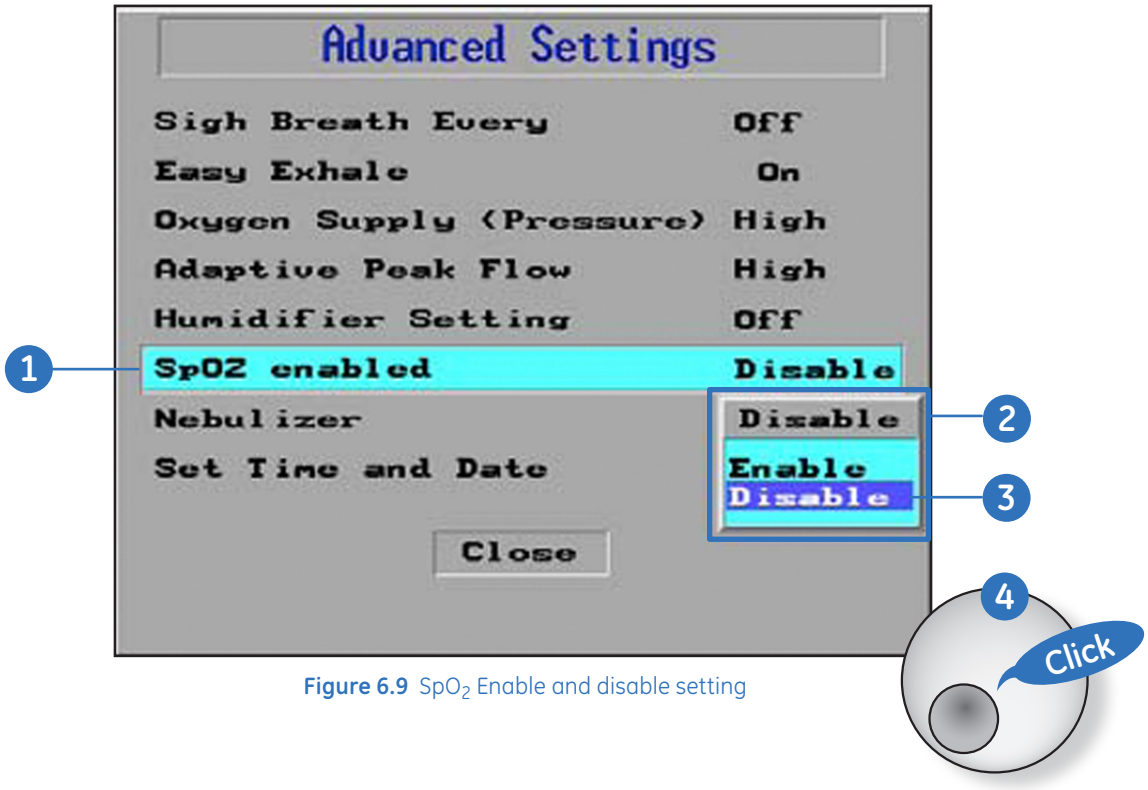


Figure 6.9 SpO$_2$ Enable and disable setting

Nebulizer

If required, a synchronized nebulizer device may be connected to the iVent$_{201}$.

Note! *The Oxygen Supply option must be set to High in the Advanced Settings window, as the nebulizer uses 100% oxygen as a driver gas.*

To connect a synchronized nebulizer device:

1. Connect the Nebulizer tube to the Nebulizer outlet on the front panel.
2. The Nebulizer icon is displayed in gray at the lower bar of the screen, showing that the nebulizer is connected but not activated.
3. Install the nebulizer with the desired medication to the patient circuit so that the added flow goes through the flow sensor during inspiration.
4. Connect the other side of the Nebulizer tube to the nebulizer.

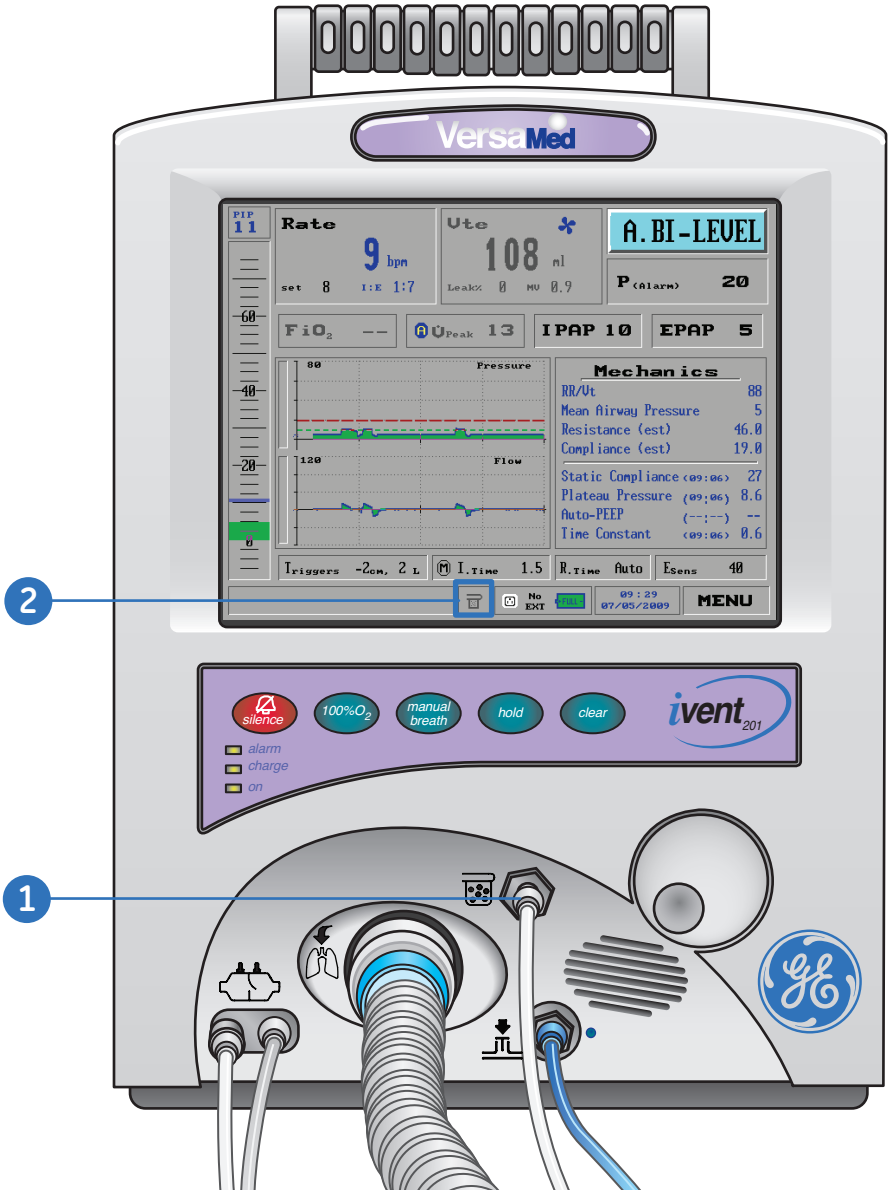


Figure 6.10 Nebulizer connection

To set and activate the nebulizer device:

1. From the ***Advanced Settings*** window, turn the control knob to highlight ***Nebulizer.*** The current setting is shown to the right of the selection.
2. Press the control knob. The ***Nebulize***r window appears. The default time is ***Off.***
3. Turn the control knob to set the time duration for nebulization. You can set the time between ***5 minutes*** and ***4 hours***. More nebulization time can be set while the nebulizer is activated. The new set time will be the sum of the time you have added and the elapsed time.
4. Press the control knob to confirm the settings. During the nebulization process you may re-enter the Nebulizer window and view the elapsed time.
5. When the set time for the Nebulizer operation has elapsed, the nebulizer will deactivate automatically, and the nebulizer icon in the lower bar area of the display will gray out.

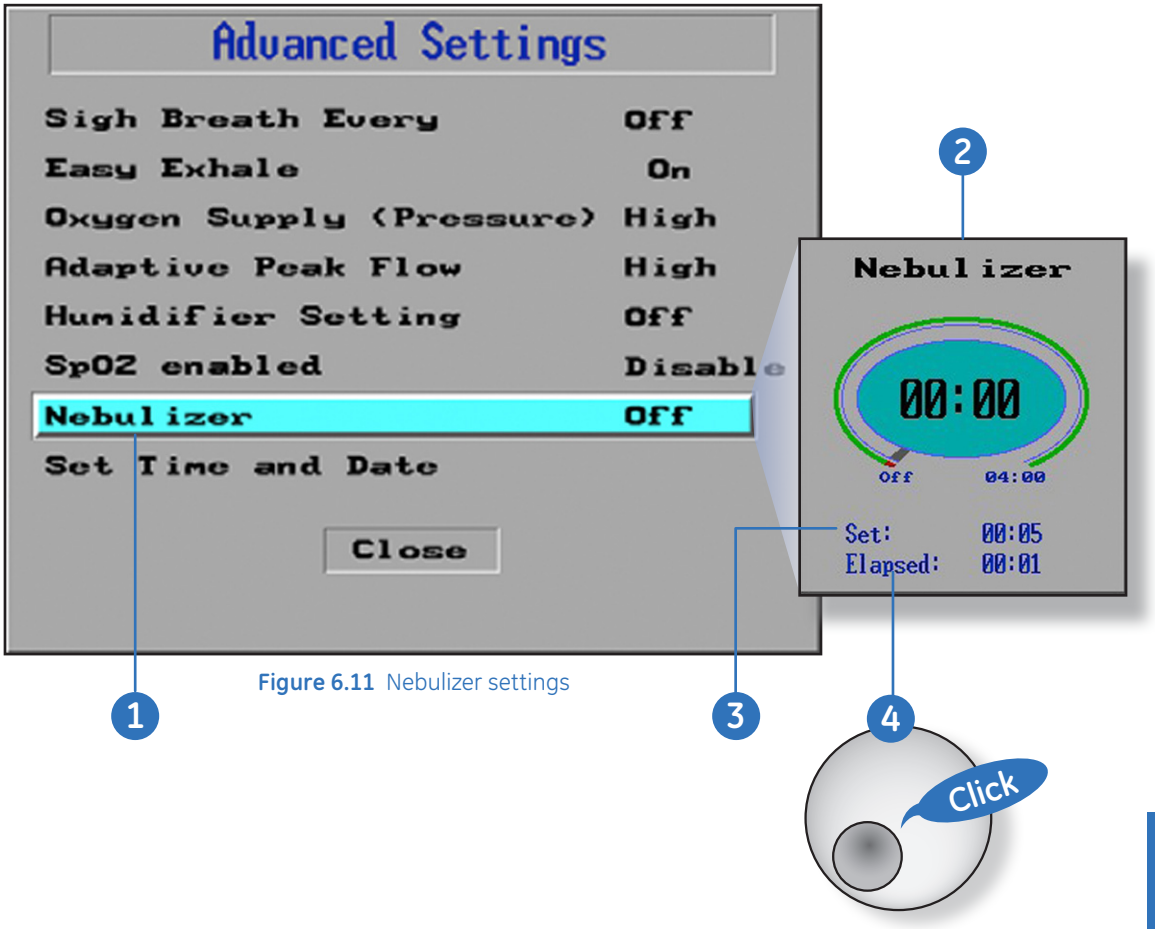


Figure 6.11 Nebulizer settings

Set Time and Date

To set the time and date:

1. From the ***Advanced Settings*** window, turn the control knob to highlight the ***Set Time and Date*** selection.
2. Press the control knob. The ***Set Time and Date*** window appears, showing the currently set time, with the hour (in 24-hour mode) selected.
3. To change the hour, make sure the hour is selected, and then press the control knob. Rotate the control knob to adjust the time. Turn clockwise to set the clock to a later hour, counterclockwise to set it earlier.
4. Press the control knob to confirm and accept the setting.
5. Turn the control knob to select the ***minute, day, month,*** and ***year*** fields. Press the control knob, and turn the knob to adjust the time and date.
6. Turn the control knob to ***OK*** and press to confirm the settings.
7. Close the Advanced Settings window and verify that the time and date has changed on the main screen clock, on the lower right of the display.

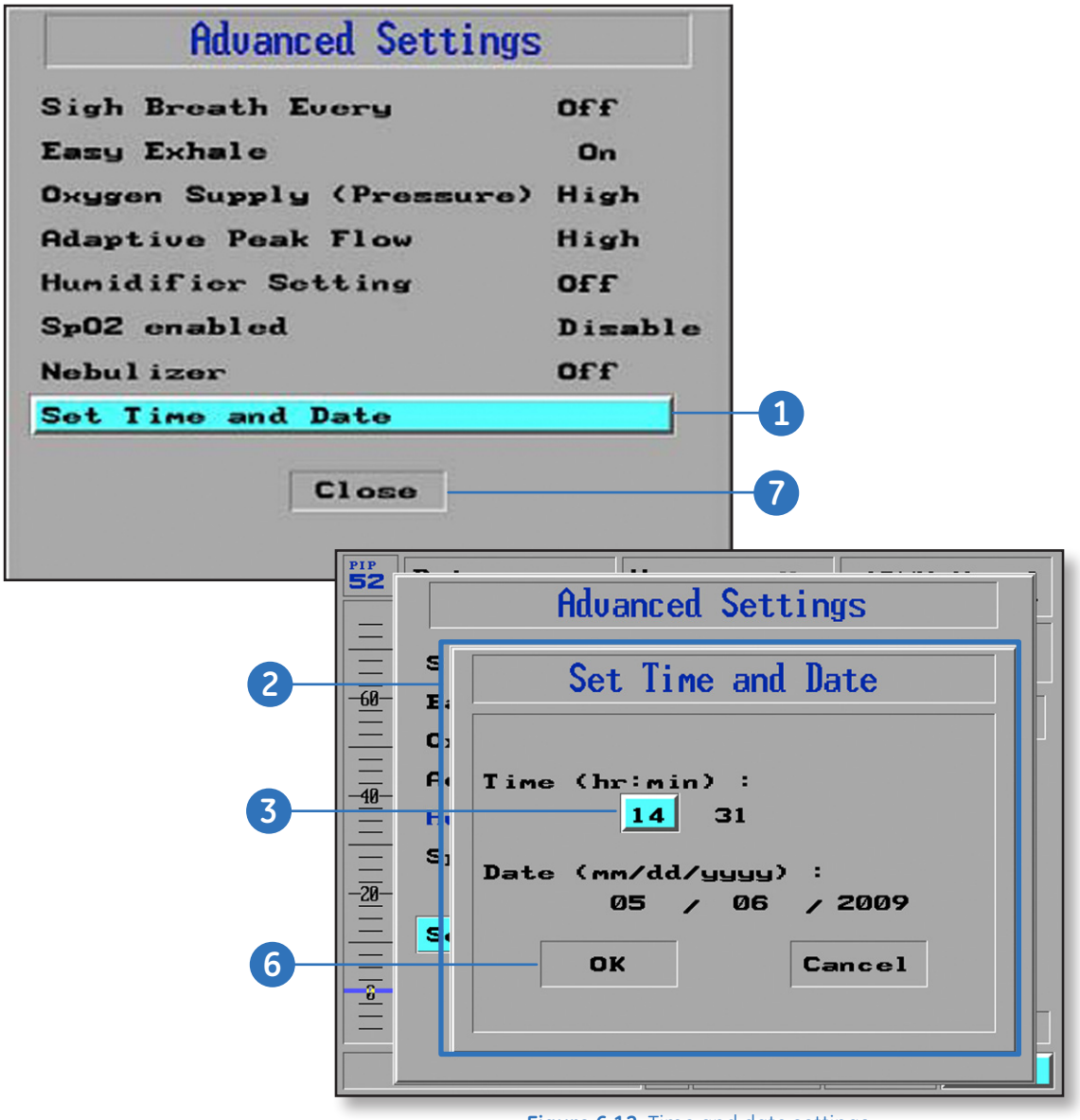


Figure 6.12 Time and date settings

Restore Default Settings

To clear ALL settings and return the iVent$_{201}$ to its default startup state, use ***Restore Defaults***. The factory startup default state is based on a patient weight of 70+kg and SIMV-Volume Control mode.

Note! *Restoring Defaults resets ALL parameters and settings to their default values.*

To restore the default settings:

1. Access the Main menu from the Main screen by turning the control knob until the ***Menu*** field in the lower right corner is highlighted in bright blue.
2. Press the control knob, the ***Main*** menu will appear.
3. Highlight ***Restore Defaults,*** and press the control knob.
4. A red warning window will appear:
5. Turn the control knob to ***Confirm*** and press.
6. The Restore Defaults window will appear, asking you to select a default weight. Choose a default weight by turning the control knob. The factory default is ***70+kg.***
7. Press the control knob again. The ventilator settings will return to their defaults and the ***Main*** screen is displayed.

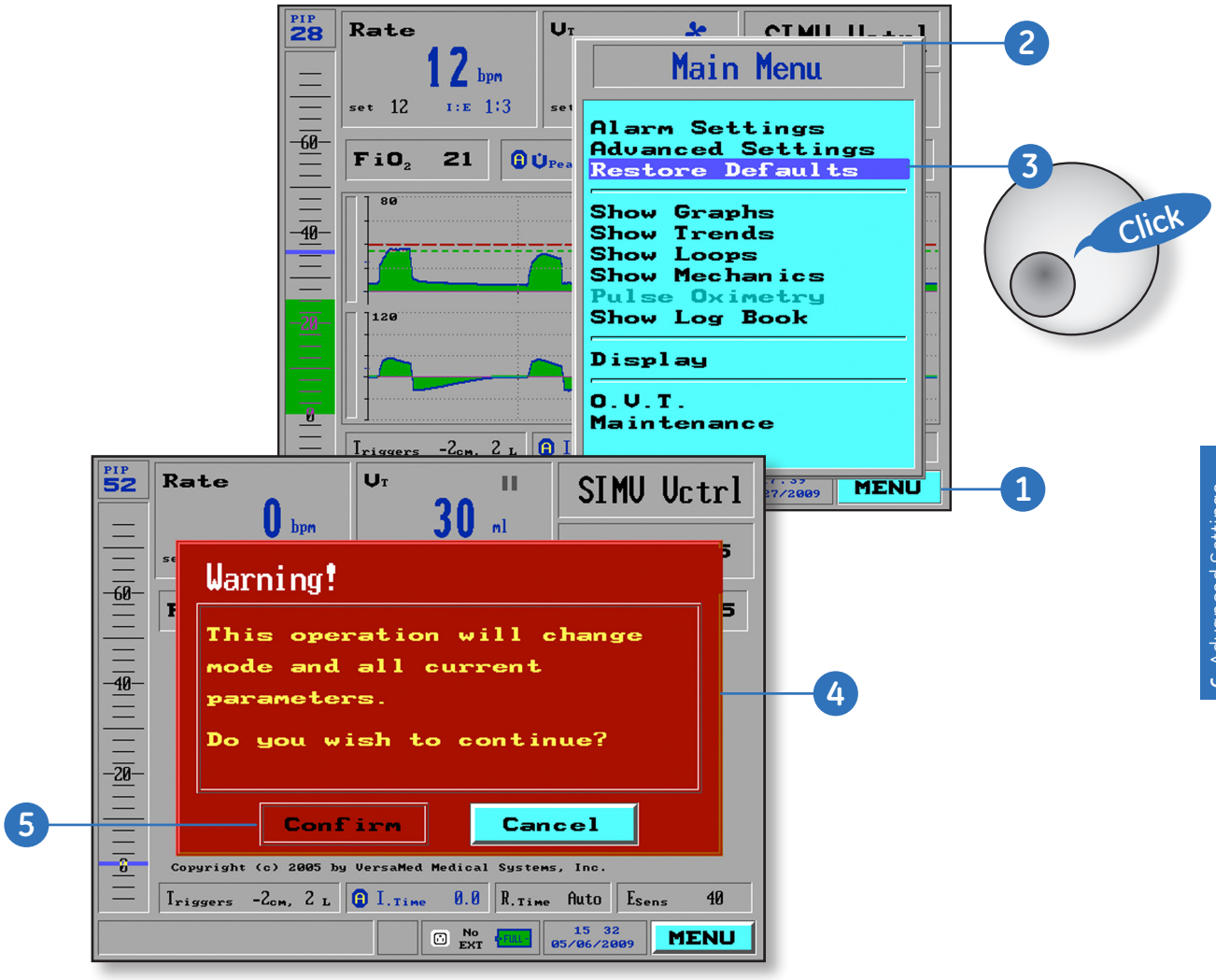


Figure 6.13 Restore defaults

Check Your Knowledge: Advanced Settings

Circle the correct answer.

1. How do you access the Advanced Settings window?
   - a. Press the Advanced Settings dedicated key on the front of the unit.
   - b. Access the Main Menu, and then select Advanced Settings.
   - c. Press the Settings dedicated key on the front of the unit, and then select Advanced Settings.

2. Which of the following is ***not*** one of the Advanced Settings?
   - a. Oxygen Supply Pressure
   - b. Sigh Breath Every
   - c. Nebulizer
   - d. Alarm Disable

3. Which feature of the iVent$_{201}$ is best described by the following: An advanced PEEP mode designed for use with severe obstructive airway flow.
   - a. HME
   - b. SpO_2
   - c. Easy Exhale
   - d. Sigh Breath

4. Which Oxygen Supply setting would you use for an oxygen supply from either a wall outlet (central supply system) or an O_2 cylinder?
   - a. High
   - b. Low + Monitoring
   - c. Low
   - d. None

5. Where is the nebulizer outlet located on the iVent$_{201}$?
   - a. The left side of the unit
   - b. The right side of the unit
   - c. The rear of the unit
   - d. The front of the unit

Hands on Activity: Advanced Settings

Place a check mark next to each task that is verified by the instructor.

- ☐ Access the Advanced Settings window
- ☐ Exit from the Advanced Settings window
- ☐ Change a Sigh Breath setting
- ☐ Enable and disable Easy Exhale
- ☐ Change an Oxygen Supply setting
- ☐ Change the Adaptive Peak Flow setting
- ☐ Change the Humidifier setting
- ☐ Enable and disable the Pulse Oximetry function
- ☐ Connect a nebulizer device
- ☐ Set and activate a nebulizer device
- ☐ Change the time and date

Answers: Check Your Knowledge - Advanced Settings

1. How do you access the Advanced Settings window?
   b. Access the Main Menu, and then select Advanced Settings.

2. Which of the following is ***not*** one of the Advanced Settings?
   d. Alarm Disable

3. Which feature of the iVent$_{201}$ is best described by the following: An advanced PEEP mode designed for use with severe obstructive airway flow.
   c. Easy Exhale

4. Which Oxygen Supply setting would you use for an oxygen supply from either a wall outlet (central supply system) or an O_2 cylinder?
   a. High

5. Where is the nebulizer outlet located on the iVent$_{201}$?
   d. The front of the unit

7 Graphics, Trends and Views

Objectives: Graphics and Trends

By the end of this chapter you should be able to:

- Display pressure and flow waveforms
- Browse waveforms
- Change a waveform range
- View trends
- Change a trend to view
- Browse trends
- Access the default pressure/flow graph view
- Display all available loops
- Freeze a loop
- Unfreeze a loop
- Display the Mechanics window
- Show the Log Book
- Access the Main, Monitoring and Home Care displays, if applicable.

Show Graphs

The Show Graphs function on the Main menu allows you to:

- View real-time ventilation waveforms in a variety of scales
- Scan through patient ventilation waveforms for up to 7.2 hours

Note! *The Waveforms package is an optional feature and not available on all units.*

The iVent201 defaults to displaying the waveform graphs while ventilating. The Main Menu allows you to choose to display only the waveform graphs (default), or to split the view between waveform graphs and Trends, Loops, or Mechanics. These features will be discussed in detail further in the chapter.

To view the Graphs:

1. Access the Main Menu from the Main screen by turning the control knob until the ***Menu*** field in the lower right corner is highlighted in bright blue.
2. Press the control knob, the ***Main Menu*** will appear.
3. Highlight ***Show Graphs***, and press the control knob.
4. The graphs are displayed, as shown below. If the iVent201 display is split between Graphs, Trends, Loops or Mechanics, then it will return to display only Graphs.

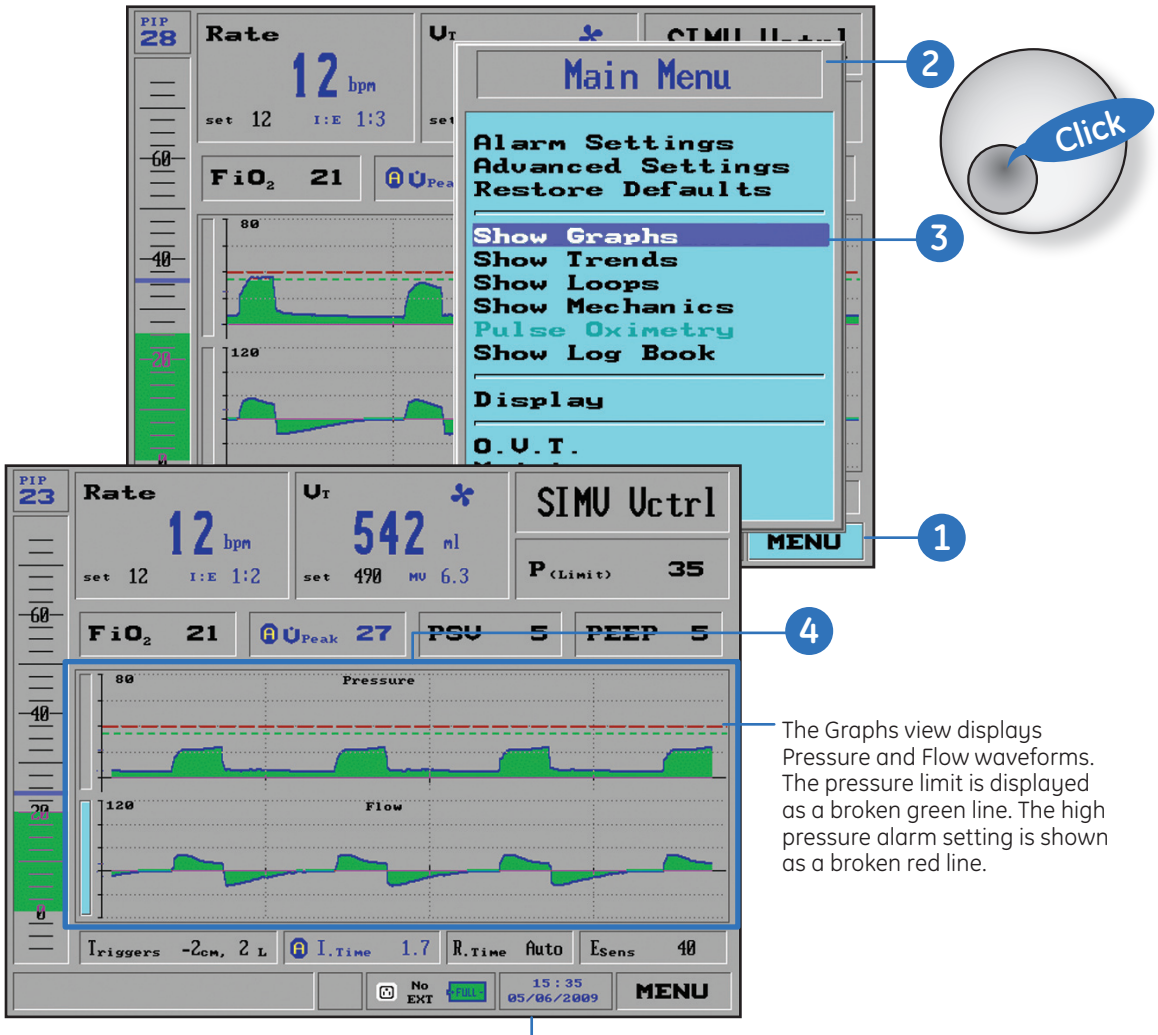


Figure 7.1 Accessing the graphs

Browse Waveforms

You may browse forward or backward to examine the patient ventilation history, up to 7.2 hours.

To browse the waveforms:

1. On the Main screen select either the ***Pressure waveform*** or the ***Flow waveform*** by rotating the control knob so that the Select bar of either is highlighted in bright blue. In the example below the Flow waveform is selected.
2. Press the control knob to access the ***Graph Choice*** window.
3. From the ***Graph Choice*** window, highlight ***Browse*** and press the control knob. The waveform display will hold at that moment, although it is continuing to record and the results are kept in memory.
4. Turn the control knob counterclockwise, and the time coordinate cursor will move backward along the time axis; turn the dial clockwise and the time coordinate cursor will move forward along the time axis.

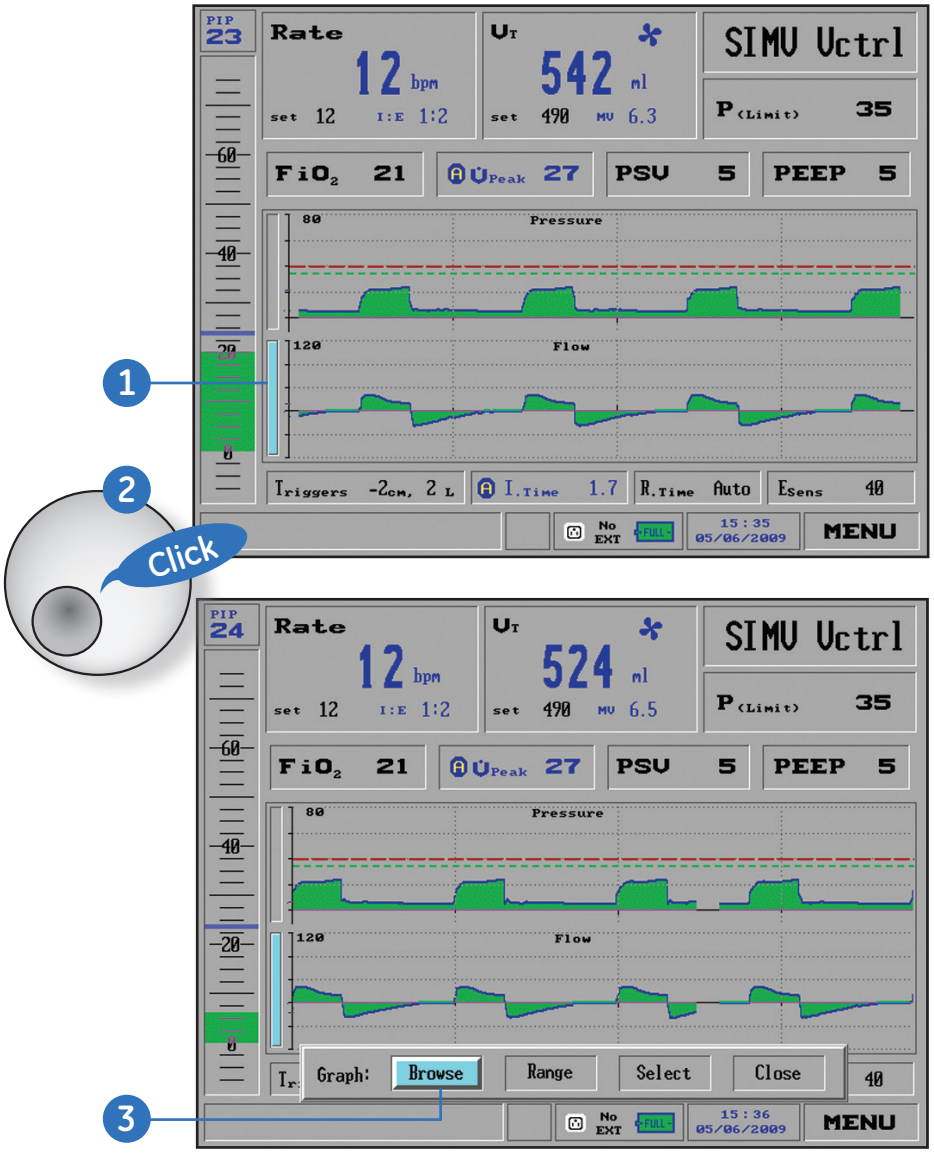


Figure 7.2 Accessing the graphs

Select Range

The iVent$_{201}$ automatically selects an appropriate range to display waveforms based on the selected ventilation parameters. If you wish to change the view scale of Pressure or Flow waveforms, use the ***Range*** function.

To change the waveform range:

1. On the Main screen select either the ***Pressure waveform*** or the ***Flow waveform*** by rotating the control knob so the Select bar will be highlighted in bright blue. Press the control knob to access the ***Graph Choice*** window.
2. From the ***Graph Choice*** window, highlight ***Range*** and press the control knob
3. The Range choice window will appear If you have chosen the Flow graph, the choices are ***210, 150, 120, 90, 60, L/minute*** and ***Auto*** (the default). The Pressure graph choices are ***80, 60, 40 cmH$_2$O*** and ***Auto*** (the default). Turn the control knob to the desired value, and press the knob to accept the new range.
4. To return to the Main screen, turn the control knob to highlight ***Close*** in the Graph Choice window and press the control knob.

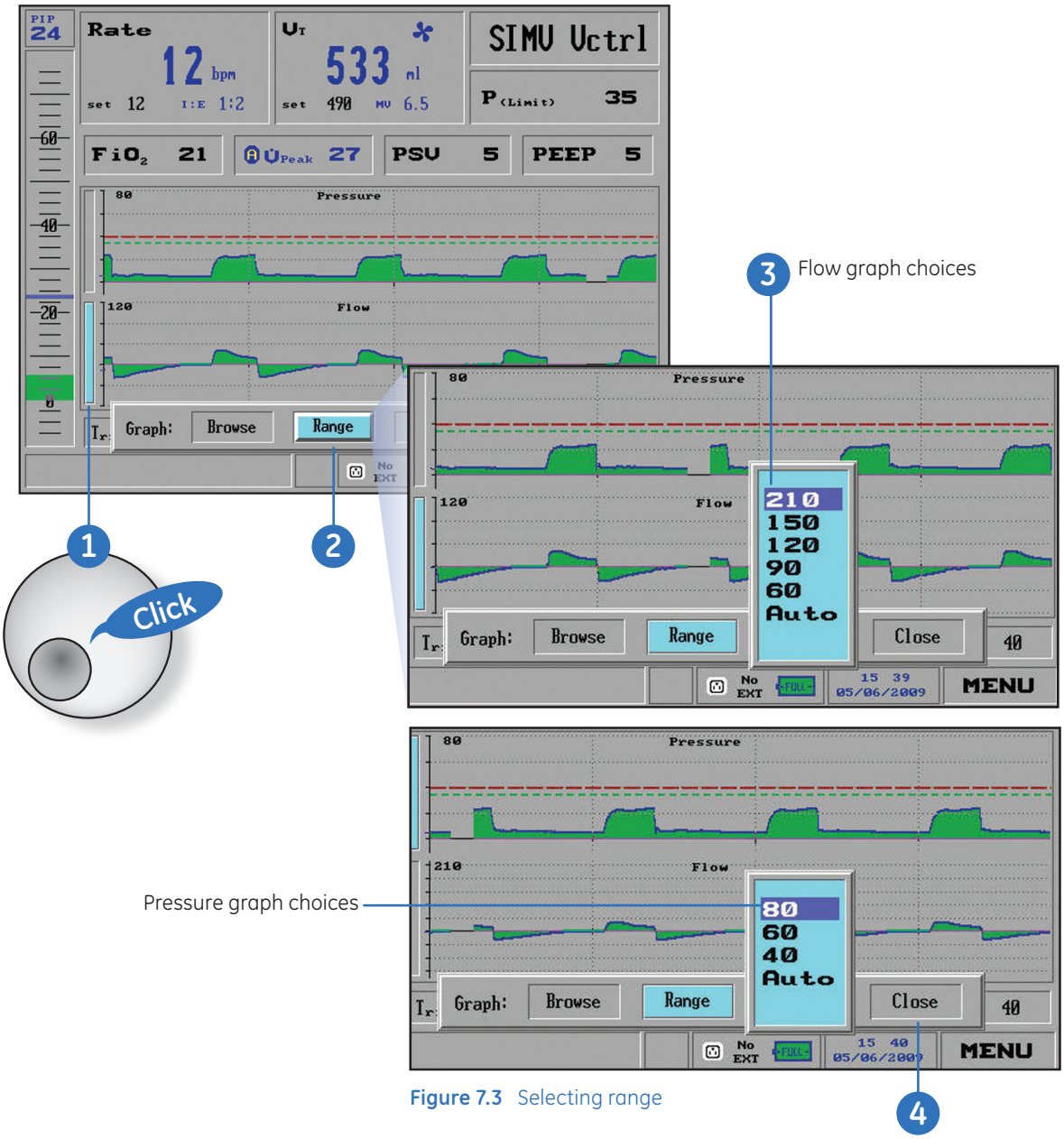


Figure 7.3 Selecting range

Trends

You can view trends in any of fourteen parameters and calculated patient response characteristics over a period up to 72 hours:

- Peak Flow
- Peak Pressure
- Minute Volume
- Total Rate
- Mandatory Rate
- Spontaneous Rate
- Mandatory Volume
- Spontaneous Volume
- Spontaneous inspiratory time
- Mandatory inspiratory time
- I:E Ratio
- Mean Airway Pressure
- Resistance
- Compliance

To view the Trends:

1. Access the Main Menu from the Main screen by turning the control knob until the ***Menu*** field in the lower right corner is highlighted in bright blue.
2. Press the control knob, the ***Main Menu*** will appear.
3. Highlight ***Show Trends***, and press the control knob.

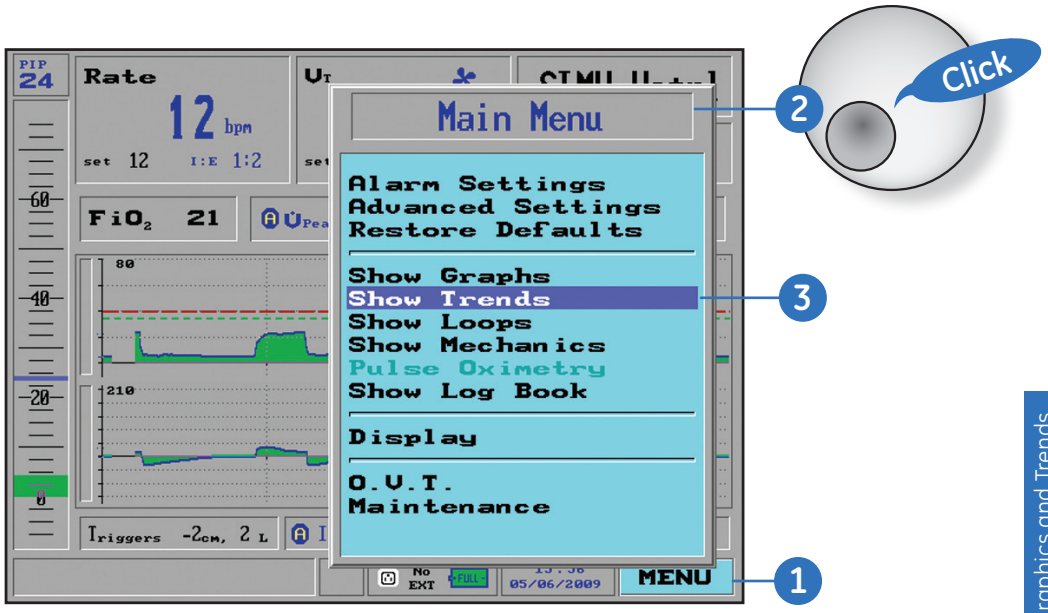


Figure 7.4 Main menu/show trends

If you show the trends while the ventilator is in Standby Mode, three Trends will appear in a window on the right side of the screen. The default Trends shown are ***Peak Flow, Peak Pressure,*** and ***Minute Volume.***

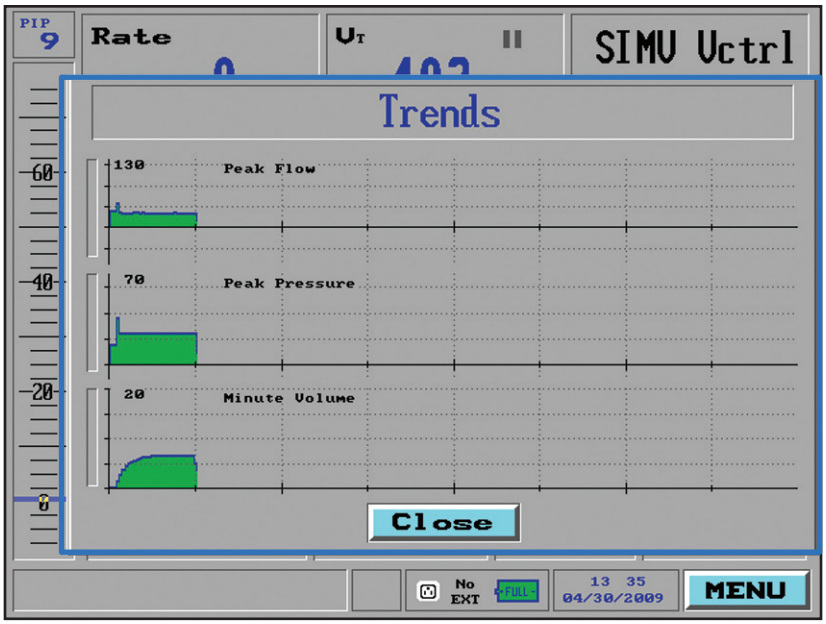


Figure 7.5 Trends window in standby mode

If the ventilator is operating, the three displayed Trends will appear in a window beside the waveforms.

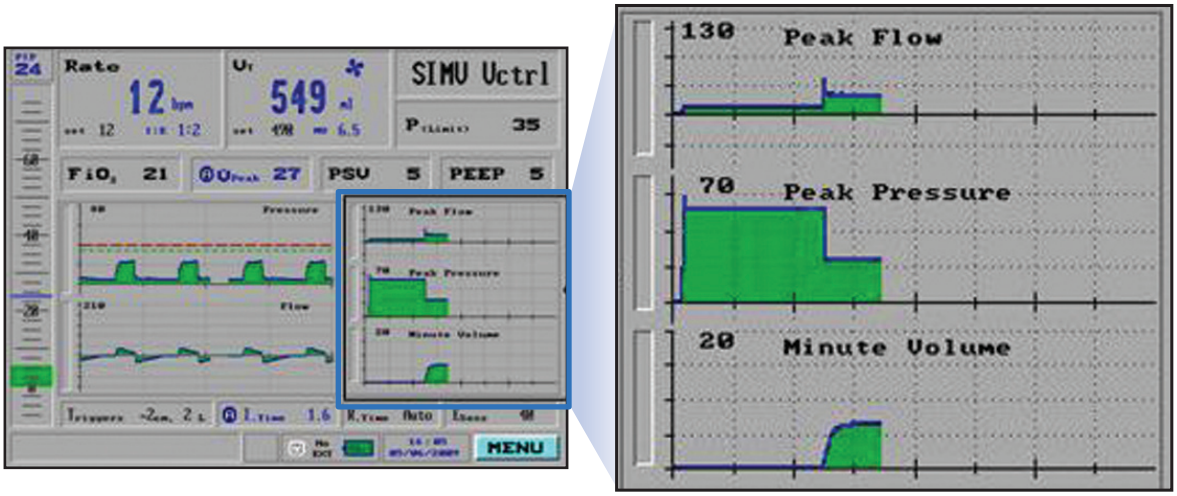


Figure 7.6 Trends window during ventilation

Note! *To turn off the trends display, select* ***Show Graphs*** *from the Main Menu.*

To change the Trend you wish to view:

1. Turn the control knob to highlight the ***Select bar*** of the Trend graph you want to change in bright blue. In the example below, ***Minute Volum***e is selected.
2. Press the control knob and the ***Trends Choice*** window will appear. Highlight ***Select***, and press the control knob.
3. A window will appear offering a choice of parameters and diagnostic variables. Highlight your selection and then press the control knob. In the example below, ***I:E Ratio*** is selected. The selected parameter will be displayed in the Trends Graph window.

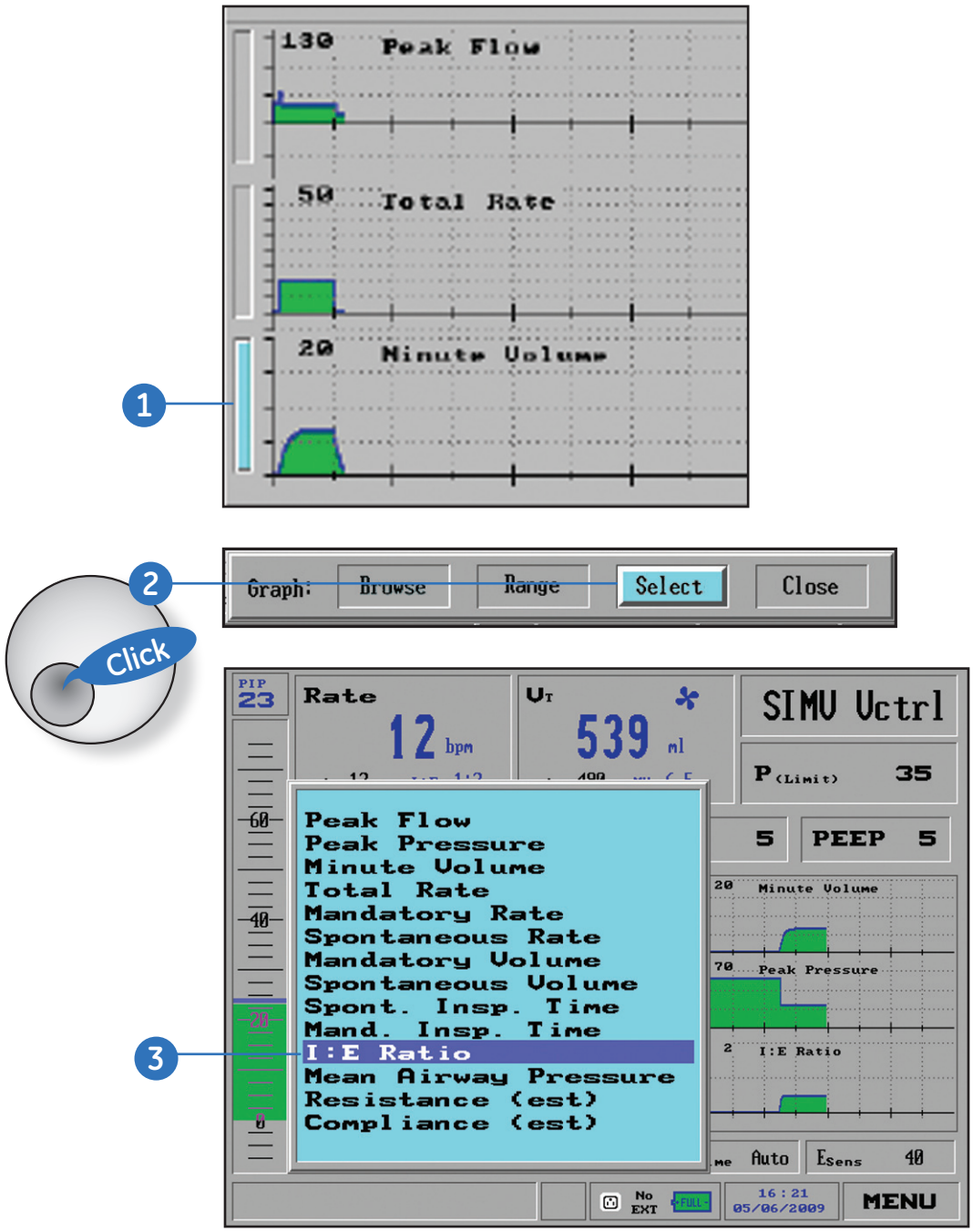


Figure 7.7 Trends selection

To browse the Trends:

1. Turn the control knob to highlight the ***Select*** bar of the Trend graph you want to browse in bright blue.
2. Press the control knob and the ***Trends Choice*** window will appear. Turn the control knob to highlight ***Browse***, and press the control knob.
3. A small blue highlighted window labeled ***Browse*** appears, with the time and graph's cursor in center of the viewable data.
4. Rotating the control knob clockwise will move the time cursor indicator forward; rotating counterclockwise will move the indicator backward along the timeline.

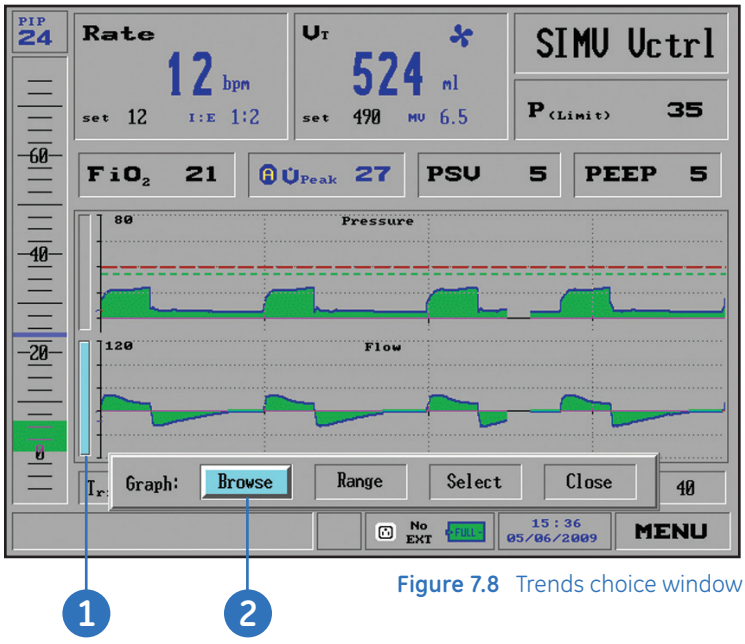


Figure 7.8 Trends choice window

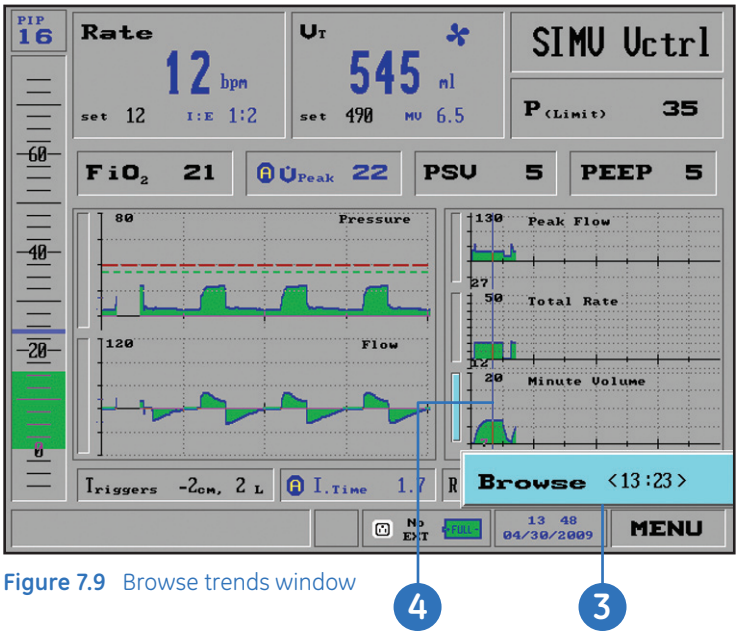


Figure 7.9 Browse trends window

5. You can change the scale of the time coordinate on which the Trends display. Select any of the graphs and press the control knob to access the ***Trends Choice*** bar.

6. Select ***Zoom,*** and the ***Zoom*** window will appear. Turning the control knob will adjust the scale of the time shown, to enable viewing of larger or smaller scale trends over time.

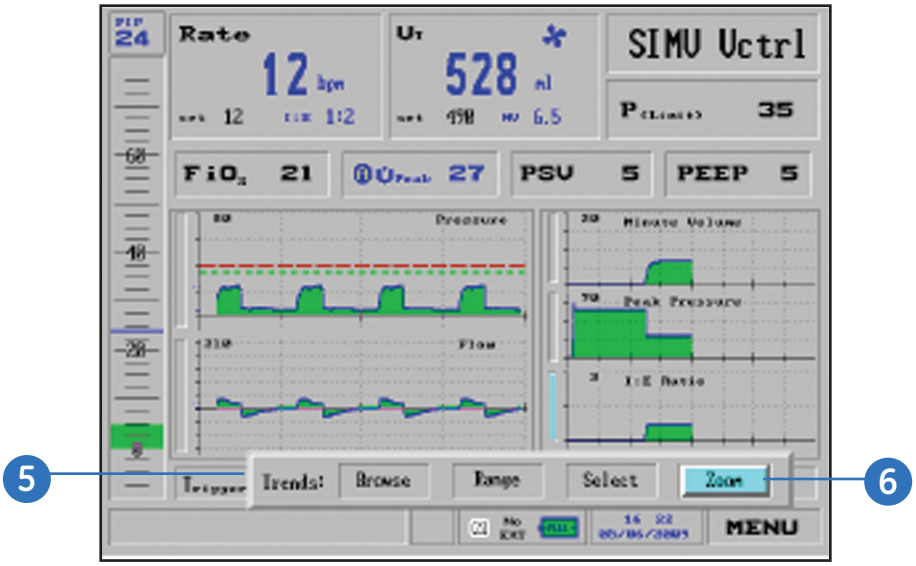


Figure 7.10 Trends choice window with zoom highlighted

Note! *You can recall trend information over a 72-hour period using the Browse feature.*

To switch back to the default Pressure /Flow graph view:

1. Access the Main Menu from the Main screen by turning the control knob until the ***Menu*** field in the lower right corner is highlighted in bright blue.

2. Highlight the ***Show Graphs*** option and press the control knob. The Trends window is closed and only the graphs are displayed.

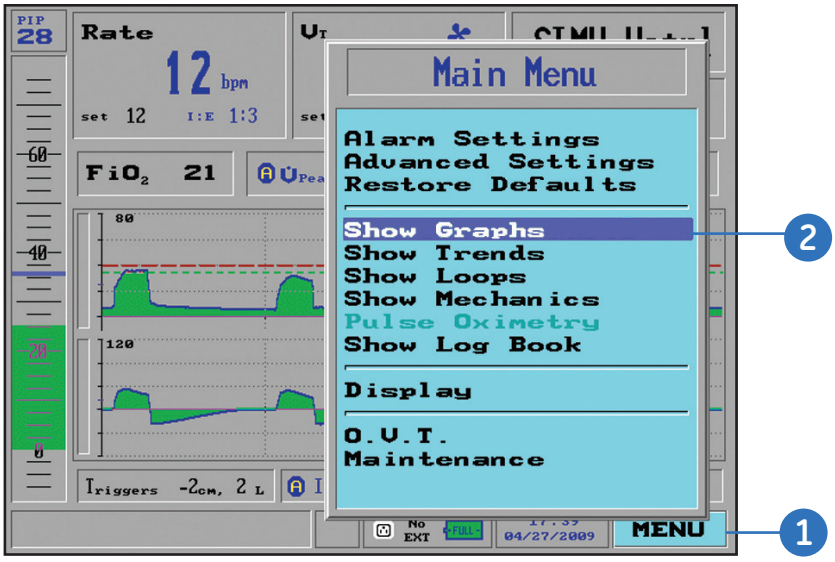


Figure 7.11 Returning to Pressure/Flow graph view

Show Loops

There are four available views of Loops on the iVent$_{201}$:

- Pressure - Volume
- Pressure - Flow
- Volume - Flow
- All three

You may select one Loop to display or show all three Loops at once.

To display loops:

1. Access the Main Menu from the Main screen by turning the control knob until the ***Menu*** field in the lower right corner is highlighted in bright blue.
2. Highlight the ***Show Loops*** option and press the control knob.
3. The ***Show Loops*** window will appear. Select any or all three of the loops.
4. The loops appear on the right side of the Main screen. The Pressure – Volume Loop is shown below.

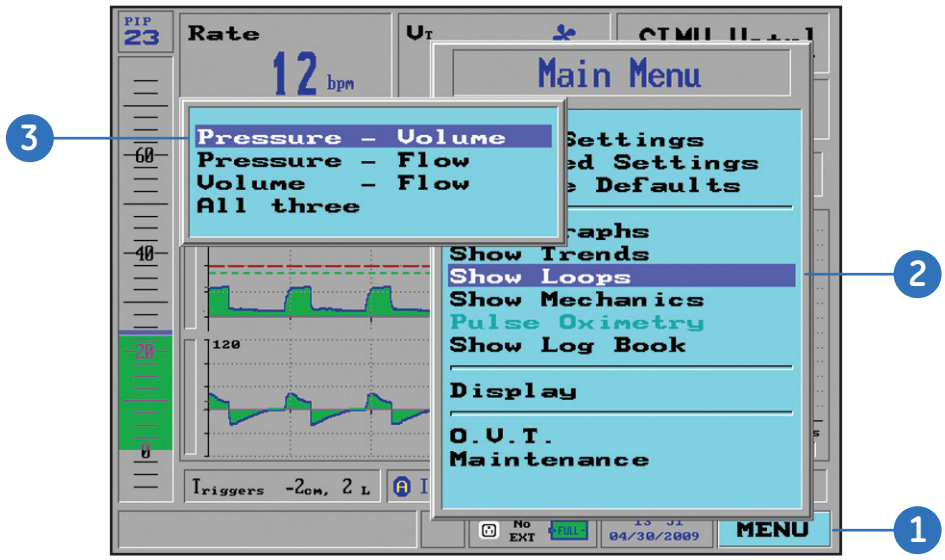


Figure 7.12 Show loops window

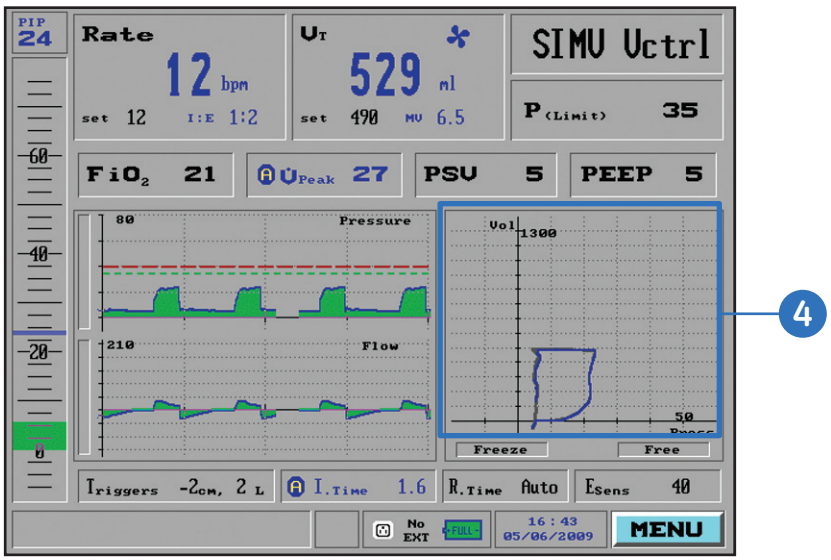


Figure 7.13 Pressure – Volume loop

Freezing Loops

When a single loop is displayed, the Loop window has two selection fields labeled ***Freeze*** and ***Free***. You can use these selections to freeze and unfreeze a loop for clinical comparison.

To freeze a loop:

Highlight the ***Freeze*** selection field on the displayed loop and press the control knob.
The current inspiratory cycle will change to red. Only the present loop (drawn in blue) and the previous loop (dark gray) will continue to display in the foreground, while the frozen loop will show in red in the background.

To unfreeze the currently displayed loop:

Highlight the ***Free*** selection field on the displayed loop and press the control knob. As soon as the current breath is completed, the frozen loop will disappear and the display will resume its default behavior, drawing each new loop in blue and displaying the two previous loops in black.

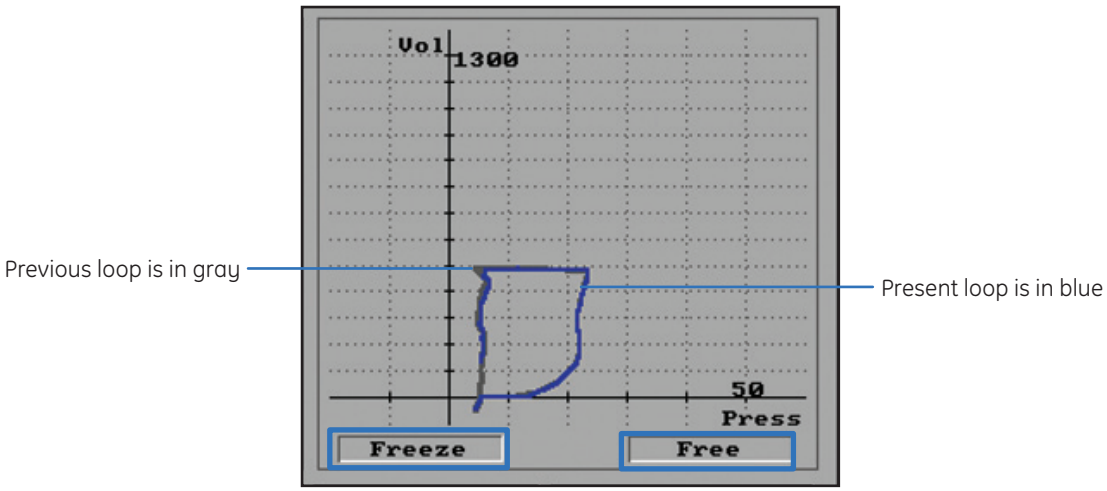


Figure 7.14 Freeze and free loop options

Note! *The Freeze and Free features are only available when displaying one loop.*

To switch back to the default Pressure /Flow graph view:

1. Access the Main Menu from the Main screen by turning the control knob until the ***Menu*** field in the lower right corner is highlighted in bright blue.
2. Highlight the ***Show Graphs*** option and press the control knob. The Trends window is closed and only the graphs are displayed.

Show Mechanics

The iVent$_{201}$ will calculate and display Mean Airway Pressure, Resistance, Compliance, RR/Vt, Static Compliance, Plateau Pressure, Auto-PEEP, and Time Constant.

To display the Mechanics window:

1. Access the Main Menu from the Main screen by turning the control knob until the ***Menu*** field in the lower right corner is highlighted in bright blue.
2. Highlight the ***Show Mechanics*** option and press the control knob.
3. The right section of the screen will display the ***Mechanics*** window with the numeric values.
4. Press the ***Hold*** key on the keypad. Perform an inspiratory and expiratory hold to update the static compliance, auto-PEEP, plateau pressure and other measurements.

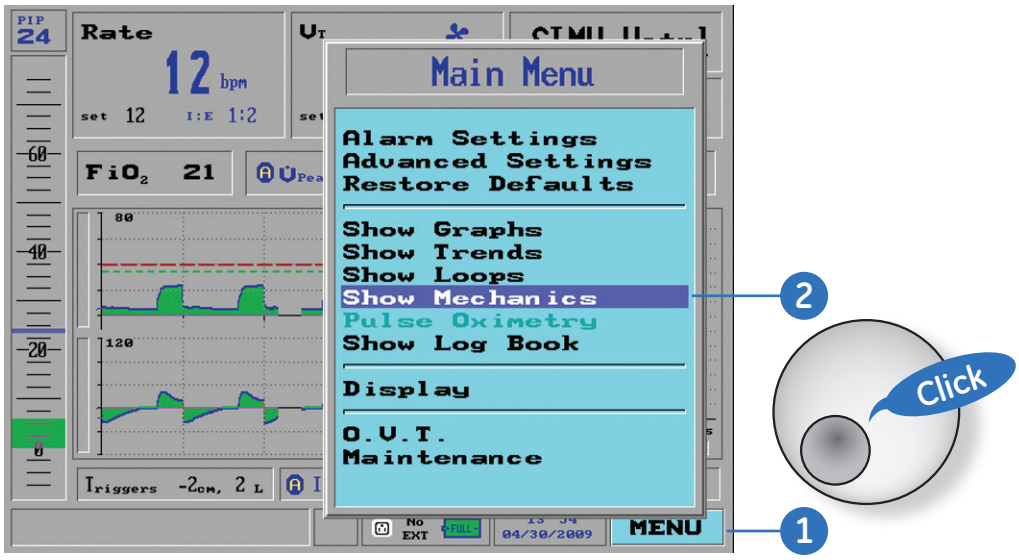


Figure 7.15 Show mechanics option

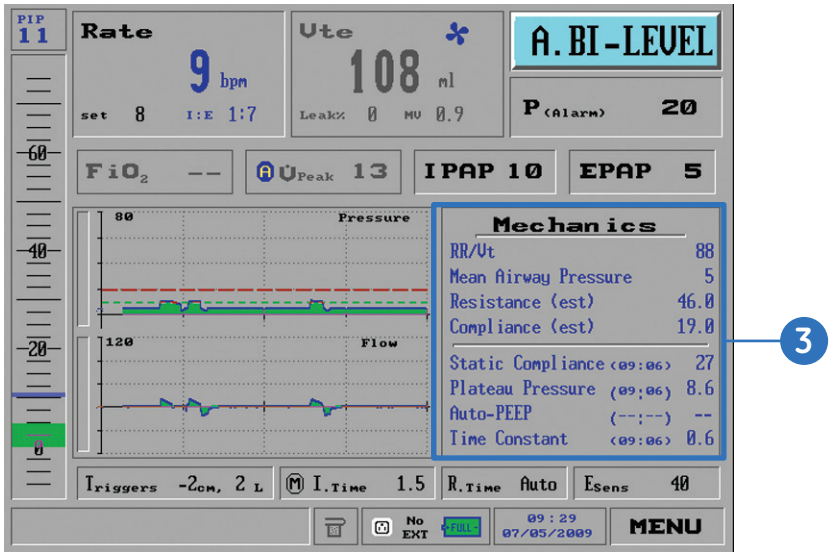


Figure 7.16 Show mechanics window

Show Log Book

An entry is noted in the iVent$_{201}$ Log Book when the following conditions occur:

- Each time the ventilator is powered up
- Every time the ventilator enables a setting
- Every time the ventilator sounds an alarm
- Every time a user makes an adjustment to the iVent$_{201}$

To show the Log Book:

1. Access the Main Menu from the Main screen by turning the control knob until the ***Menu*** field in the lower right corner is highlighted in bright blue.
2. Press the control knob and the ***Main Menu*** appears.
3. Highlight the ***Show Log Book*** option and press the control knob.
4. The ***Show Log Book*** window will appear, showing in chronological order each event, stamped with the date and time. Rotating the control knob counterclockwise will move the highlight bar backwards up the log of events; rotating the dial clockwise will advance the log book forward in time.

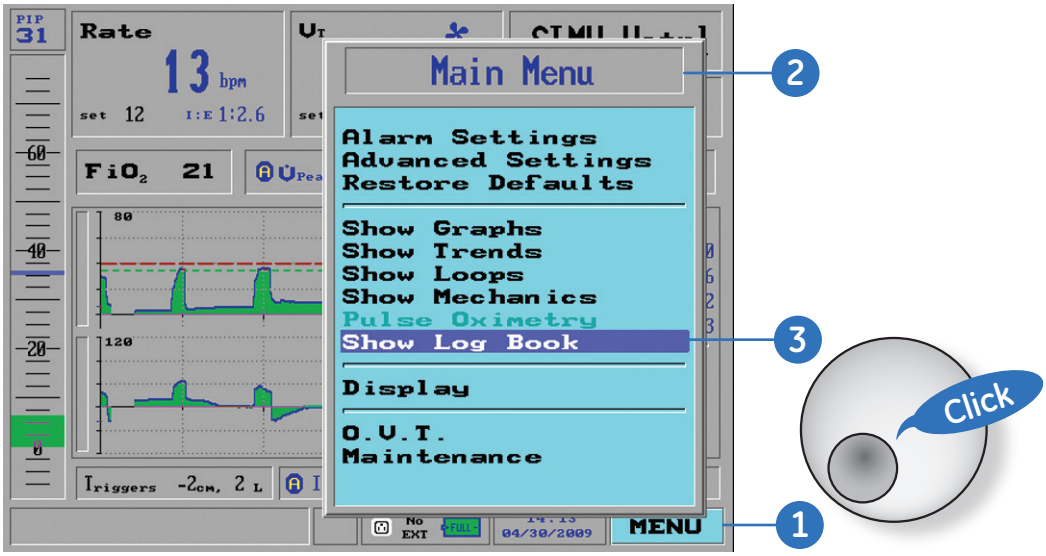


Figure 7.17 Show log book option

Displays

There are three displays available on the Ivent$_{201}$:

- Main
- Monitoring
- Home Care

Note! *Depending on the configuration purchased, some iVent$_{201}$ models may not have every display available.*

To access the Main, Monitoring or Homecare display:

1. Access the Main Menu from the Main screen by turning the control knob until the ***Menu*** field in the lower right corner is highlighted in bright blue.
2. Press the control knob and the ***Main Menu*** appears.
3. Highlight the ***Display*** option and press the control knob.
4. Highlight the desired display (Main, Monitoring or Home Care) and press the control knob.

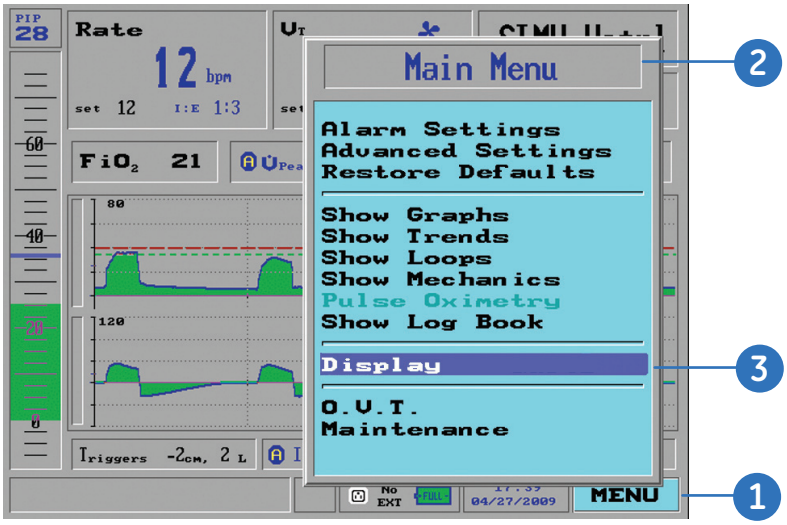


Figure 7.18 Accessing a display

Main Display

The Main display is the most commonly used, as shown throughout this participant guide.

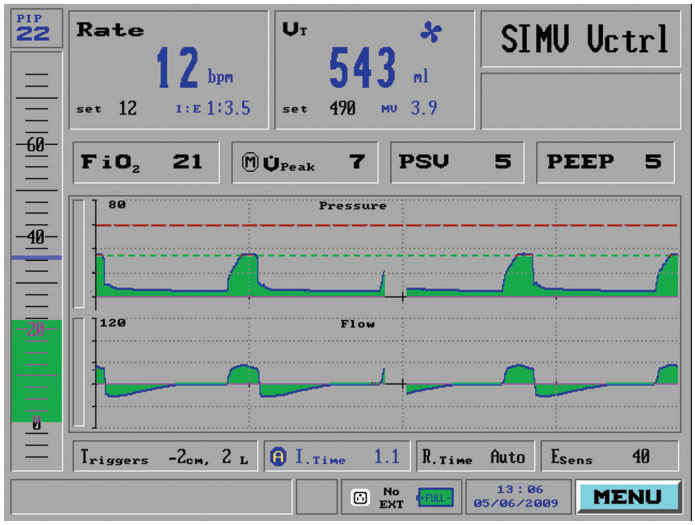


Figure 7.19 Example of main display

Monitoring Display

The Monitoring display features a scaled down menu with quick access to Mode, Parameters, Alarms, and Waveforms.

To access settings from the Monitoring display:

1. Rotate the control knob to highlight the desired selection field.
2. Press the knob to accept your selection.

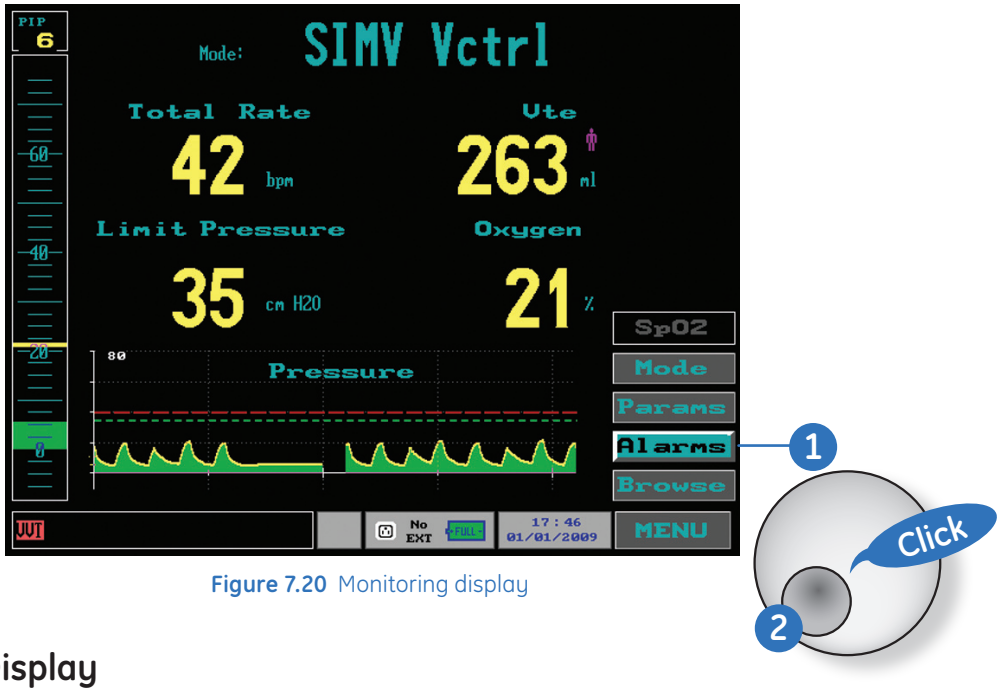


Figure 7.20 Monitoring display

Home Care Display

The Home Care display only shows the essential data: Mode, Exhale Volume and Total Rate. It is designed primarily for the simplest kind of monitoring.

Figure 7.21 Home Care display

Note! You cannot change settings from the Home Care display. In order to change settings, you should change to the Main Display.

Check Your Knowledge: Graphics and Trends

Circle the correct answer.

1. How do you display the pressure and flow waveforms on the iVent$_{201}$?
   - a. Press the Waveforms dedicated key on the front of the unit.
   - b. You cannot view pressure and flow waveforms, only numeric values.
   - c. From the Main Menu, select Show Graphs.
   - d. From the Main Menu, select Display

2. What color is the selector bar for selecting waveforms and trends to view?
   - a. Red
   - b. Bright Blue
   - c. Green
   - d. Yellow

3. How do you display Trends on the iVent201?
   - a. From the Main Menu, select Display.
   - b. Press the Trends dedicated key on the front of the unit.
   - c. From the Main Menu, select Show Trends
   - d. There are no trends on the iVent$_{201}$

4. Which loops are available for viewing on the iVent$_{201}$?
   - a. Volume - Flow
   - b. Pressure - Flow
   - c. Pressure - Volume
   - d. All of the above

5. To freeze a loop, how many loops must be displayed?
   - a. One
   - b. Two
   - c. Three
   - d. Four

6. What the three displays available on the iVent$_{201}$?
   - a. Neonatal, Adult and Pediatric
   - b. Main, Monitoring and Home Care
   - c. ICU, Emergency Room and Operating Room
   - d. High resolution, Medium Resolution and Low Resolution

Hands on Activity: Graphics and Trends

Place a check mark next to each task that is verified by the instructor.

- ☐ Display pressure and flow waveforms
- ☐ Browse multiple waveforms
- ☐ Change a waveform range
- ☐ View trends
- ☐ Change a trend to view
- ☐ Browse multiple trends
- ☐ Access the default pressure/flow graph view
- ☐ Display all available loops
- ☐ Freeze a loop
- ☐ Unfreeze a loop
- ☐ Display the Mechanics window
- ☐ Show the Log Book
- ☐ Access the Main, Monitoring and Home Care displays, if applicable.

Answers: Check Your Knowledge - Graphics and Trends

1. How do you display the pressure and flow waveforms on the iVent$_{201}$?
   c. From the Main Menu, select Show Graphs.

2. What color is the selector bar for selecting waveforms and trends to view?
   b. Bright Blue

3. How do you display Trends on the iVent201?
   c. From the Main Menu, select Show Trends

4. Which loops are available for viewing on the iVent$_{201}$?
   d. All of the above

5. To freeze a loop, how many loops must be displayed?
   a. One

6. What the three displays available on the iVent$_{201}$?
   b. Main, Monitoring and Home Care

8 Maintenance

Objectives: Maintenance

By the end of this chapter you should be able to:

- Calibrate the O_2 system
- Perform a battery full recharge procedure
- Perform a Ventilator Verification Test (VVT)
- Change the default startup weight
- Change the default start screen
- Change the default FiO_2 setting
- Access the maintenance chart
- Access the accessories chart

Note! *Maintenance should only be undertaken by competent individuals who have a general knowledge of and experience with devices of this nature. No repairs should ever be undertaken or attempted by anyone not having such qualifications.*

O_2 Calibration

It is recommended to perform O_2 calibration every three months to ensure system integrity. The calibration process comprises two separate calibration procedures, one for 100% oxygen and another for 21% oxygen.

To calibrate the O_2:

1. Access the Main Menu from the Main screen by turning the control knob until the ***Menu*** field in the lower right corner is highlighted in bright blue.
2. Press the control knob, the ***Main Menu*** will appear.
3. Highlight the ***Maintenance*** option and press the control knob.
4. A caution window will appear, warning that the selection is a restricted maintenance area and is for trained personnel only.
5. Select ***Yes***, and press the control knob The ***Maintenance*** window will appear.
6. Select ***Calibration Screen***, and press the control knob.

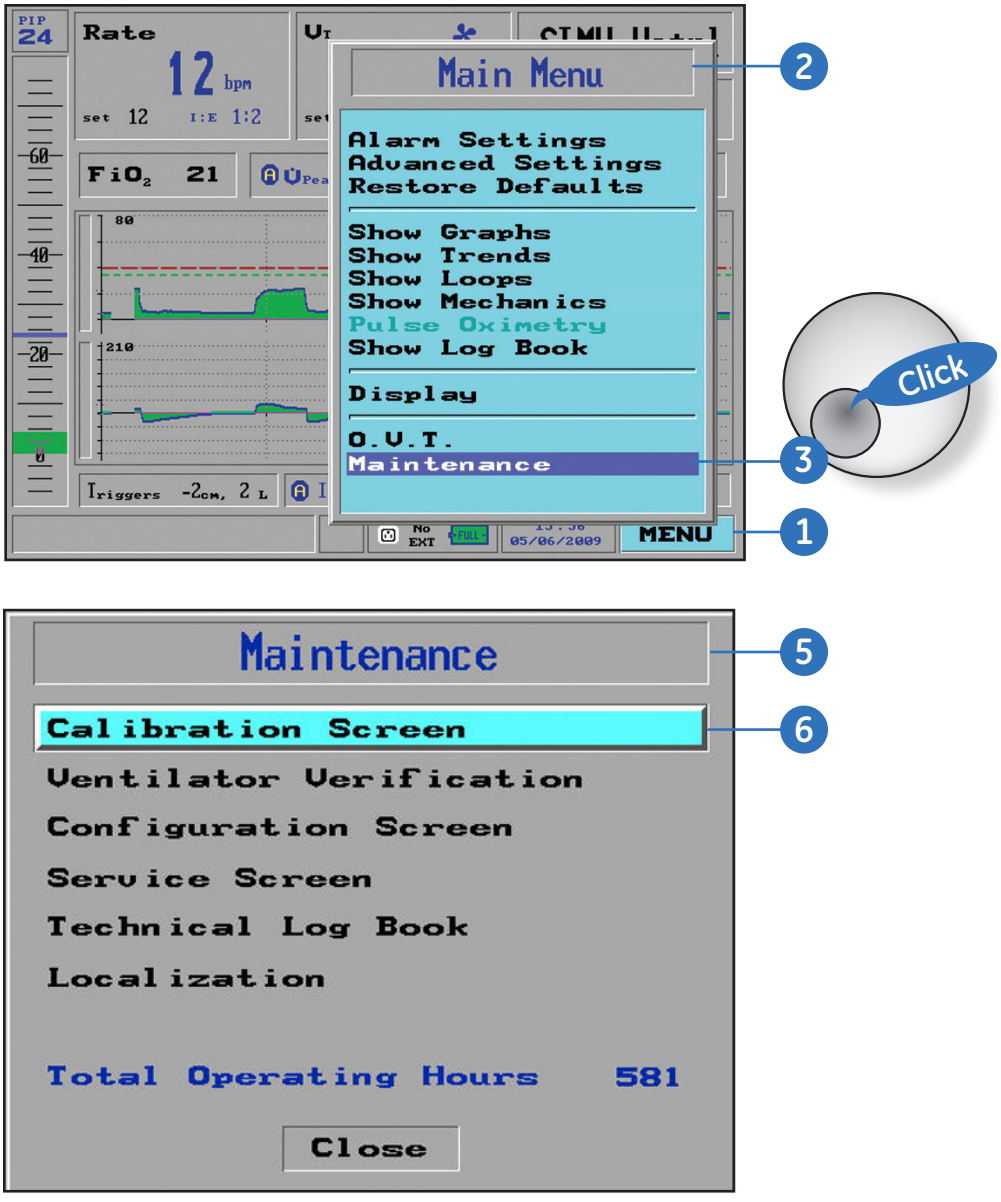


Figure 8.1 Maintenance Window

7. The ***Calibration*** window will appear. Select ***Calibrate O_2 System***, and press the control knob.
8. The ***O_2 System Calibration*** window will appear with 100% O_2. Follow the instructions on the display, and verify the following:
   - A high pressure oxygen source is connected to the unit
   - The patient circuit is open and not sealed by any component

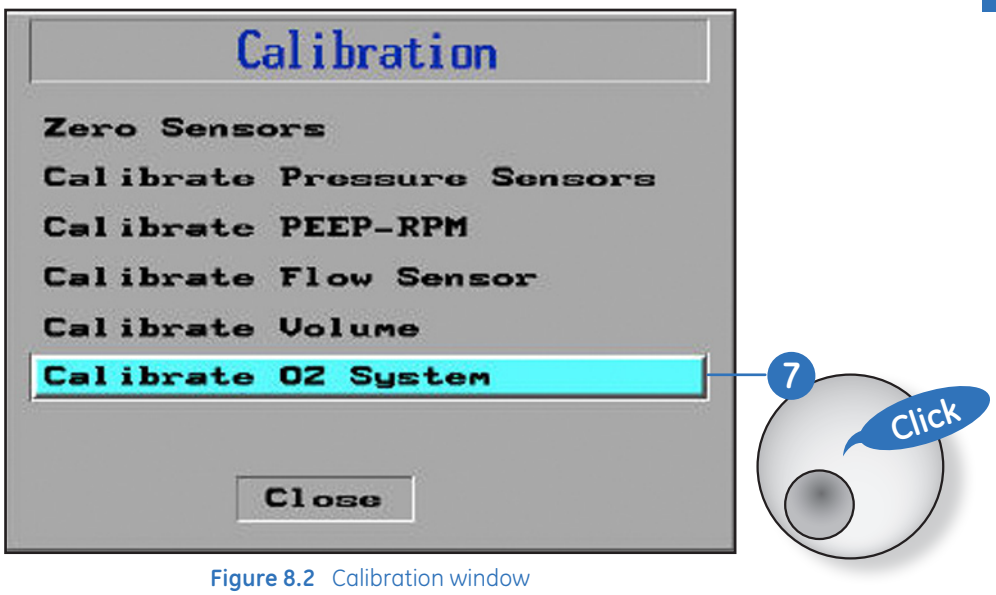


Figure 8.2 Calibration window

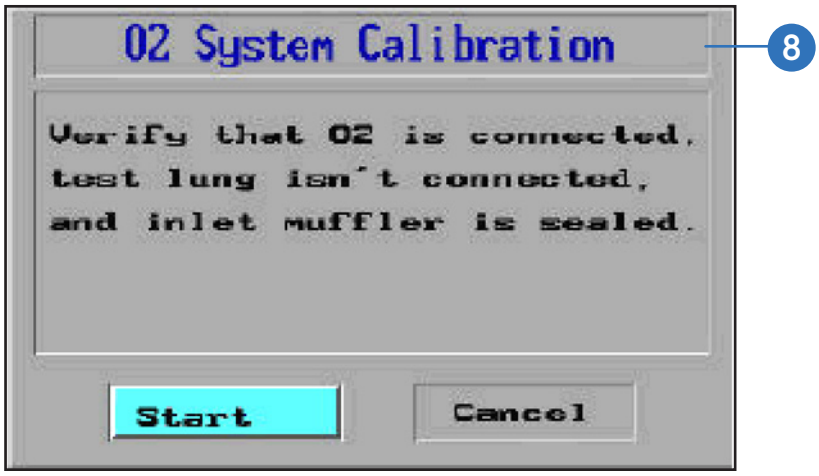


Figure 8.3 O_2 System calibration window

9. Remove the inlet filter, on the side of the ventilator, and install the O_2 calibration cover.

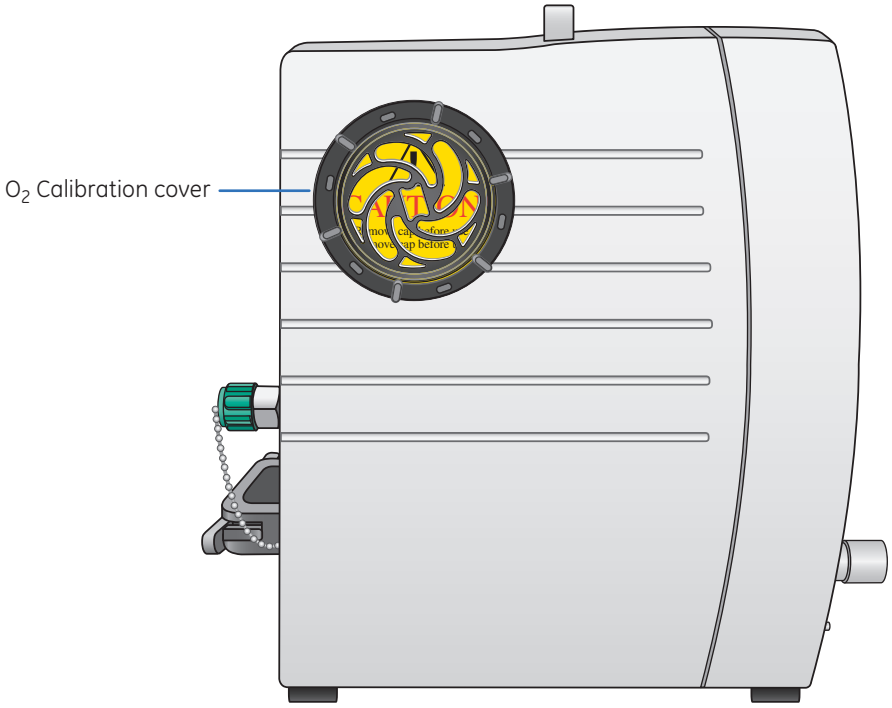


Figure 8.4 iVent$_{201}$ with O_2 calibration cover installed

10. Select ***Start*** to proceed. This calibration takes approximately thirty seconds, during which the message ***working*** is displayed on the screen. After the calibration is completed the O_2 System Calibration for 21% is displayed.

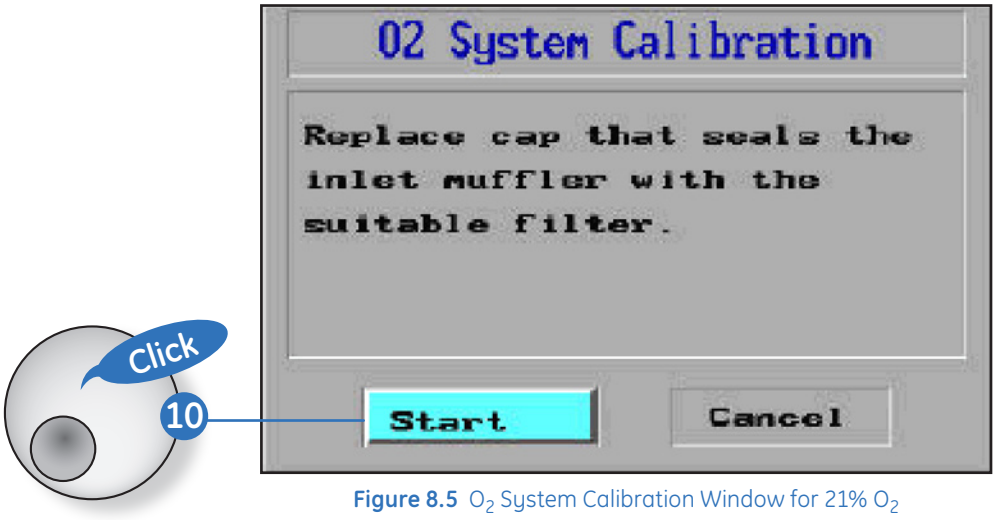


Figure 8.5 O_2 System Calibration Window for 21% O_2

11. Remove the O_2 calibration cover and re-insert the inlet filter.
12. Select ***Start*** to proceed. This calibration takes approximately ninety seconds, during which the message ***working*** is displayed on the screen.
13. When the calibration is completed the ***Calibration*** window will appear. Select ***Close***.
14. The ***Save*** window will appear. Select ***Yes*** to save the calibration and close the Calibration window.

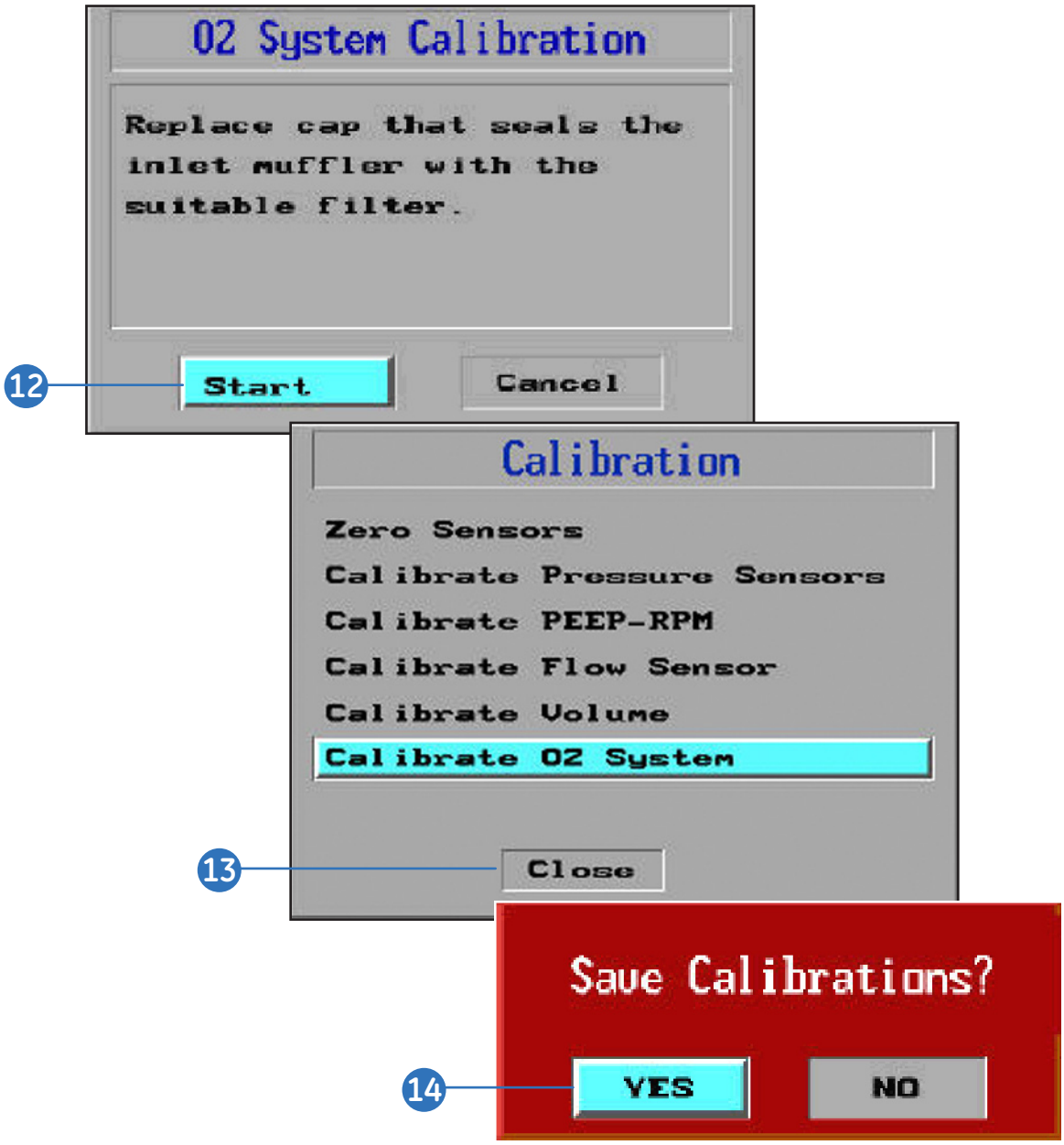


Figure 8.6 Saving calibrations

Battery Full Recharge Procedure

The full recharge procedure first empties the battery of all its charge. Charging it to capacity then allows for proper calibration of the battery gauge.

Note! *If the **Low Battery** or **Empty Battery** alarm appears, the internal battery must be fully recharged. Continued usage of the battery after the **Empty Battery** alarm appears may disable the battery's charging capability and/or lead to battery failure. Ventilation parameters may not be met in this condition.*

To perform a full recharge procedure:

1. Plug the AC power cord into the ventilator. Verify that the amber LED (charge) is lit.
2. Allow the unit to charge for at least ten hours for the standard battery and at least 24 hours for the extended battery.
3. Turn on the ventilator power. When the ***Weight Selection*** window appears, select the ***70kg*** patient weight setting.
4. Set the pressure alarm to ***60 (cmH20)***.
5. Connect the ventilator with a patient circuit to the Rp20 resistor (part number 910V0004-A0) and test lung.
6. Start the ventilator.
7. Adjust the tidal volume so that a peak inspiratory pressure of 40 is attained on each breath.
8. Disconnect the power cord. The ***AC Disconnect*** alarm will sound and a warning window will appear. Press the red ***silence*** key to remove the window and stop the alarm.
9. Allow the ventilator to run off the battery continuously. When the ***Empty Battery*** alarm sounds, clear it by pressing the red ***silence*** key.
10. Place the unit in ***Standby*** mode, and then turn off the ventilator power. Connect the AC power cord.
11. Allow the unit to charge for at least 10 hours for the standard battery and at least 24 hours for the extended battery.

If after a full recharge, the battery indicator fails to reach Full, or a Low or Empty Battery alarm displays, then the battery pack must be replaced.

Ventilator Verification Tests

The Ventilator Verification Test (VVT) is a set of simple self-tests designed to confirm ventilator functionality. It is designed as a troubleshooting procedure to check the operation of a multitude of functions. A series of simple user prompts guides the user through each step.

The Ventilator Verification Test should be performed:

- Quarterly
- Whenever a ***Call Service*** window appears
- After a software update

When the iVent$_{201}$ detects that a VVT has not been performed, or if for any reason the iVent$_{201}$ has failed to pass a VVT previously, a warning window will appear. If this occurs, immediately perform a VVT.

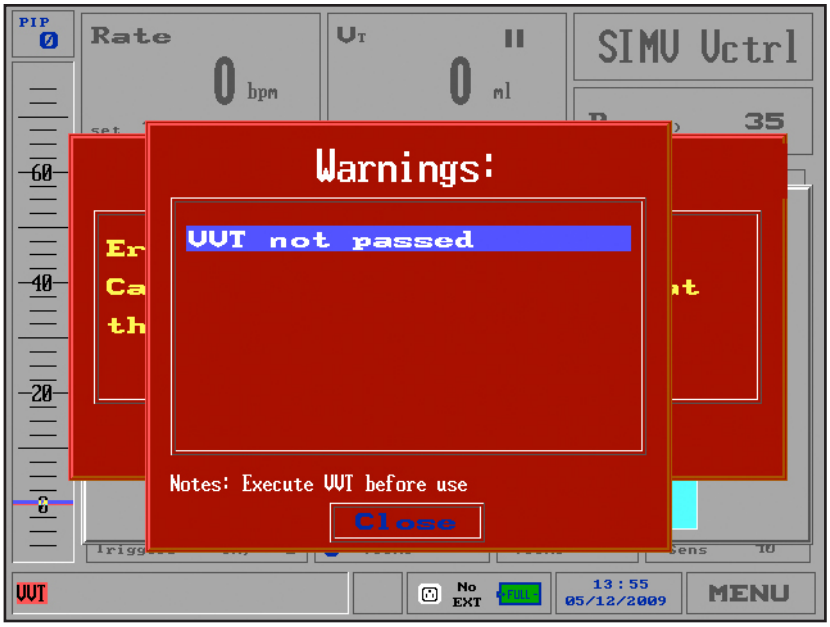


Figure 8.7 Saving calibrations

Note! *To perform a VVT, you will need a plug for blocking the breathing circuit, and a high pressure O_2 supply.*

To perform the VVT:

Note! Prior to performing the VVT, the unit must be in a ***warm*** condition. Connect the breathing circuit to a test lung and operate the ventilator for at least fifteen minutes.

1. Connect a breathing circuit to the iVent$_{201}$.
2. Make sure the ventilator is plugged into a working AC supply and turn on the power.
3. Select a patient weight to enable the ventilator to enter standby mode.
4. Access the Main Menu from the Main screen by turning the control knob until the ***Menu*** field in the lower right corner is highlighted in bright blue.
5. Press the control knob, the ***Main Menu*** will appear.
6. Highlight the ***Maintenance*** option and press the control knob.
7. A caution window will appear, warning that the selection is a restricted maintenance area and is for trained personnel only.
8. Select ***Yes***. The ***Maintenance*** window appears.
9. Select ***Ventilator Verification***, and press the control knob.

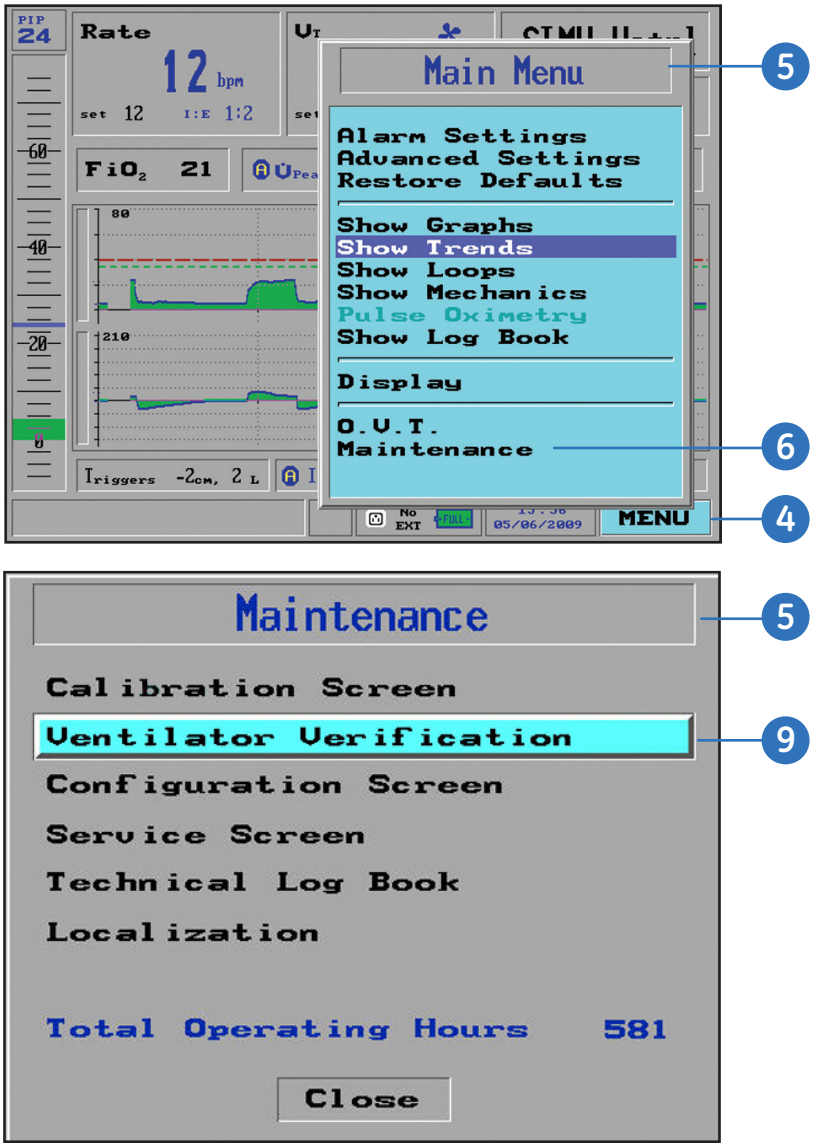


Figure 8.8 Ventilator verification option

10. The ***Ventilator Verification*** window appears. Select ***Start*** to proceed. A series of prompts will guide you through each step.

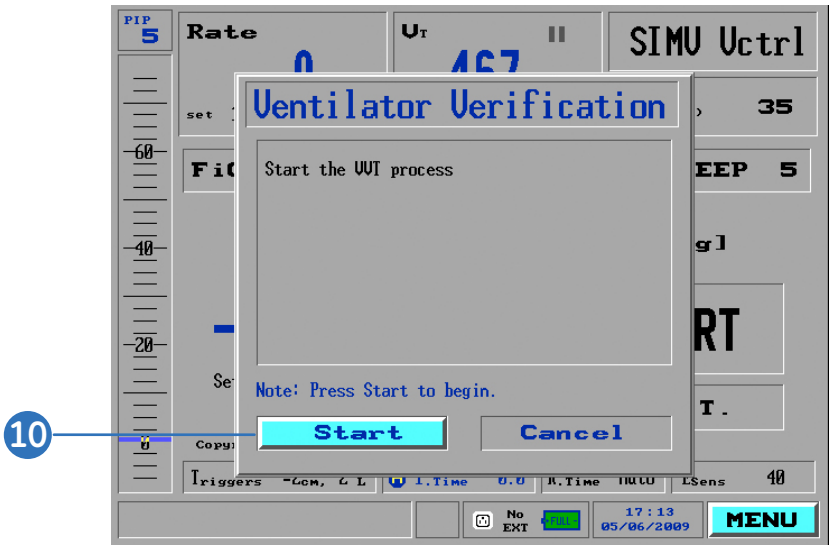


Figure 8.9 Ventilator verification window

When the VVT has completed, a System Message window will indicate success or failure. If the ventilator has failed the VVT, contact your authorized service facility.

Note! *If the VVT fails, on each power up the ventilator will post an alarm window that indicates a VVT must be completed before it is put into use.*

Configuration Screen

The Configuration Screen is used to adjust:

- Default startup weight
- Default start screen
- Default FiO_2 setting

To access the Configuration Screen:

1. Starting from the ***Main Menu***, highlight the ***Maintenance*** option and press the control knob.
2. A caution window will appear, warning that the selection is a restricted maintenance area and is for trained personnel only. Select ***Yes***.
3. The ***Maintenance*** window appears, select ***Configuration Screen***, and press the control knob.

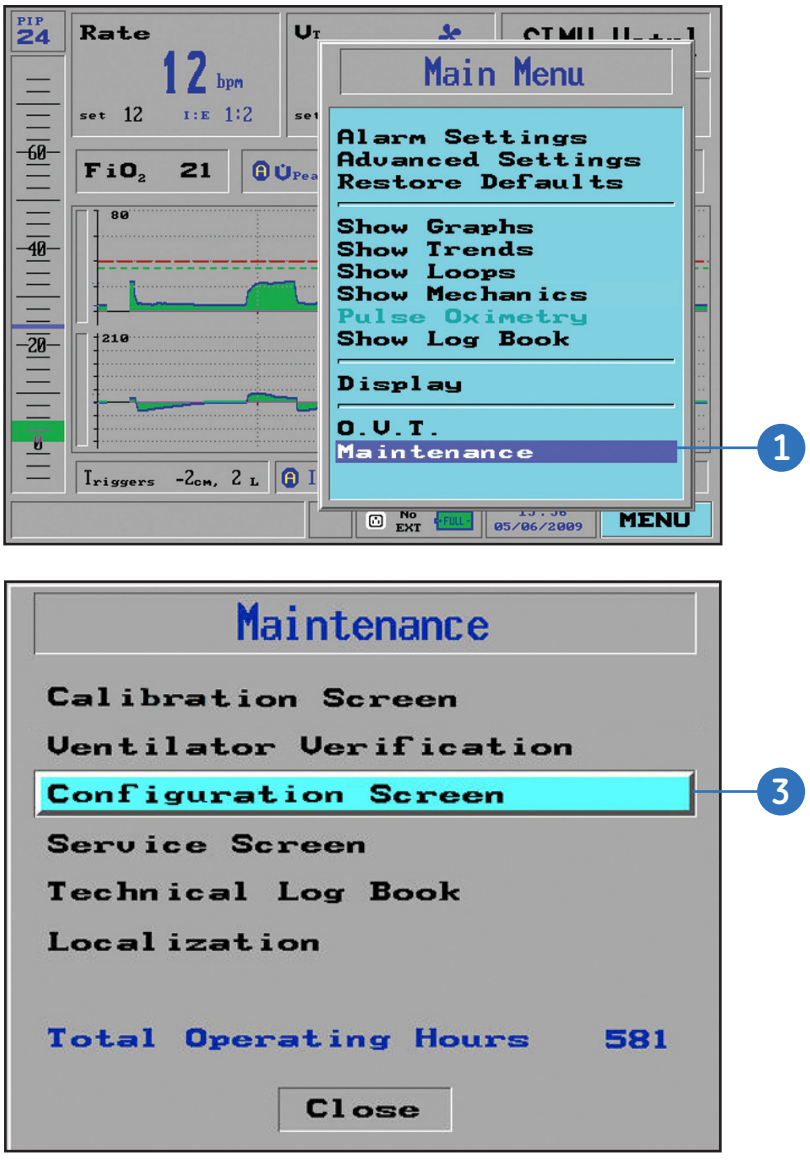


Figure 8.10 Configuration screen option

To change the default startup weight:

1. From the ***Configuration screen*** turn the control knob to highlight ***Default start weight***, and then press the knob.
2. A window will appear showing a range of choices from ***10*** to ***>70***, and ***Last***. Select the desired weight, and press the knob to confirm (The iVent$_{201}$ defaults to a patient weight of >70kg).

To change the default start screen:

1. From the ***Configuration screen*** turn the control knob to highlight ***Default start screen***, then press the knob to confirm.
2. A window appears showing ***Main Screen, Monitoring,*** and ***Home Care***. Select the screen you prefer, and then press the knob to confirm.

Note! *For more information on the start screen, refer to* ***Chapter 7, Graphics and Trends Display, page 7.14.*** *Depending on the configuration purchased, some iVent$_{201}$ models may not have every display available.*

To change the default FiO_2 setting:

1. From the ***Configuration screen*** turn the control knob to highlight ***Default FiO_2*** Setting, and then press the knob to confirm.
2. A window appears offering a range of choices: ***21%, 40%, 60%,*** and ***100%.*** Make the desired selection and press the knob to confirm.

Maintenance Schedule

For technical support in the U.S: call **800-345-2700**. Please have the serial number of the unit available when contacting technical support.

Interval	Parts Affected	Maintenance	General	Prolong Storage
As necessary	Ventilator enclosure	Wipe clean the exterior	X	X
	Patient Tubing	Replace and perform OVT	X	X
	Cooling air filter and vents	Clean and replace filter as needed	X	
	O_2 Sensor	Replace the O_2 sensor	X	
Every 500 hours or **1 month** of use, whichever comes first.	Air inlet filter	Replace the air inlet filter.	X	
1500 hours of operation or **3 months**	Power pack gas gauge	Change the power pack	X	X[1]
		Perform a VVT	X	
		Perform O_2 Calibration	X	
3000 hours or **6 months** of use whichever comes first.	Power pack gas gauge	Deep discharge and recharge	X[2]	X[2]
		Perform a VVT	X	X
Annually, install the annual PM kit, refer to section 9.3.4 in the TRM.	Air Inlet filter	Replace the air filter	X	
	Air Inlet Muffler	Replace the air inlet muffler	X	
	Ventilator outlet port (muffler)	Replace the outlet port (muffler)	X	
	Cooling inlet filter	Replace the cooling inlet filter	X	
	Internal Battery	Replace internal battery and re-initialize the gas gauge	X	
		Perform full calibration	X[3]	X[3]
		Perform VVT	X	X
		Perform safety checks	X	
Every 2 years	O_2 sensor	Replace the O_2 sensor	X	X
Every 15,000 hours, or **4 years**, whichever comes first. Install the 15,000 hour PM kit. Refer to section 9.3.6 in the Technical Reference Manual.	Pneumatic unit	Replace pneumatic unit	X	

Note! *On removing the device from prolonged storage then battery charge, O_2 calibration and VVT MUST be performed to ensure trouble free operation. If the VVT fails a full calibration MUST be performed.*

In addition to the items of planned maintenance suggested above electrical safety testing should be performed as mandated by national, local or institutional regulations.

1. It is recommended that the Power Pack (battery module) be disconnected (removed) prior to placing the ventilator in storage. If the Power Pack is disconnected, there is no need to recharge the battery every 3 months.
2. Charge - Deep discharge - Recharge of the internal battery is very ime consuming. For that reasion it may not be practical to perform during a field service visit
3. Inspection and replacement of annual kit items if required.

Supplies and Accessories

Part Number	Description
620B0006-20	Disposable Breathing Circuit, box of 20 includes: Six feet corrugated main tube, Exhalation Valve Assembly with Airway Flow and Pressure Sensor
620B0008-02	Reusable Multi-use breathing circuit
620B0008-20	Reusable Multi-use breathing circuit, box of 20
660A0001-12	Air inlet filter, box of 12, disposable
504A0110-A1	Adapter for CBRN Filter
660L0001-12	Low Pressure Oxygen Adapter and Filter, box of 12, disposable
630B0001-02	Roll Stand and Mounting Bracket
630B0004-A1	Breathing Circuit Support Arm
404J1516-01	A/C Power Cable, Hospital Grade 115 volt 1.8 m
507A020-A0	D/C Power Cord - 12 volt vehicle adapter
507A022-A0	D/C Power Cord - 12 volt clip-on adapters
620B0002-01	Oxygen Supply Hose, Fifteen feet, DISS oxygen fittings
630B0003-A1	Oxygen Cylinder Holder
503A0012-SP	Power Pack Assembly (Internal)
650R0001-A0	Remote Alarm Interface for free standing (Respironics compatible)
650R0002-A0	Remote Alarm Interface for central alarm system (call for details)
504A0050-A0	External Battery Assembly
920C0001-01	Calibration Syringe – 500mL
920C0002-01	Calibration Manometer
375B0002-01	Transportation Case
620B0010-01	Reservoir Bag – 1 liter, non latex
620B0009-01	Manifold/adapter for Low Pressure O_2
910V0005-01	Test lung, 2L, gray
910V0004-A0	Resistor, RP20
910V0003-B0	Resistor, RP50
311B0005-00	PSV High Pressure O_2 Enrichment System
130B0002-03	O_2 sensor
504A0100-B0	Inlet Muffler Assembly
375A0002-A0	$iVent_{201}$ Shipping Package

To contact customer service, call: **800-345-2700**

Additional contacts:_____

Check Your Knowledge: Maintenance

Circle the correct answer.

1. How often should the O_2 system be calibrated?
   - a. Every day
   - b. Every 3 months
   - c. Every year
   - d. Every 2 years

2. How do you access the Maintenance window on the Ivent$_{201}$?
   - a. From the Main Menu, select Maintenance
   - b. Press the Maintenance dedicated key on the front of the unit
   - c. Select Install/Service, and then select Maintenance

3. What are the steps for a battery full recharge procedure?
   - a. Charge the unit for 10 to 24 hours.
   - b. Run the unit on battery until the Empty Battery alarm sounds, then place back into service
   - c. Run the unit on AC Power for 10 to 24 hours, then place back into service
   - d. Charge the unit for 10 to 24 hours, run on battery until the Empty Battery alarm sounds, and then recharge the unit for 10 to 24 hours.

4. Which of the following statements best describes the Ventilator Verification Tests?
   - a. A set of simple self tests designed to confirm ventilator functionality, initiated by the user.
   - b. A series of self tests that occur every time the unit is turned on.
   - c. A series of self tests that occur every time the unit is turned off.
   - d. It is part of the O_2 calibration.

5. What are the three default settings that can be set from the configuration screen?
   - a. Default AC power, default AC current and default battery charge time.
   - b. Default language, default units and default colors.
   - c. Default startup weight, default start screen and default FiO_2 setting.

Hands on Activity: Maintenance

Place a check mark next to each task that is verified by the instructor.

- ☐ Calibrate the O_2 system
- ☐ Perform the Ventilator Verification Test
- ☐ Change the default startup weight
- ☐ Change the default start screen
- ☐ Change the default FiO_2 setting

Answers: Check Your Knowledge - Maintenance

1. How often should the O_2 system be calibrated?
   b. Every 3 months

2. How do you access the Maintenance window on the Ivent$_{201}$?
   a. From the Main Menu, select Maintenance

3. What are the steps for a battery full recharge procedure?
   d. Charge the unit for 10 to 24 hours, run on battery until the Empty Battery alarm sounds, and then recharge the unit for 10 to 24 hours.

4. Which of the following statements best describes the Ventilator Verification Tests?
   a. A set of simple self tests designed to confirm ventilator functionality, initiated by

5. What are the three default settings that can be set from the configuration screen?
   c. Default startup weight, default start screen and default FiO_2 setting.

9 MRI

Objectives: MRI

By the end of this chapter you should be able to:

- Properly setup the iVent$_{201}$ for use in the MRI environment
- Describe the important reminders when using the iVent$_{201}$ with MRI

Using the iVent$_{201}$ with MRI

Note! *For more information on use of the iVent$_{201}$ with MRI, refer to pages 26 through 32 of the Operator's Manual.*

The iVent$_{201}$ ventilator (serial number 15,000 and higher) is classified as MR conditional for 1.5T and 3T MR scanners. This means that the iVent$_{201}$ is safe to use in the MR environment if the operation conditions specified on pages 30 and 31 of the Operator's Manual are met.

Note! *The iVent$_{201}$ ventilator cannot be subjected to field strength greater than 100 Gauss and must be kept outside of 100 Gauss perimeter, typically about 3.0 meters from the magnet's isocenter.*

For maximum safety, each facility must measure the Gauss field around the imaging device and map the strength levels to ensure that the ventilator is not placed inside the mapped Gauss lines. In addition, it is recommended to use the iVent$_{201}$'s attached Gauss alarm (part number 888A1005-A0), which provides both visual and audible alerts should the ventilator be inadvertently moved inside the 100 Gauss perimeter.

Upon completion of mapping, the 100 Gauss strength lines should be permanently marked on the floor. It is very likely that the magnetic shielding of older MRI units may not be 100% effective. Therefore, the Gauss levels at a given distance may differ within the same given radius from the center of the magnet core. For this reason, it is important to map correctly the Gauss levels for each MRI suite. Stationary objects that are ferrous, such as steel I-beams in the building wall or floor affect the field lines of the magnet, and therefore the 100 Gauss line may not be symmetrical, and should be mapped out on both sides of the MR device.

Note! *The safe distance for ventilators will most likely require a special patient circuit to reach the patient while they are located within the range of the imaging magnets. The part number for the MRI Patient Circuit Extension is 620B0019-01.*

Important reminders when using the iVent$_{201}$ with MRI:

- Connect the potential equalization pin on the back of the ventilator to the ground during battery (DC power) operation
- Before using the MR suite, remove the green cover and the attached metal chain from the high-pressure oxygen fitting
- To avoid degrading image quality, do not use the static mechanics function during MRI scanning
- Lock the ventilator's chart wheel to prevent inadvertent movement
- The ventilator will be attracted to the magnet if it is brought within 2.2 meters of the MR magnet
- If there is a risk of personnel moving the ventilator, it should be tethered to the wall, or placed within a retaining box affixed to the floor
- The SpO_2 option is not intended for use in the MR environment

Course Evaluation

iVent 201

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

Course Content	4 = Strongly agree	3 = Agree	2 =Disagree	1 = Strongly disagree	
The content covered the topics adequately and clearly.	4	3	2	1	NA
The activities/exercises helped me learn the content presented.	4	3	2	1	NA
The participant guide was easy to follow.	4	3	2	1	NA
The knowledge checks and/or assessments in this course were effective in helping me validate my existing and acquired knowledge.	4	3	2	1	NA
Comments:					

Instructor Delivery	4 = Strongly agree	3 = Agree	2 =Disagree	1 = Strongly disagree	
Instructor was prepared for the training session.	4	3	2	1	NA
Instructor was knowledgeable about the course content.	4	3	2	1	NA
Instructor effectively presented the course content.	4	3	2	1	NA
Instructor effectively responded to student questions.	4	3	2	1	NA
Comments:					

Course Experience	10 = Strongly agree									1 = Strongly disagree
Rate your overall satisfaction with the course content.	10	9	8	7	6	5	4	3	2	1
Rate your overall satisfaction with the Instructor delivery.	10	9	8	7	6	5	4	3	2	1
I would recommend this training course to a friend or colleague.	10	9	8	7	6	5	4	3	2	1
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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