Gaumard®
Simulators for Health Care Education

HAL® S1030 Quick Start /User Guide

Dynamic Airway and Lung Compliance

HAL is an interactive educational system developed to assist a certified instructor. It is not a substitute for a comprehensive understanding of the subject matter and not intended for clinical decision making.

HAL S1030 12.3.1

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QUICK START

WELCOME TO THE FAMILY

Meet HAL S1030 dynamic airway and lung compliance simulator.

This Quick Start Guide is intended to provide a basic understanding of HAL's functionality and interaction with a mechanical ventilator.

Please review the HAL S1030 User Guide and equipment manuals for all the items included with the S1030 system for important safety warnings, operation, and features information.

SETUP

Quick start items check list:

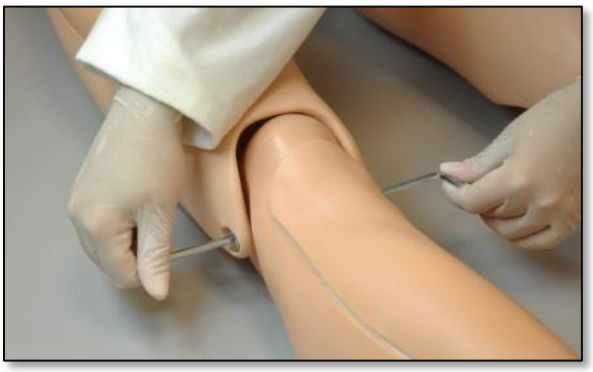
Included with HAL	Equipment not included
HAL S1030	Ventilator (e.g. Puritan Bennett® 840™)
HAL AC Adapter	
USB Communication Module	Patient breathing circuit
Ethernet cable	Lubricant
Control Laptop	
Laptop AC Adapter	

Please see the shipping manifest for a complete list of the items included with the HAL S1030 system.

HAL SETUP

Place HAL on a flat surface and remove the fixed bolts from the leg joint.

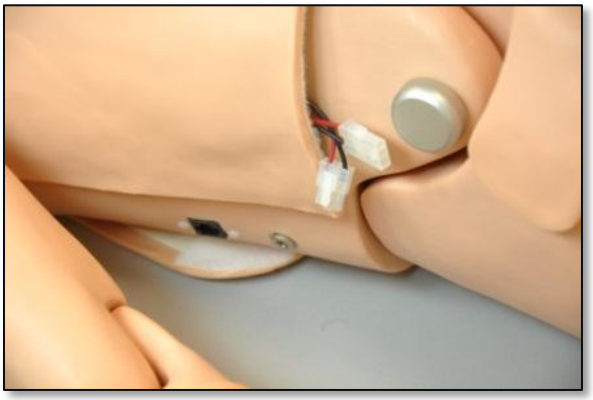
Connect the **CO_2 tubing** to the right lower leg and position both lower legs on the knee joint.



Use the two hexagonal wrenches provided to secure the knee bolts without over tightening.

INTERNAL BATTERY

Locate the battery connectors on HAL's right hand side.



Gently lift the right corner on the chest skin as shown and connect the battery clips.

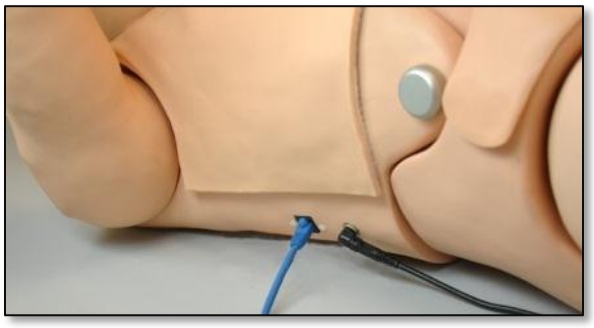
WARNING: Do not remove the chest skin. Internal components are serviced by Gaumard certified technicians only.

Slide battery plugs into the cavity and secure the skin.

LAPTOP CONNECTION

Connect the Ethernet cable to the USB communication module.

On HAL's right side, connect the Ethernet cable to the communications port and the AC adapter.



Connect the laptop's AC Adapter, and then the communication module to an available USB port.

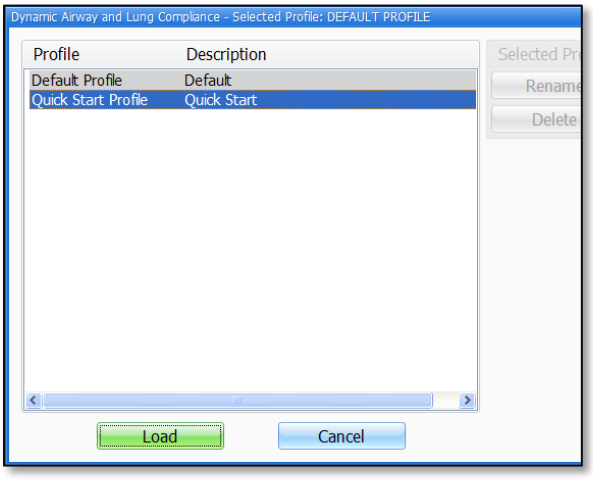
Lastly, power on the laptop and continue onto the Windows® home screen.

STARTING GIGA MODULE

To start the simulator, double click on the **GIGA Module** icon on the laptop's home screen.

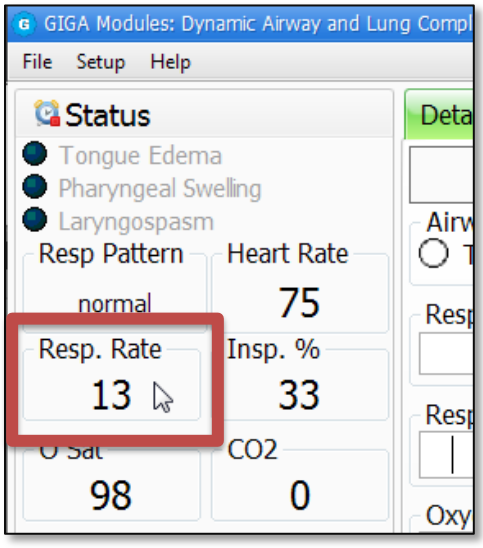
LOAD A PROFILE

Select the **Quick Start Profile** and click **Load**. Hal will establish a connection and power on within 30 seconds of activating the GIGA Module software.

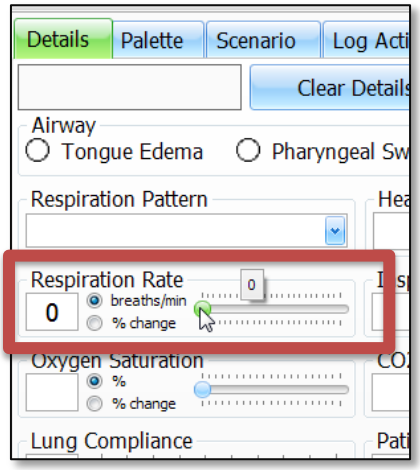


GIGA MODULE INTERFACE

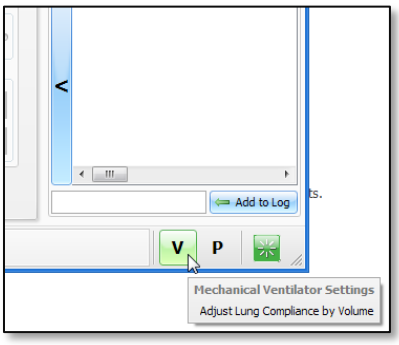
By default, HAL will initialize to a healthy state. **At this point the ventilator should not be connected to the ETT**; as the simulator's normal breathing rate could create a conflict with the medical equipment. On the main screen, HAL's current parameters are seen on the left status panel.



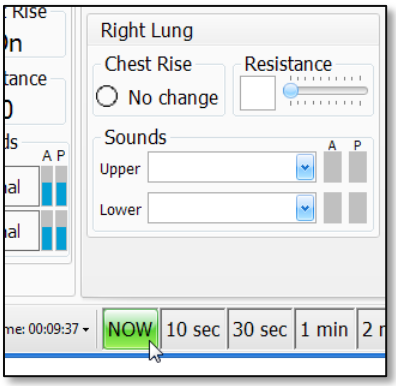
First, **set the respiration rate to 0** on the details tab of the GIGA Module interface.



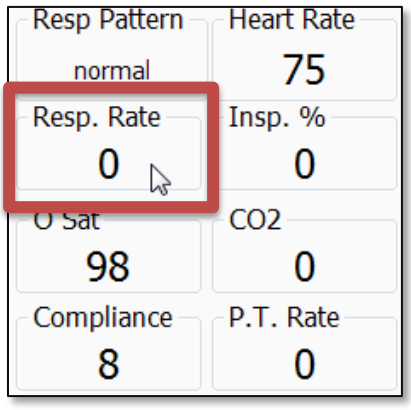
Click the **V** button to adjust HAL's lung compliance by volume.



Finally, click **NOW** on the apply controls located at the bottom of the screen to submit the settings.



The status panel shows the updated settings. HAL is now ready to be mechanically ventilated.



CONNECTING THE VENTILATOR

First, **lubricate** and insert the ETT into HAL's airway. Then, connect the ventilator circuit and power on the ventilator. For additional information, go to page 54.

WARNING: Do not introduce liquids, humidified gases or administer aerosol medications into the airway. Moisture in the airway will damage the simulator's internal sensors and mechanics.

WARNING: HAL's operating limitations are consistent with that of a real human. Treating HAL in a manner that would seriously harm a real person is likely to result in damage to the internal mechanics. Always treat HAL as a real patient.

VENTILATOR SETTINGS

For this simulation exercise, configure the ventilator with the following parameters. **HAL's theoretical weight is 75 Kg (165 lbs.)**

- **Ventilation Type** = Volume controlled
- **Respiratory Rate** = 12 breaths/min
- **VT** = 550 mL
- **Flow** = 40 ltr / min

SIMULATION EXERCISE

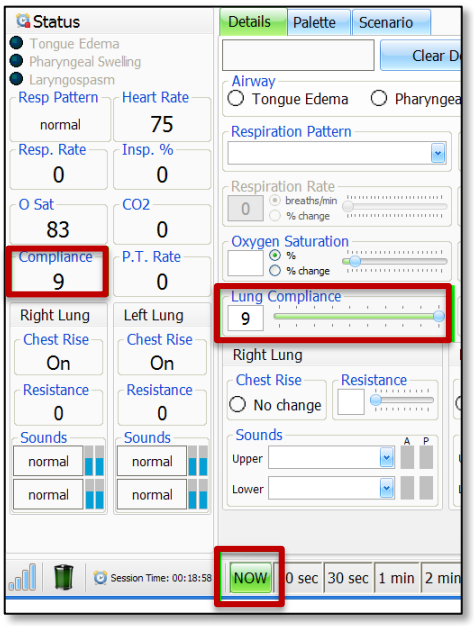
Now that HAL is connected to the ventilator, use the manual physiological parameters controls on the details tab to change HAL's condition.

LUNG COMPLIANCE LOOPS

First, change the **Lung Compliance** values in the GIGA software to view the volume-pressure graphs on the ventilator screen.

Start by entering a value of **9** for the compliance level and click **Now** at the bottom of the window to immediately apply the changes.

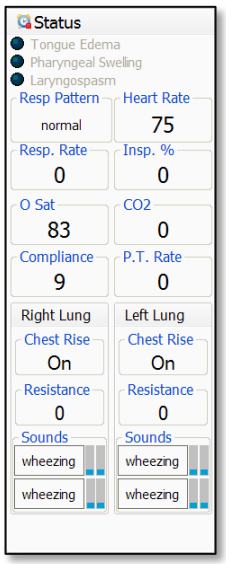
WARNING: Do not change the mechanical ventilator settings while the simulator is adjusting lung compliance parameters.

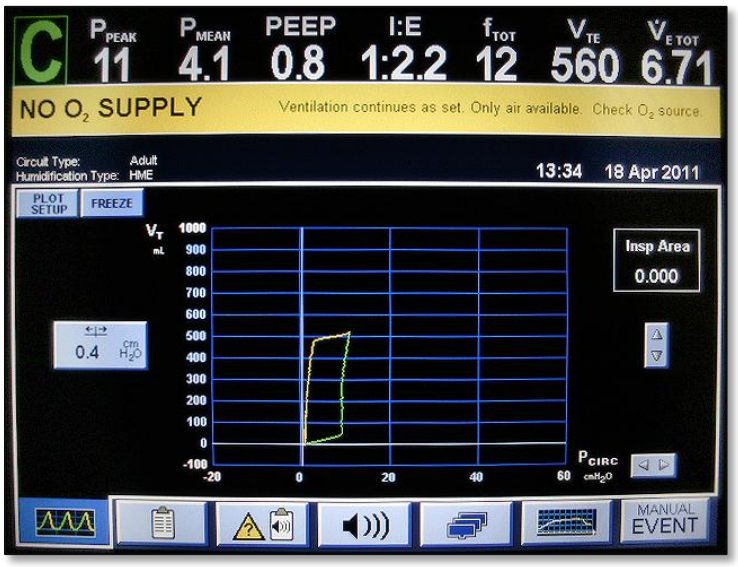


The lung compliance values range from 0 to 9. A lung compliance setting of 0 will provide the lowest (tight) compliance characteristics while a setting of 9 will provide the highest (loose) compliance characteristics. For more information on the lung compliance control, go to page 30.

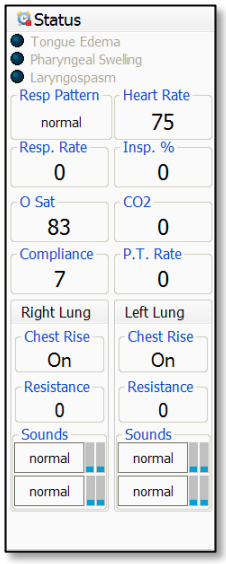
The following screenshots are a side by side comparison between HAL's vital signs, shown on the GIGA status panel (Left), and the ventilator's monitor screen (right).

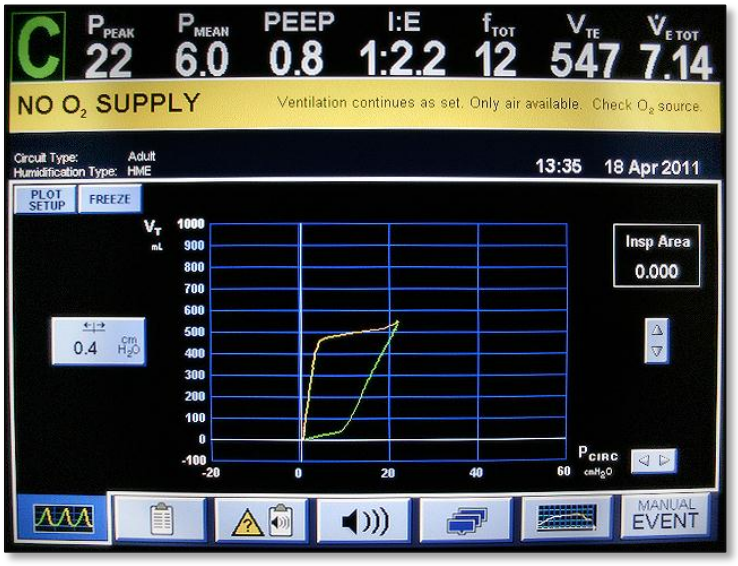
High Compliance Loop – **Compliance 9**



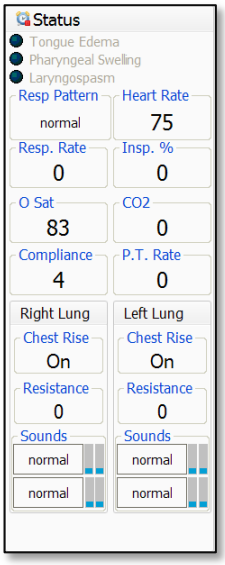


Normal Compliance Loop – **Compliance 7**

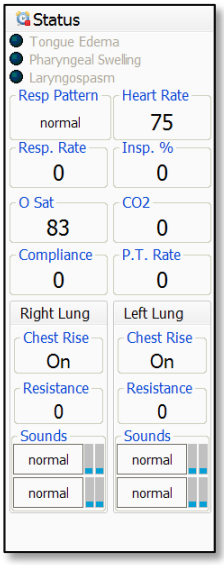


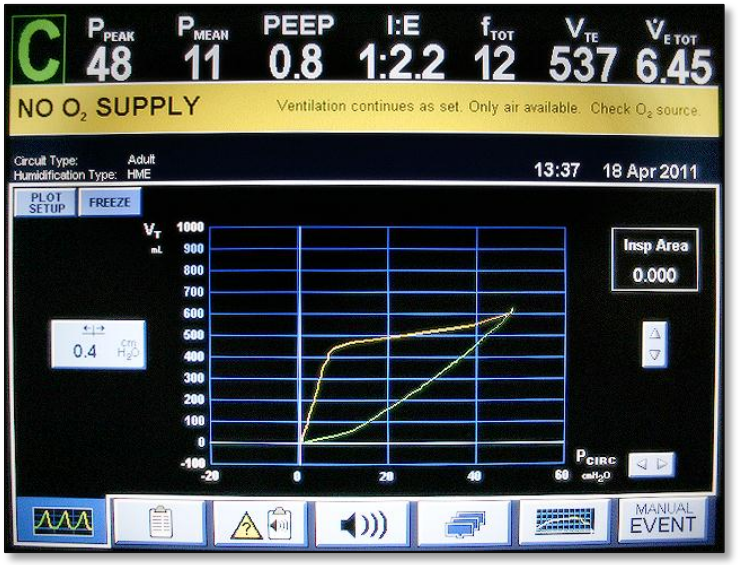


Mid Compliance Loop - **Compliance 4**



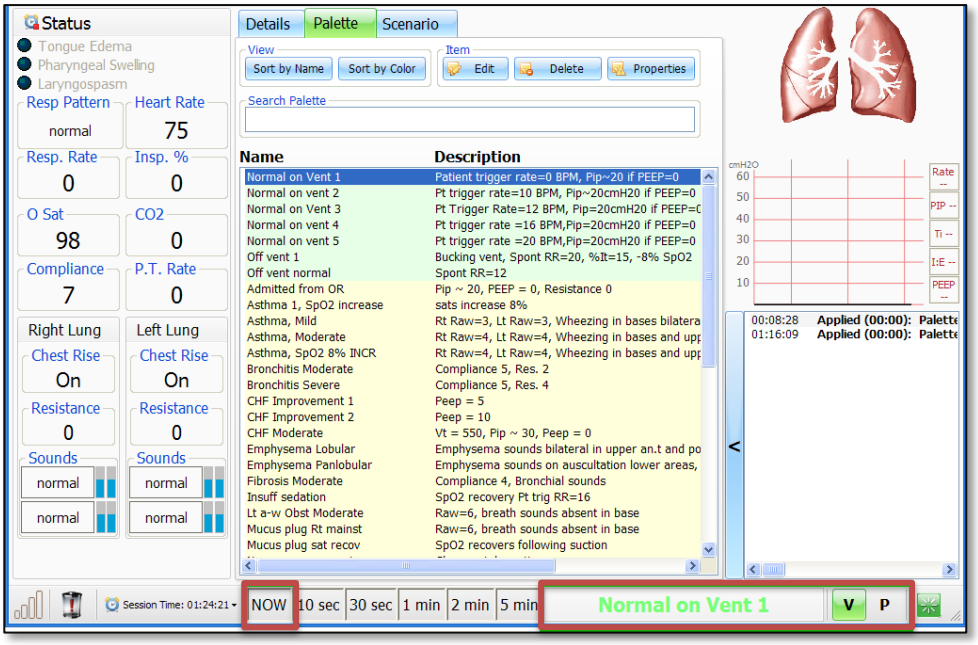
Low Compliance Loop **– Compliance 0**





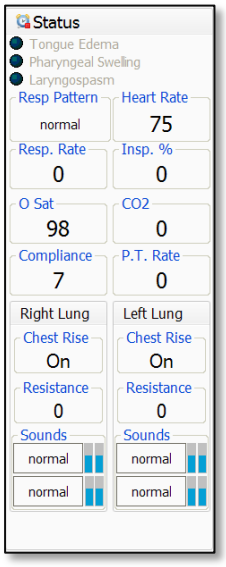
PRELOADED PALETTE ITEMS

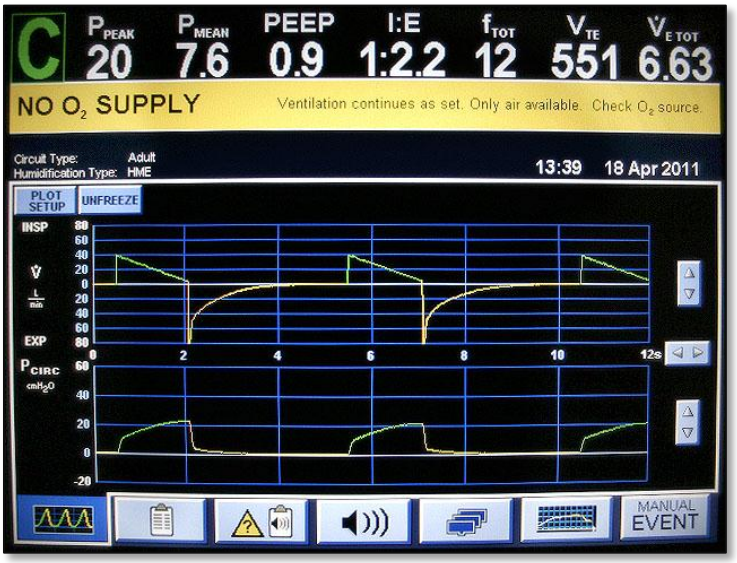
A **palette item** stores a set of preprogrammed physiological parameters in a single loadable item. Click on the palette tab and select the **Normal on Vent 1** palette item from the list. Click **Now** to apply the palette item and change HAL's condition.



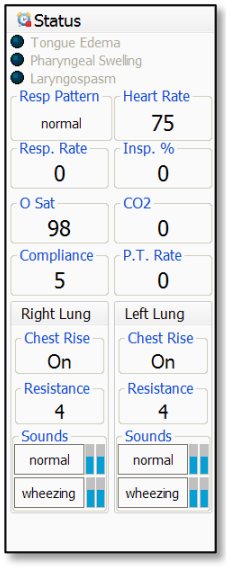
Normal on vent 1 will set HAL's respiratory rate to 0, patient trigger rate to 0 and compliance to 7. The new vitals are updated on the status panel located on the left of the screen. For information on creating new palette items, go to page 32.

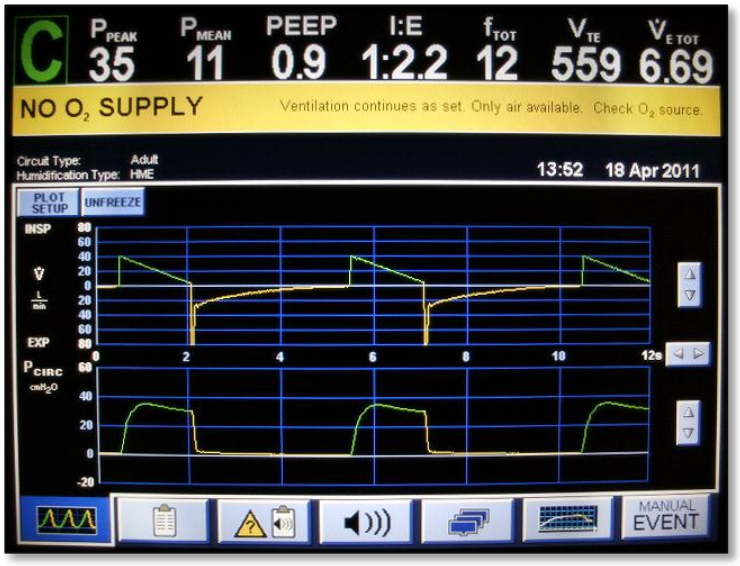
Palette: Normal on Vent 1 - Compliance 7



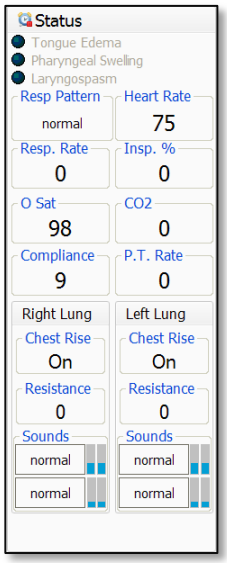


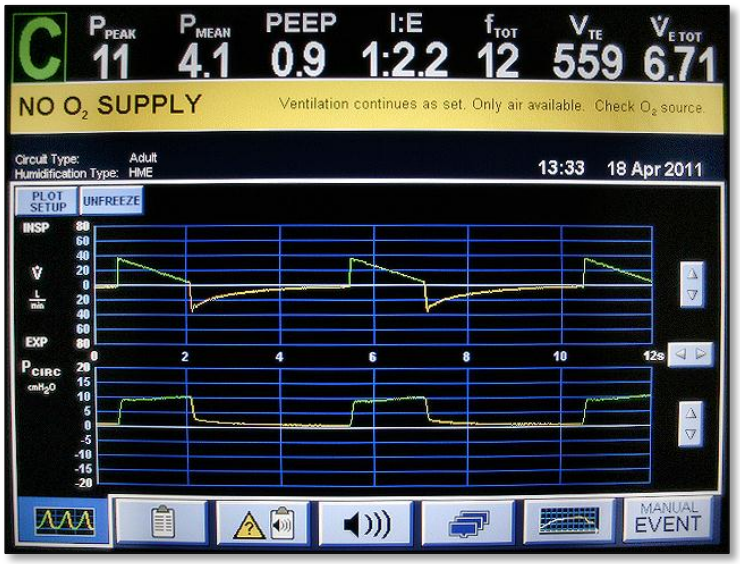
Palette: Bronchitis Severe – Compliance 5, left/right lung resistance 4



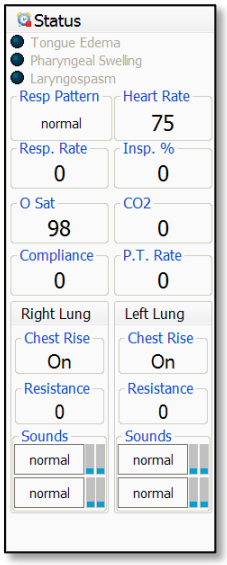


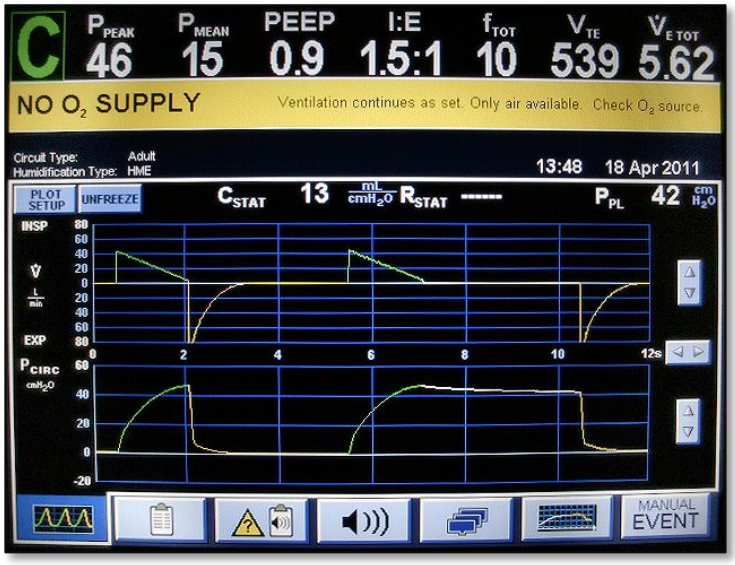
Palette: Emphysema Lobular – Compliance 9



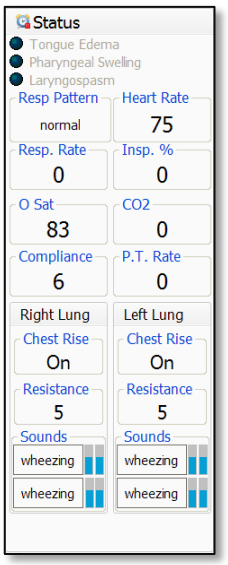


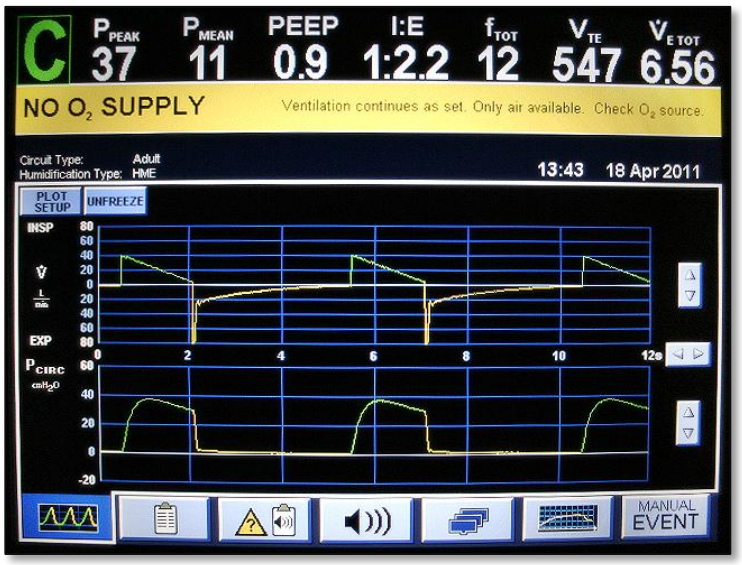
Palette: Fibrosis Severe – Compliance 0



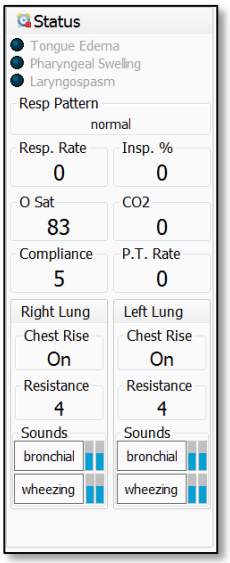


Palette: Asthma Moderate - Compliance 6, left/right lung resistance 5





Palette: Bronchitis severe – Compliance 5, left/right lung resistance 4



USER GUIDE

OVERVIEW

The HAL S1030 Dynamic Airway and Lung Compliance Simulator is a training simulator equipped with the following features.

SIMULATOR FEATURES

- BVM, intubate or mechanically ventilate
- Tongue edema, pharyngeal swelling and laryngospasm
- Practice intubation and management of anatomic and pathologic conditions
- Treat HAL with mechanical ventilators set to operate by volume or pressure control
- Ten levels of static compliance, from 15 to 90 mL/cm H2O
- Ten levels of independently controlled airway resistances
- Capable being treated with A/C, and PCV modes of ventilation
- Capable of assisting the ventilator at variable respiratory rates
- Capable of holding PEEP
- Real CO_2 exhalation
- O_2Sat readings using a real monitor on the left index finger
- Set inspiratory effort rate to trigger the ventilator for assistance
- Four anterior and four posterior lung sounds
- Articulating adult HAL full size body

USER INTERFACE

- Monitor and control HAL's physiologic state from the user interface.
- Program tongue edema, pharyngeal swelling and laryngospasm
- Built in software respiratory monitor
- Pre-programmed clinical scenarios
- Create new scenarios using our proven, easy to use, GIGA Module software
- Evaluation feature for assessing and logging care provider performance
- Profile based log-in to support different users or areas of study
- Pre-programmed airway and lung pathologies including
    - Asthma
    - Chronic Bronchitis
    - CHF
    - Emphysema

TERMINOLOGY

It is wise to spend a moment familiarizing yourself with some of the terminology that will be used to discuss simulation with the HAL system.

Facilitator - the person conducting the simulation; an instructor or lab staff member.

GUI - the Gaumard User Interface - is the software application, used to control the simulator and evaluate care providers.

Palette Item - A **palette item** stores a set of preprogrammed physiological parameters in a single loadable item.

Profile - a unique HAL software configuration, including custom Palette, Scenarios, and options. Each Profile acts as a separate program, in that changes made to one profile have no effect on the others.

Provider - a person participating in the simulation as a healthcare provider.

Scenario - a saved sequence of physiological states, like a "playlist." Scenarios provide a level of automation that unburdens the facilitator and allows standardized presentation of symptoms.

Scenario Item - a Palette Item that is part of a scenario. Scenario Items may also represent a fixed delay period ("Wait") or a pause ("Wait Indefinitely").

WORKING WITH GIGA Module

STARTUP

The simulator will establish a connection within 30 seconds of activating the software. By default, HAL will initialize in a healthy state.

CAUTION: At this point the ventilator should not be connected to the ETT or the ventilator; as the simulator's normal breathing rate could create a conflict with the medical equipment.

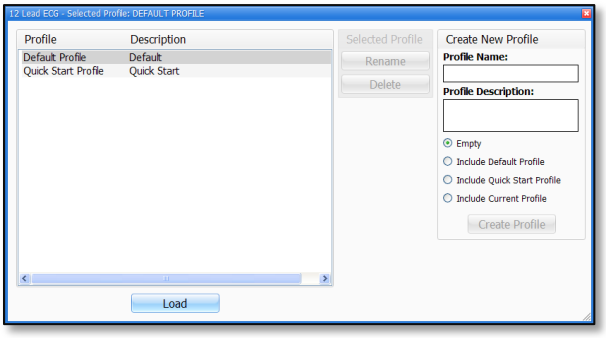
Double click the GIGA Module icon on the home screen of the laptop computer to initialize HAL.

PROFILES MENU

A profile is a unique configuration of customized **Palettes**, **Scenarios,** and **Options.** Each profile functions independently, in that changes made to one profile have no effect on the others. The following profiles are preloaded into GIGA Module.

Default Profile – includes one palette with healthy physiological parameters. When creating a new profile, it is often useful to include the Default profile contents and begin customization from that foundation.

Quick Start Profile – contains a series of preprogrammed palette items and preprogrammed scenarios.

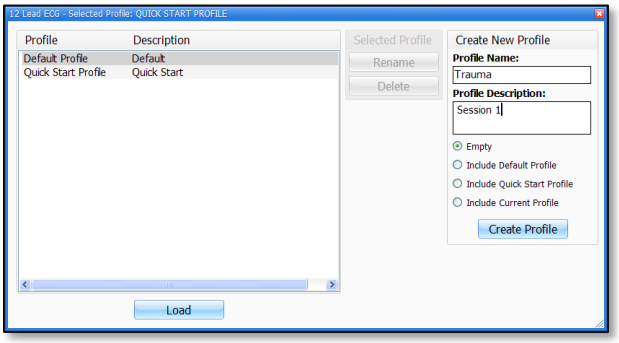


It is recommended that first time users select the Quick Start Scenarios profile, which was created in conjunction with experienced healthcare instructors and working medical professionals. It has applicable Palettes that are useful for simulating common medical emergencies. For many applications, it serves a convenient starting point that can be customized to fit most simulation objectives. Simply select the applicable profile and click **Load** to continue.

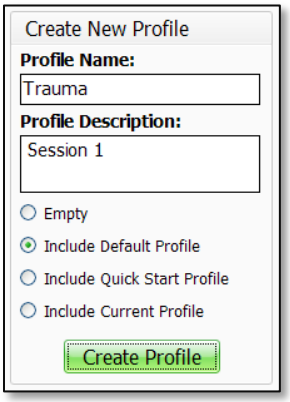
CREATING A NEW PROFILE

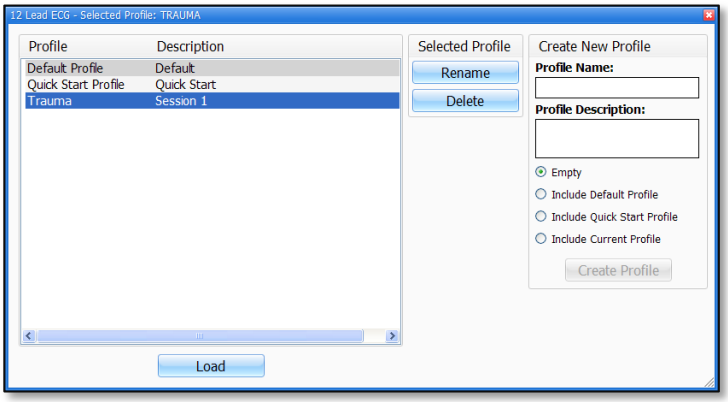
Create a new profile for each user of the HAL system or a specific academic course. For the most detailed exercises, it is sometimes useful to devote an entire profile to one particular subject area, or even one particular scenario.

On the left panel and enter a name for the new profile followed by a description.

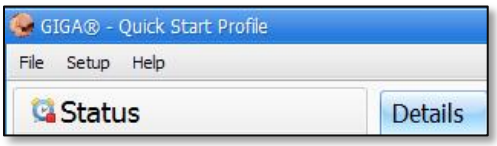


Include items from other profiles by making the appropriate selection below and click **Create Profile** to finish.





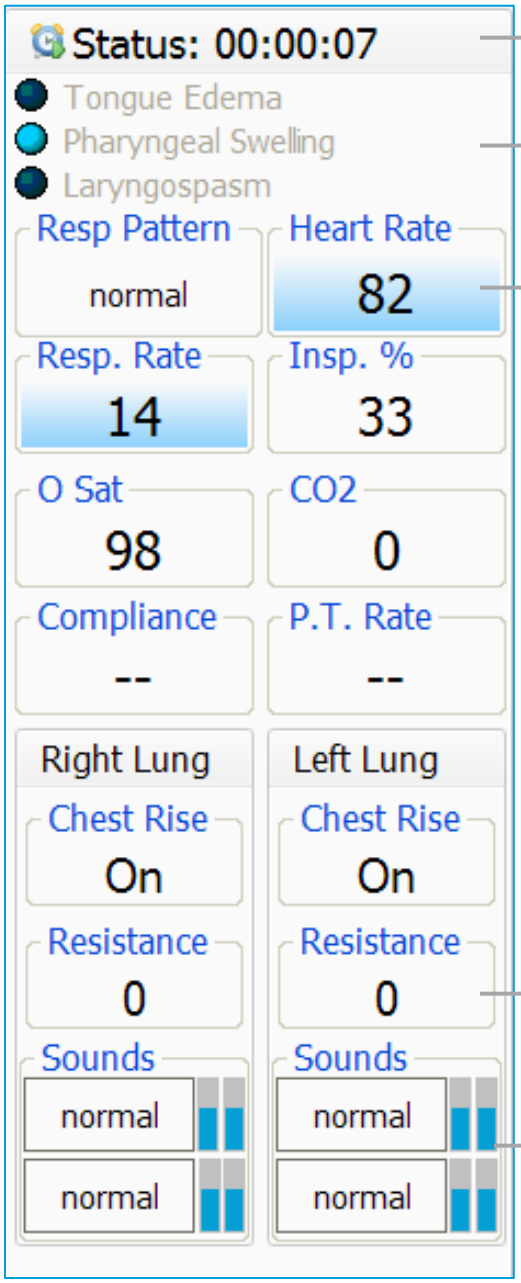
The profile name is displayed on the GIGA Module title bar. To change profiles without restarting the software click **File > Profiles**.



ENVIRONMENT

STATUS PANEL

The Status panel is visible along the left edge of the GUI window at all times. It displays the simulators current vital signs, volumes, and active features.



TREND TIME

The status countdown displays the time left for vitals to reach the state programmed on the details page. Depending on the trend time, the countdown timer will display 10 seconds, 30 seconds, 1 minute, 2 minutes or 5 minutes.

FEATURE INDICATORS

Each of these icons corresponds to a complication. Active features are marked with light blue icons. In this example, pharyngeal swelling is enabled while tongue edema and laryngospasm are disabled.

CURRENT PARAMETERS

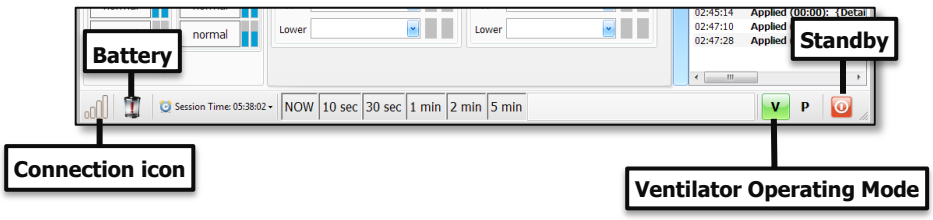
Vital signs undergoing change are highlighted in blue.

SOUND AND VOLUME

Monitor the sound type and volume level for each lung.

CONTROL BAR

The lower panel displays the signal, battery, session time, and power options.



CONNECTION

The signal icon is used to monitor the hard wired connection between the laptop and the simulator.

The indicator is clear when no attempts to communicate with the simulator are being made; for example when the module is not connected to the computer or the system is in STAND-BY mode. Full bars indicate excellent communication between the computer and the simulator (i.e., normal operation).

BATTERY INDICATOR

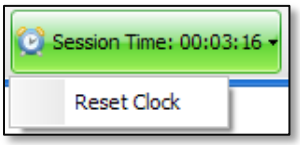
The battery charge level is displayed in real time when a connection is established with the simulator,

The exclamation mark is shown when there is no communication with the simulator. When the battery is so low that the indicator turns blinking red, the simulator is sent automatically to STAND-BY mode (to protect some of the simulator's internal components) and will not operate until the simulator is reconnected to the AC adapter.

Always operate HAL while connected to AC adapter. The internal battery only provides temporary power during transport or an outage.

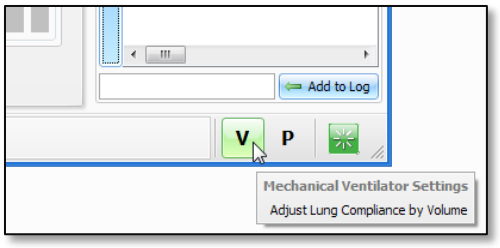
SESSION TIME

Keep track of a simulation's duration using the session timer. Log entries are session time dependent. Reset the session time counter before starting a new exercise. The session timer can be reset from the file menu, or by clicking on the session time icon and selecting reset.



VENTILATOR OPERATING MODE

By default, HAL is set to work with mechanical ventilators operating in volume control mode. To set HAL to work with a ventilator set to pressure control, toggle the ventilator operating mode button to **P** on the GIGA module software. To prepare HAL for a ventilation exercise, go to page 54.



STAND-BY

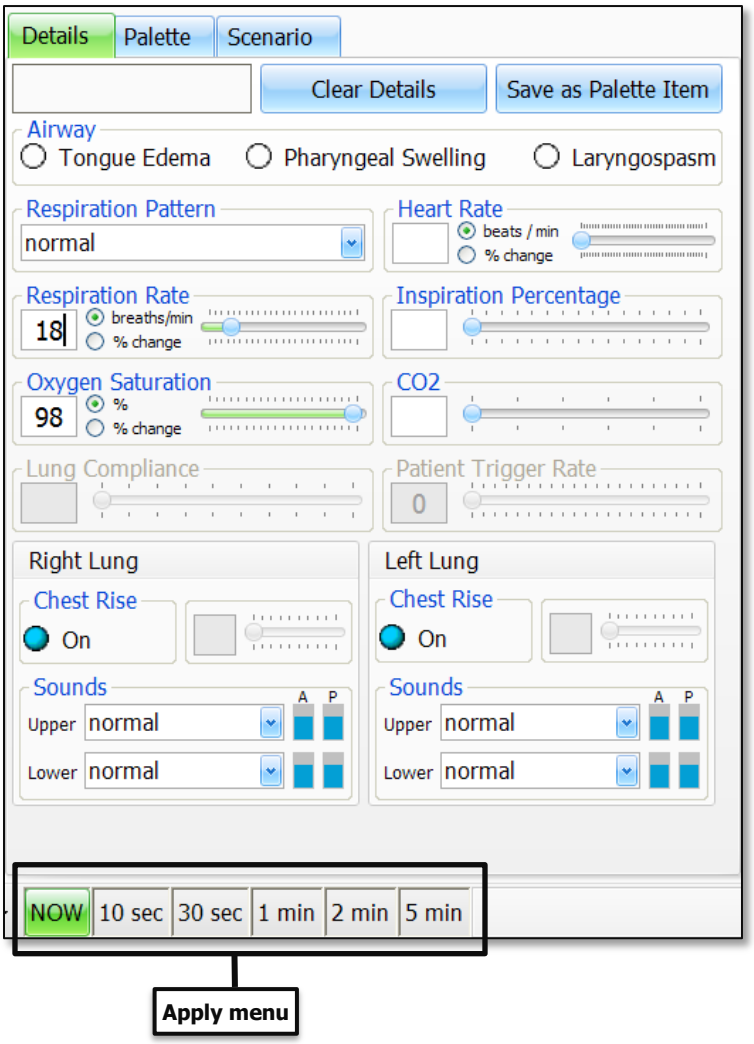
HAL uses what is called soft power, which means that the simulator is activated from the software. After the battery is connected during the setup procedure, HAL is always in **SLEEP** mode. HAL will automatically wake up in the **ON** mode less than 1 minute after starting the GIGA Module software. Click the stand-by mode to conserve battery during transport. To completely power down the simulator, click **File>Exit.**

The Simulator is currently in Stand-by mode.

The simulator is currently connected and operational.

DETAILS TAB

It is best to think of controlling the simulator in terms of three levels of complexity: Firstly Details, then the Palette, and finally Scenarios. The Details page is the first of the tab-pages found in the main area of the user interface window. This is the simplest form of control available to the facilitator. Note that, for each item in the Details tab, there is a corresponding entry on the Status panel.



APPLY MENU

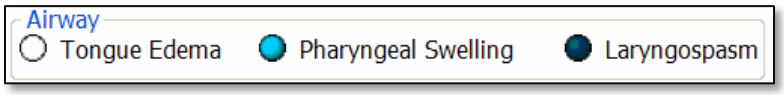
After the physiological parameters are selected, click one of the apply buttons to update HAL's condition. Click **NOW** to change the vital signs immediately. Alternatively, click a timed apply option automate the gradual increase or decrease of numeric physiological parameters (e.g. blood pressure) over the span of several minutes. **It is very important to note that those settings that you do not specify will remain unchanged.**

WARNING: Do not change the mechanical ventilator settings while the simulator is adjusting lung compliance parameters.

PHYSIOLOGICAL PARAMETER CONTROLS

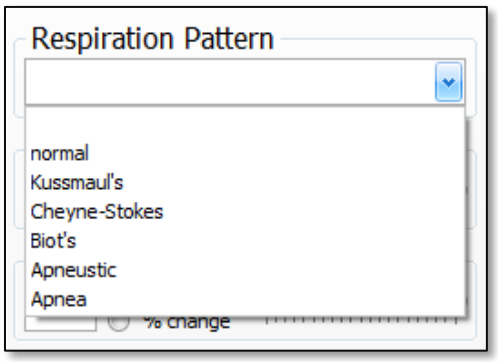
Airway

Airway complications have three states, on/off and no change. To set the complication to active click the circle icon light blue. To disable the complication, click again to darken the control. If no change is to be made from the previous state, the control will display clear. Recall that to change HAL's condition, all changes must be submitted using the apply menu.



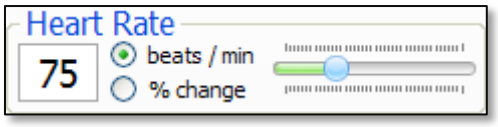
Respiratory Pattern

Select from the following options: normal, Kussmaul's, Cheyne-Stokes, Biot's, Apneustic and Apnea.



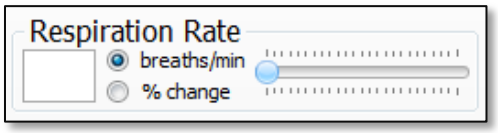
Heart rate

The heart is a virtual value can be expressed either as beats-per-minute, or a percentage of change. Maximum heart rate is 220.



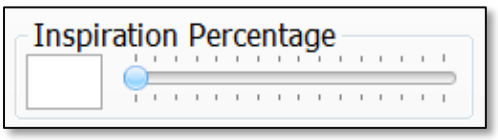
Respiratory Rate

The respiratory rate can be expressed either as breaths-per-minute, or a percentage of change. Maximum respiratory rate is 120.



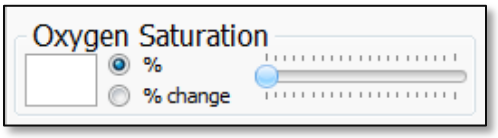
Inspiration Percentage

Control the inspiration percentage by using the numerical input of slider. The maximum value is 75.



Oxygen saturation

The oxygen saturation is a virtual value can be expressed either as percentage overall, or a percentage of change. Place a real oximeter on the left index finger to obtain a reading. For more information on calibrating the oximeter equipment, navigate to page 49.



Carbon dioxide

Adjust the exhalation of carbon dioxide when a CO_2 cartridge is installed. If no cartridge is found, the software will accept the input as a virtual value. The maximum output rate is 10. To install a CO_2 cartridge, go to page 56 for instructions.

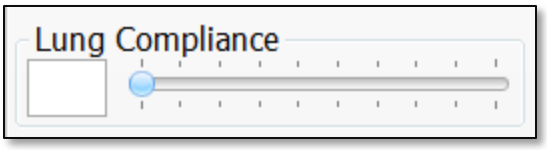
CO2 LEVELS

The chart below is an estimate of the duration of CO_2 output for each of the programmable CO_2 levels with the following parameters: RR=13, Compliance= 8, Airway Resistance=0, VT = 550. For information on installing the CO2 cartridge, go to page 56.

CO_2 Level	Approximate kPa	Approximate duration (in minutes) of CO_2 cartridge
0	0	
1	1.7	125
2	2.8	110
3	3.9	75
4	4.7	55
5	5.5	45
6	6	35
7	6.7	30
8	7.3	25
9	7.7	25
10	8.5	20

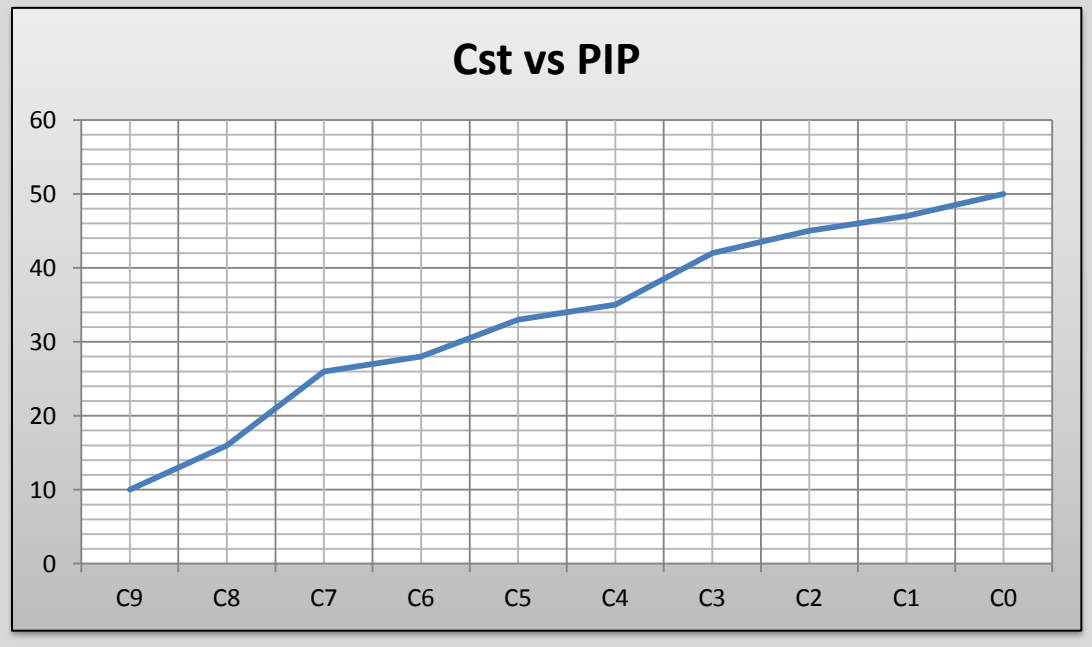
Lung compliance

The lung compliance values range from 0 to 9. A lung compliance setting of 0 will provide the lowest (tight) compliance characteristics while a setting of 9 will provide the highest (loose) compliance characteristics.



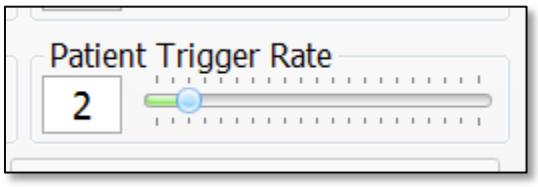
WARNING: Do not change the mechanical ventilator settings while the simulator is adjusting its lung compliance parameters.

The graph below shows an estimate of the peak inspiratory pressure across HAL's compliance levels while the ventilator's volume is set to 550mL and a flow of 40 ltr/min. It is assumed that HAL's weight is 75 Kg (165 lbs.). To accommodate for fluctuations in the results as seen on ventilators, values on the graph may differ by +/- 2.



Patient trigger rate

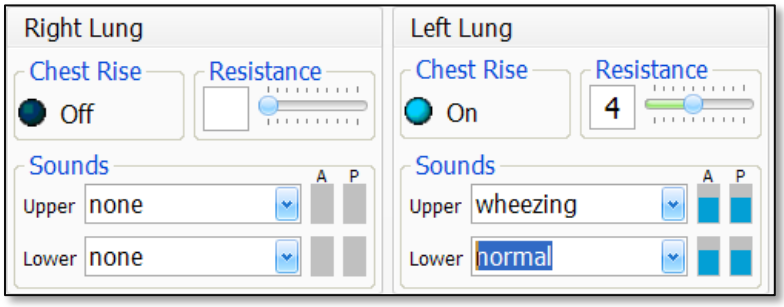
Set the rate of shallow inhalations per minute that will trigger the ventilator for breathing assistance. The simulator is able to trigger the ventilator either when: Flow ≤ 1 Lts/min, or Pressure ≤ 1 cmH2O.



Facilitator's may need to adjust the flow/pressure triggers sensors on the ventilator so the equipment can easily recognize HAL's shallow inhalations (gasps).

Lung controls

The lung fields include several settings that work independently on each lung. Recall that to change HAL's condition, all changes must be submitted using the apply menu. (e.g Now, 10 sec, 30 sec).



- **Chest Rise** – The chest rise mechanism on each lung can be enabled or disabled independently. Click on the circular icon to cycle through the states (disabled, enabled and no change). A dark circle disables the lung and a light blue circle enables it. A clear circle specifies no change from the previous state of the lung. Recall that to change HAL's condition, all changes must be submitted using the apply menu.

  Disable the lung mechanism to simulate a collapsed lung. However, to simulate an apneic patient, change the respiratory rate to 0 and keep the lung enabled.

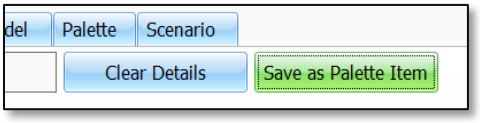
- **Resistance** – Adjust the resistance of each lung bronchi.

- **Sounds** – Select an independent sound for the upper and lower lungs. Choose between normal, none, wheezing, inspiratory squeaks, crackles and rales. In addition, anterior and posterior volumes can be adjusted and programmed into palettes.

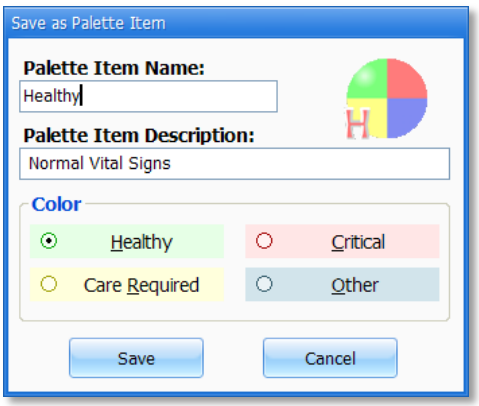
PALETTE ITEMS

The Details tab is also used to create palette items. A **palette item** stores a set of preprogrammed physiological parameters in a single loadable item. Use a palette item to quickly load several physiological parameters at once. Palette items are also used in scenarios as covered in the next section.

To create a palette item, set several physiological parameters on the Details tab and click the **Save as Palette Item** button near the top of the page.



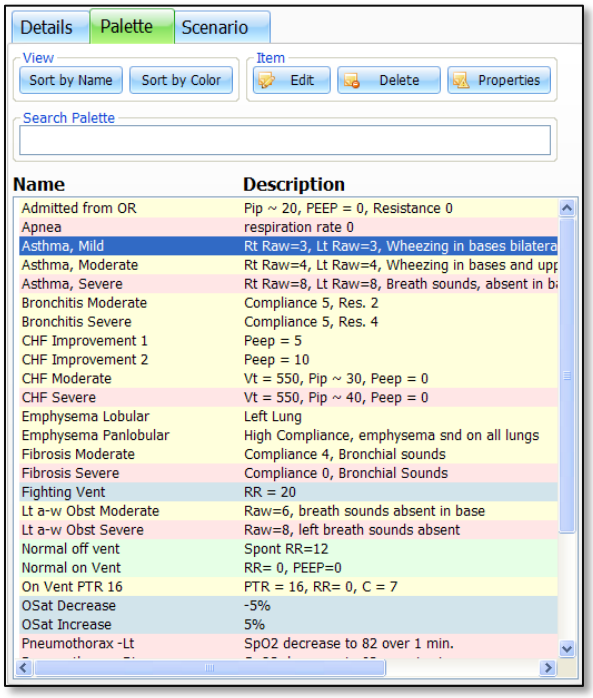
On the Save as Palette Item window, enter the name and palette description. Assign one of four color-coding labels for easier identification and click Save.



Once a palette is created, it is listed in the Palette tab library. Different palette items are then used to create scenarios. For more information on scenarios see page 34

PALETTE TAB

The palette tab displays all of the palette items in the current profile. Each item on the palette stores set of preprogrammed physiological parameters. Recall that palette items are created using the Details tab.

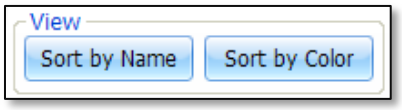


Apply palette items using the apply menu buttons at the bottom of the page, exactly as changes to HAL's condition are applied on the Details tab.

To modify an existing palette item, select the item and click the Edit button. The palette item will be loaded in the Details tab and the settings that comprise the selected palette item will be displayed. Change them as desired, and click the **Save as Palette Item** button.

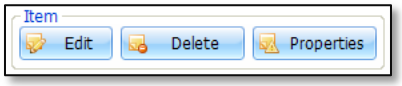
PALETTE ITEM CONTROLS

Select a palette from the list to enable the following options.



Sort by Name – sorts alphabetically by palette name

Sort by Color – sorts by condition (healthy, care required, critical or other.)



Edit – allows revision of the palette item's settings on the Details tab.

Delete – permanently deletes the selected palette item.

Properties – displays a Status panel-like summary of the palette item settings.

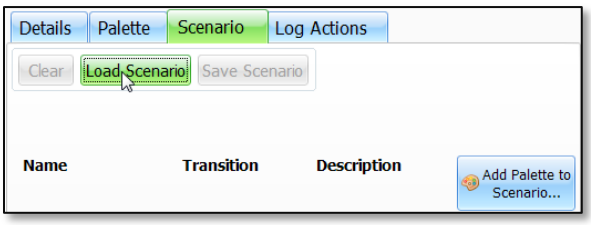
SCENARIO TAB

The most advanced method of controlling the HAL system is to use a scenario. Scenarios automate most of the changes to HAL's condition, so that facilitators can keep their attention on the providers' actions. The scenario system can also provide standardization of the patient's presentation of symptoms. For fair assessment of providers and any research application, such standardization is key.

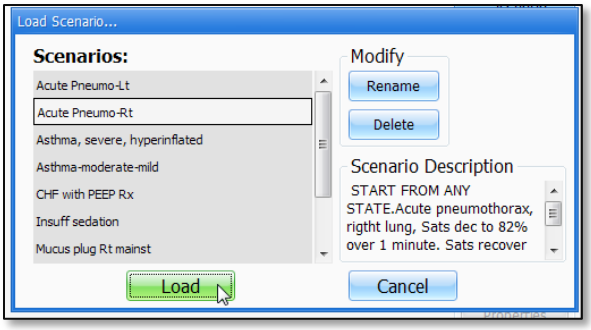
LOADING PREPROGRAMMED SCENARIOS

GIGA Module includes several preprogrammed scenarios to simulate a variety of airway and lung pathologies. All preprogrammed scenarios are included in the **Quick Start Profile**.

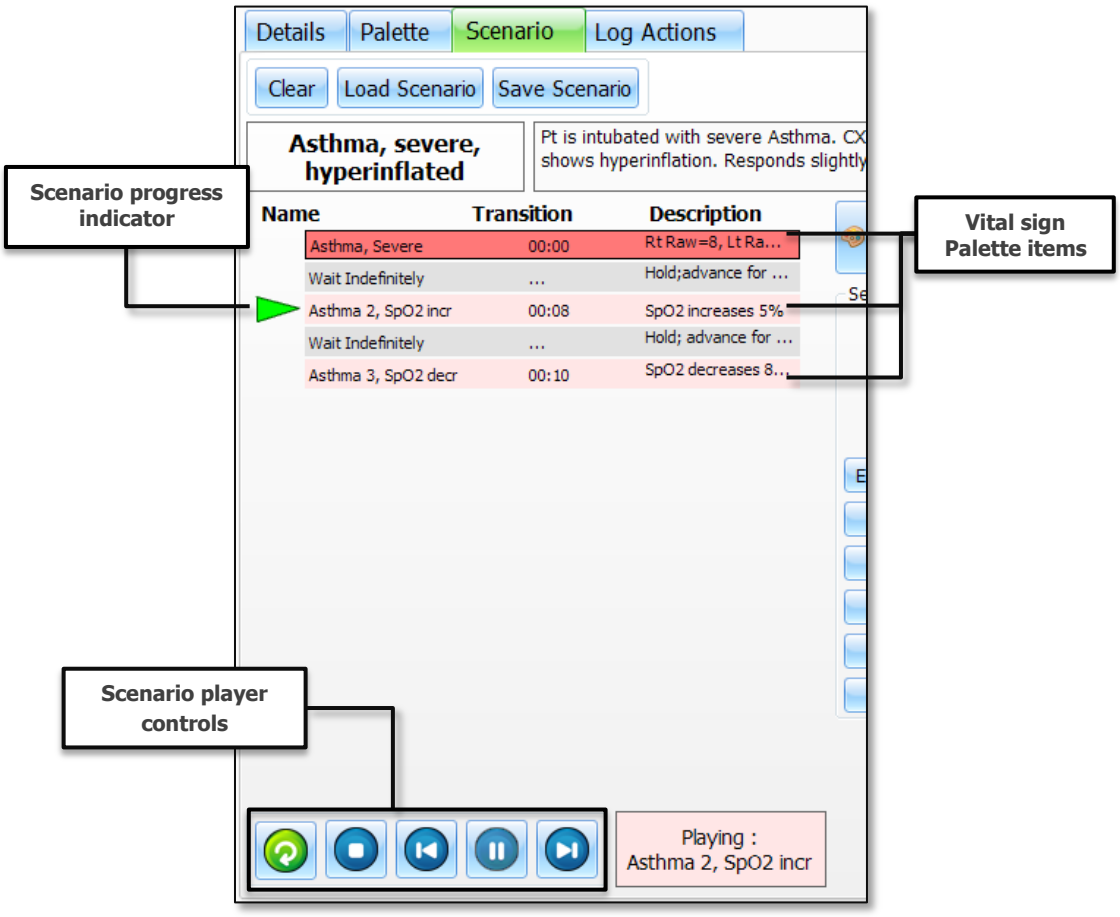
First, click **FILE> Profile** and load the **Quick Start Profile**. Then, go to the **Scenario** tab and click **Load Scenario**.



The Load Scenario dialog box appears. Select a scenario and click on **Load**.



Scenarios are a playlist of palette items played in a linear sequence. At any point, the facilitator can pause, resume, rewind, fast forward, or restart the scenario using the scenario player controls.



Scenarios are composed of vital signs palette items and wait palette items. The progress from one palette item to the next is controlled by the palette's transition time or manually by the facilitator.

In a scenario, each vital signs palette updates HAL's condition. As outlined previously, palette items are created using the Details tab.

The transition time trends the increase or decrease of numerical vital signs such as blood pressure over seconds or minutes. On palette 2 below, vital signs from the previous inherited state will trend to the new vital signs over the span of 5 seconds. Note that on palette 1, no transition time is programmed so vital signs are applied immediately.

Wait palettes do not update or change vital signs. Instead, a **Wait** palette item will maintain the inherited vital signs until the transition time expires. Alternately, a **Wait Indefinitely** palette will maintain the inherited vital signs until the facilitator manually clicks the **next palette item** button from the scenario player controls.

Wait palettes give the provider time to perform an action; this may be treatment in response to a complication or a standard assessment of the vital signs. The vital signs palette following a wait palette is programmed as if the provider performed the action as expected.

Scenario walkthrough

	Palette Name	Palette Vital Signs	Transition Time	Simulator Vital Signs
Start				
	Palette 1	**Resp. Rate = 10 HR =90**	**00:00 sec**	**Resp. Rate = 10, HR =90**
	Wait palette	————	**01:30 min**	**Resp. Rate = 10, HR =90**
	Palette 2	**Resp. Rate = 15 HR =100**	**00:05 sec**	**Resp. Rate = 11, HR =92**
				Resp. Rate = 12, HR =94
				Resp. Rate = 13, HR =96
				Resp. Rate = 14, HR =98
				Resp. Rate = 15, HR =100
	Wait palette	————	**02:00 min**	***Resp. Rate = 15, HR =100***
	Palette 3	**Resp. Rate = 10 HR =80**	**00:05 sec**	**Resp. Rate = 14, HR =96**
				Resp. Rate = 13, HR =92
				Resp. Rate = 12, HR =88
				Resp. Rate = 11, HR =84
				Resp. Rate = 10, HR =80
End	**Total scenario time**		**03:40 min**	

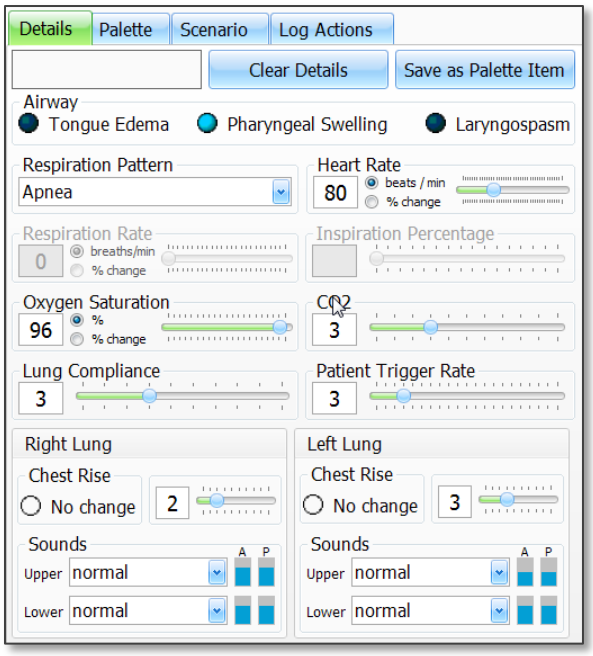
CREATING A NEW SCENARIO

Build new scenarios to expand the number of exercises available in a training program. Below is a brief overview of the steps necessary to create and save a new scenario. For detailed information on scenario planning and theory, go to page 62.

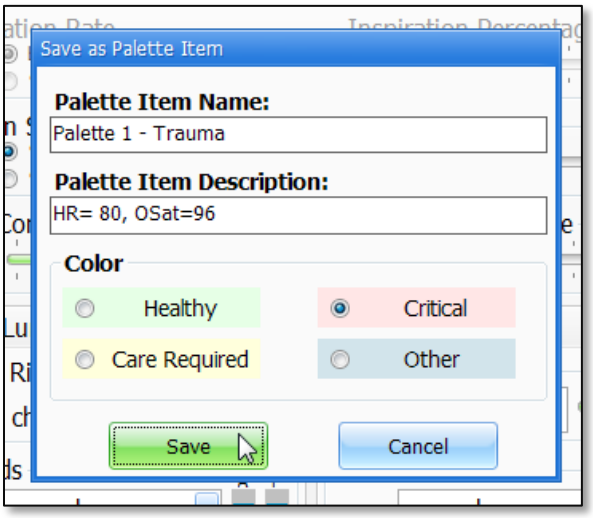
- Create scenario vital sign palette items
- Add vital signs palettes and wait times to the scenario
- Play the scenario
- Modify and edit palettes
- Save the scenario

The first step is to create the vital sign palette items that will be used in the scenario using the Details tab. Each palette item will represent a physiological state in HAL's condition. It is recommended that all the physiological parameters, sound types, and volumes are programmed in the scenario's first palette. Physiological parameters not specified are inherited from one palette to the next.

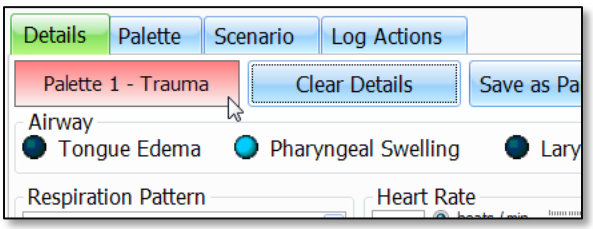
Enter the vital signs for the first physiological state in the scenario, and then click the **Save as Palette Item** button.



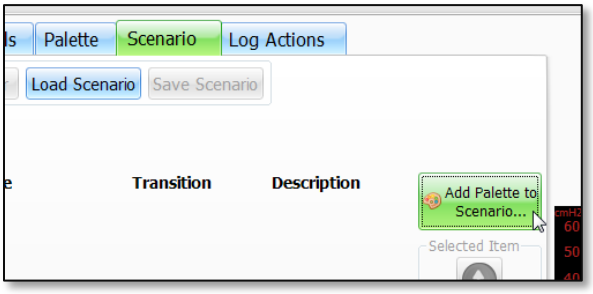
The Save as Palette Item dialog box is displayed. Type in the palette item name and a brief description; assign a color tag and click **Save**.



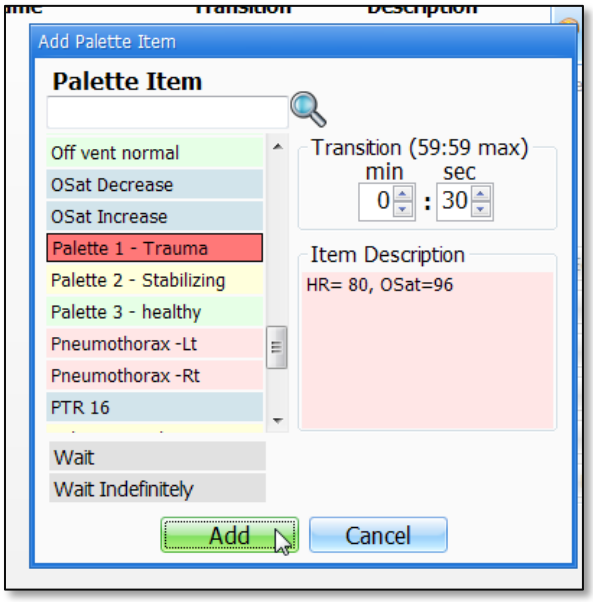
The first vital signs palette is now created. Repeat the previous process to create new vital sign palettes for each of the states in HAL's conditions during the scenario.



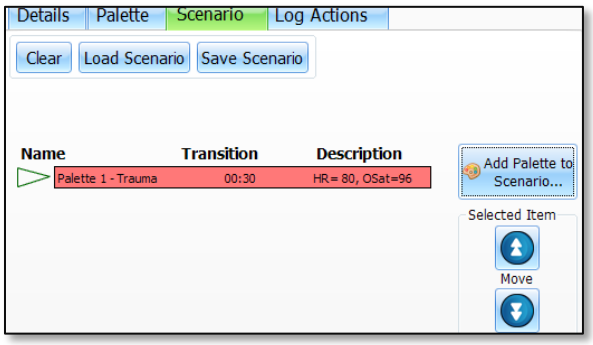
After creating all the palettes, go to the **Scenario** tab and click **Add to Scenario**.



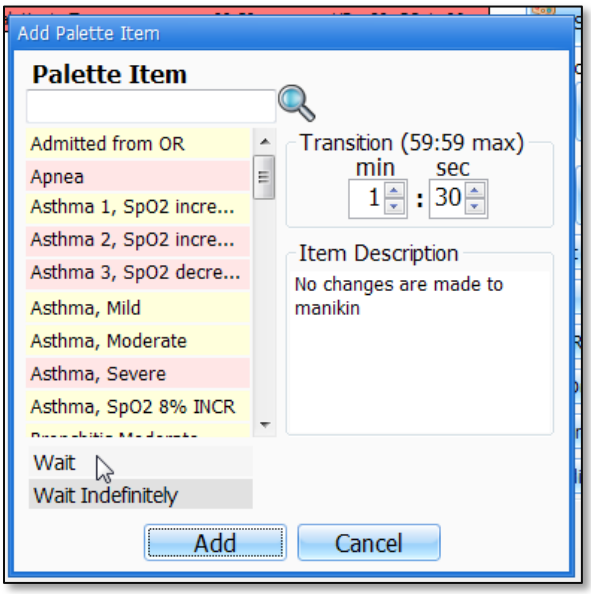
Select the vital sign palette previously programmed to be first on the scenario. Enter a transition time and click **Add**.



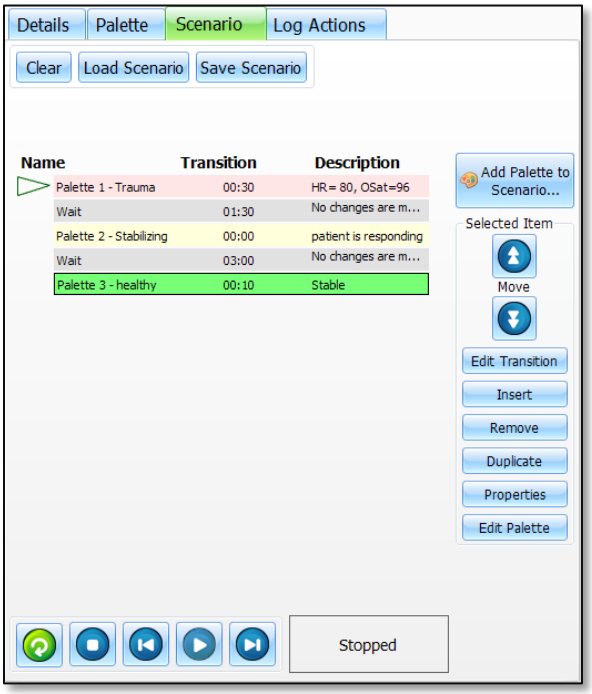
The first palette is now added. Click **Add Palette to Scenario**… to add a wait palette item.



Select the **Wait** palette item and enter a transition time, then click **Add**.

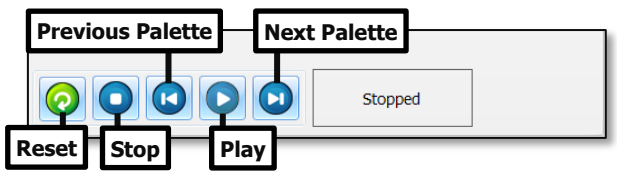


Repeat the process to add more palette items and wait periods.

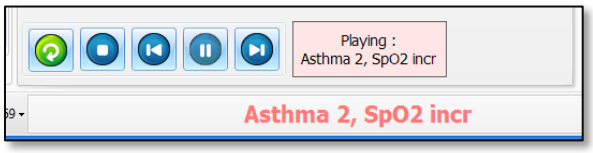


START THE SCENARIO

To start the scenario, click the play button.

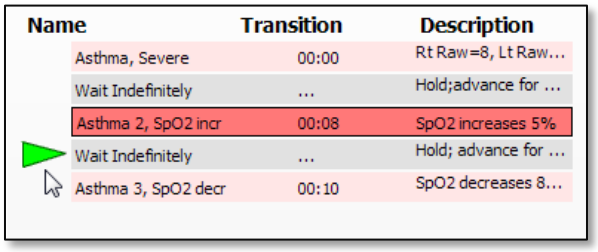


Monitor the scenario status panel for information on the palette item currently loaded.



SCENARIO POSITION INDICATORS

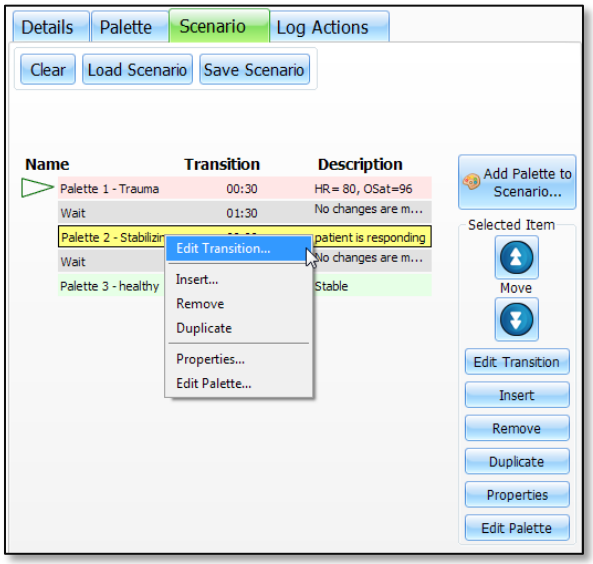
The green position indicator changes between the following states as the scenario progresses.



	**An unfilled triangle means that the scenario is stopped. When the Play button is clicked, the item pointed by the indicator is be played.**
	**A rapidly blinking triangle means that the scenario is playing the item to which the indicator is pointing.**
	**A slowly blinking triangle means that the scenario is paused at the item to which the indicator is pointing.**

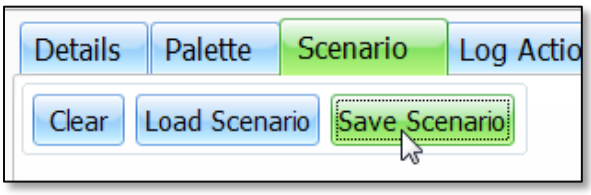
EDITING A SCENARIO

Select a palette item and use the **Selected Item** panel to modify. Alternatively, use the right click menu.

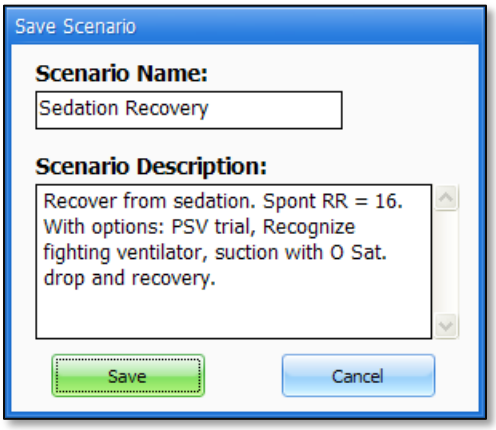


Saving a scenario

Use the scenario menu to clear any palettes listed on the scenario page, load or save a scenario. Click the **Save scenario** button to store the scenario in the current profile.

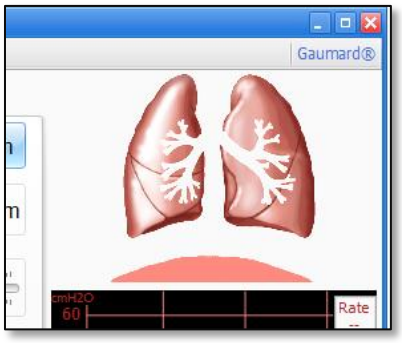


Enter a name and a description for the scenario and click **Save.**

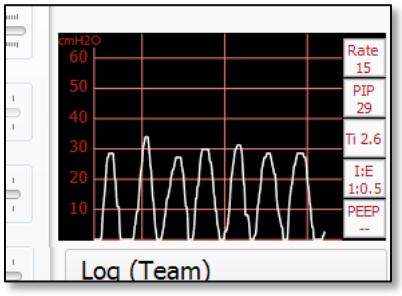


RESPIRATORY MONITOR

On the right of the screen, the lung graphic is synchronized with HAL's breathing rate. A red half circle will appear beneath the lung graphic every time HAL attempts to trigger the ventilator. If HAL is intubated, the graphic will also display the approximate location of the ET tube in the airway.



The respiratory monitor displays real time information as detected by the simulator. All the readings displayed are approximate values.

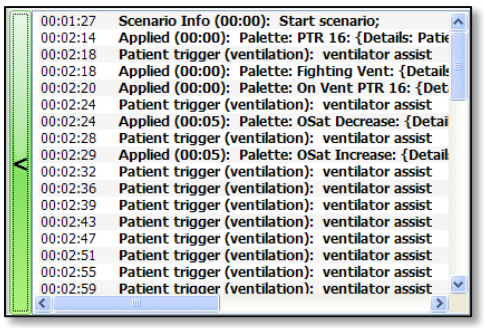


- Ventilations per minute
- Peek inspiratory pressure
- Inspiratory time (sec)
- Inspiration: Expiration
- Positive end-expiratory pressure

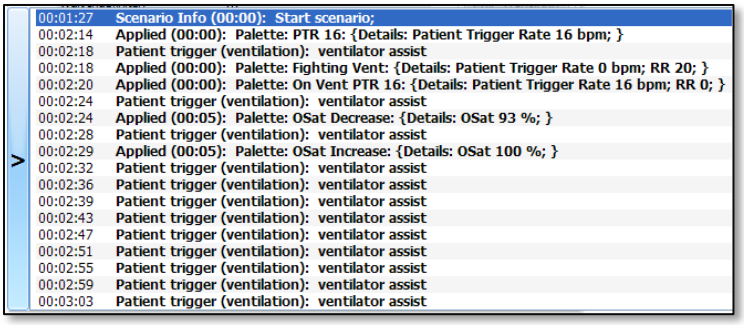
LOG PANEL

The Log records entries for every simulation event and parameter change. In addition, facilitators can log observed provider actions using the evaluation feature. To save and print a log report, go to page 48.

COMPACT LOG VIEW



EXPANDED LOG VIEW



EVENT TYPES

The different types of entries are: Actions, Applied Changes, Detected Events, Evaluations, and Notes.

Actions

Actions refers to those performed by one of the providers in the session. The facilitator can quickly log actions from the Provider Actions section and make the entry more specific using the Team Logging feature. The following is an example of an Action entry:

"00:07:24 Action (Assess responsiveness)"

Applied Changes

An 'Applied' log entry occurs automatically every time there is a change to the physiological condition of the simulator. In other words, every time changes are made from the Details page, Palette page, or from a Scenario a log entry like the following is created:

"00:04:01 Applied (00:30): Details: Rhythm Sinus; Cardiac event 0; HR 80;"

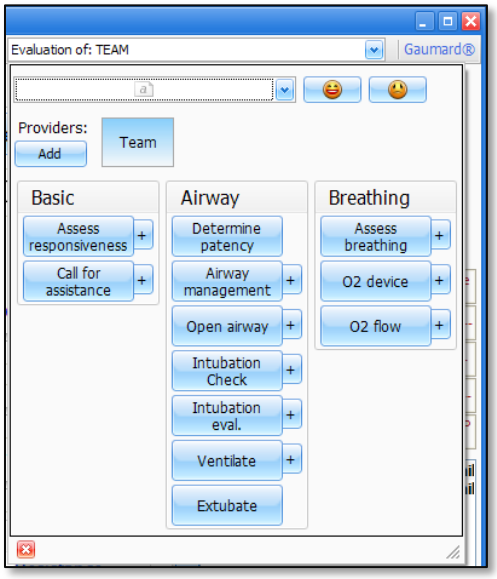
Detected Events

Every time one of the various sensors in the simulator detects a provider action, it is automatically logged as a 'Detected' entry. These actions include electrical therapy (pacing, defibrillation, cardioversion, inappropriate shock). The following example shows an entry after a provider attempts to perform a chest compression.

"00:03:26 Detected (chest compression): integral=140, peak=70, duration=0.4 seconds."

LOG ACTIONS TAB

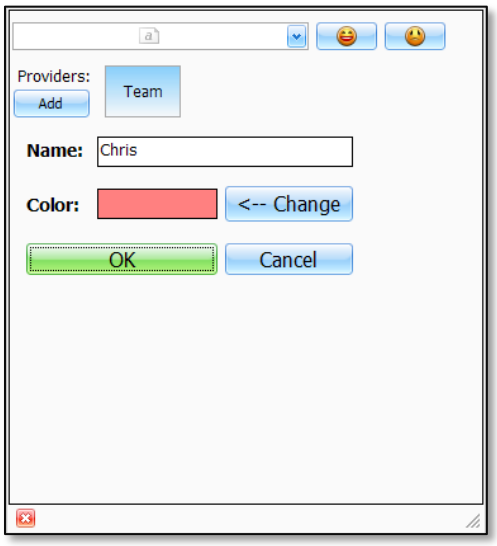
The evaluation field is used to track provider actions and rate individual or team performance. All entries made on the evaluation field will be visible in the log panel near the bottom of the page.



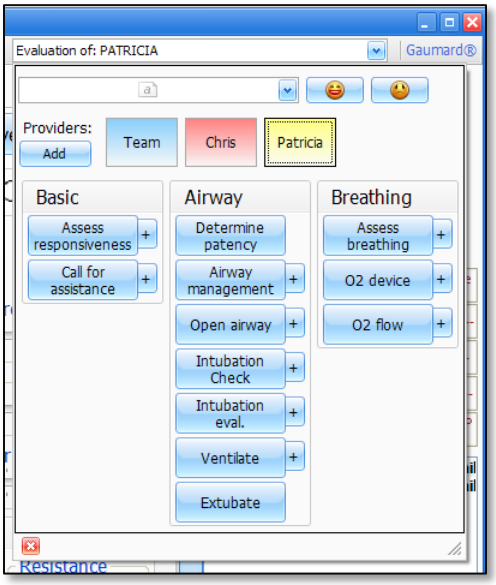
TEAM LOGGING

The Team Logging feature allows the facilitator to designate which member of the team performed a particular action.

First, the facilitator should add all providers in the team, one by one, by clicking on the *Add* button. Enter the name of the first team member and designate a color. Finally click OK to create the new provider. There can be up to four different providers, each with a corresponding button.



To indicate the active provider, the evaluation bar will display the providers name. While a provider is active, every time an action is clicked or Evaluation log entry is created it will have the name of the provider prepended to it.



PROVIDER ACTIONS

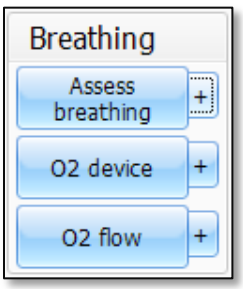
The Provider Actions section refers to the collection of buttons in the middle of the window. It allows the facilitator to accurately keep track of provider actions. The buttons are grouped into 3 groups: Basic, , Airway and Breathing. Anytime the facilitator clicks one of the buttons, a time-stamped log entry is generated with that particular action. For example, if the 'Assess responsiveness' button is clicked when the session clock reads 00:07:24, the following entry is automatically generated:

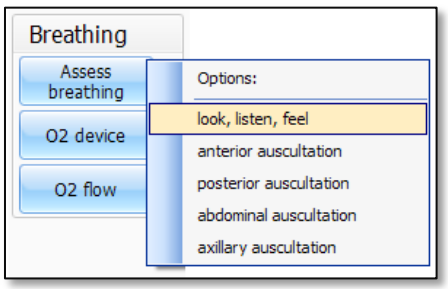
"00:07:24 [Patricia] Action (Assess Responsiveness)"

Some provider-action buttons are accompanied by a special option button.The first special button, " **+** ", lets the facilitator be a log actions in more detail. For example, if the button "Assess breathing" is clicked, the following entry is created:

"00:01:28 [Patricia] Action (Assess breathing)"

On the other hand, if the " **+** " button next to "Assess breathing" is clicked, a list of additional options appears. The facilitator can be more specific and choose, for example, "look, listen, feel":

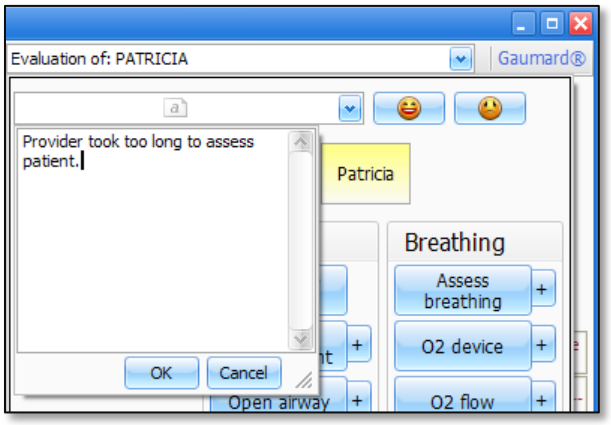




...and the following log entry is added: "00:01:28 [Patricia] Action (Ventilate): look, listen, feel"

EVALUATION

The Evaluation feature allows the facilitator to insert standard evaluations or arbitrary notes into the log.

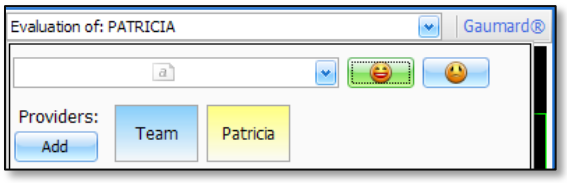


Standard evaluations are given context by their position in the log relative to detected and observed provider actions. To add entries for specific providers, select the active provider and type the note in the entry field. After clicking OK, the following entry is shown in the log panel.

"00:07:41 [Patricia] Note: provider took too long to assess patient "

To deactivate, deselect the active provider and return to general logging, click the “Team”.

Each provider can also be graded using the satisfactory and unsatisfactory buttons. The satisfactory entry is show below:

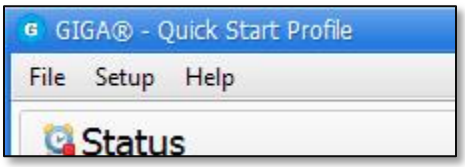


"00:07:41 [Patricia] Evaluation (Care Provided) : Satisfactory”

For information on saving the log report, navigate to page 48.

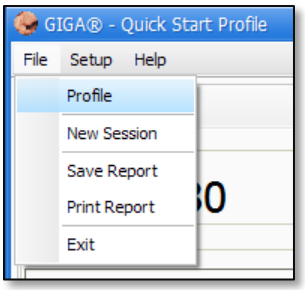
MENU BAR

The following sections will explain each of the menu bar options.



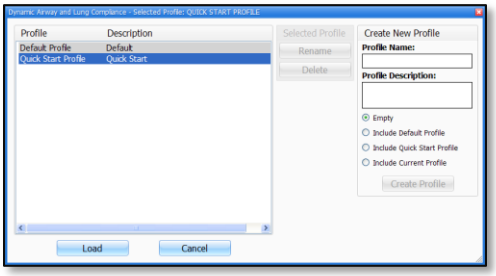
FILE

Click **File** to change between profiles, start a new session and save or print the log report.



PROFILE

Click **Profile** to open the profiles menu window and manage profile options without restarting the software.

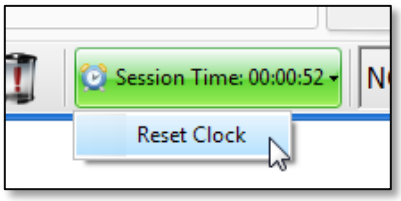


NEW SESSION

Click **File > New Session** to:

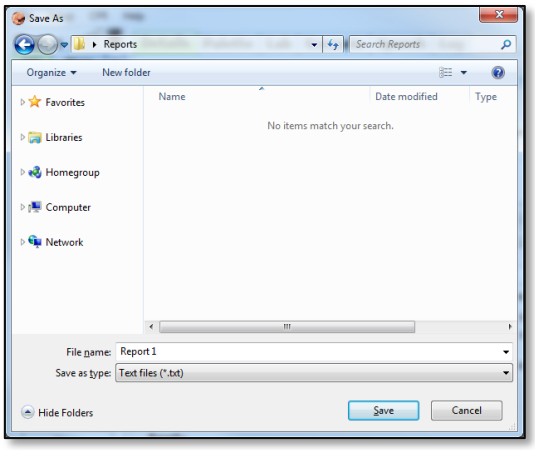
- Clear any loaded/playing scenario
- Clear any loaded/playing palette
- Reset physiological parameters to normal values
- Clear out log page
- Restart the session clock.

The session time can also be reset by clicking on the timer and selecting reset.



SAVE REPORT

Click **Save Report** to save all the information recorded in the log as a plain text file.



Enter a name for the log file, and click **Save.**

PRINT REPORT

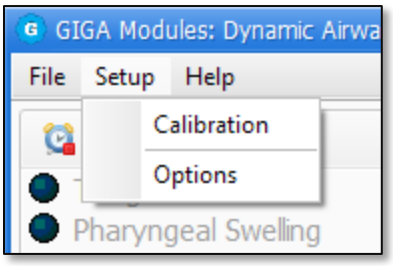
Print a text file containing all the information in the current log session. Click **Print Report** to open the Print dialog box. The shortcut key for this option is **Ctrl + P**.

EXIT

Exit the software and power down HAL.

SETUP

Click **Setup** to open the Calibration and Options menu.



CALIBRATION

To view the calibration menu, HAL must first establish a connection with the GIGA Module software. Once connected, the Calibration option will appear in the Setup dropdown.

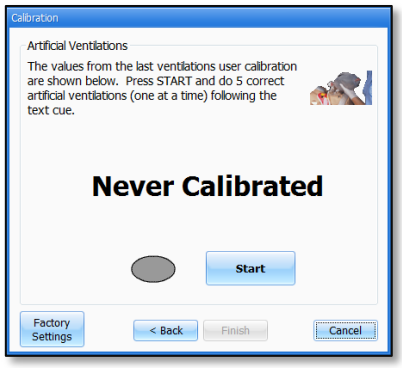
During the calibration process the respiratory Rate, inspiration percentage, O Sat, compliance, and patient trigger rate are changed to zero.

CALIBRATION WIZARD

Calibration uses multiple steps. Navigation through the wizard uses the "Next" and "Back" buttons at the bottom of the dialog box. Select "Artificial Ventilation", then "Next".

Artificial Ventilations

Click **Start** and follow the on-screen instructions. A green oval indicates a successfully-completed action; a red oval indicates a failed action.



Oxygen Saturation

Calibrating the oxygen saturation sensor located on the left index finger.

CAUTION: Oxygen saturation is calibrated to match a specific oximeter. Repeatability is accomplished when using the same oximeter and sensor. Even if the oximeter is interchanged with another one from the same brand and model, the reading might not coincide. To avoid reading discrepancies, calibrate this feature each time a different oximeter or sensor is used.

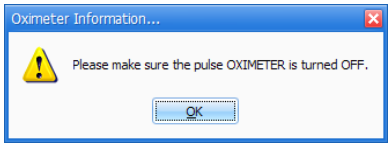
DISCLAIMER: Co-Oximeters that in addition to reading oxygen saturation also read carbon monoxide (SpCO) and methemoglobin (SpMet) **are not compatible** with this simulator.

To calibrate the oxygen saturation feature, follow the steps below:

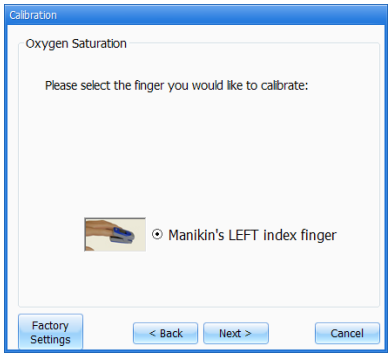
1. Make sure that the oximeter is turned off. Place the oximeter sensor on the left **index** finger and verify that the center of the fingertip is covering the emitting and sensing element.

2. Go to Setup>Calibration and select “Oxygen Saturation”. Click “Next”.

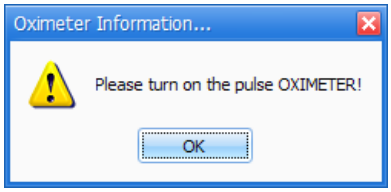
A message box is displayed to remind you to have the oximeter turned off. “Click OK”.



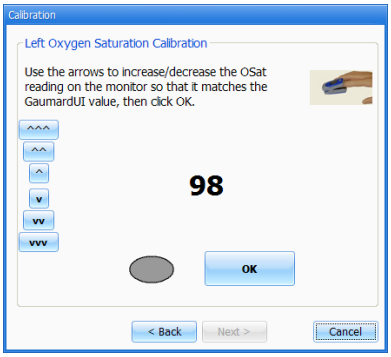
3. Select the left index finger. Then click “Next”.



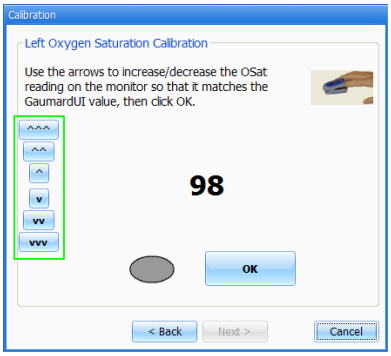
4. **Turn on the oximeter** and click “OK” on the dialog box.



5. The oxygen saturation calibration dialog box is displayed (for 98%).



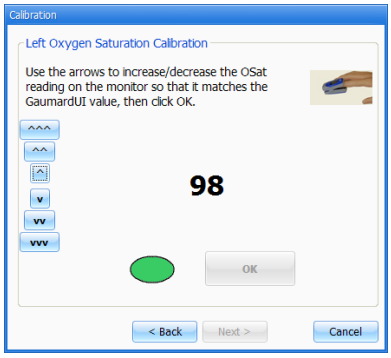
6. Using the arrows on the left column of the calibration dialog box, adjust the reading on the oximeter monitor screen, to match the 98 displayed on the calibration window.



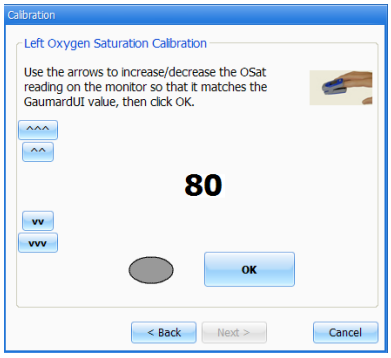
For large increases or decreases, use the triple arrows. For moderate changes, use the double arrows. Use single arrows for small changes of one or two percent reading (only for 98% calibration).

To ensure proper calibration, always allow the oximeter to stabilize readings by waiting 3-5 seconds after the onscreen value is displayed. After the value on the oximeter screen stabilizes, click “Next” to continue calibration.

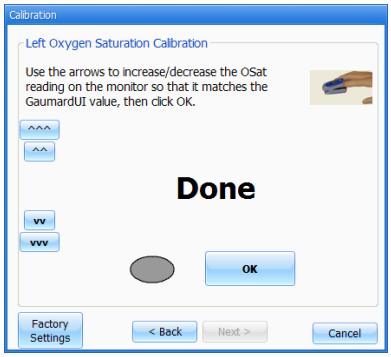
7. Click “OK”. The calibration oval blinks green before showing the next value.



8. The oxygen saturation calibration dialog box for 80% is now displayed. Calibrate using the instructions from step 6 and 7. Continue the process until the final screen.



9. After all the checkpoint values are calibrated, click Finish to save the calibration.



TESTING THE CALIBRATION

With the oximeter on the finger, go to the details page and change the oxygen saturation value on the software. Observe that the oximeter reading coincides with the value you specified (±3 differences are acceptable on readings above 80%). Test calibration at two points; values between 80 and 95% are recommended.

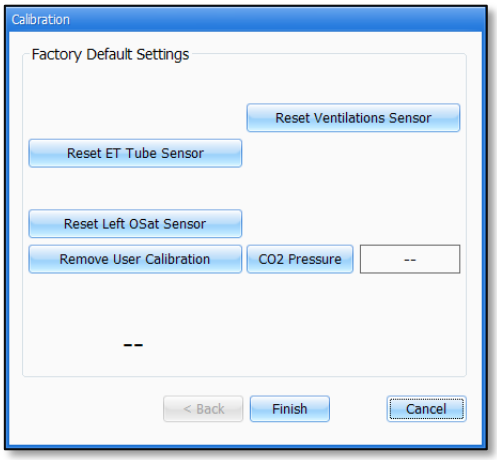
Now take the oximeter sensor off the finger, wait for five seconds and again place the sensor on the finger. **Slide the finger all the way into the oximeter sensor and in the same position as it was calibrated.** Check that the oximeter reading coincides with the value specified on the Details page (±3 % value differences are accepted).

If it does, you are ready to use the oxygen saturation feature with this oximeter. If the first, second, or both readings do not coincide, make sure to slide the finger all the way into the oximeter sensor. If the reading still does not coincide, the feature was not properly calibrated. Go back to step one and repeat the calibration procedure.

For information on troubleshooting this feature, refer to the troubleshooting guide in the Appendix.

Factory Settings

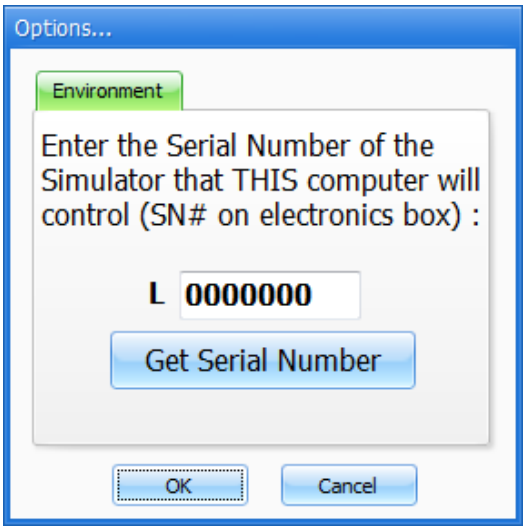
On the calibration wizard menu, click **Factory Settings** to restore default settings.



- **Reset Ventilations Sensor**
- **Reset ET Tube Sensor**
- **Reset Left OSat Sensor**
- **CO2 Pressure reading** – Display reading of the current CO2 cartridge pressure.
- **Cancel –** Closes Factory Default Settings with no action taken
- **Finish -** save the settings and exit.

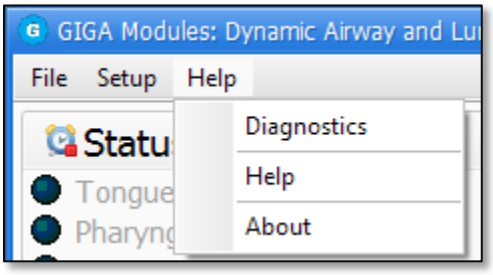
Options

Enter the simulator's serial number to automatically establish a connection on startup.



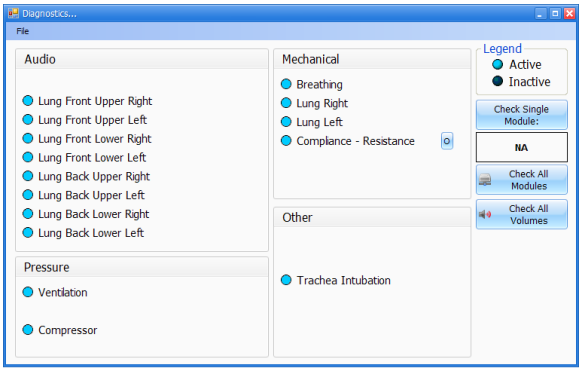
Help

Click **Help** to access the diagnostics menu, electronic documentation and software version information.

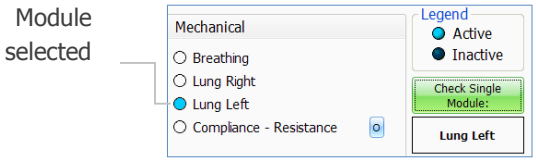


Diagnostics

This window is very useful for troubleshooting because it gives the user feedback on all of the working modules inside the simulator. Click "**Check All Modules**" and the software checks which modules are responding.



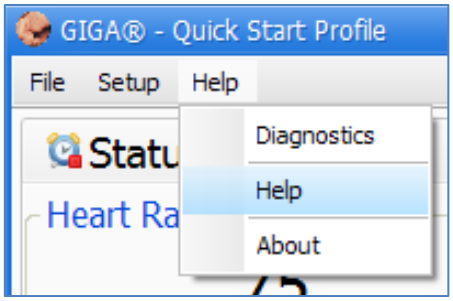
Also check individual modules by clicking on the module to highlight. Notice that the name of the module is displayed on the right column. Now click on the "Check Single Module" button:



Active modules report light blue, and inactive modules report black. If there is a specific module that fails to respond please contact customer support (ensure that the module that is unresponsive is not specific to an Add-On feature that is not installed on your simulator).

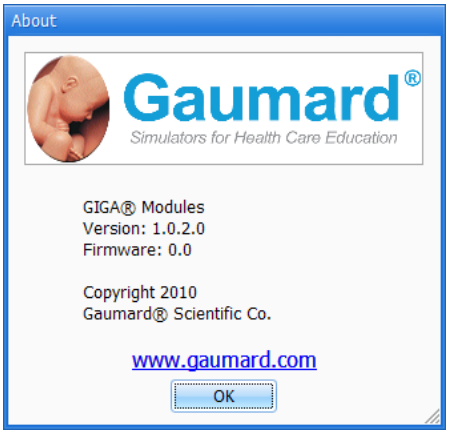
Help

Click help to open an electronic copy of the HAL S1030 User Guide No internet connection is required to view the file.



About

Clicking on "About" displays the following dialog box:



Visit www.Gaumard.com for information on software updates.

WORKING WITH HAL

CONNECTING THE VENTILATOR

HAL is designed to work with most microprocessor-based mechanical ventilators and respond like real patient. Review the information below before starting a ventilation exercise.

FEATURE HIGHLIGHTS

The list below outlines some of HAL's patient capabilities.

- Treat HAL with mechanical ventilators set to operate by volume or pressure control
- Ten levels of static compliance, from 15 to 90 mL/cm H2O
- Ten levels of independently controlled airway resistances
- Capable being treated with A/C, and PCV modes of ventilation
- Capable of assisting the ventilator at variable respiratory rates
- Capable of holding PEEP
- Set inspiratory effort rate to trigger the ventilator for assistance

DISCLAIMER: HAL is not designed to test the performance, functionality, and accuracy of a mechanical ventilator.

WARNING

Always follow the mechanical ventilator's guidelines and precautions.

Do not introduce liquids, humidified gases or administer aerosol medications into the airway. Moisture in the airway will damage the simulator's internal mechanics.

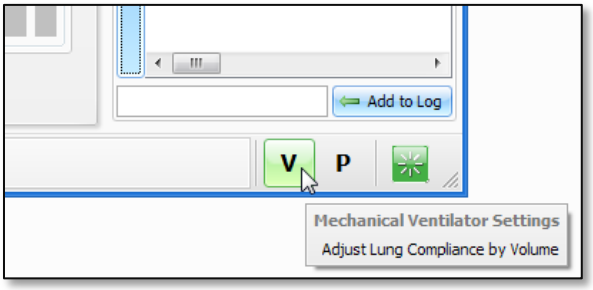
HAL's operating limitations are consistent with that of a real human. Treating HAL in a manner that would seriously harm a real person is likely to result in damage to the internal mechanics.

Always treat HAL as a real patient.

Follow the steps below to connect HAL to a mechanical ventilator.

CAUTION: Do not intubate the airway when the simulator is powered off. Doing so will result in inaccurate intubation readings when the GIGA software is activated. To reset, remove the tubing the airway and restart the software.

1. By default, HAL will initialize to a healthy respiratory rate of 13 breaths per minute. If the ventilator is connected at this point, the healthy breathing rate may trigger the ventilator alarms and put unnecessary stress on the simulator's breathing mechanism. **Set HAL's respiratory rate to 0 for at least 8 seconds before continuing to the next step.**
2. Configure the ventilator settings to treat an apneic patient weighting 75Kg (165 lbs.)
3. Set the ventilation control mode on the GIGA module software. By default, HAL is set to work with mechanical ventilators operating in volume control mode. To set HAL to work with a ventilator set to pressure control, toggle the ventilator operating mode button to **P** on the GIGA module software.



4. Lubricate the endotracheal tube prior to intubating the airway. Placement procedures and tube sizes follow the specifications of an adult patient.
5. Start mechanically ventilating HAL.

After HAL is successfully intubated, simulate numerous respiratory conditions by changing the physiological parameters.

WARNING: Do not change the mechanical ventilator settings while the simulator is adjusting lung compliance parameters.

For detailed information on all the lung compliance, airway resistance, patient trigger rate, and other respiratory physiological controls, go to page 27.

CO_2 EXHALATION

When a CO_2 cartridge is installed, HAL can exhale real CO_2 through the airway. The CO_2 output rate is adjusted using the CO_2 physiological parameter control on the Details tab. For more information about the CO_2 output rate, physiological parameter control, and approximate duration of CO2 release, go to page 28.

Due to shipping regulations, CO2 cartridges are NOT included with the system. The required 16g threaded CO2 3/8"-24UNF-2A cartridges can be purchased at most bicycle or hardware stores. 12g threaded cartridges are also compatible.

CO_2 SAFETY AND WARNING CHECKLIST

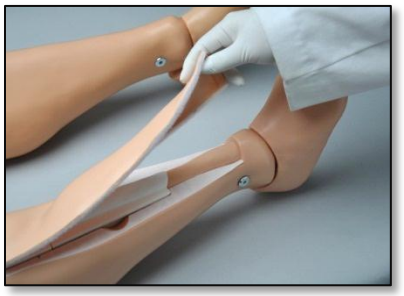
Read all the safety and warning information included with the CO_2 cartridge package before installing.

- **Never point the CO_2 cartridge at yourself or others.**
- **Remove the CO_2 cartridge only when the LOW CO_2 warning is displayed on the main screen.**
- **Do not use damaged CO_2 cartridges.**
- **Do not over tighten the cartridge into the adapter harness. Do not puncture the cartridge CO_2 seal manually.**
- **Do not expose the CO2 cartridges to high temperatures.**

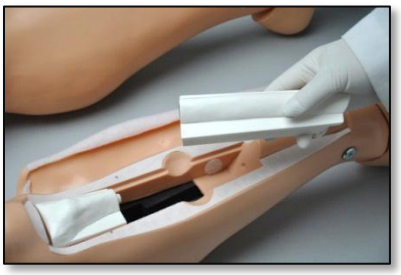
CO_2 CARTRIDGE INSTALLATION

For maximum duration, the CO_2 cartridge should be installed just before the simulation begins. If left overnight, the cartridge will empty within 24 hours whether it is used or not.

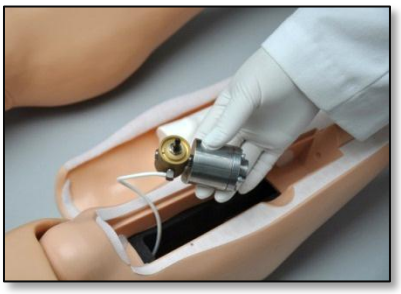
1. Remove the right leg skin cover.



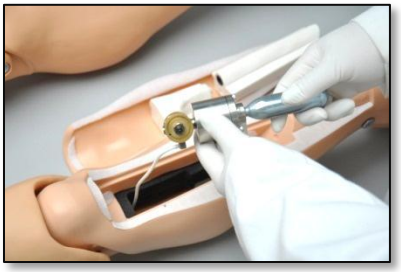
2. Remove the tibia bone insert.



3. Remove the adapter harness located inside the right lower leg chamber.



4. Screw in a new **CO_2 cartridge** into the harness adapter. As the cartridge is tightened, the harness adapter will puncture the CO_2 seal. The cartridge will feel cool to the touch when the seal is broken. Continue to tighten the CO2 cartridge until it is fully secured in the harness adapter.



5. Finally, insert the adapter into the chamber and replace the tibia insert and skin.

OXYGEN SATURATION

Use commercially available monitors on the left index finger to read HAL's oxygen saturation. Control the oxygen saturation directly from the Details Tab. To calibrate HAL to work with an OSAT monitor, go to page 49.

Co-oximeters that in addition to reading oxygen saturation also read carbon monoxide (SpCO) and methemoglobin (SpMet) are not supported and may provide inaccurate readings.

CARE AND CAUTIONS

OVERALL WARNINGS

Remember that damage caused by misuse is not covered by your warranty. It is critical to understand and comply with the following guidelines:

WARNING: There are inherent dangers in the use of some medical devices. For simulations that incorporate mechanical ventilation, always know your equipment and follow the device manufacturers' safety guidelines.

HAL should be cleaned with a cloth dampened with diluted liquid dishwashing soap. If medical adhesives remain on the skin, clean with alcohol wipes. **DO NOT USE "GOO GONE"** as the citric acid in the formula will cause pitting of the various materials comprising your simulator.

WARNING: When connecting the simulator's internal battery leads, be sure to **match the two color-coded connectors to the corresponding color-coded battery terminals**.

WARNING: Do not attempt to intubate without lubricating the airway adjunct with silicone oil lubricant (provided). Failure to do so will make intubation very difficult and is likely to result in damage.

WARNING: NEVER disconnect the communications module while the GIGA Module software is running. The software will halt, and the module may be damaged.

WARNING: When simulating drug administration **via endotracheal tube, providers must use an empty syringe**. Passing liquids into the trachea or esophagus will cause internal damage.

Store HAL in a cool, dry place. Extended storage above 85 degrees Fahrenheit (29 Celsius) will cause the simulator to soften and slowly warp. It is acceptable to *operate* HAL at an ambient temperature of 95 degrees Fahrenheit (35 Celsius).

WARNING: HAL is "splash-proof" but not water-proof. Do not submerge or allow a large volume of fluid to enter the interior of the simulator. Do not expose the tablet computer to water or excessive dust unless it is protected by a rugged case (available separately).

Mouth to mouth resuscitation without a barrier device is not recommended, as it will contaminate the airway. Treat HAL with the same precautions that would be used with a real patient.

WARNING: HAL is not equipped with hemothorax sites puncturing his chest skin will damage the simulator and void the warranty.

WARNING: Do not introduce liquids, humidified gases or administer aerosol medications into the airway. Moisture in the airway will damage the simulator's internal mechanics.

WARNING: HAL's operating limitations are consistent with that of a real human. Treating HAL in a manner that would seriously harm a real person is likely to result in damage to the internal mechanics. Always treat HAL as a real patient.

DISCLAIMER: HAL should never be used to test the performance, functionality, and accuracy of a mechanical ventilator.

WARNING: Do not change the mechanical ventilator settings while the simulator is adjusting lung compliance parameters.

WARNING: Do not remove the chest skin. Internal components are to be serviced only by Gaumard certified technicians.

APPENDIX

TIPS ON CREATING SCENARIOS

Thinking in Terms of Palette Items

As described previously, Palette items represent complete or partial groups of settings that have been stored as a single item. We learned how applying partial states will hold constant all settings that are left unspecified.

Not only does it take time to customize the palette, but a very large palette becomes difficult to navigate. So, it is desirable to minimize the number of Palette Items in each Profile. To accomplish this, an experienced facilitator tries to create items that are as generally applicable as possible and can, thus, be applied to a wide range of scenarios. The key is to only include in your Palette Items the settings that are directly related to the physiological event represented by that Palette Item.

Smart Scenarios

After reading the Details, Palette, and Scenarios sections of this guide, it should be clear how to build a scenario. You may have already tried building your own or modifying some of the factory presets. The following four guidelines will refine your ability to build the best possible scenarios.

1. How will the scenario begin?

The first thing to consider is the initial condition of the patient. Create a Palette Item to describe this condition. Make sure that this first step in the scenario is a complete state. That is, indicate some selection for each and every available setting on the Details page. Remember that only the settings you specify will cause a change in HAL, and all other settings will remain constant. So, by starting with a complete state, HAL's condition will always be the same when the scenario starts, regardless of what he was doing previously.

Likewise, the "transition duration" of the first step in the scenario should be zero, indicating that changes are applied immediately.

There is one point that can cause confusion and warrants further explanation. It is an extension of the above discussion of partial states. The issue is best illustrated through the following example:

> Suppose that you are creating a Palette Item to start your scenario. In this case, you have decided that the patient will be apneic. The question is, "How should the lung sounds be set?"
>
> Most people's first inclination is to set the lung sounds to "none." This is incorrect, despite apnea. Obviously, no lung sounds should be heard during apnea, but since you have already set respiratory rate to zero, none will be. (Sounds are synchronized to the breathing cycle.)
>
> What you are really setting here when you choose a lung sound is the condition of the lungs, given respiratory drive. That is, if the patient's respiratory rate were changed from zero, what sound would be heard? Assuming that the lungs themselves are normal in this scenario, you would choose "normal" for the lung sound setting.
>
> Then, as the scenario progresses, if the patient starts breathing, there will be no need to set the lung sound again. It will already be set. The same principle applies to the heart sound and other settings.

2. Include notes to guide the facilitator during the simulation.

It is common for scenario designers, especially those who act as facilitators, to neglect the importance of notes in the scenario. They think that they will remember the learning objectives, patient history, and other details at the time they are ready to conduct the simulation. hey usually don't, especially when revisiting a scenario months after creating it.

When you add "Wait" and "Wait Indefinitely" steps to a scenario, you have an opportunity to edit the item description. Use this description field to hold notes to the facilitator. Typically, scenario designers write notes in that space to indicate what the provider(s) or facilitator should be doing at that point.

Further, when saving the scenario, you may edit the scenario description. This is the best place to put patient history and any other longer notes and instructions.

3. Assume that providers will do the right thing.

Usually, you should create a scenario with the assumption that the providers will perform correctly. As long as they do, the scenario can simply be allowed to continue.

Naturally, you must be prepared for what might happen to HAL® when providers deviate from expectations. The consequences of such deviations can sometimes be included in the scenario, punctuated by "Wait Indefinitely" items. In other cases, the simulation will require more direct control by the facilitator via either the Palette or Details page.

FILE STRUCTURE

Advanced users may find it helpful to understand the GIGA Module directory structure. With direct file manipulation, one can easily move palette items and scenarios between profiles, as well as move entire profiles from one computer to another.

PROFILES

In the GUI program folder is the "profiles" sub-folder (e.g. "C:\Program Files\Gaumard Scientific\GIGA Module\profiles"). All user information is saved there, and it is the only folder that should be modified manually. In the example shown, notice that there are two profiles in this installation, "Default Profile", and "Quick Start Scenarios".

PALETTE ITEMS

Saved as "*.plt" files, palette items in each profile are located at the top-level of each profile folder. To copy palette items from one profile to another, simply copy the .plt file found in the source profile folder.

SCENARIOS

Scenarios are stored as sub-folders within profile directories. Scenarios can also be transferred between profiles by copying the scenario folder and its contents.

Never…

- modify files in the "resources" directory or those at the top-level of the "Gaumard User Interface" directory.
- manipulate files or folders while the GaumardUI software is running.
- modify or delete "*.dll", "*.scn", or "*.sys" files.

TROUBLESHOOTING

GENERAL TROUBLESHOOTING GUIDE

Use the following table to find causes and solutions to a number of possible problems.

Symptom	Possible Cause	Solution
Communication never gets established or is lost (**No signal bars or battery reading.**)	Data cable is not connected. USB Module is not connected.	Verify connection of the Ethernet cable and USB module to the computers USB port.
	Serial number on the environment does not match the simulator.	Navigate to setup>options>Environment. Enter the simulator's serial number and save.
Incorrect intubation reading.	Simulator indicates that no ETT is present.	Remove ETT and restart the software.
Chest compressions are not properly detected or not detected at all	Is the respiratory rate set to '0 / min'? Chest compressions are only detected when the respiratory rate is set to 0 per minute (0 / min). Otherwise they are ignored	Set respiration rate to zero
	All others	See "Calibration" section
Simulator's chest does not rise with artificial ventilation (e.g. BVM)	Simulator is not running	In some simulators, the trachea is disconnected from the lungs when they are not on
	Disabled lung/s	Enable the lungs from "Detail" page on the User Interface software

Symptom	Possible Cause	Solution
Low chest rise (or no chest rise at all) while breathing	Wrong settings or disable lungs	Make sure lungs are enabled and both respiration rate and inspiration percent are different than '0'. Try changing the respiration rate to a different value or turn the simulator off and then on again.
Oximeter reading does not coincide with value set	Using a different Oximeter/Sensor for which the simulator was calibrated	The simulator must be calibrated with the Oximeter instrument that it is going to be used (including the Pulse Oximeter Sensor). Oximeter Sensors cannot be swapped even with same kind of oximeter's brand and model. An oximeter which includes carbon monoxide and/or methemoglobin sensing cannot be used. Oximeter has been placed on the arm that doesn't have the O2Sat feature. Check in the Diagnostic if that arm has the feature installed
	Pulse Oximeter Sensor not properly placed	Make sure to slide the Pulse Oximeter Probe all the way into the simulator's finger. Make sure the emitter part (the red light) of the probe is on the nail side of the finger. If user is sure that the probe is properly placed, it means that it was not when calibration was performed, then re-calibration is necessary. See O2Sat calibration section for more info.
	Offset value within +/- 2	User should expect a +/- 2 discrepancy between value set and Oximeter reading for O2Sat values above 80%, and +/-3 below 80%.
CO2 not being exhaled Mechanical Ventilator is not triggered when assisting the simulator	Empty CO2 canister	Make sure the CO2 canister is in place. For S1030, the User Interface displays the "Low CO2" message when CO2 pressure is low. Notice that CO2 canister must be plug just before the training section starts to get maximum duration. If left overnight, the canister will slowly empty. (See "CO2 exhalation" section). The CO2 canister once it is plugged, will empty within 24 hours whether it is used or not.

Symptom	Possible Cause	Solution
	CO2 pressure regulator is "OFF"	Go to "Calibration/Factory Settings" and then press the "CO2 Pressure" button. In the window to the right a value between 3-6 psi (ideal 4.5 psi) indicates good level. Should not be the case, call tech support for advanced troubleshooting.
Mechanical Ventilator is not triggered when assisting the simulator	Settings exceeding the simulator's capabilities	The simulator is able to trigger the ventilator either when: Flow ≤ 1 Lts/min, or Pressure ≤ 1 cmH2O

WARRANTY

EXCLUSIVE ONE-YEAR LIMITED WARRANTY

Gaumard warrants that if the accompanying Gaumard product proves to be defective in material or workmanship within one year from the date on which the product is shipped from Gaumard to the customer, Gaumard will, at Gaumard's option, repair or replace the Gaumard product.

This limited warranty covers all defects in material and workmanship in the Gaumard product, except:

1. Damage resulting from accident, misuse, abuse, neglect, or unintended use of the Gaumard product;

2. Damage resulting from failure to properly maintain the Gaumard product in accordance with Gaumard product instructions, including failure to property clean the Gaumard product; and

3. Damage resulting from a repair or attempted repair of the Gaumard product by anyone other than Gaumard or a Gaumard representative.

This one-year limited warranty is the sole and exclusive warranty provided by Gaumard for the accompanying Gaumard product, and Gaumard hereby explicitly disclaims the implied warranties of merchantability, satisfactory quality, and fitness for a particular purpose. Except for the limited obligations specifically set forth in this one-year limited warranty, Gaumard will not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory regardless of whether Gaumard has been advised of the possibilities of such damages. Some jurisdictions do not allow disclaimers of implied warranties or the exclusion or limitation of consequential damages, so the above disclaimers and exclusions may not apply and the first purchaser may have other legal rights.

This limited warranty applies only to the first purchaser of the product and is not transferable. Any subsequent purchasers or users of the product acquire the product "as is" and this limited warranty does not apply.

This limited warranty applies only to the products manufactured and produced by Gaumard. This limited warranty does not apply to any products provided along with the Gaumard product that are manufactured by third-parties. For example, third-party products such as computers (desktop, laptop, tablet, or handheld) and monitors (standard or touch-screen) are not covered by this limited warranty. Gaumard does not provide any warranty, express or implied, with respect to any third-party products. Defects in third-party products are covered exclusively by the warranty, if any, provided by the third-party.

Any waiver or amendment of this warranty must be in writing and signed by an officer of Gaumard.

In the event of a perceived defect in material or workmanship of the Gaumard product, the first purchaser must:

1. Contact Gaumard and request authorization to return the Gaumard product. Do NOT return the Gaumard product to Gaumard without prior authorization.

2. Upon receiving authorization from Gaumard, send the Gaumard product along with copies of (1) the original bill of sale or receipt and (2) this limited warranty document to Gaumard at 14700 SW 136 Street, Miami, FL, 33196-5691 USA.

3. If the necessary repairs to the Gaumard product are covered by this limited warranty, then the first purchaser will pay only the incidental expenses associated with the repair, including any shipping, handling, and related costs for sending the product to Gaumard and for sending the product back to the first purchaser. However, if the repairs are not covered by this limited warranty, then the first purchaser will be liable for all repair costs in addition to costs of shipping and handling.

Extended Warranty

In addition to the standard one year of coverage, the following support plans are available:

- Two-Year Extension (covers second and third years)
  Call for pricing (USA only)

CONTACT US

Technical Support:	**support@gaumard.com**		
E-mail Sales and Customer Service:	**sales@gaumard.com**		
Office hours:	**Monday-Friday 8:30am - 4:30pm EST (GMT-5, -4 Summer Time)**		
Phone:	**Toll-free in the USA: (800) 882-6655**	**Worldwide:**	**01 (305) 971-3790**
Fax:	**(305) 667-6085**		
Post:	**Gaumard Scientific 14700 SW 136 Street Miami, FL 33196-5691 USA**		

Before contacting Tech Support, please have the simulator's serial number ready. It is located in the left leg under the IM site. In addition, maintain close proximity to the simulator if troubleshooting is needed.

Always dispose of this product and its components in compliance with local law and regulations.