

Apollo™

User Guide (for Maestro)



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Maestro System Requirements

Operating System Support

Maestro Supports

Windows 10

Minimum Requirements

Any computer (Instructor Workstation) used to operate Müse or TouchPro must meet the following minimum requirements.

Any computer NOT associated with a simulator (SCE Development Workstation) used to operate Maestro or TouchPro must also meet the following requirements, with the exception of ethernet/network connectivity.

Windows® Operating System:

- Windows 10
- Google Chrome
- Adobe Reader DC 2015+
- Hardware
- Intel Core 2 Duo, 2.0 GHz, 4 GB DDR3 RAM
- 8 GB Hard Drive space available
- 1366x768 screen resolution
- USB 2.0
- Wireless 802.11b/g/n Ethernet card
- 100BASE-T Ethernet Adapter

System Requirements

Note: Chrome is a registered trademark of the Google. Adobe Flash Player is a trademark of Adobe Systems Inc.

APOLLO SPECIFICATIONS

Size

Manikin/Simulator 74" H x 26" W x 11" D (188cm x 66cm x 28cm)

Weight

Manikin/Simulator 100lbs (45.4kg)

Environmental Requirements

Ambient Temperature Range

Manikin/Simulator

Operation: 40°F to 104°F (4°C to 40°C)

Storage: 40°F to 122°F (4°C to 50°C)

Relative Humidity: 0% to 90% non condensing

Power

Manikin/Simulator

AC Input: AC 90 – 240VAC, 50/60Hz

Consumption: 70W nominal

Internal Batteries: 18.5V lithium-ion, rechargeable

Run Time: 4 hours (Typical)

Communications

Simulator Network

Wired: 10/100 Ethernet or

Wireless: IEEE 802.11g

Wireless Voice

537 MHz to 819MHz (Country Specific)

Electrotherapy

Defibrillation: 20 to 360 joules (Monophasic, Biphasic)

Pacing : 20ma to 180ma

Air Supply

When using the optional external compressed air kit in conjunction with the facility supply source and facility wall adapter. Maximum pressure: 50 psi to 120 psi

CO₂ Supply

When using the optional external CO₂ kit in conjunction with the facility CO₂ source and facility wall adapter.

Maximum pressure: 30 psi to 120 psi

CAUTIONS AND WARNINGS

Please read and understand these cautions and warnings before you begin using the Apollo system.



USE OF THIS EQUIPMENT IN AN UNSPECIFIED MANNER, MAY IMPAIR DESIGNED PROTECTION.

Your safety is in your hands. Be sure to follow the instructions on the proper setup, breakdown and use of the Fidelis system.



SHOCK HAZARD

Electrical Safety

- This product must be connected to an electrical outlet that is properly grounded. Precautions should be taken so that grounding or polarization is not defeated
- Do NOT place defibrillator paddles on or adjacent to the ECG patient electrodes. Contact between defibrillator paddles and the electrodes may cause injury to the user and damage to the equipment
- Always use the supplied power cords. Do NOT substitute.
- Operate the system from a power source with the following rating:
 - 115VAC, 50/60 hertz (cycles per second) (e.g., North America, Japan)
 - 230VAC, 50/60 hertz (cycles per second) (e.g., Europe)
- Do NOT allow excess fluids to flow on or into electronic parts
- Do NOT attempt to disassemble the simulator or service any of the electrical components other than changing of fuses
- Always remove the power cable and have simulator turned off when replacing fuses
- Always use the supplied power adapter to charge or run simulator from AC

Latex Warning

Certain components of the simulator, such as vein tubing and wound umbilicals, contain latex. Users with latex sensitivity should use caution when working with these components or during maintenance with exposure to latex on the simulator.

Electrical System

- Operate the system from a power source with the following rating:
115VAC, 50/60 hertz (cycles per second) (e.g. North America, Japan), and 230VAC, 50/60 hertz (cycles per second) (e.g. Europe)
- Do NOT operate the Apollo system in rain. Apply water to the manikin only in accordance with the supported clinical procedures identified in this User Guide.
- Do NOT allow excess fluids to flow on or into electronic parts

CO₂ Production System

- Care must always be taken when using high-pressure equipment
- Do NOT disassemble or alter regulator
- Store CO₂ canisters in dry location between 32° and 104° F. (0 to 40°C). Do NOT expose CO₂ canister to heat above 140° F as rupture may occur.
- Never point CO₂ canister towards your face or someone nearby
- Use only CAE specified CO₂ canisters
- Wear protective gloves and eye protection when removing canister from regulator assembly

Bleeding and Secretion System

- DO NOT modify the tank or any assembly component
- ALWAYS protect eyes, skin and clothing against accidental exposure
- NEVER exceed 35 strokes while pressurizing the tank
- ALWAYS read and follow instructions for creating trauma fluids (e.g. blood). NEVER fill the tank with more than 6 liters (1.6 gallons) of fluid.
- After use, ALWAYS release pressure and clean the tank. DO NOT store liquids in the tank
- ALWAYS release tank pressure before servicing. NEVER transport or ship in a pressurized and/or full state or leave a pressurized tank unattended.

Manikin

- Do NOT disassemble factory-assembled parts of the manikin
- Do NOT clean the manikin with chemical solvents or abrasive pads. Use only water and a light soap solution only.
- Make sure that manikin is set up on a stable, sturdy work surface to avoid collapsing and causing injury to users
- Apollo should be operated in ambient temperatures below 104 degrees Fahrenheit (40 degrees Celsius). Prolonged operation (>4hrs) in ambient temperatures greater than 104 degrees Fahrenheit (40 degrees Celsius) may result in anomalous behavior and out of specification performance

- Do NOT introduce foreign substances into the airway - with the exception of small amounts of approved lubricant. Only perform invasive procedures supported by the system as described in the applicable sections of the User Guide.
- Do NOT pick the manikin up by the limbs — support head and leverage weight with torso. It may be necessary to have the help of a second person to lift and move Apollo

Transport

- Prior to using the stretcher packed with the shipping container, the manikin must be wrapped in a sheet. Failure to wrap the manikin in a sheet may result in permanent damage to the manikin skin.
- CAE is not responsible for damage to the manikin skin if the manikin is not wrapped in a sheet while using the stretcher

Battery

Apollo uses Li-ion batteries. Li-ion batteries have special requirements during handling to avoid hazardous situations.

- The Polymer Li-ion Battery pack should be stored indoors and be kept far from fire and high temperatures
- Do NOT store batteries with hairpins, coins, screws or other similar objects
- Do NOT heat the battery
- Do NOT throw the battery into a fire
- Do NOT use or leave the battery close to heat or flame
- Do NOT use the battery inside of a car where temperature may exceed 80° C (176° F). Also do NOT charge/discharge the battery in such conditions.
- Do NOT short-circuit the positive (+) and negative (-) terminals with other metals
- Do NOT place the battery in a device with the positive (+) and negative (-) terminals in the incorrect positions
- Do NOT strike the battery with force
- Do NOT step on, throw or drop or drop the battery to cause strong shock
- Do NOT disassemble or modify the battery
- Do NOT solder a battery directly
- Do NOT use a battery that has been damaged or deformed

Additional Warnings

- Stop charging the battery if the battery has not completed charging within the specified time
- When leakage or foul odor is detected, do NOT use and keep away from heat or flame
- Immediately wash thoroughly with fresh water if liquid leaks onto your skin or clothes
- If liquid leaking from the battery gets into your eyes, do NOT rub your eyes. Immediately wash eyes completely with clean water and seek medical attention

- If the amount of time the battery is able to power the equipment diminishes significantly, the battery life is at an end. Replace the battery with a new battery of the exact same make and model.
- Immediately remove a battery whose life cycle has expired from the equipment
- When the battery is thrown away, apply vinyl tape to the positive (+) and negative (-) terminals to avoid short circuits
- When not using battery for an extended period, remove it from the equipment and store it in a place with low humidity and temperature
- In all instances, keep the battery away from objects or materials with static electric charges
- The battery can be used within the following temperature range. Do NOT exceed this range:
 - Charge temperature range: 0° C (32° F) to 45° C (113° F)

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INTRODUCTION

Apollo Nursing and Prehospital simulators give you all the power of CAE's cutting edge simulation technology with more of what you want. Apollo Nursing was created by nurses to teach the fundamentals of nursing practice, and Apollo Prehospital was built for medics by medics. Both simulators are less expensive than other simulators, are easy to use and have everything you need with nothing you don't.

Apollo

Apollo is fully wireless with on-board fluid, pneumatic and electrical systems and is built tough to withstand a wide variety of real-life, indoor and outdoor learning environments. Apollo comes with extensive clinical features and capabilities designed specifically for emergency medical personnel and nurses.

The simulator can be placed on standard operating room tables, on an ICU bed, on the ground or even in a vehicle (in the case of a simulated accident). Apollo can also be seated in an upright position.



Apollo

In addition, Apollo has the assessment, cardiovascular, genitourinary and trauma features familiar to CAE customers plus an SpO₂ finger probe, fluids on board, bilateral noninvasive blood pressure and IV access. Wireless and tetherless, Apollo takes simulation education to an exciting level of realism.

EQUIPMENT OVERVIEW

Apollo has been designed to be used in any learning environment. Apollo's standard features are easily integrated into a laboratory setting or remote locations. Apollo comes with standard equipment as well as optional equipment. Optional equipment refers to items which are available for purchase to enhance the simulation experience and additional accessories refers to consumable items which are available for purchase as they may need to be replaced.

Laptop Instructor Workstation

The laptop Instructor Workstation is a computer that utilizes Maestro software to operate as the main simulation control center. Instructors control the simulation session from the workstation by running Simulated Clinical Experiences (SCEs) that meet their learning objectives, or on the fly.

IMPORTANT: All CAE computer components are preconfigured for use with the simulator. There are no software installation steps required. Only approved CAE applications should be installed or run with the simulator.

Battery Charger and External Power Supply

The simulator is rechargeable using the **Battery Charger** provided.

CO₂ Canisters (Prehospital Only)

Four CO₂ canisters are included with Apollo to supply the on-board CO₂ exhalation feature.

Inventory Kit

Apollo comes with a number of accessories and replacement components. Included in the Inventory Kit are:

- Start-Up Kit (Quick Start Chart and Setup Map)
- Priming syringe
- Roll (4 ft) of VHB tape and roll of 2 inch wide red tape (for cricothyrotomy)
- BP adapter kit
- Silicone lubricant
- ECG posts
- Pacing/Defibrillation disks
- Condensation drain
- Chest Tube prime tubing
- Female genitalia
- CO₂ Cartridge Kit
- Arm IV tubing
- Hospital gown
- Battery charger

Trauma Fill Tank

Fluids are supplied to the simulator using a trauma fill tank. One tank is supplied and can be used for distilled water mixed with red food coloring to create simulated blood.



Trauma Fill Tank (Disassembled and Assembled)

This tank should be cleaned after each use.

Optional Equipment

Optional equipment is available to accommodate special customer requirements. For example, options like an air compressor and FX Simulated Wound Kit enable instructors to create real-life scenarios at authentic locations.

Optional Equipment
Additional Instructor Workstation (Laptop)
TouchPro Patient Monitor
Apollo Replacement Lithium Battery
External Compressed Air Kit
External CO ₂ Kit
Air Compressor
Hands-Free Training Cables

Tool Kit
FX Simulated Wound Kit
Moulage Kit

Contact CAE Customer Service at 866-462-7920 if there are any questions or if optional equipment is needed.

Additional Instructor Workstation:

Laptop

The Instructor Workstation is a computer that utilizes Maestro Software to operate as the main simulation control center. Instructors control the simulation session from the Workstation by running Simulated Clinical Experiences (SCEs) that meet their learning objectives, or on the fly.

IMPORTANT: All CAE computer components are preconfigured for use with the simulator. There are no software installation steps required. Only approved CAE applications should be installed or run with the simulator.

Apollo Replacement Lithium Battery

Under normal usage, a battery pack should last up to two years.

External Compressed Air Kit

The External Compressed Air Kit gives the user the ability to connect Apollo to a CAE compressor, tank or wall air using the kit's hose and fittings. When connecting to wall air, the kit attaches to the customer's wall adapter.



External Compressed Air Kit

The internal pump turns off automatically when external compressed air is sensed.

The External Compressed Air Kit includes a flexible 30 ft (9 m) hose attached to a preset air regulator, a fitting for air compressors and adapters for wall or tank air.

External CO₂ Kit

The External CO₂ Kit gives the user the ability to connect Apollo to an external source of CO₂ (30-120 psi). The External CO₂ Kit includes a flexible 30 ft (9 m) hose attached to a preset air regulator and an adapter for wall or tank fittings.

Air Compressor

An air compressor (product #AIR-003) designed for quiet operation is available for same-room use, and an alternative air compressor (product #AIR-002) is available for situations where the compressor resides in a location, such as a storage room, set apart from the simulator.



Both Air Compressors are AC powered and include a regulator and an air hose with the appropriate connector fitting.

A 220VAC/50 Hz version of the Quiet In-Room Air Compressor (product #AIR-004) is also available.

Hands-Free Training Cables

Hands-Free Training Cables connect to most popular defibrillators and cardiac pacing units and take the place of non-reusable electrode pads.



Hands-Free Training Cables

Three different cable designs are available to support the most popular defibrillation and pacing equipment. Each cable kit includes posts that attach to the defibrillator or pace locations on Apollo.



***Physio-Control (Medtronic, Inc.)
Product #ACC-005***



***Zoll (Zoll Medical Corporation)
Product #ACC-006***



Philips (Koninklijke Philips Electronics, N.V.) Product #ACC-007

Tool Kit

To simplify common adjustments and periodic repairs, CAE has put together a kit containing tools selected for use with the simulator (product #TOL-001).



Tool Kit

FX™ Simulated Wound Kit

Lifelike moulage wounds to fully immerse learners in trauma situations. Developed with the assistance of the U.S. Army, FX is a complete, turnkey moulage simulation solution that comes in a convenient flight-case with organized product compartments. Optional components include amputations, degloving of the hand, and impalement.



FX Simulation

Moulage Kit

The kit provides the materials needed to create wounds on Apollo (product #MODS-999).



Moulage Kit

The Moulage Kit may also be ordered separately.

APOLLO SETUP

The following pages will guide you through assembling and configuring Apollo. Below is a list of steps required to prepare Apollo for operation.

Apollo Operation Steps	
1	Place Apollo in the Work Area
2	Power On Apollo
3	Power On the Instructor Workstation (Laptop)
4*	Connect to the Apollo Network*
	Connect the SpO ₂ Probe (Optional)
	Connect the External Air (Optional)
	Insert the CO ₂ Canister (Optional, Prehospital Only)
	Detach the Arms (Optional)
	Prepare the Bleeding System (Optional)
	Connect the TouchPro (Optional)

Before Beginning Setup

Proper operation of the Apollo simulator requires correct configuration. Before setting up the system, keep in mind these basic guidelines:

Understand the Cautions and Warnings information located in the Introduction section of this User Guide.

- Follow the sequence of steps carefully
- Complete all steps in order
- Do not power on any components until instructed in the text
- KEEP all original shipping materials, including BOXES — warranty and repair items must be return shipped to CAE in their original packaging

When unpacking Apollo for the first time, careful use of a box cutter protects both the packaging and the product.

A Setup Map, included with the unit, covers these same steps in abbreviated fashion.

Step 1: Place Apollo in the Work Area

Select a work area with enough room for all equipment, providing ample space for easy access to the simulator. At a least 10' x 12' (3 meter x 4 meter) work area is recommended for movement and positioning of components around the simulator.



Apollo

Apollo and the Laptop or Tablet Instructor Workstation can be operated from their batteries, allowing for wireless use.

In a lab environment, make sure a multi-plug AC power outlet exists within the workspace to recharge the simulator's battery and its powered components.

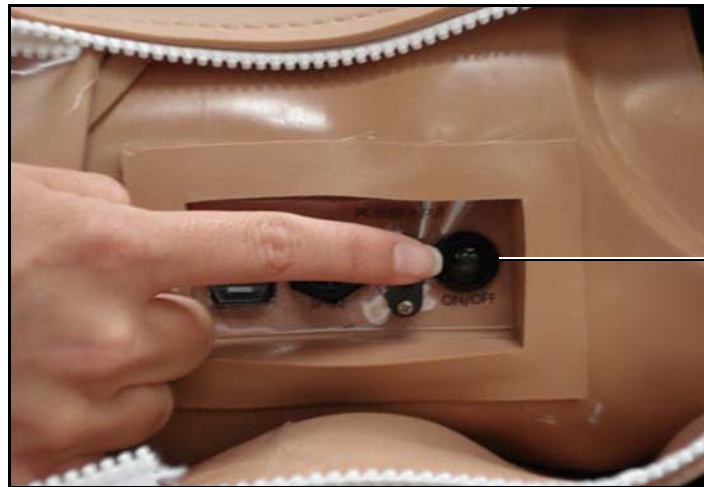
Before placing the simulator on a surface, be certain the surface can easily support 200 pounds.

NEVER lift the simulator by the LIMBS. When lifting, be sure to support the torso and head of the simulator while lifting.

Prior to using the stretcher packed with the shipping container, the manikin must be wrapped in a sheet. Failure to wrap the manikin in a sheet may result in permanent damage to the manikin skin. CAE is not responsible for damage to the manikin skin if the manikin is not wrapped in a sheet while using the stretcher.

Step 2: Power On Apollo

- a. Locate the ON/OFF button beneath the skin covering Apollo's left hip



The **ON/OFF** Button

Apollo's ON/OFF Button

- b. Press and hold the ON/OFF button for one second. The power light blinks, indicating the system is busy. In approximately one minute, the light stops blinking and remains solid, indicating the simulator is now ready.

Note: Apollo can be operated continuously for approximately four hours without recharging the battery.

Step 3: Power On the Instructor Workstation

- a. Place the Laptop near Apollo in a convenient location
- b. Ensure the Instructor Workstation battery is fully charged, or connect the AC adapter to the workstation and a surge-protected power outlet
- c. Power on the Instructor Workstation

Step 4: Connect to the Apollo Network – Laptop or Tablet Instructor Workstation (Microsoft Windows)

Once Apollo and the Instructor Workstation are both powered on, they automatically establish a wireless connection and, when the Internet Explorer browser is opened, the Maestro software launches. If the auto-connect does not occur, perform the following steps:

1. Click or tap on the **Wireless Network** icon in the task bar

2. Select the Apollo wireless network (e.g., APPXXX or APNXXX, where XXXX is the serial number for the unit). The network password is *metiadmin* and the password is case-sensitive.
3. Click or tap the **Connect** button

The wireless connection is established. The Maestro software can now be launched using Google Chrome.

Optional: Connect the SpO2 Probe

Connect and attach the SpO2 probe to Apollo.

1. Locate the SPO2 port on Apollo's left hip
2. Connect the SpO2 probe to the SPO2 port
3. Place the SpO2 probe on Apollo



Attached SpO₂ Probe

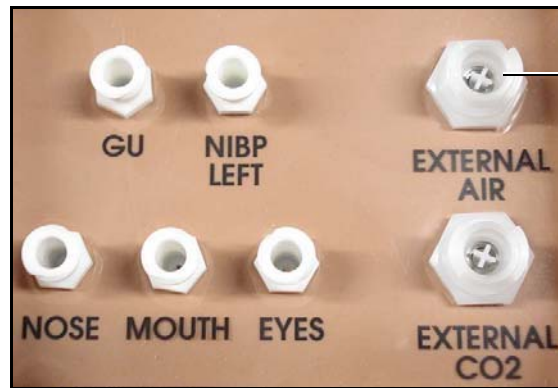
Optional: Connect External Air

Using the External Air kit allows Apollo to be run by an external air source rather than the internal compressor. The air hose can be connected to or disconnected from Apollo at any time. When the external air pressure is sensed, the pump internal to Apollo turns off automatically. When you want to make Apollo mobile again, simply disconnect the hose.

The optional External Compressed Air Kit consists of a flexible 30 ft (9 m) hose attached to a preset air regulator and a fitting for air compressors and adapters for wall or tank air.

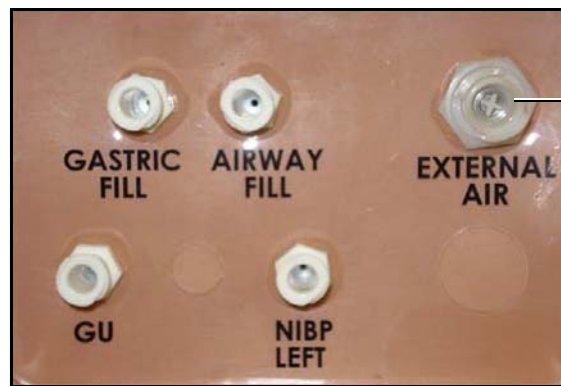
To connect the air hose:

1. Connect the External Compressed Air Kit to a CAE compressor using the Quick Coupler attached to the regulator. (Other compressed air sources have their own adapters. Locate the adapter for your compressed air source.)
2. Connect the other end of the External Compressed Air Kit to the **EXTERNAL AIR** port on the left shoulder



The **External Air** port

Apollo Prehospital's Left Shoulder



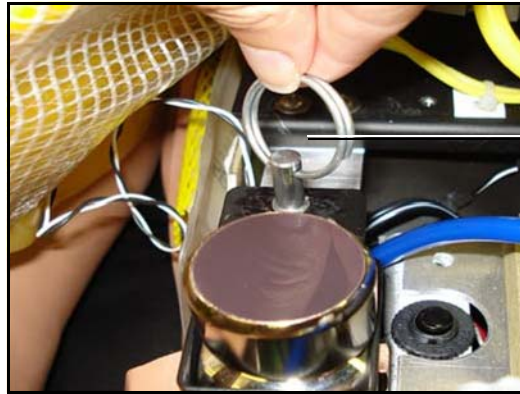
The **External Air** port

Apollo Nursing's Left Shoulder

Insertion of the CO₂ Canister (Prehospital Only)

To insert the CO₂ canister:

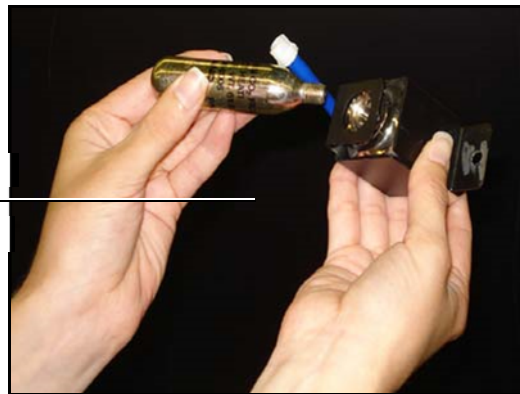
1. Lift the chest skin at the waist and lift the abdominal insert
2. From the simulator's right midsection, remove the pull pin and disconnect the blue CO₂ hose



Remove the pull pin

The Pull Pin

3. Remove the regulator from the simulator
4. While holding the regulator firmly, carefully twist the CO₂ canister into the regulator as far as it will go. The final turns puncture the CO₂ canister, which is necessary for correct operation.



Insert the CO₂ canister into the regulator

Connecting the CO₂ Canister

CAUTION: Do not loosen the canister once it has been inserted into the regulator assembly until the contents are exhausted and pressure relieved.

CAUTION: Removing the canister before it is empty results in the sudden release of all high-pressure gas with a possibility of liquid CO₂ spray. Unprotected skin could receive freezing burns.

5. Place the CO₂ canister, regulator and hoses inside the simulator. Use the pull pin to secure this assembly to the tray. A properly installed assembly will have the CO₂ canister pointed down toward the rear of the simulator.



Place the canister, regulator and hoses inside the simulator

Placing the Canister, Regulator and Hoses

6. Attach the blue CO₂ hose to the connection on the regulator
7. Carefully reposition the abdominal insert and pull the skin back over the simulator to its original location

Once the canister and regulator assembly are in place, CO₂ is measurable with a disposable ETCO₂ detector during positive pressure ventilation.

Based on the training environment, a CO₂ canister may last from 10 minutes (rapid ventilation) to 25 minutes.

Use of CO₂ Canisters

- Store the CO₂ canisters in a dry location between 32° and 104° F. (0° to 40°C)
- Do not expose the CO₂ canister to heat above 140° F, as rupture may occur
- Never point the CO₂ canister toward your face or someone nearby
- Use only CAE specified CO₂ canisters
- Do not remove the canister from the regulator base until empty. The canister end is punctured when screwed into the regulator base.
- Never ship the CO₂ canister attached to the regulator assembly

Assembly of the CO₂ Regulator

- Care must always be taken when using high-pressure equipment
- Do not disassemble or alter the regulator
- Dry completely if the regulator becomes wet
- Discontinue use of this equipment if leakage or visible damage is evident

Optional: Insert the CO₂ Canister (Prehospital Only)

Some SCEs include the simulation of CO₂ exhalation. The following instructions show how to safely connect the CO₂ canister to the simulator.

WARNING: Careful handling, including the use of eye protection, is required when using CO₂ canisters. Please read and understand all the important cautions and warnings on removing canisters as well as safety steps that must be used when handling CO₂ canisters.

Optional: Detach the Arms

Apollo's arms may be removed for use with trauma scenarios.

To detach Apollo's arms:

1. Unscrew and remove the locking pin at the elbow.



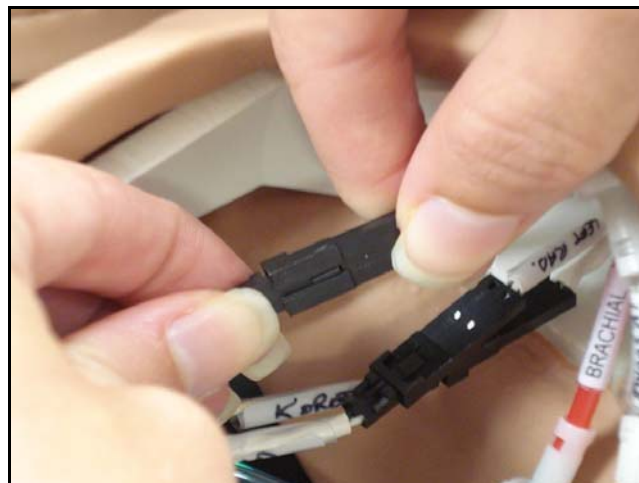
Removing the Locking Pin

2. Carefully separate the lower arm from the upper arm.
3. Twist to disconnect the four tubing connectors (white).



Disconnecting the Tubing

4. Squeeze to disconnect the three electrical connectors (black).



Disconnecting the Electrical Connectors

5. Place the loose connectors carefully within the upper arm.

Note: When replacing arms, ensure tubing and electrical connectors are matched using the colorcoding.

Optional: Prepare the Bleeding System

ONLY distilled water or distilled water containing food coloring should be used with the secretion system.

A mixture of no more than 29 mL (1 oz) red food coloring with 3.8 liters (1 gallon) of distilled water should be used to create simulated blood. The blood mixture should be created in advance in a separate distilled water container.

Note: The higher the ratio of food coloring, the greater the possibility of staining.

Using the Trauma Fill Tank

The Trauma Fill Tank is used to fill the on-board blood reservoir.

CAUTIONS and WARNINGS

Carefully follow all instructions for using the Trauma Fill Tank. Pay particular attention to the following cautions and warnings:

- **ALWAYS** read and follow instructions for creating trauma fluids (e.g. blood)
- **ALWAYS** protect eyes, skin and clothing against accidental exposure
- After use, **ALWAYS** release pressure and clean the tank
- **ALWAYS** release tank pressure before servicing
- **DO NOT** modify the tank or any assembly component
- **DO NOT** store liquids in the tank
- **NEVER** transport or ship in a pressurized and/or full state
- **NEVER** leave a pressurized tank unattended
- **NEVER** fill the tank with more than 6 liters (1.6 gallons) of fluid
- **NEVER** exceed 35 strokes while pressurizing the tank

Attaching the Overflow Bottle to the Trauma Fill Tank Assembly

The overflow bottle is used to collect overflow when the Apollo on-board tank is filled.

To attach the Overflow Bottle to the Trauma Fill Tank:

1. Connect the clear trauma fill tank hose to the bottle lid fitting



Connect the clear hose to the bottle lid fitting

Connecting the Trauma Fill Tank Umbilical to the Overflow Bottle

2. Clip the bottle to the tank using the attached carabiner mechanism



The carabiner

The Carabiner

Operating the Trauma Fill Tank

Be careful to complete the following steps correctly to ensure proper use and maintenance of the Apollo and its peripherals.

Step 1: Pour the Fluid into the Trauma Fill Tank

Pour the desired amount of fluid into the Trauma Fill Tank, being careful to NOT to exceed 6 liters (1.6 gallons) of fluid.

Note: The right thigh tank holds 1.5 liters and is used for blood.

Three (3) liters of simulated blood provides enough fluid to fill the right thigh reservoir twice. The amount of blood used in a training session varies with the patient, the wounds simulated and the learner's experience.

Step 2: Connect the Trauma Fill Tank Connector to the Simulator

- a. Locate the tan **FILL** port and white **VENT** port
- b. Connect the **FILL** (with the tan label) and **VENT** (with the white label) hoses of the Trauma Fill Tank to the corresponding ports on the simulator

Note: Both connections must be made for correct operation.

Step 3: Pressurize the Trauma Fill Tank and Fill the On-Board Blood Reservoir

An integrated hand pump is used to create the pressure for the Trauma Fill Tank.

WARNING: To prevent ejected pump assembly and/or solution from striking and injuring you, NEVER stand with your face or body directly over the top of the tank when pumping or loosening the pump.

To operate the pump and fill the reservoir:

- a. Unlock the pump handle by turning counter-clockwise. Be careful not to loosen the pump from the tank

- b. Stroke the pump handle up and down from 25 to 35 times to transport 2 liters of simulated blood to the on-board blood reservoir. NEVER exceed 35 strokes while pressurizing the tank.
- c. Lock the pump handle back into the pump assembly by turning clockwise
- d. Watch the Overflow Bottle located on the tank assembly. When liquid begins to appear in this bottle, the on-board blood reservoir is full. Filling the on-board blood reservoir takes approximately 3 to 5 minutes.

Step 4: Release Pressure from the Trauma Fill Tank

Immediately release pressure from the tank by turning and holding the yellow pressure relief knob clockwise until all air pressure is gone.

If pressure will not release using the relief knob:

- a. Place a rag over the top of the tank and pump handle
- b. While firmly pushing down on the pump handle, slowly turn the handle counter-clockwise

NEVER leave a pressurized tank unattended.

Step 5: Disconnect the Trauma Fill Tank Umbilical from the Simulator

Disconnect the Trauma Fill Tank Umbilical from the simulator and store the assembly out of the way for later use.

After use, ALWAYS release pressure and clean the tank.

Preparing for Storage

After filling and using the Trauma Fill Tank and the simulator's blood reservoir, both must be cleaned before storage.

Step 1: Clean the Simulator and Fluid System

When the simulation is completed and the Trauma Fill Tank has been disconnected, remove the fluids and clean the simulator.

Step 2: Clean the Trauma Fill Tank

Before storing the Trauma Fill Tank, make sure the equipment is clean.

Step 3: Store the Trauma Fill Tank

After cleaning, the Trauma Fill Tank assembly should be stored securely for future use.

- a. Allow the interior of the tank to dry by loosening the pump assembly. Do NOT leave the pump assembly out of bottle, however, because dust contaminates the system.
- b. Loosely wrap the Trauma Tank Umbilical around the neck of the tank to protect it
- c. Store all components in a clean, dry area

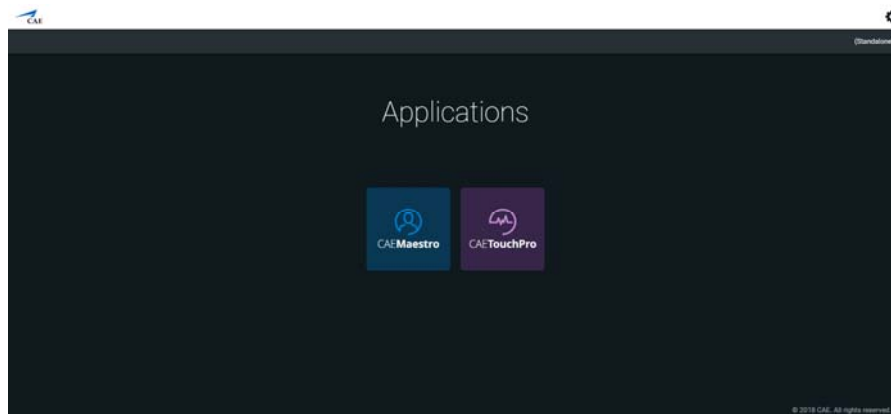
Optional: Connecting a TouchPro Computer to the Wireless Network

The CAE TouchPro computer is pre-configured for use with Apollo. If you wish to supply your own TouchPro computer, use the following instructions to connect the computer to the Apollo network.

Up to two additional computers may be used to run the TouchPro software. The additional computers must meet the TouchPro Software Specifications mapped out in

Step 5: Access the Software from the TouchPro Computer

- a. On the TouchPro computer, launch the web browser (e.g., Safari®)
- b. Enter the IP address obtained in **Step 2** into the browser's address field



The CAE Maestro Start Screen

OPTIONAL: From your web browser, a bookmark can be created on the TouchPro computer for ease of access to the Maestro or TouchPro software. Please consult your web browser's help menu for aid in creating a bookmark.

IMPORTANT: The Instructor Workstation MUST remain on and connected to the Apollo network for the TouchPro computer to be able to operate.

USING CAE Maestro

The CAE Maestro software is a browser-based application that can communicate directly with the simulator. With the software, users can run SCEs, create scenarios and SCEs, import and export educational content and perform administrative functions.

Note: For optimal Maestro performance, no other software programs should be open while Maestro is running.

IMPORTANT: Only one Maestro application window or tab and one TouchPro window or tab can be used per Instructor Workstation at a time.

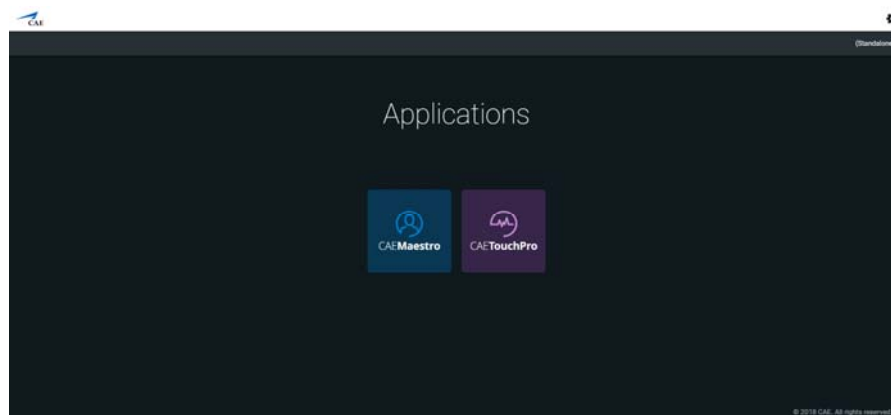
IMPORTANT: Do NOT use any of the browser's navigational tools (i.e., back and forward buttons) while operating Maestro.

Starting Maestro

Once the simulator is powered on and the Instructor Workstation is connected to the simulator network, the Maestro software can be launched.

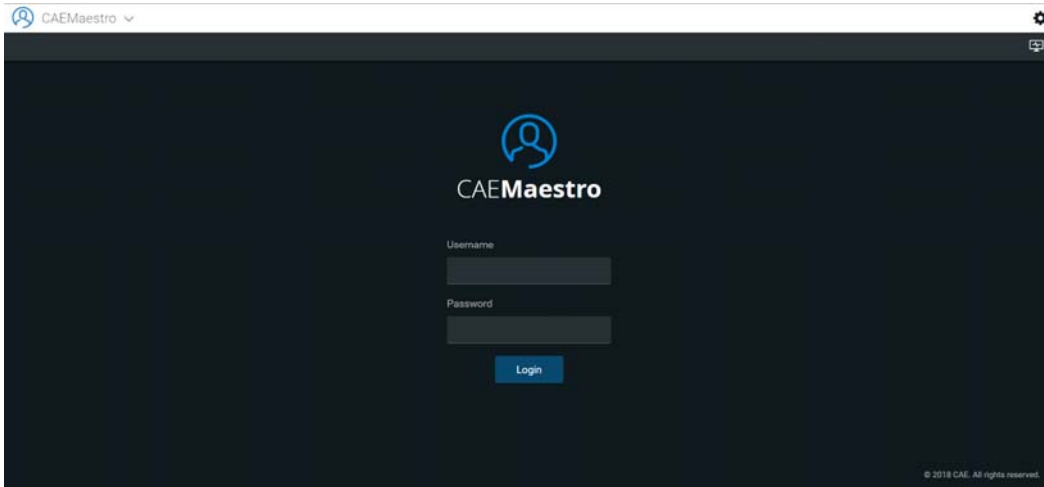
To launch the software:

1. Using the Laptop or Tablet Instructor Workstation, launch the web browser



The CAE Maestro Start Screen

2. Select CAE Maestro



The CAE Maestro Login Screen

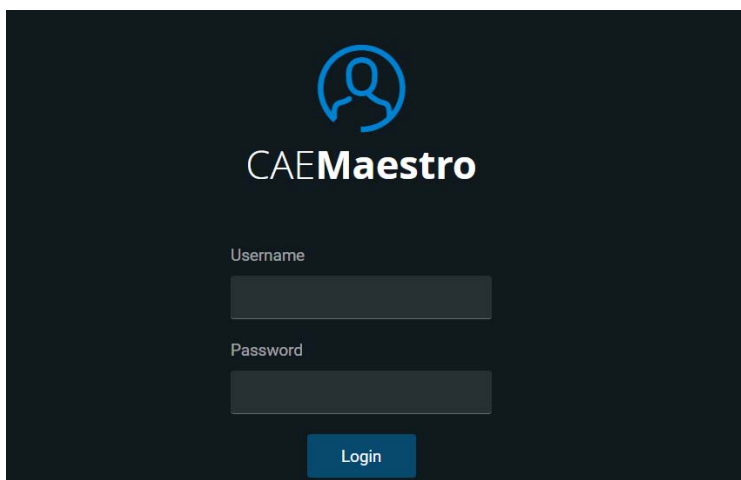
The icon in the top right corner of the screen provides access to additional information about the software:

Clicking the **Gear** icon to access the Info menu. From the Info menu, users can select from the following options:

- Select **System** to access information about the Maestro software version, the type of simulator, along with **Preferences**, **License Manager** and **Maintenance**.
- Select **Language** to change the Maestro language.
- Select **About** to access information about the Maestro software version, the type of simulator and the serial number.
- Select **User Guide** to download the user guide (English version). To access the User Guide in other languages, please visit www.caehealthcare.com and click the **Support** link.
- Select **Support** for CAE Support contact information.
- Select **Select Simulator** (only when using Maestro Standalone) to change the simulator (Apollo Prehospital, Apollo Nursing).

3. On the Login screen, enter the **Username** and **Password** in the appropriate fields and click **Login** to access Maestro

The default **Username** is *admin* and the default **Password** is *admin*.

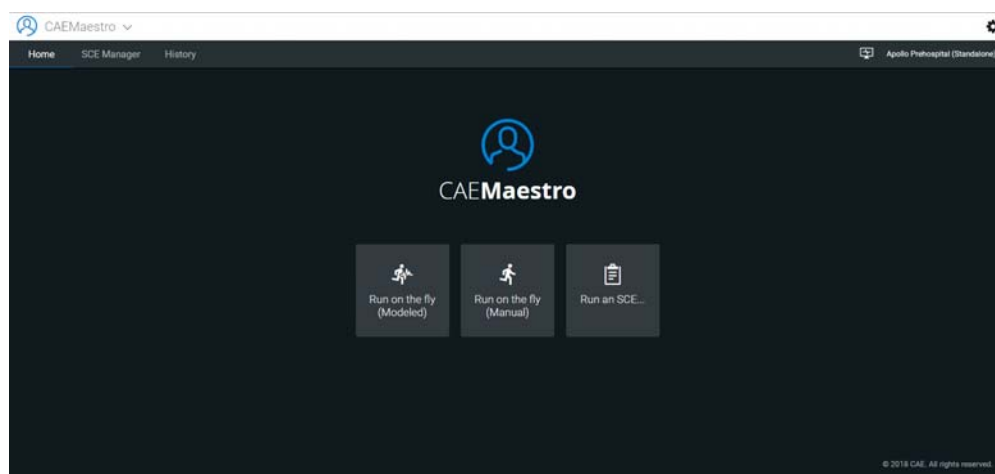


The Maestro Login Fields

The Home Page View

From the Home page, users can choose between **Run on the fly (Modeled)**, **Run on the fly (Manual)**, or **Run an SCE**.

The Home page can be accessed by clicking the **Home** button in the upper left corner of the Maestro software or, on any screen without a **Home** button, by clicking the **Return** button in the upper left corner of the screen.



The Maestro Home Page

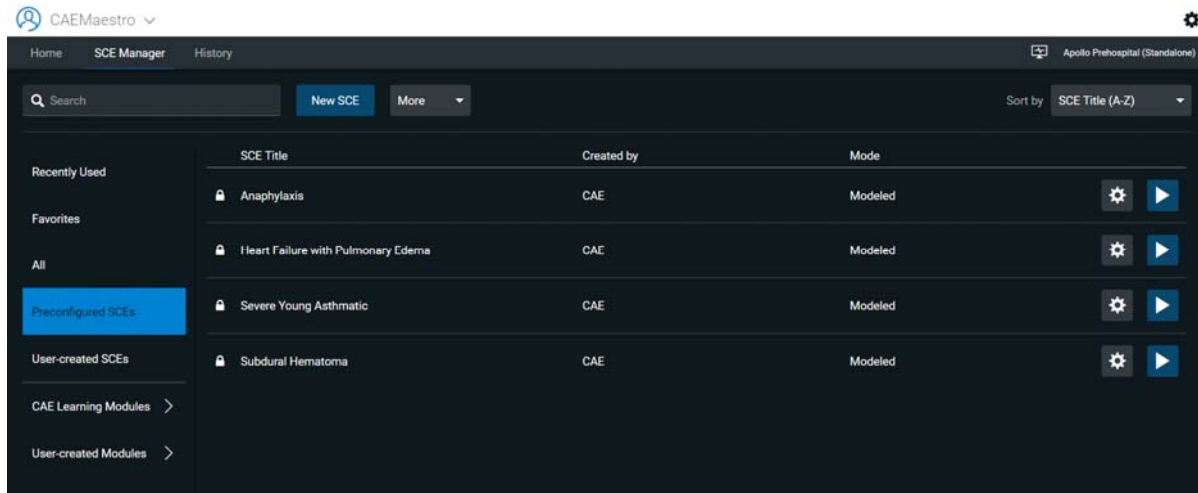
The SCE Manager Panel

SCEs are process tools that enable the facilitator to execute a learning strategy using simulation. Preconfigured CAE SCEs provide an extensive overview and outline of the learning exercise and require minimal additional faculty development time for use. Each SCE is comprised of a patient and a scenario.

Available SCEs appear in the SCE Manager panel.



The SCE Manager Panel

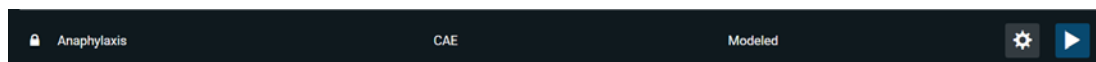


The SCE Manager

The SCE Manager has multiple tabs that access SCEs: Recently Used, Favorites, All, Preconfigured SCEs, User-created SCEs, CAE Learning Modules, and User-created Modules

- **Recently Used** tab: Lists all the recently run or edited SCEs.
- **Favorites** tab: Lists all SCEs that have been selected as favorites and is only displayed after favorites have been selected. To add a favorite SCE to your profile, click the **Add to Favorites** button at the gear icon of any SCE in the SCE Manager.
- **All** tab: Lists all SCEs, including user-created SCEs and all SCEs from available learning modules.
- **Preconfigured SCEs**: SCEs that cannot be edited or deleted.
- **CAE Learning Modules**: Includes SCEs pertaining to a CAE Learning Module.
- **User-created Modules**: lists modules created by the user.

The **Lock** icon indicates a locked SCE. Locked SCEs are installed by CAE and cannot be edited or deleted.



Locked SCE

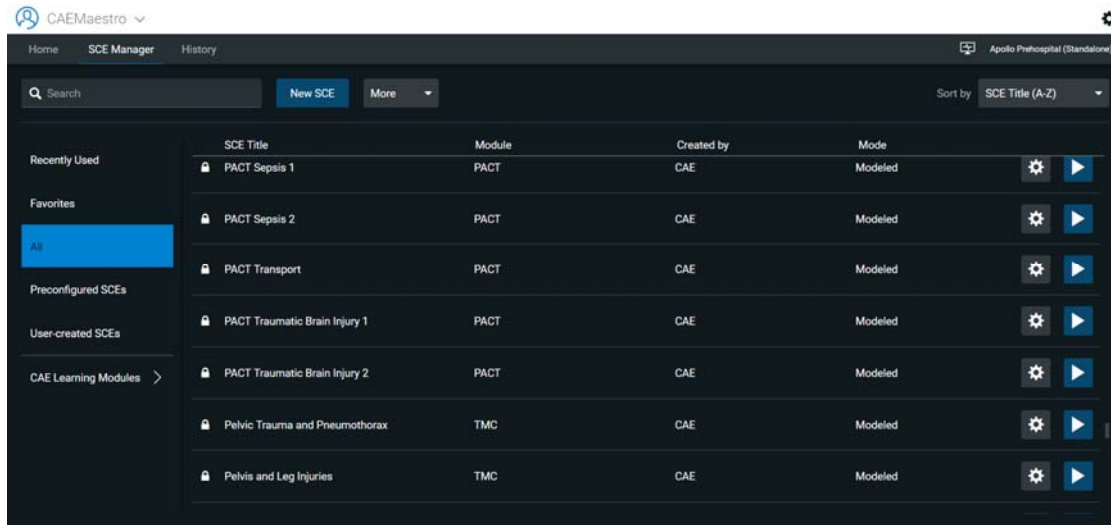
To search for an installed SCE, enter part of the name of an SCE in the **Search** field.

Click any SCE to select it. Once an SCE is selected, the **SCE Editor** panel will open.

To run an SCE, click **Run SCE** in the **SCE Editor** panel to execute the SCE, or click the **Play** button next to any SCE in the SCE Manager panel.

To create a new SCE, click the **New SCE** button in the SCE Manager.

The SCE Manager lists all SCEs available on your workstation, by selecting **All**



List of All SCEs

Click the desired learning module name in the **CAE Learning Modules** tab to access its SCEs, or click **Preconfigured SCEs**. The selected SCEs appear.

To open an SCE, click the name of the SCE.

Running on the Fly

Running on the fly has no scenarios nor progression of events. Running on the fly is designed to provide facilitators with a baseline to run simulations or as a physiological baseline from which to design their own SCEs.

To run on the fly, select **Home**, then click **Run on the fly (Modeled)** or **Run on the fly (Manual)**.

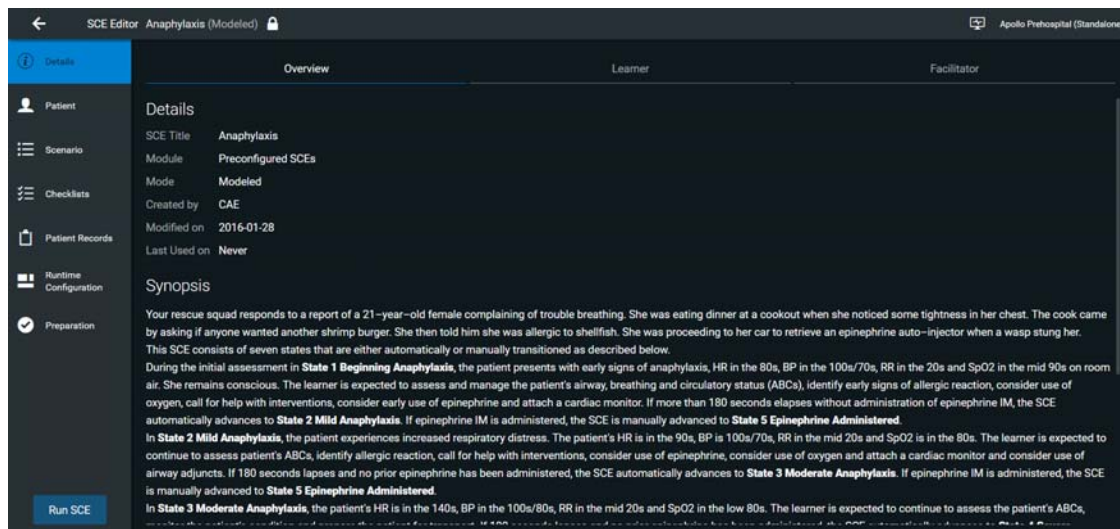
Preconfigured SCEs

Preconfigured SCEs are training tools with scenarios and multiple states. They are intended to be used for learner education and training.

To access a preconfigured SCE from the SCE Manager, select **Preconfigured SCEs**, then click the desired SCE.

The SCE Editor Panel

The SCE Editor Panel provides information about the selected SCE.



SCE Editor Panel

The **Details** tab lists relevant information of the SCE

The **Patient** tab includes the patient profile along with patient baseline

The **Scenario** tab includes states pertaining to the SCE

The **Patient Records** tab is used to keep patient documents

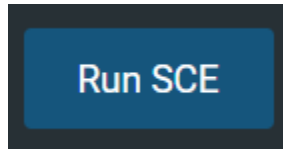
The **Runtime Configuration** tab lists condition, treatment, and medication Quick Links

The **Preparation** tab lists equipment and supplies related to the SCE

Select the **Run SCE** button to run the SCE

Running an SCE

To run an SCE, from the SCE Manager panel, select an SCE and click the **Run SCE** button in the bottom left of the SCE Editor page. The Run screen can also be accessed by clicking the **Play** button on the right of any SCE listed in the SCE Manager.



Run SCE Button



Play Button

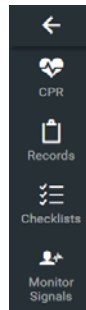


Run Screen

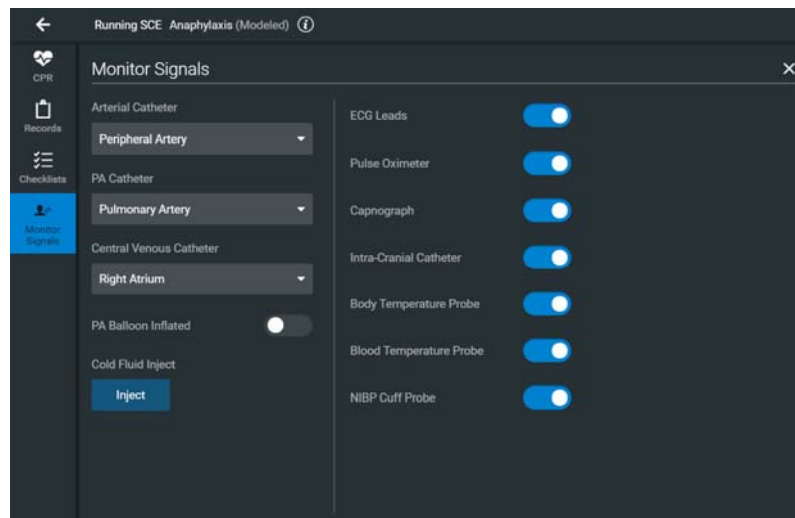
From the Run screen, users can manage the SCE, perform interventions, view physiological status and events, save events as states, save the Patient and associate records with the Patient.

Monitor Signals

Lets the user control which vital sign signals are displayed on the patient monitor; including TouchPro and commercial monitors connected via VitalsBridge.



Monitor Signals Tab



Monitor Signals Panel

A panel opens displaying a dedicated group of controls.

The listed probes impact which vital sign signals are displayed on the patient monitor; including TouchPro and commercial monitors connected via VitalsBridge. By default they are all on. Turning probes off here will impact some of the graphs as follows:

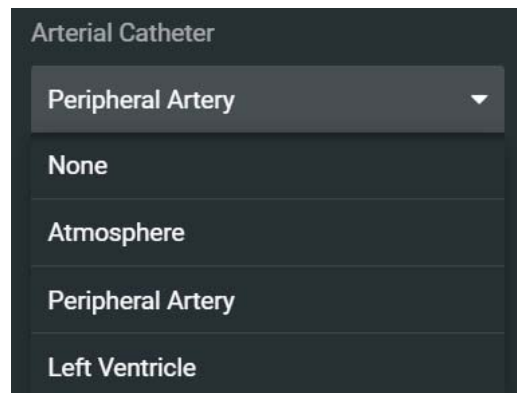
- ECG Leads OFF:
 - The ECG waveform is not displayed
- Pulse Oximeter OFF:
 - The PLETH waveform is not displayed
- Capnograph turned OFF:
 - The CO2 waveform is not displayed

The listed probes also impact the numerical values as follows:

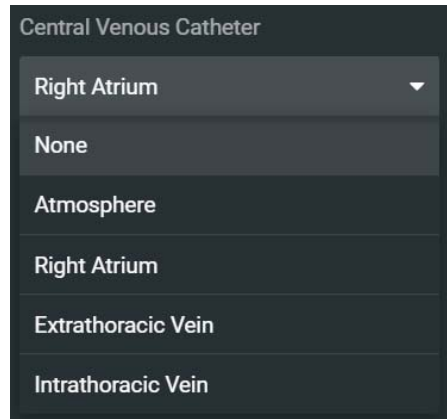
- ECG Lead OFF and Pulse Oximeter OFF:
 - The HR (Heart rate) is not displayed
- Pulse Oximeter OFF:
 - SpO2 is not displayed
- Capnograph OFF:
 - EtCO2 not displayed
- Pulse Oximeter OFF and Capnograph OFF:
 - RR (Respiratory rate) not displayed
- Blood Temperature Probe OFF:
 - T_{Blood} and T_{Rectal} not displayed
- Body Temperature Probe OFF:
 - T_{Axilla} and T_{Body} not displayed

Note: In simulators that include an emulated SpO2 probe which connects to the simulator's side and is placed on the finger, the detected on/off status of the emulated probe will take precedence over the on/off status indicated in the monitor signals menu.

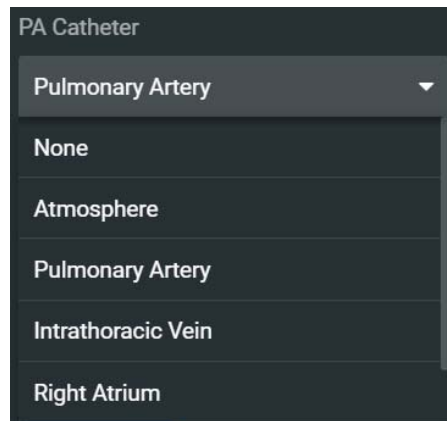
Setting the catheter placement to Atmosphere causes a flat line to be displayed even when an override is used.



Arterial Catheter Placement



Central Venous Placement

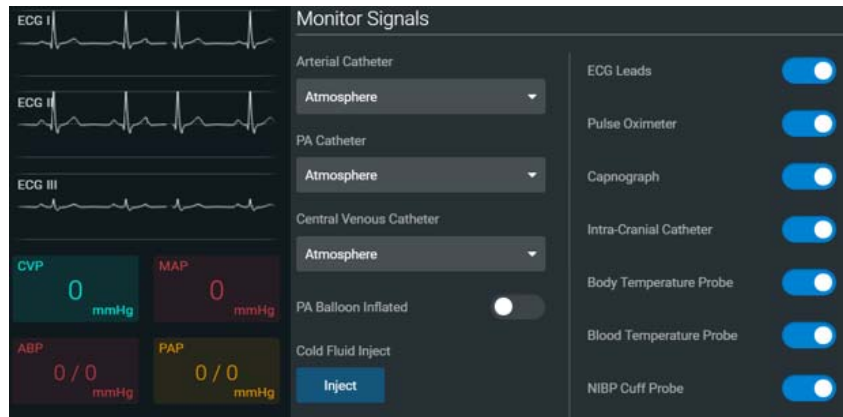


PA Catheter Placement

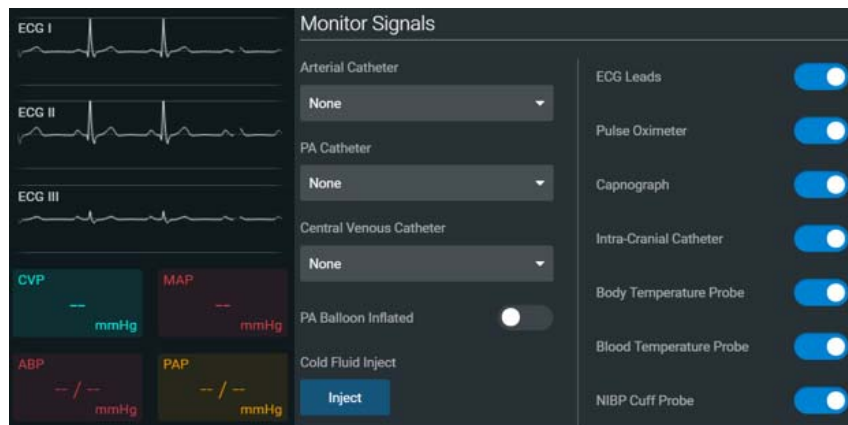
If the catheter placement is none, no graph is displayed vs a flat line when Atmosphere is selected. The associated widget is displayed and no alarm is generated.



Catheters in Proper Locations



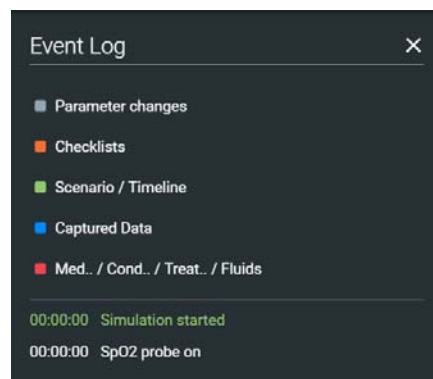
Catheters set at Atmosphere



Catheters set at None

The Event Logs

During an SCE, all software operations sensed by the simulator or entered manually (e.g., virtual defibrillation, setting a physiological parameter value) are recorded by an event entry that appears on the screen. The event entry notes what occurred and the time it happened.



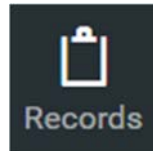
Event Logs

Displaying Patient Records

Patient records can be uploaded to Maestro and displayed in the TouchPro software while an SCE is running.

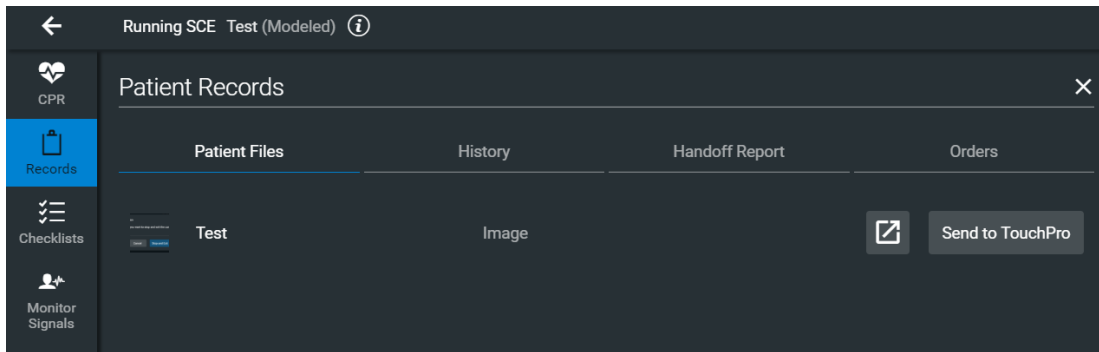
To display an uploaded patient record:

1. From the Maestro Run screen, click the **Records** button



Records Button

The Patient Records list appears, displaying all available patient records.



Patient Records

2. Select **Send to TouchPro** on the desired Patient Record

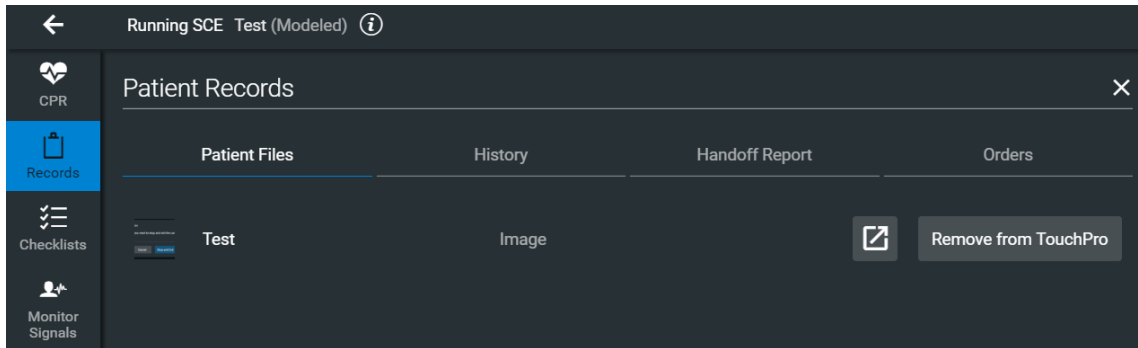
The patient record is shown in a new TouchPro web browser window.

IMPORTANT: Ensure pop-up blocking is turned OFF in the web browser of the Instructor Workstation and any TouchPro workstations. Consult the web browser's help menu for assistance.

Note: The web browser window containing the patient record may be minimized initially. If the window is not readily visible, click the web browser icon on the Dock (Macintosh Instructor Workstation) or Taskbar (Windows Instructor Workstation) to locate the new window.

The Patient Records Button

The **Send to TouchPro** button at the bottom of the Patient Records list changes to **Remove from TouchPro** button.



Remove from TouchPro Button

To stop displaying a patient record in TouchPro, click **Remove from TouchPro** on the right of the patient record.

To close the Patient Records list, click the **Records** button. The list closes.

Note: Only one patient record can be displayed at a time.

The patient record can also be previewed in Maestro by selecting the preview button on the right of the desired record



Preview Button

Changing Physiology

The patient physiology can be adjusted while an SCE is running in two ways: by using one of the physiological views on the Run screen to modify parameters or by using the Conditions, Treatments and Medications palettes.

Using the Physiological Views

From the Run screen, users can select from different views representative of various body systems and features:

- Cardiovascular
- Respiratory
- Neurological
- Fluids
- Eyes
- Sounds
- Pulse
- Speech

To access each view, click the appropriate tab, icon or button.

- For Cardiovascular, click the **Cardiac** tab
- For Respiratory, click the **Respiratory** tab or on the lungs icon
- For Neurological, click the **Neuro** tab
- For Fluids, click the **Fluids** button
- For Eyes, click the **Eyes** button or on the eyes icon
- For Sounds, click the **Sounds** button
- For Pulse, click the **Pulse** button
- For Speech, click the **Speech** button

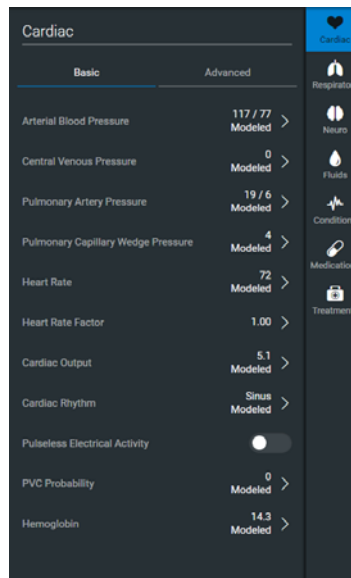
From each view, various parameters can be viewed and adjusted.



Physiological Views

To change a patient's physiology using the physiological views:

1. Click the appropriate tab, icon, or organ to select the desired physiological view

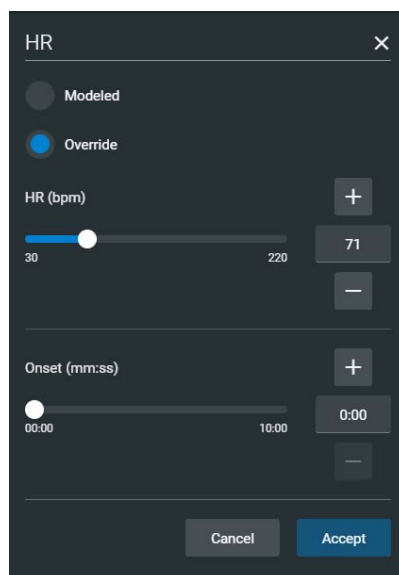


Physiological Parameters - Cardiac

2. Locate the desired parameter

Note: Some simulators have a **Basic/Additional** switch on the Respiratory and Cardiovascular views. Basic parameters are shown by default. The **Basic/Additional** switch can be toggled to show more parameters.
3. Select the parameter and set the new value

Parameters have varying controls, such as sliders, switches and menus. In the image below, the Heart Rate parameter is shown. Within the Heart Rate parameter, there are buttons that toggle between **Modeled** and **Override**, a slider that sets the beats per minute and an available field where the beats per minute value can be keyed in.



Heart Rate Parameter

Once the parameter has been set, it is reflected in the patient's physiology.

Types of Parameters

There are two types of parameters: numeric and discrete.

Once a parameter is selected and set, the patient's physiology changes according to the model for that parameter.

Numeric Parameters

Numeric parameters set either a measured value (e.g., 20 mL), a multiplied value called a factor (e.g., Heart Rate Factor 2.0 is two times the baseline Heart Rate) or a coefficient that affects a physiological value in a non-linear way (e.g., FHR Variability Coefficient).

Numeric parameters are changed by clicking in the relevant field and entering a new value in place of the existing one or using a slider to move through the range of parameter values until the desired numeric value is established.

Once a measured value is set, that value overrides the physiologically modeled parameter value. To return to a physiologically modeled value, select the **Modeled** button.

Discrete Parameters

Discrete parameters enable users to select one of two or more options.

Discrete parameters are changed by choosing the appropriate option using a drop-down menu or toggle switch.

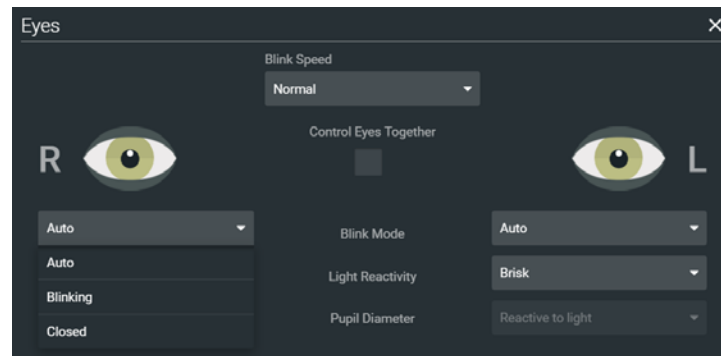
In the image below, the **Bronchial Occlusion** parameter is shown. The **Bronchial Occlusion** parameter is set using a discrete parameter switch that toggles between **Off** and **On**.



Bronchial Occlusion Parameter

Once the parameter has been set, it is reflected in the patient's physiology. Some parameters have two toggle switches or buttons, one for the left side of the manikin and one for the right.

In the image below, the **Blink Mode Parameter** is shown.



Blink Mode Parameter

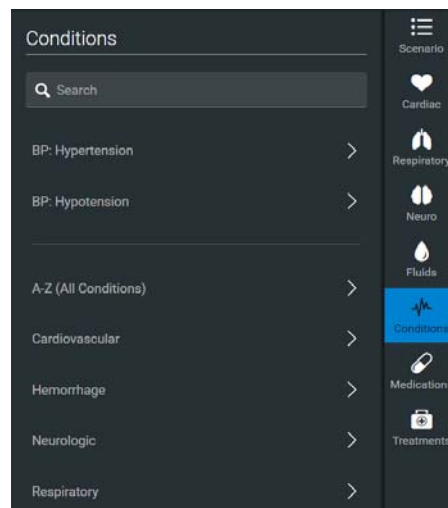
When the **Apply to Both Eyes** parameter is set to **On**, any change made to the left or right side is also automatically applied to the other side.

Note: Not all changes to parameters affect the patient's physiology, but all are logged.

Using the Conditions, Medications and Treatments Palettes

The Conditions, Medications and Treatments palettes on the Run screen enable the application of conditions, medications and interventions during simulation. Once applied, conditions are reflected in the patient's physiology and logged. All medications and interventions are also logged, and most affect the patient's physiology.

TIP: Click on the appropriate tab to collapse or expand the palette.



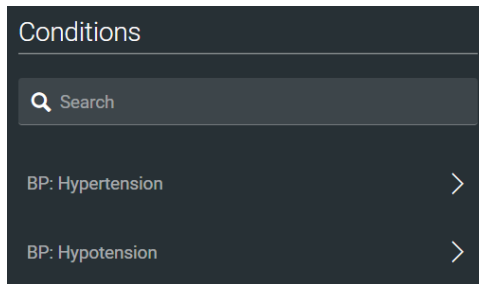
Conditions Palette

Using the Conditions Palette

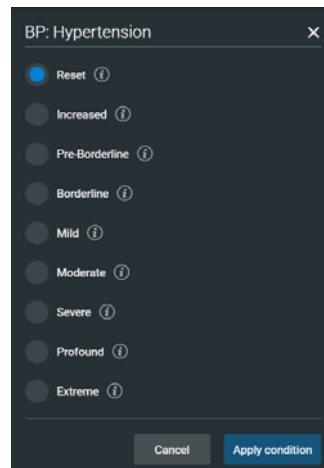
Conditions are pre-programmed pathophysiological states that use one or more physiological parameters and are designed to enable you to create physiological changes on the fly.

There are two ways to apply conditions using the Conditions palette: using a Quick Link or using the complete Conditions menu. Quick Links are pre-configured conditions that are made accessible in the Conditions palette for quick application. Quick Links can also be created for the Medications and Interventions palettes.

To set parameters using the Quick Links in the Conditions palette, click one of the Quick Link conditions. A popup menu will show the available conditions; and hovering over the condition will show the parameters. Click a specific condition to apply it and affect the patient's physiology.



Condition Quick Links



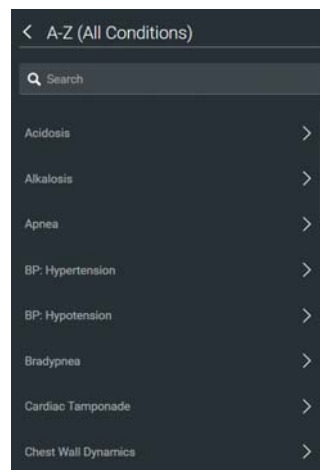
Conditions – BP: Hypertension

Note: Quick Links can only be added while creating or editing an SCE.

To apply a condition that is not set up as a Quick Link in the **Conditions** palette:

1. Click the **Conditions** button

Conditions are organized by system, or all available conditions are listed under **All Conditions**.



All Conditions

2. Navigate the menus to find the desired condition

Once the desired condition has been located, click the condition's name from the list.

The condition is applied and affects the patient's physiology.

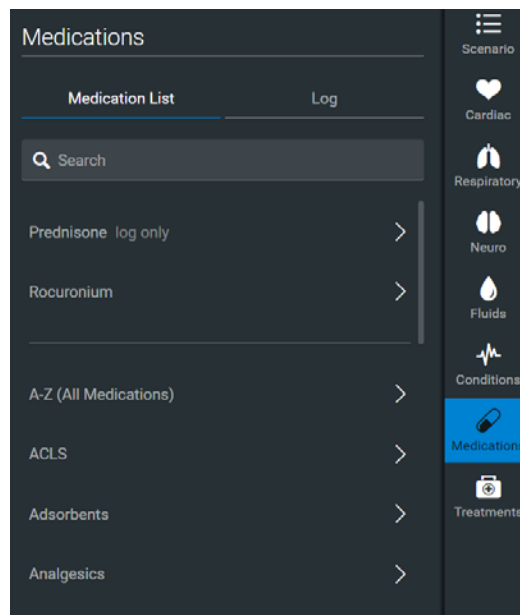
Using the Medications Palette

There are two ways to administer medications using the **Medications** palette: using a Quick Link or using the **Medications** menu. Quick Links are preconfigured medications that are made accessible in the **Medications** palette for quick application. Quick Links can also be created for the **Conditions** and **Treatments** palettes.

To set parameters using the Quick Links in the **Medications** palette, click one of the Quick Link medications. A popup menu will show the available doses. Click a specific dose to apply it and affect the patient's physiology.

The option for custom doses will also be in the popup menu. Click the route of administration to get the Custom Dose Administration menu.

Note: Not all medications affect the patient's physiology, but all are logged.

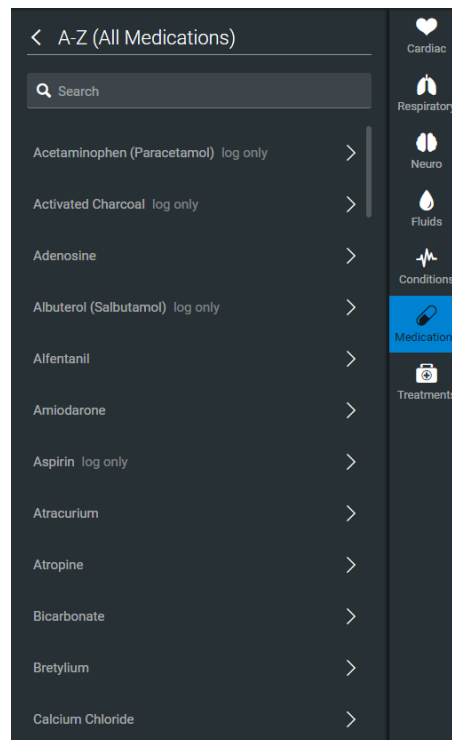


Medications Palette

Note: Quick Links can only be added while creating or editing an SCE.

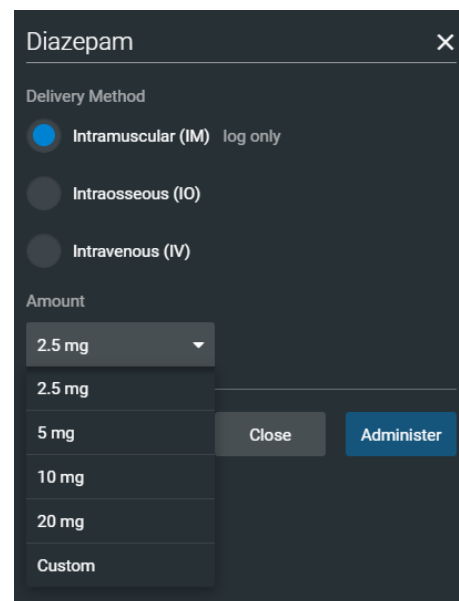
Or, to apply a medication that is not set up as a Quick Link in the **Medications** palette:

1. Click the **Medications** button. Medications are organized by type, and all available medications are listed under **ALL MEDICATIONS**
2. Navigate through the menus to locate the desired medication
3. Once the medication has been located, click the medication's name from the list



All Medications

The Medication Dose menu appears, displaying the pre-defined dose and custom dose routes for the chosen medication.



The Medication Dose Menu

4. Select a dose option. This can be done one of two ways:
 - a. Choose a pre-defined dose

Diazepam

Delivery Method

Intramuscular (IM) log only

Intraosseous (IO)

Intravenous (IV)

Amount

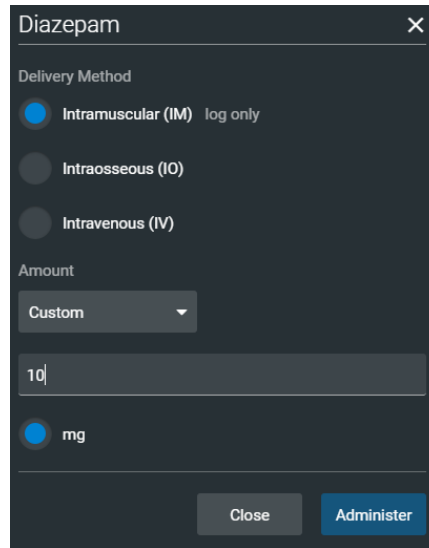
20 mg

Close Administer

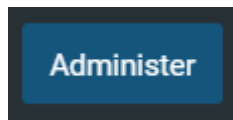
Pre-Defined Dose

The dose is applied and appears in the patient’s physiology. The medication selected also appears in the Medication Log.

b. Choose a route of administration to administer a custom dose



Custom Dose



Administer Button

5. Enter the desired dose and click the **Administer** button

The dose is applied and appears in the patient's physiology. The medication selected also appears in the Medication Log.

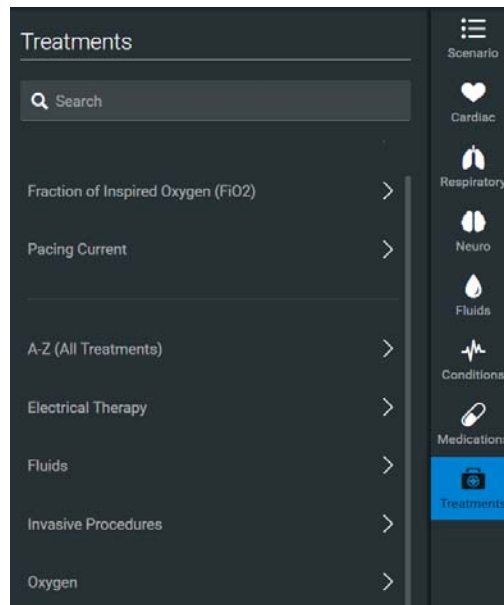
Note: Not all medications affect the patient's physiology, but all are logged.

Using the Treatments Palette

There are two ways to perform and/or administer interventions using the Treatments palette: using a Quick Link or using the complete **Treatments** menu. Quick Links are preconfigured treatments that are made accessible in the **Treatments** palette for quick application. Quick Links can also be created for the **Conditions** and **Medications** palettes.

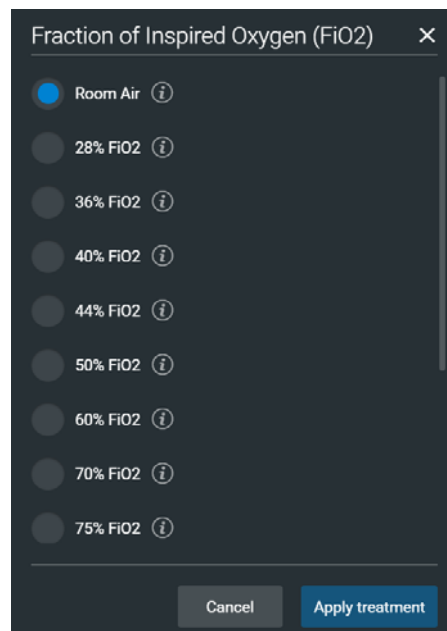
To apply an intervention using the Quick Links in the **Treatment** palette, click a treatment Quick Link.

Note: Not all treatments affect the patient's physiology, but all are logged.



Treatments Palette

Once a treatment is selected, a menu appears with available options for the selected treatment. Click the desired option to select it. The treatment is applied and appears in the patient's physiology.

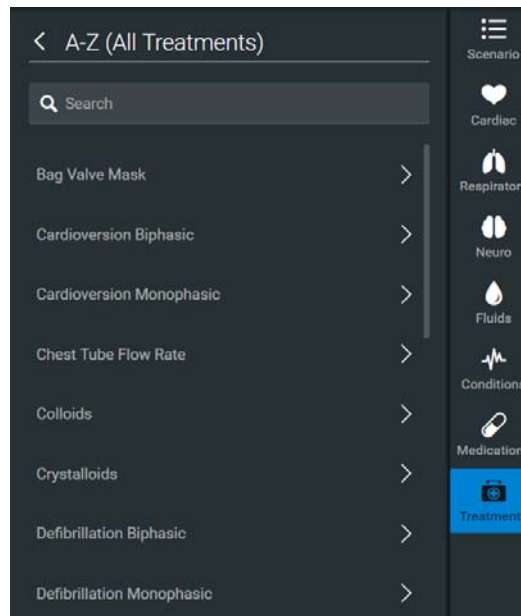


Treatments - Fraction of Inspired Oxygen (FiO2)

Note: Quick Links can only be added while creating or editing the SCE.

To apply a treatment that has not been set up as a Quick Link in the **Treatments** palette:

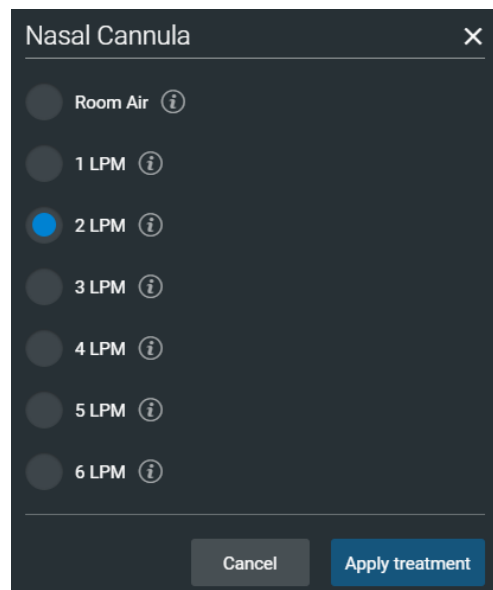
1. Click the **Treatments** button



All treatments

Treatments are organized by type, or all available treatments are listed under **All Treatments**.

2. Navigate through the menus to find the desired treatment
3. Once the desired treatment has been located, click the treatment's name from the list



Treatments - Nasal Cannula

4. Click the desired option
The treatment is applied and appears in the patient's physiology.

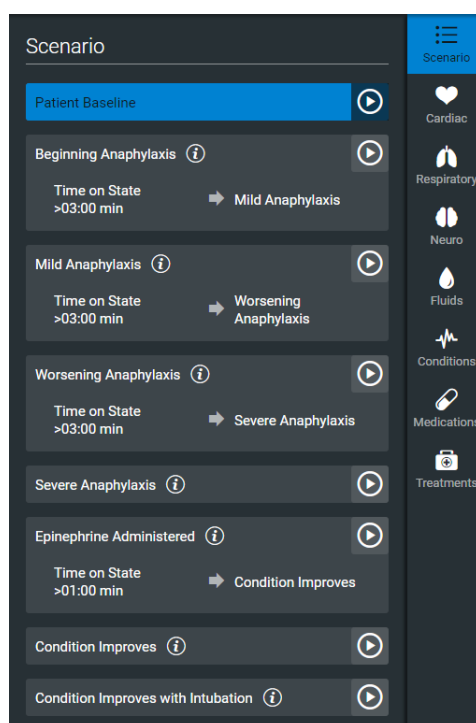
Transitioning Scenario States from the Run Screen

To move between scenario states from the Run screen:

1. Click the desired scenario



SCE - Anaphylaxis



Scenario - Anaphylaxis

2. Select **Scenario** button from the run screen, and subsequently select the desired state. The scenario proceeds to the selected state

The scenario can also be paused or continued by selecting the **Pause** and **Play** options from the Scenario Management Pop-Up menu.

SCE Time Controls

The SCE time controls are located at the top of the Run screen.



- The **Timeline** bar shows the amount of time that has elapsed and bookmarks that have been created
- The **Bookmark** button creates a bookmark at the current point in the SCE. The bookmark can be used later to reset the patient's physiology to what it was when the bookmark was created.
- Clicking the **Fast-Forward** button once accelerates the SCE time at a 4:1 ratio.
- The **Pause/Play** button pauses the SCE time or starts the SCE if it has been paused. The **Pause/Play** button also returns the SCE time to normal speed after **Fast-Forward** has been selected.

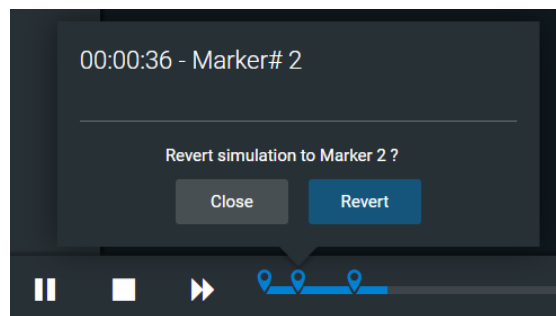
Using Bookmarks

To create a bookmark, click the **Bookmark** button. A bookmark appears on the **Timeline** bar.



To return to a bookmarked time in the SCE:

1. Click the bookmark on the timeline



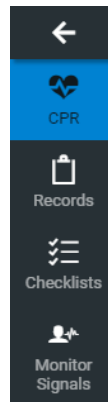
Revert to Bookmark

2. Click **Revert**
The patient's physiology returns to the selected point in the timeline.
Note: The SCE time continues moving forward and does not reset to the bookmarked time.

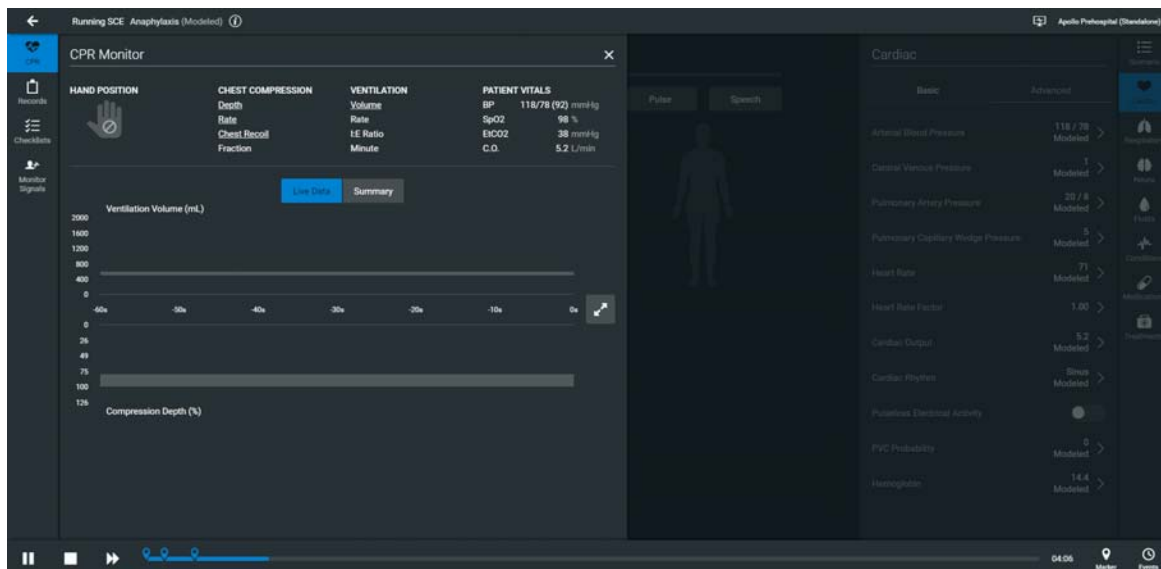
The CPR Monitor

The CPR monitor is used to monitor the efficacy of CPR interventions and is available from the Run screen.

To use the CPR monitor, click the **CPR Monitor** button at the top left of the Run screen.




CPR Monitor Button



CPR Monitor – Live Data

Click the **CPR Summary** button to display the summary view.

CPR Monitor
✕

<p>HAND POSITION</p> 	<p>CHEST COMPRESSION</p> <p><u>Depth</u></p> <p><u>Rate</u></p> <p><u>Chest Recoil</u></p> <p>Fraction</p>	<p>VENTILATION</p> <p><u>Volume</u></p> <p>Rate</p> <p>I:E Ratio</p> <p>Minute</p>	<p>PATIENT VITALS</p> <p>BP 117/78 (93) mmHg</p> <p>SpO2 98 %</p> <p>EtCO2 38 mmHg</p> <p>C.O. 5.1 L/min</p>
---	---	---	---

Live Data
Summary

<p>AVERAGE CHEST COMPRESSION</p> <p><u>Depth</u></p> <p><u>Rate</u></p> <p><u>Chest Recoil</u></p> <p>Fraction</p>	<p>AVERAGE VENTILATION</p> <p><u>Volume</u></p> <p>Rate</p> <p>I:E Ratio</p>
---	---

CPR Monitor - Summary

Click the **CPR Live Data** button to return to the live data view.

The CPR Monitor displays several statistics, including current hand position, compression and ventilation rates, compression depth, ventilation volume, and compression-ventilation ratio.

CPR data is recorded in the Event Logs.

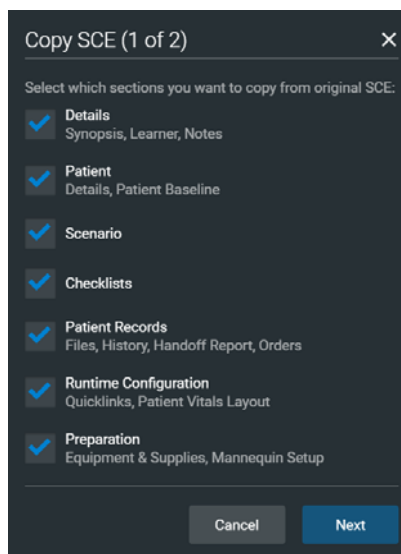
To close the CPR Monitor, click the **X** button.

Copying an SCE

When an additional SCE with specific physiological characteristics is needed for repeated use, a new SCE can be copied from an existing SCE.

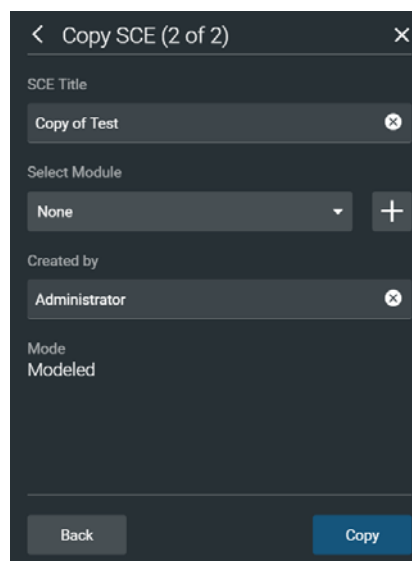
To copy an SCE:

1. From the SCE Manager, select the gear icon on the right of the desired SCE that has a patient with the same gender as the patient to be created
2. From the options, select copy
3. Once complete, click the sections to be copied from the original SCE



Copying SCE

4. Select Next



Saving Copied SCE

5. Enter a new SCE title in the **SCE Title** field
6. Click **Copy**

The new SCE is copied and available for selection from the SCE Manager.

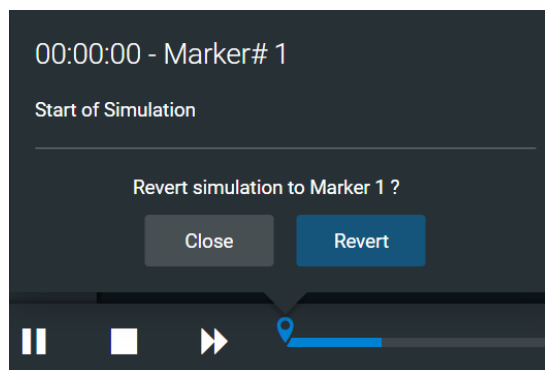
Note: Overwriting an SCE will only impact the running SCE, not any other SCE copied from the same base patient.

Resetting an SCE

Resetting an SCE brings the Patient back to its original physiological state before any scenarios were applied or modifications were made. The SCE time is unaffected. Additionally, the reset appears in the Event Logs.

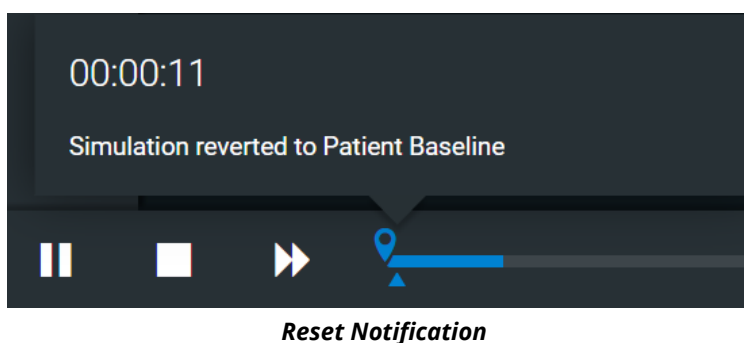
To reset a Patient:

1. While running an SCE, click the first bookmark on the timeline



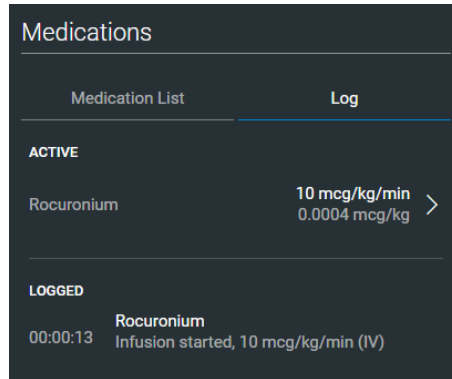
2. Click **Revert**

The patient returns to its original physiological state as at the start of the SCE. The patient reset is indicated on the SCE timeline bar.



The Medication Log

The Medication Log tracks the infusion of medication administered for medications that affect patient physiology. To activate the Medication Log, from the Run screen, click the **Medications** palette, and subsequently click the **Log** button in the top, right portion of the screen.



Medication Log

The Medication Log appears.

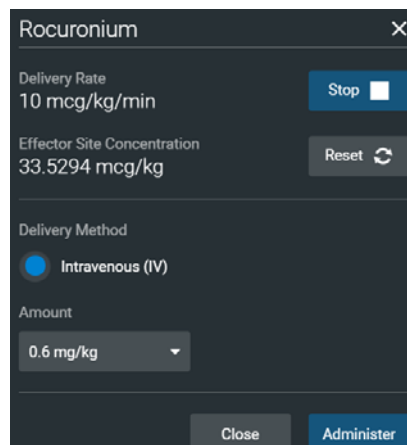
The normalized effector site concentration is shown next to each medication listing.

The **Reset** button is used to clear a medication from the physiological model and the Medication Log.

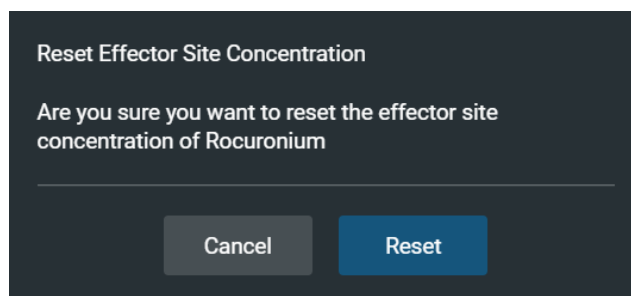
Resetting a Medication

To reset a medication from the Medication Log, click an active medication. Once selected, click the **Reset** button.

The Reset Medication dialog box appears, asking you to confirm that you wish to reset the medication.



Active Medication



Reset Medication

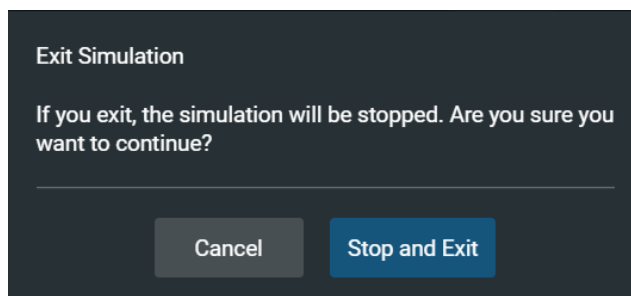
The medication is cleared from the model and from the Medication Monitor. With continuous infusions, the amount infused goes back to zero, but the infusion continues. To stop the infusion, you must select the **Stop** button from the active medication.

Returning to the Home Page

To exit the SCE and return to the Home page, click the **Return** button in the upper-left of the run screen.



Return Button



Exit Simulation

The SCE stops running and the Home page appears.

To return to the SCE from the Home page, click the SCE in the SCE Manager and then select the **Run** button.

Stopping the SCE

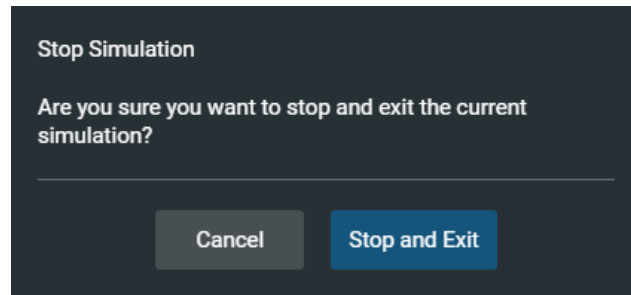
Running SCEs can be stopped from the **Stop** button.

To stop an SCE from the **Stop** button:

1. Click **Stop button** in the button left corner, next to the timeline:



Stop Button



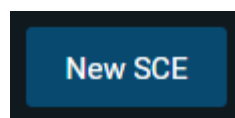
Stop Simulation

2. Click **Stop and Exit**

The SCE stops running and the Maestro Home page is shown.

Developing SCEs

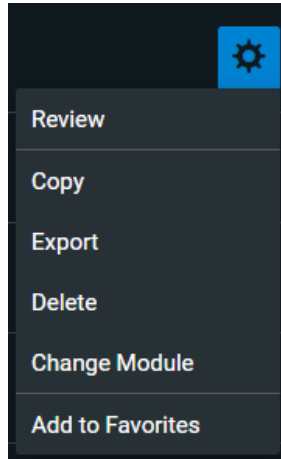
Creating and editing SCEs are similar processes. Once an SCE is created, the steps for modifying the SCE are the same as those for editing a previously-created SCE. The processes of creating and editing SCEs each begin with a unique button in the SCE Manager. Use the **New SCE** button to create a new SCE.



New SCE Button

The minimal requirements for creating a new SCE include selecting a Mode (Manual or Modeled), naming the SCE, naming the patient, selecting a gender, and saving the SCE. Once the new SCE is created, you can continue with the SCE development or edit it later.

Click on the gear icon and the **Review** button on an existing SCE to edit.



Review SCE

Creating a New SCE

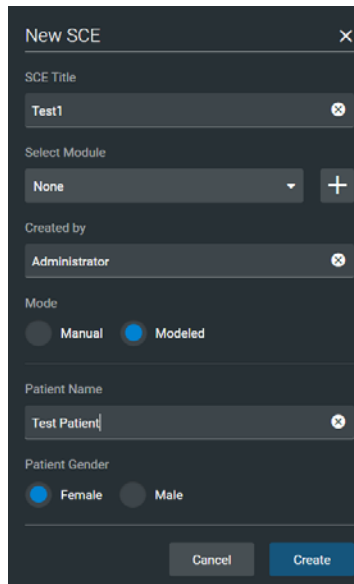
Creating an SCE requires naming the SCE, selecting a module, entering the name of the creator, selecting a mode, entering a patient name, and selecting a gender.

To create a new SCE:

1. From the SCE Manager screen, click **New SCE**



New SCE Button



New SCE

2. Enter a name for the SCE in the **SCE Title** field

Note: The name of the SCE may NOT exceed 80 characters. Additionally, SCE file names CANNOT contain any special characters, such as (' / \ : * ? < > % | ").

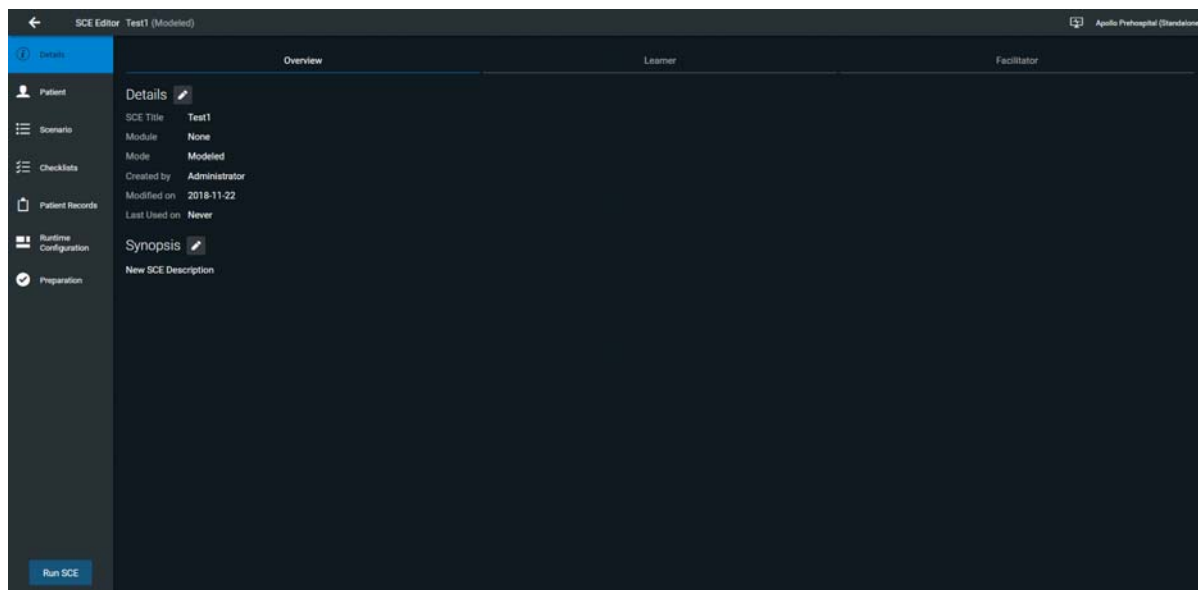
3. **Select Module** (None can be selected, if desired)
4. Fill in the **Created by** field
5. Select **Mode** (Manual or Modeled)
6. Enter a patient name in the **Patient Name** field
7. Select **Patient Gender**
8. Select **Create** button to complete

Once the SCE is saved, it is stored and can be edited and reviewed at any time, including creating a Patient Profile and content, determining settings and programming scenarios.

The SCE Editor

The SCE Editor can be used to review preconfigured SCEs and to create or edit custom SCEs.

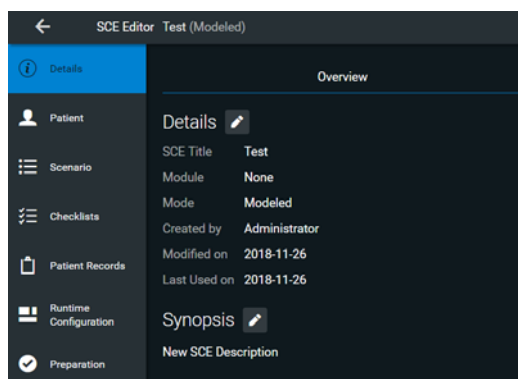
To access the SCE Editor, click the **Review** button in the gear icon next to an SCE or create a new SCE.



SCE Editor

The buttons in the left tab of the SCE Editor provide options for running the SCE, editing the patient, editing the scenario, adding checklists, adding patient records, modifying the runtime configuration, including preparation information, or returning to the Home page.

SCE Content is entered from the SCE Editor using the **Details, Patient, Checklists** and **Preparation** tabs.



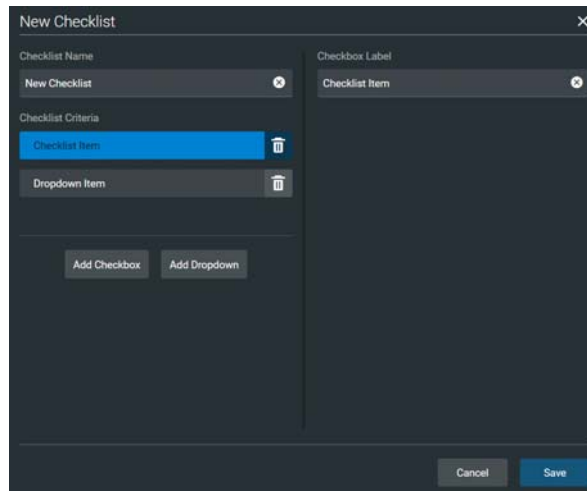
SCE Details



Edit Button

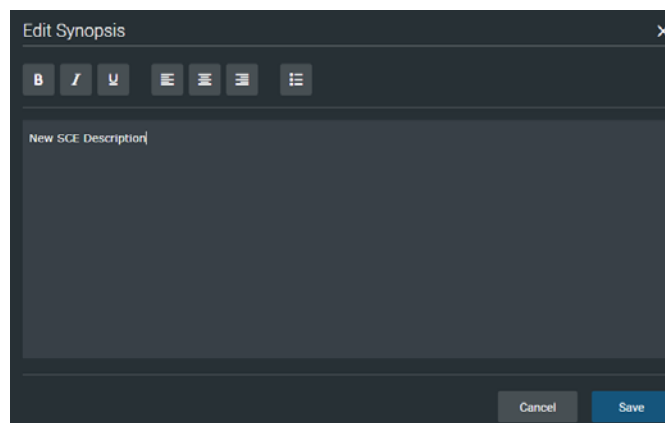
Each tab accesses a screen that allows users to enter information for the chosen section (Details, Patient, Checklists, Preparation). Click the **Edit** button of each section on the SCE Editor to access a rich-text editor that enables data entry. For instance, in the **Details** tab, the **Synopsis** can be edited.

In the **Checklists** tab, checklists along with dropdowns can be created.



SCE Checklists

IMPORTANT: Text can be copied and pasted into the fields from TextEdit or Notepad only.



Text Editor

Click **Save** when all data for the field has been entered.

(IMPORTANT: Notes can also be added when editing a **Scenario**)

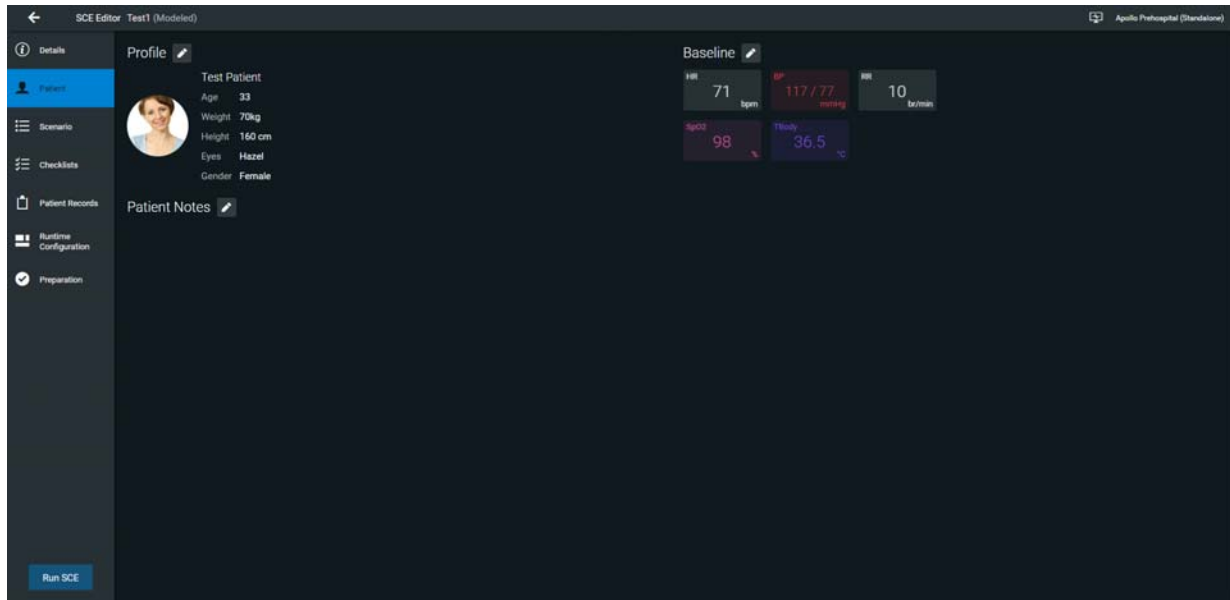
Editing a Patient's Profile

To edit the Patient Profile:

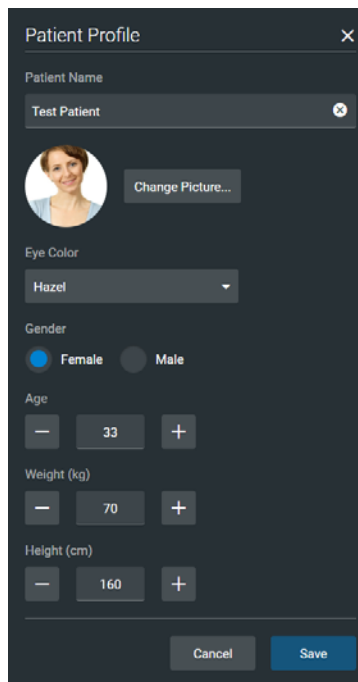
1. From the SCE Editor, in the **Patient** section, click the **Edit** button on the right of the **Profile** section or **Patient Notes** section



Edit Button



Patient Overview



Patient Profile

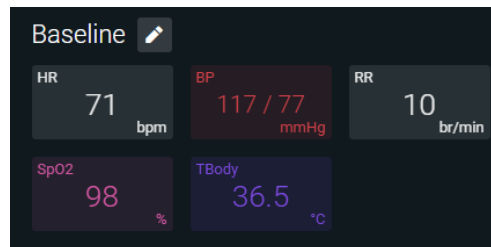
2. Set the Patient's name, age, gender, weight, and height by filling in the appropriate fields
3. Click the **Change Picture** button to change the patient's picture (optional)
4. Click **Save**

IMPORTANT: No part of the patient's profile can contain any special characters, such as / \ : * ? < > % | "

Setting a Patient's Baseline

The patient baseline is the patient's initial physiology at the beginning of an SCE. To set the Patient's Baseline:

1. From the SCE Editor, in the **Patient** section, click the **Edit** button on the right of **Baseline**



Patient Baseline



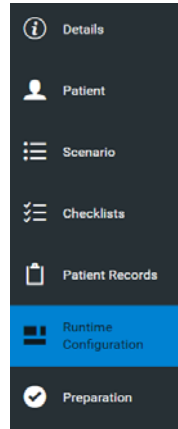
Patient Baseline Editor

2. Set the Patient's baseline physiology by modifying the desired parameters
3. Click **Save**

When the SCE begins, the Patient physiology reflects the selected baseline settings.

SCE Configuration

Setting up the Conditions, Medications, and Treatments Quick Links is achieved by clicking the **Runtime Configuration** tab in the SCE Editor.

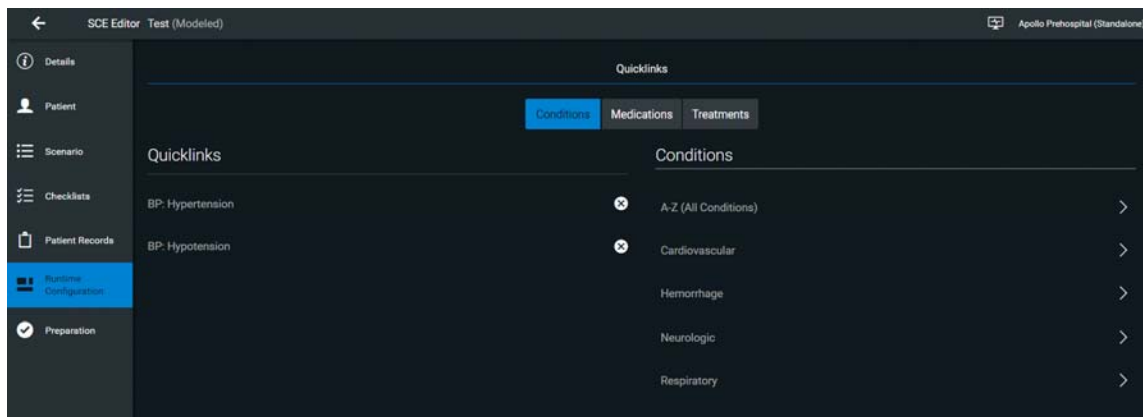


Runtime Configuration

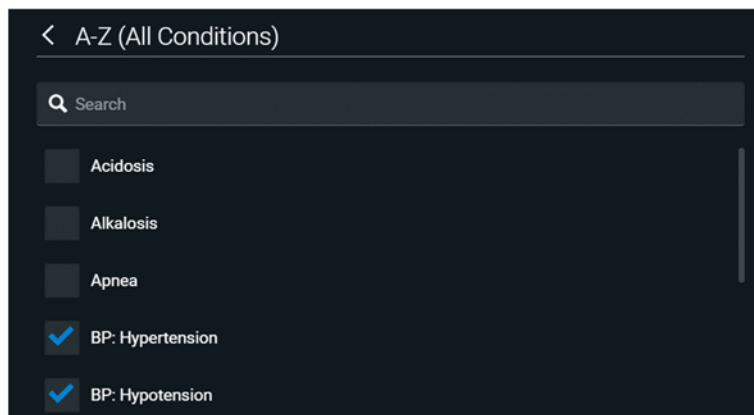
Condition Setup Screen and Creating Quick Links

Click **Runtime Configuration** to access the Condition Setup screen. From the Condition Setup screen, conditions, medications and treatments can be preconfigured for the SCE by creating Quick Links.

On the Condition Setup screen, **Conditions**, **Medications** and **Treatments** buttons are available. To navigate through available conditions, medications, and treatments, click the **Conditions**, **Medications** and **Treatments** buttons.



Condition Setup



Creating a Quick Link

To create a Quick Link, select the desired choice from the Conditions, Medications or Treatments palette.

Click the checkmark sign to remove a Quick Link from the SCE.

Patient Status Display

To configure the Patient Status Display displayed on the Run screen, click the **Patient Status Display** button from the run screen.



Patient Status Display Button

The Patient Status Display screen appears.



Patient Status Display Screen

To modify the Patient Status Display, drag and drop the desired waveform or numeric widgets from the right panel to an available Patient Status Display space on the left.

Note: Waveforms occupy two spaces.

Once the desired widget is placed, click the widget to change the physiologic parameter displayed.

Layouts can be saved to the library by selecting the **Save to Library** button.

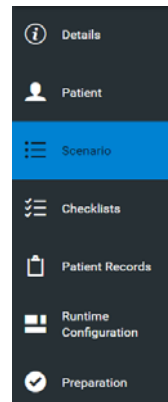
To load a saved layout, select the **Load Saved Layout** button.

Editing a Scenario

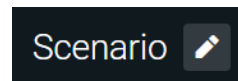
SCEs incorporate scenarios that contain preprogrammed physiology. An SCE scenario can be edited to modify patient physiology. Note that the scenario associated with the SCE begins automatically when the SCE is run.

A scenario can be edited either from the **Scenario Editor** or **Live Scenario Editor**:

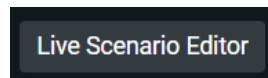
1. From the Review screen of the desired SCE, click the **Scenario** tab



Scenario Tab



Scenario Editor Button



Live Scenario Editor Button

2. The **Scenario Editor** can then be opened by selecting the **Edit** button. Moreover, the **Live Scenario Editor** can be opened by clicking the **Live Scenario Editor** Button.

The **Live Scenario Editor** allows users to edit the scenario while running the simulation.

Developing Scenarios

Both **Scenario Editor** and **Live Scenario Editor** allow users to edit the scenario of an SCE.

Editing a Scenario with Live Scenario Editor

To edit a scenario with **Live Scenario Editor**:

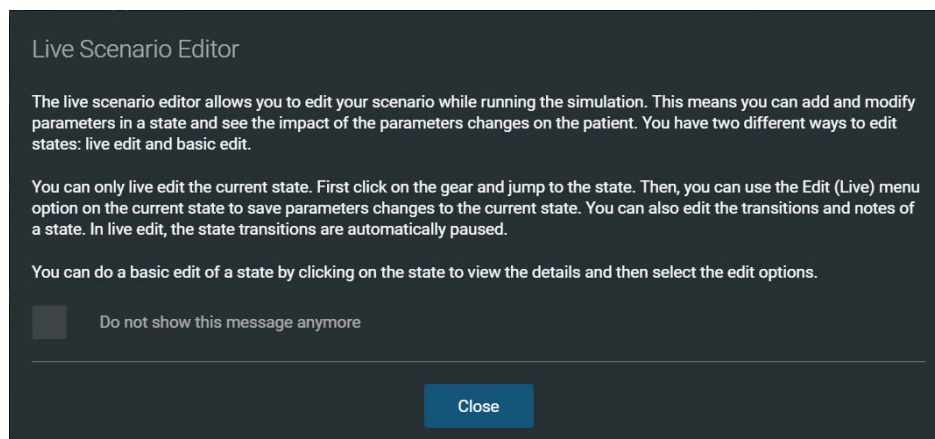
1. Select the desired SCE to edit



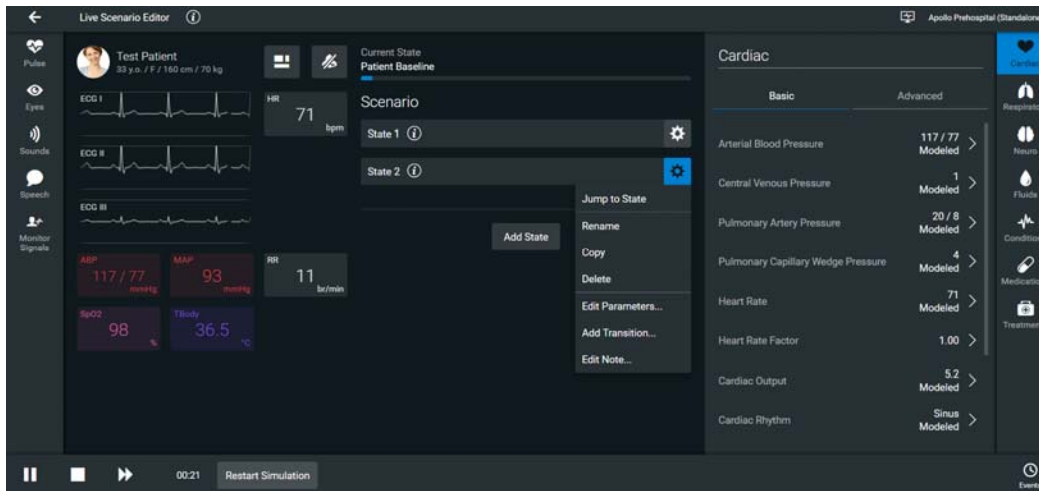
Scenario Tab

2. From the Scenario tab, select **Live Scenario Editor**

From the **Live Scenario Editor**, states can be added, modified, and deleted.

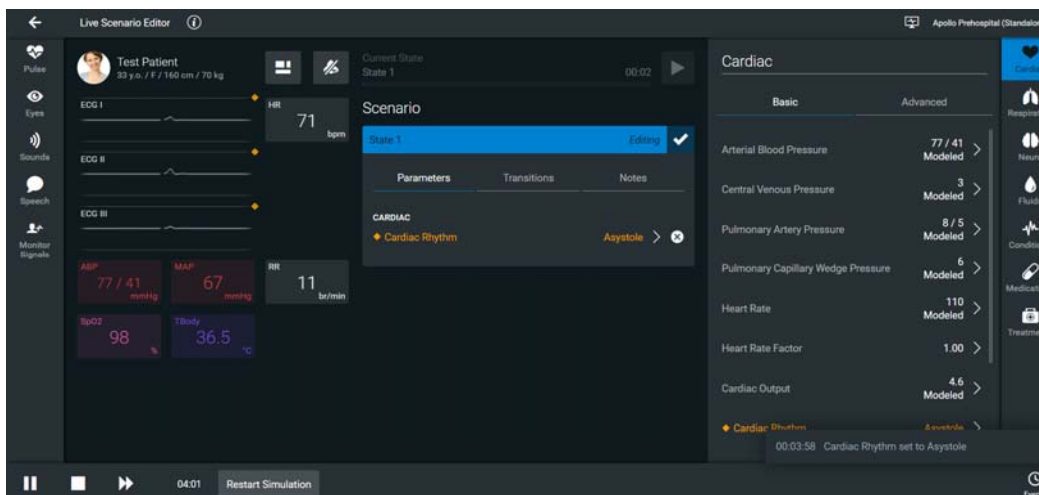


Live Scenario Editor Information



Live Scenario Editor

- The **Add State** button is used to add new states. Once created, states are displayed on the **Live Scenario Editor** canvas.
- The **Restart Simulation** buttons reverts the simulation to the patient baseline.
- Clicking the gear icon on the side of a state offers various options:
 - **Jump to State** option allows users to jump to the desired state. It is then possible to perform a live edit, by selecting the **Edit Live** button. Once completed, parameter changes will be applied to the state. This option allows users to edit state parameters and see the resulting physiological impact on the patient.
 - **Rename** option is used to rename the state.
 - **Copy** option is used to copy the state.
 - **Delete** option is used to delete the state.
 - **Edit Parameters** option is used to edit the state parameters without jumping to the specified state.
 - **Add Transition** option allows transitions to be added from one state to another.
 - **Edit Note** option allows users to add state notes.

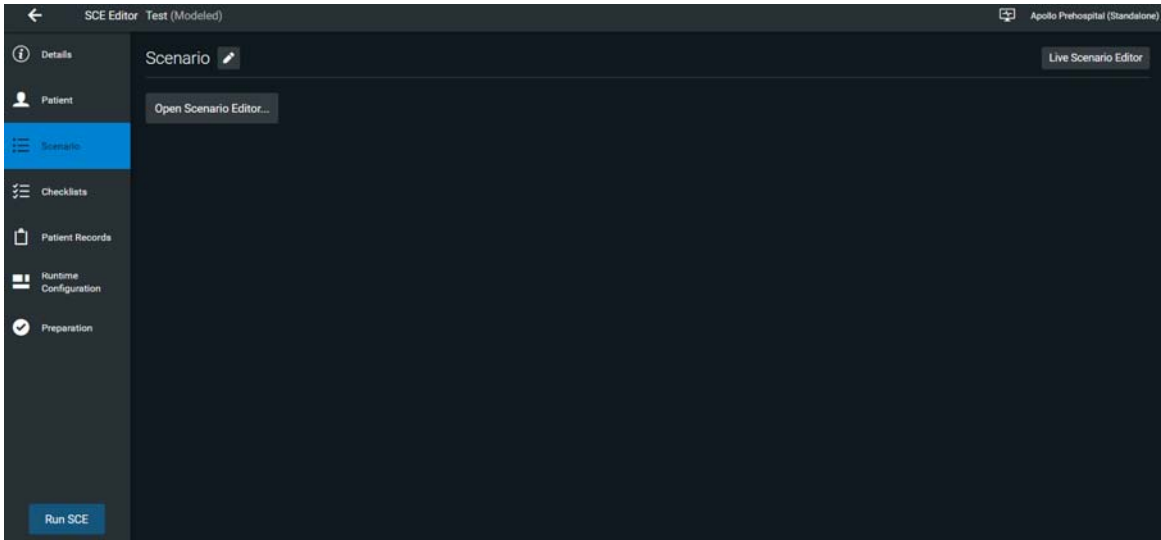


Live Edit

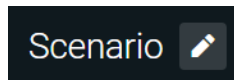
Editing a Scenario with Scenario Editor

To edit a scenario with the Scenario Editor:

- 1. Select the desired SCE to edit

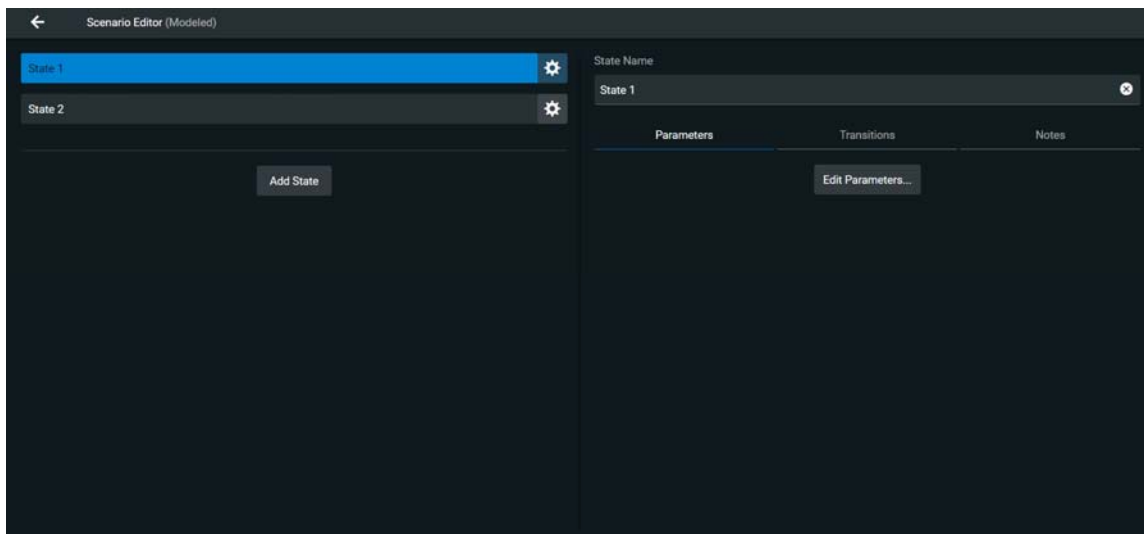


Scenario Tab



Scenario Editor Button

- 2. From the Scenario tab, select the **Edit** button. The **Scenario Editor** appears, displaying the selected scenario.



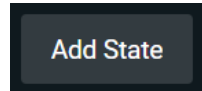
Scenario Editor

- Clicking the gear icon on the side of a state offers various options:
 - **Rename** option is used to rename the state.
 - **Copy** option is used to copy the state.
 - **Delete** option is used to delete the state.
 - **Add Parameters** option is used to edit the state parameters.
 - **Add Transition** option allows transitions to be added from the current state to another state.
 - **Edit Note** option allows users to add state notes.

NOTE: The simulation does not run while editing the state parameters, unlike **Live Scenario Editor**

Adding Scenario States

When beginning to create a new scenario, the canvas is blank. Scenario states can be created by selecting the **Add State** button in both the **Live Scenario Editor** and **Scenario Editor**.

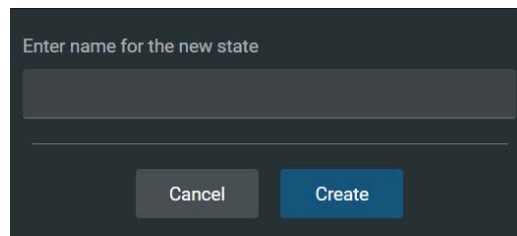


Add State Button

Or, a pre-existing state can be copied by clicking the gear icon and subsequently selecting the **Copy** option.

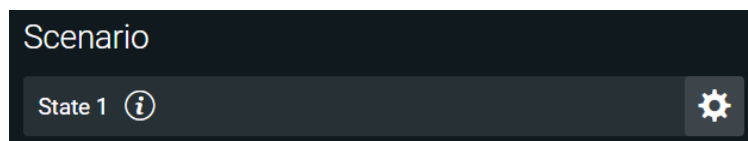
To add a new state using the **Add State** button:

1. Click the **Add State** button in the **Live Scenario Editor** or the **Scenario Editor**.
2. Enter a new name for the state.



Naming the State

3. Click **Create**. The state will appear.



New State

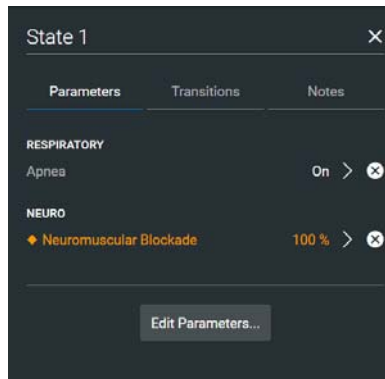
Modifying Scenario States

Once a scenario state has been placed on the canvas, it can be modified. Additional parameters, transitions and notes can be added. Each state can contain multiple parameters and transitions. Click the gear icon and select **Rename** to rename the state.

NOTE: In **Live Scenario Editor**, a state can be expanded by selecting the information icon



Information Icon



Expanded State View

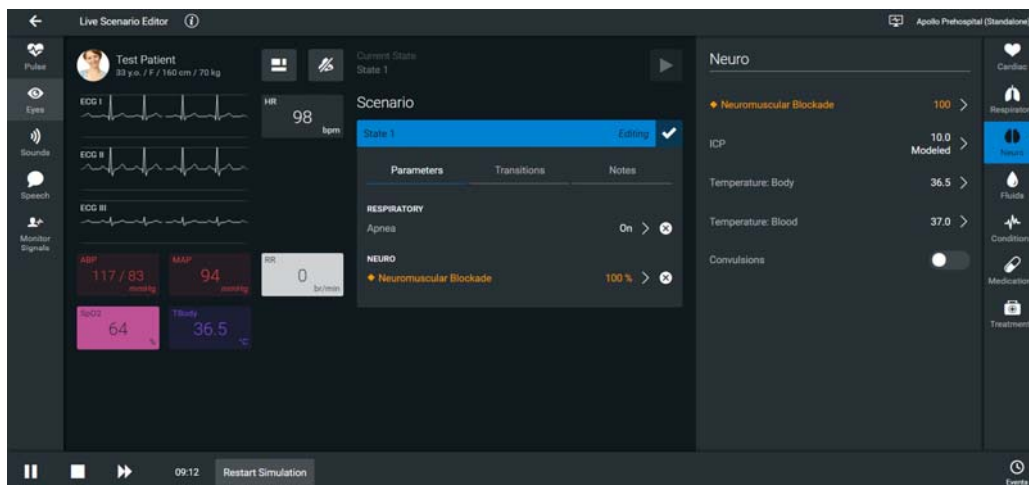
Click the **X** button to minimize the state.

Adding Conditions, Treatments and Parameters

Conditions, treatments, and parameters can be added to states using either the **Live Scenario Editor** or the **Scenario Editor**.

To add conditions, treatments, and parameters with **Live Scenario Editor**:

1. Select **Jump to State** on the state to be modified.
2. Click the gear icon and select **Edit Live** from the list.



Live Edit

3. When in live edit, any modifications made will be added to the state. Once a parameter has been selected, it appears in the State Parameters panel. Add as many parameters as needed. Added parameters appear consecutively within the state. When complete, select the **Return** button to save and exit, or exit without saving.

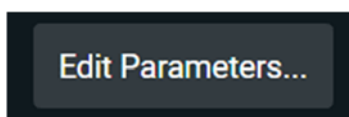
Note: If the physiology of any of the parameters conflicts, the Maestro software reflects the physiology of the last parameter entered.

To add conditions, treatments, and parameters with **Scenario Editor**:

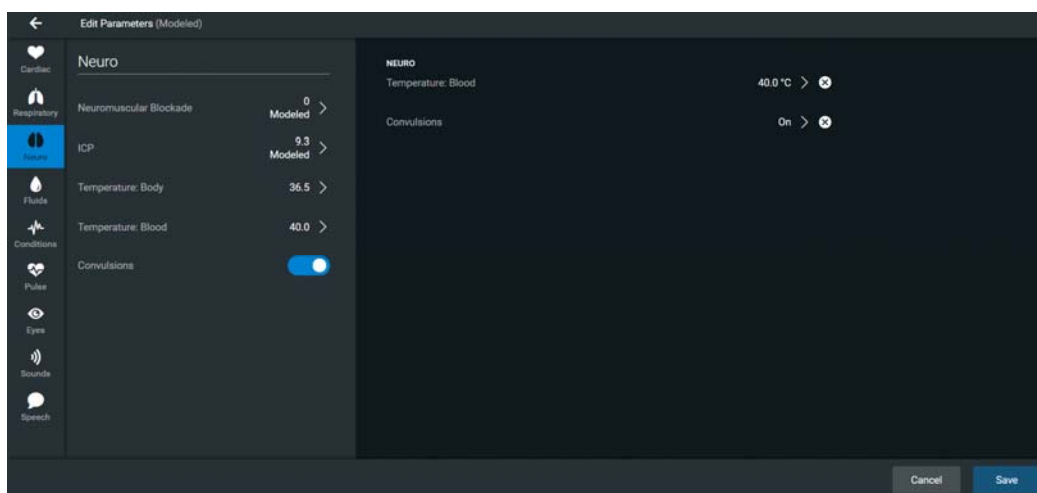
1. Select the desired state to edit.
2. On the right side of the screen, select the **Edit Parameters** button (note that this can also be achieved by clicking the gear icon next to the desired state and selecting **Add Parameters**).



Scenario Editor



Edit Parameters Button



Scenario Editor - Parameters

3. Add parameters from the list on the left side of the screen. Added parameters will appear on the right side of the screen.

NOTE: Parameters can be removed by selecting the **X** button on the right side of the screen.

4. Select **Save** to complete.

Adding Transitions

To add a transition, the scenario must have both an original state and a state that results from the transition. Transitions can be added for both **Live Scenario Editor** and **Scenario Editor**.

To add a transition:

1. Click the gear icon next to the desired state (in either **Live Scenario Editor** or **Scenario Editor**).
2. From the list, select **Add Transition**.

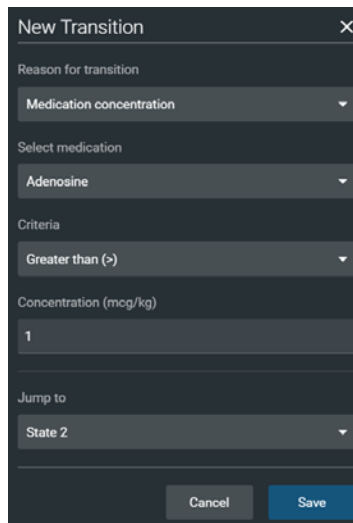


Gear Icon

Add Transition...

Add Transition Option

The Transitions Menu appears, listing all available transition variable types.



Transition Menu

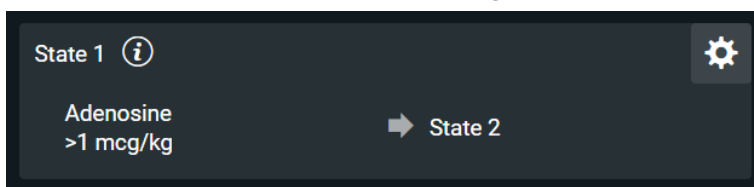
3. Select the desired variable type. For example, if a transition based on the administration of medication is desired, select **Medications** and then select the desired medication from the list.

Once a medication is selected, enter the criteria, transition value, and the state that results from the transition.

Follow the same steps to make selections from similar menus for the **Treatment, Assessment, Vitals, Medication concentration, Fluids, Time in Scenario, Time in State** variable types.

4. Once the variable values (e.g., criteria, transition value, and the state that results from the transition) have been selected, click **Save**.

The selected transition variable is listed beneath the original state.



Added Transition

Deleting Scenario States

To delete a state, in either **Live Scenario Editor** or **Scenario Editor**, click the gear icon, and select **Delete**.



Gear Icon

Delete

Delete Option

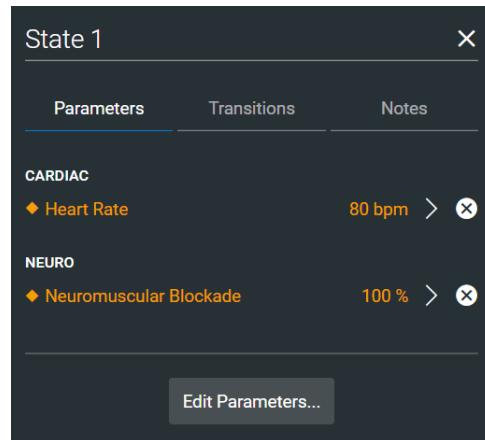
Deleting Parameters and Transitions

To delete a parameter in **Live Scenario Editor**:

1. Click the information icon to expand the state, and select the **Parameters** tab.
2. Select the **X** icon next to the parameter to be deleted.



Information Icon



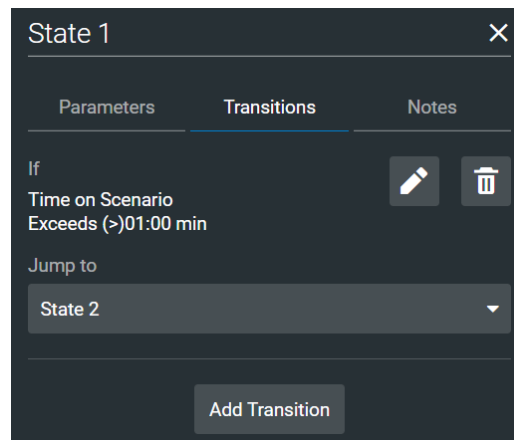
Parameters Tab



X Icon

To delete a transition in **Live Scenario Editor**:

1. Click the information icon to expand the state, and select the **Transitions** tab.
2. Select the **Trash** icon next to the transition to be deleted.



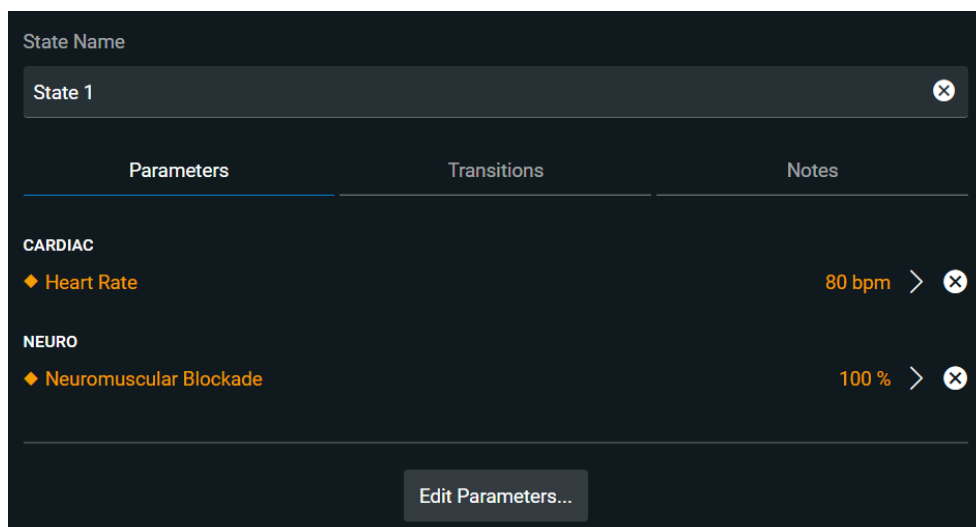
Transitions Tab



Trash Icon

To delete a parameter in **Scenario Editor**:

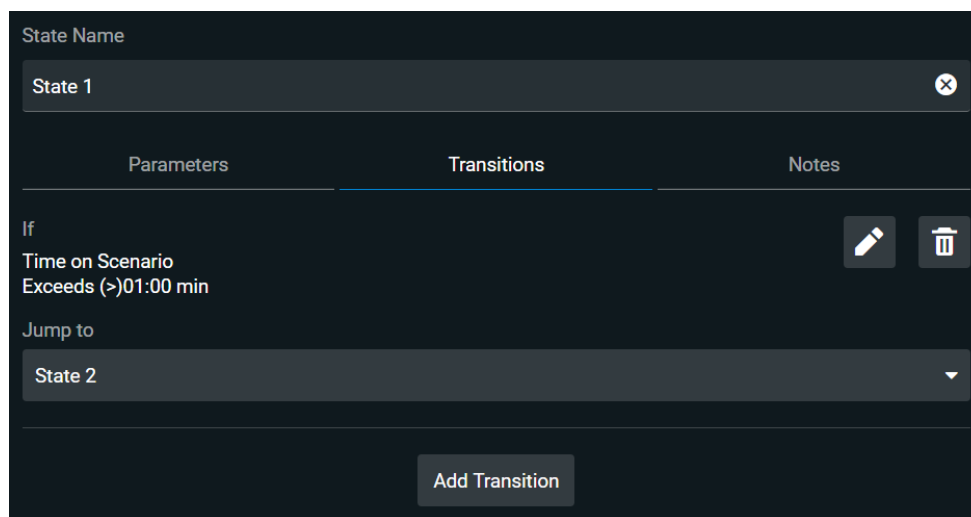
1. Select the appropriate state.
2. In the **Parameters** tab, select the **X** icon next to the parameter to be deleted.



Parameters Tab

To delete a transition in **Scenario Editor**:

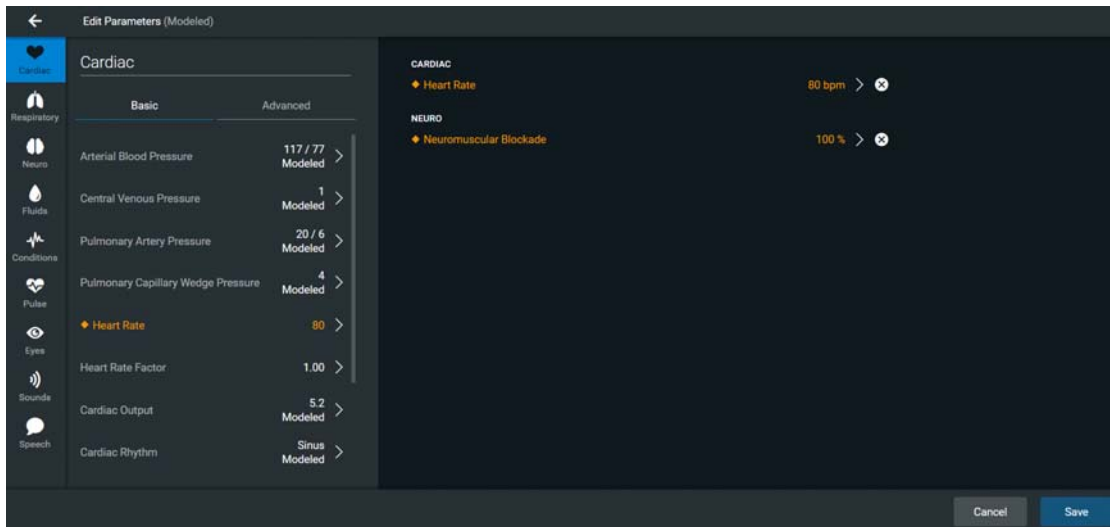
1. Select the appropriate state.
2. In the **Transitions** tab, select the **Trash** icon next to the transition to be deleted.



Transitions Tab

Saving the Scenario

When editing state parameters, transitions, or notes in **Scenario Editor**, the modifications can be saved to the state by selecting the **Save** button in the bottom right corner of the screen.



Scenario Editor - Parameters

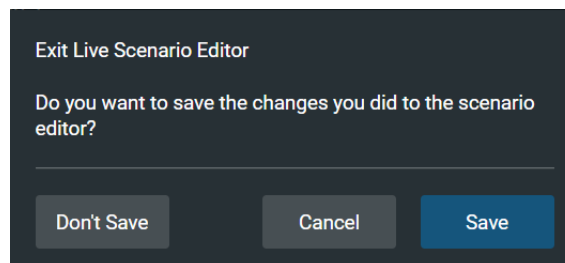


Save Button

When in **Live Scenario Editor**, the **Return** button will prompt the user to save all modifications made to the scenario.



Return Button



Save Scenario

ADMINISTRATIVE TOOLS

The Maestro software has administrative tools that allow users to access system settings, preferences, and additional information. The administrative tools are accessed via the gear icon, located on the top right corner of the Home page.



Gear Icon



- System
- Select Simulator
- Language
- User Guide
- Support
- About

Administrative Tools

- Select **System** to access information about the Maestro software version, the type of simulator, along with **Preferences, License Manager** and **Maintenance**.
- Select **Language** to change the Maestro language.
- Select **About** to access information about the Maestro software version, the type of simulator and the serial number.
- Select **User Guide** to download the user guide (English version). To access the User Guide in other languages, please visit www.caehealthcare.com and click the **Support** link.
- Select **Support** for CAE Support contact information.
- Select **Select Simulator** (only when using Maestro Standalone) to change the simulator (Apollo Prehospital, Apollo Nursing).

History

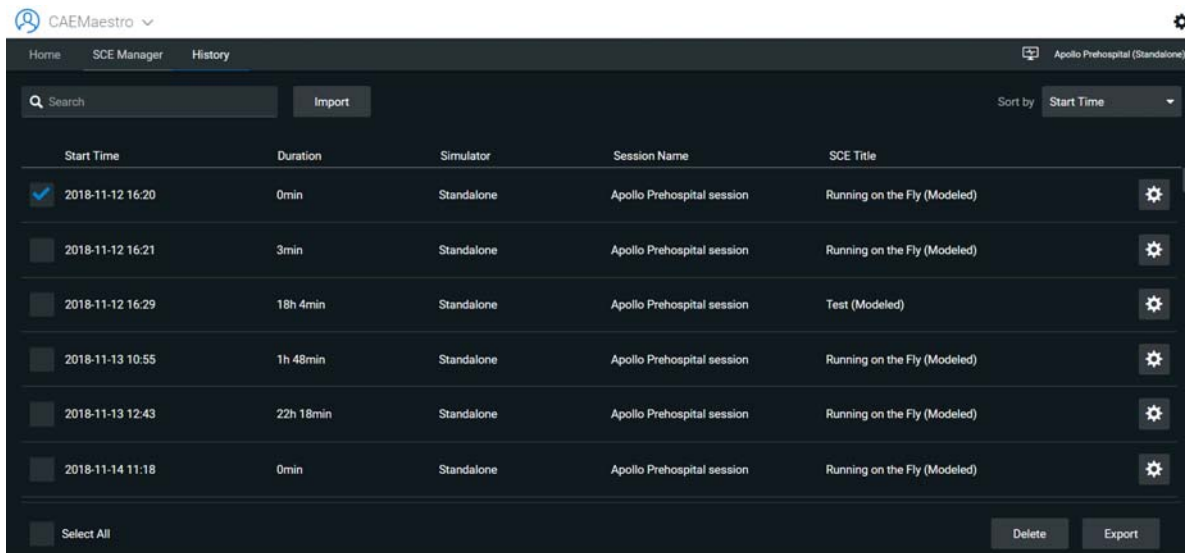
The History screen can be accessed from the upper left corner of the home page.

CAEMaestro ▼

Home SCE Manager History

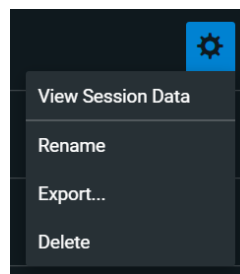
History Tab

From the History screen, users can view and export simulation session logs. Each simulation session is listed with the Start Time, Duration, Simulator, Session Name, and SCE Title. Moreover, each session log consists of CPR data, Physiological Data, and Event Log data.



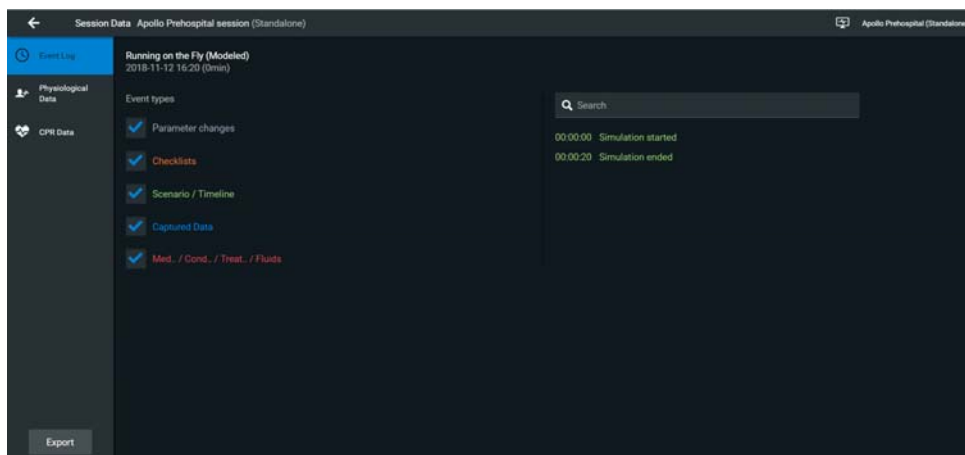
Start Time	Duration	Simulator	Session Name	SCE Title
<input checked="" type="checkbox"/> 2018-11-12 16:20	0min	Standalone	Apollo Prehospital session	Running on the Fly (Modeled)
<input type="checkbox"/> 2018-11-12 16:21	3min	Standalone	Apollo Prehospital session	Running on the Fly (Modeled)
<input type="checkbox"/> 2018-11-12 16:29	18h 4min	Standalone	Apollo Prehospital session	Test (Modeled)
<input type="checkbox"/> 2018-11-13 10:55	1h 48min	Standalone	Apollo Prehospital session	Running on the Fly (Modeled)
<input type="checkbox"/> 2018-11-13 12:43	22h 18min	Standalone	Apollo Prehospital session	Running on the Fly (Modeled)
<input type="checkbox"/> 2018-11-14 11:18	0min	Standalone	Apollo Prehospital session	Running on the Fly (Modeled)

History Screen



History Log Options

By clicking the gear icon of a simulation session and selecting **View Session Data**, users can view the **Event Log, Physiological Data, and CPR Data**.



Event Log

Time	HR	SBP	DBP	MAP	RR	VT	SpO2	TBody	CVP	PAS
00:00:00	71	116.15	76.12	91.26	10.7	441	98.1	36.50	1.74	20.15
00:00:05	72	117.85	77.73	93.24	10.7	434	98.1	36.50	1.31	19.84
00:00:10	72	116.87	76.52	91.78	10.7	459	98.1	36.50	0.93	20.31
00:00:15	72	116.68	77.27	92.77	10.8	473	98.1	36.50	0.97	19.95

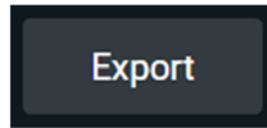
Physiological Data

Time	CCR	CCD	CCDMax	CCDv	CCF	Hands	Recoll	Vvol	IEr	SBP

CPR Data

When the **Physiological Data** of a simulation session is clicked, users can view all the physiological data that occurred during the SCE.

On the **Event Log**, **Physiological Data**, and **CPR Data** screens, there is an **Export** button that, when clicked, exports the data to a CSV file or MSS file (session file in Maestro format) that can be stored on an external device. The Export button can also be used from the History screen, where the desired simulation sessions can be selected for export.



Export Button

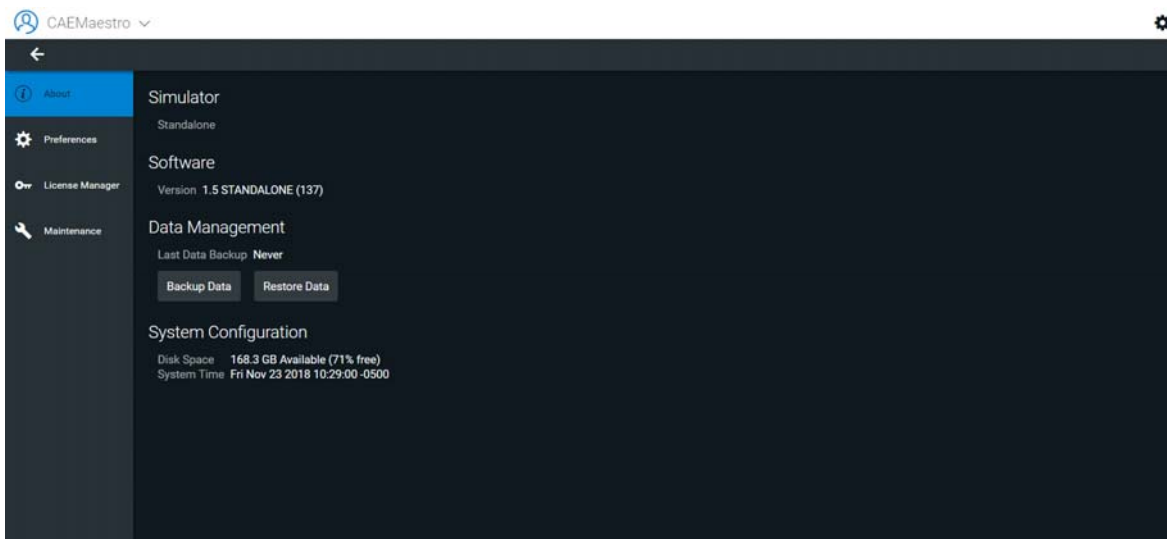


Selected Session from History Screen

System Administration

From the System Administration screen, users can access **System** information, **Preferences**, the **License Manager**, and **Maintenance** information.

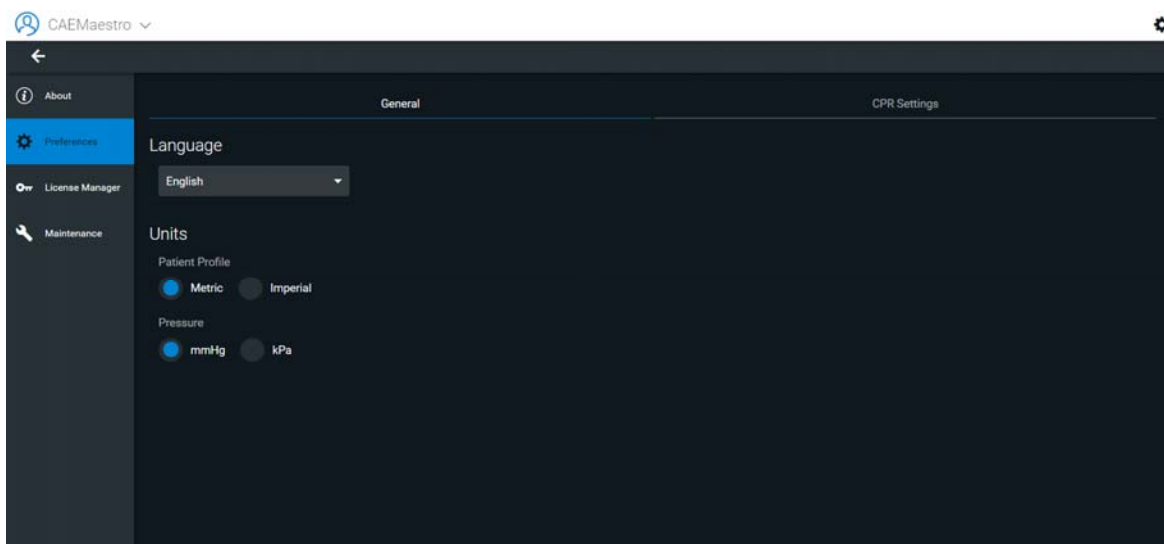
To access the System Administration screen, from the Home page, click the gear icon and select **System**.



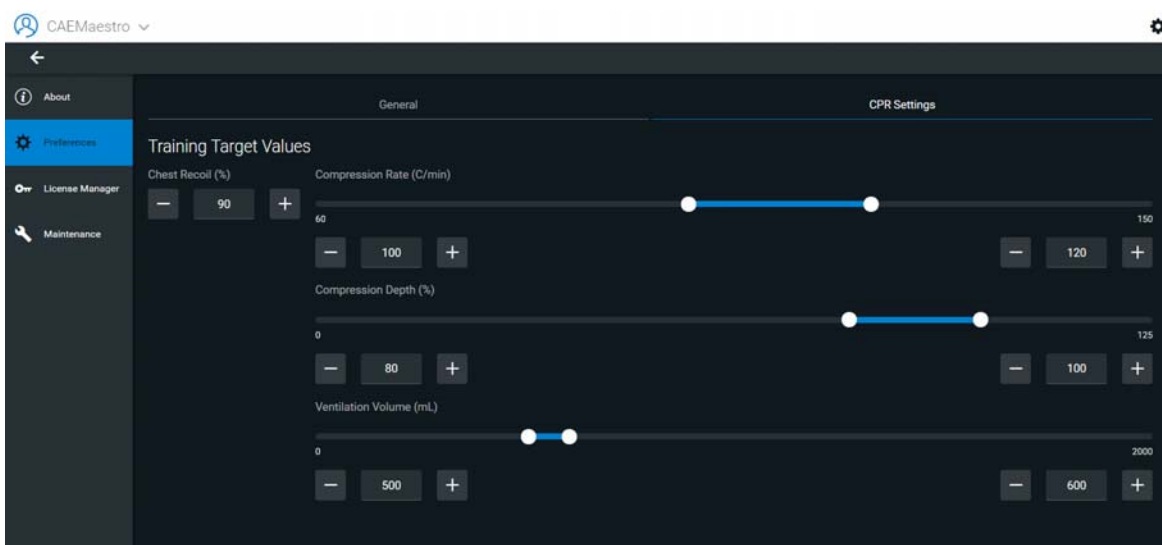
System Administration

- Select **About** to access **Simulator** type, **Software** version, **Data Management**, and **System Configuration**.
 - Under **Data Management**, it is possible to backup and restore data through the **Backup Data** and **Restore Data** buttons respectively.

- Select **Preferences** to adjust **Language**, **Units**, and **CPR Settings**.
- Select **License Manager** to access license information.
- Select **Maintenance** to access maintenance options, including **Simulator Configuration** and **Connected Devices**.



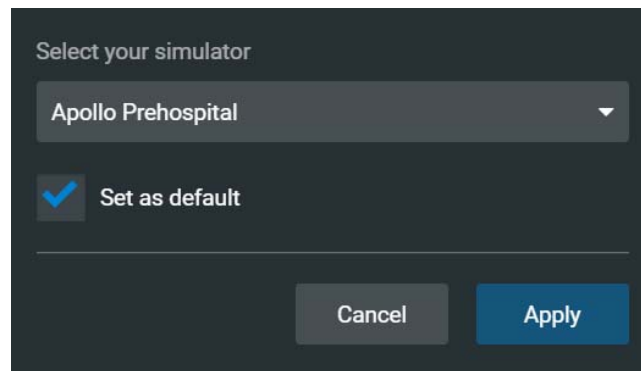
General Preferences



CPR Settings

Select Simulator

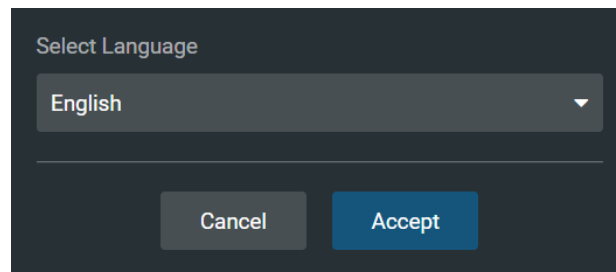
If using Maestro Standalone software, the simulator type can be selected. To change the simulator type, from the Home page, select the gear icon and click **Select Simulator**.



Select Simulator

Language

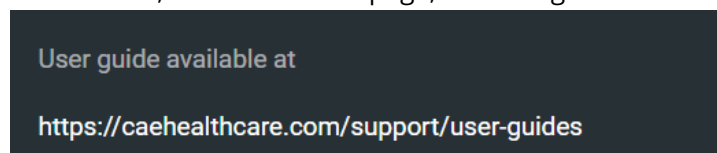
To access the Language screen, from the Home page, click the gear icon and select **Language**.



Select Language

User Guide

To access user guide information, from the Home page, click the gear icon and select **User Guide**.



User Guide

Support

To access support information, from the Home page, click the gear icon and select **Support**.

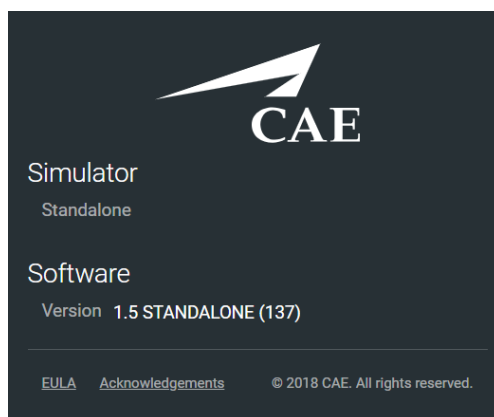
For support please go to

<https://caehealthcare.com/support>

User Guide

About

To access information regarding simulator type and software version, from the Home page, click the gear icon and select **About**.



About Screen

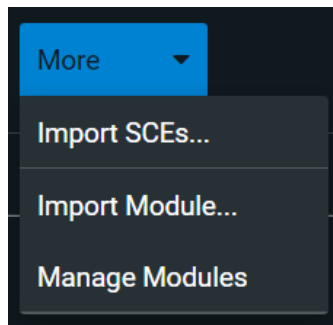
Learning Modules

From the **SCE Manager** panel, learning modules can be installed or deleted. In addition, new learning modules can be created.

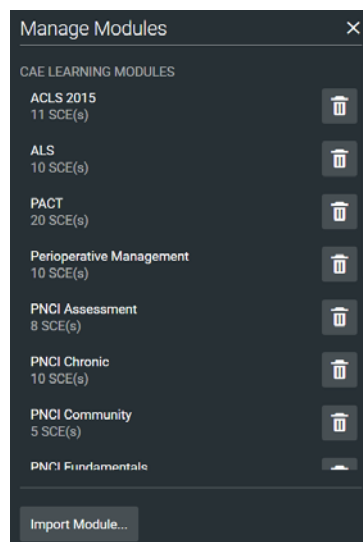
Learning modules can be accessed from the **CAE Learning Modules** tab along with the **User-created Modules** tab.

To install a learning module:

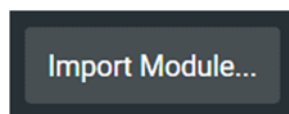
1. Click **More**.
2. Click **Manage Modules**.
3. On the bottom left of the screen, select the **Import Module** button.
4. Locate the correct learning module file on the external storage device or the hard drive location where the learning module is saved. The file extension is **mlm**.
5. Select the file and click **Open**.



More Button



Manage Modules



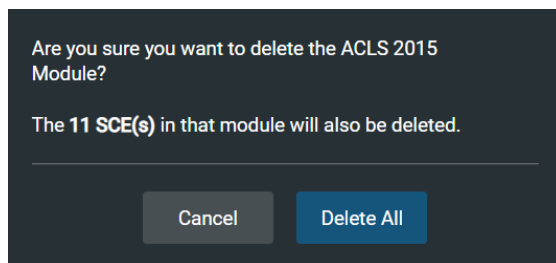
Import Module Button

To delete a learning module from Maestro:

1. Click **More**.
2. Click **Manage Modules**.
3. Click the **Trash** icon next to the learning module to be deleted.
4. Select **Delete All** to confirm the deletion.



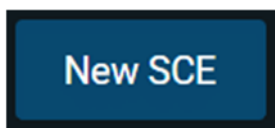
Trash Icon



Learning Module Deletion

To create a new learning module in Maestro:

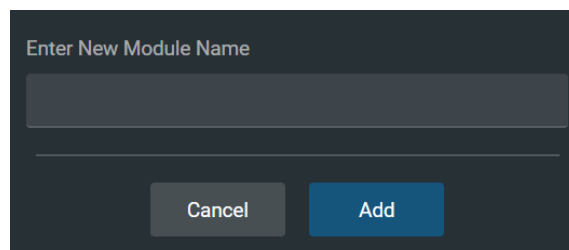
1. Click **New SCE** button.
2. Click the **+** icon in the Select Module field.
3. Enter a name for the module and confirm by selecting the **Add** button.



New SCE Button



Select Module Field



New Module

SCEs

From the **SCE Manager** panel, SCEs are organized into the following categories:

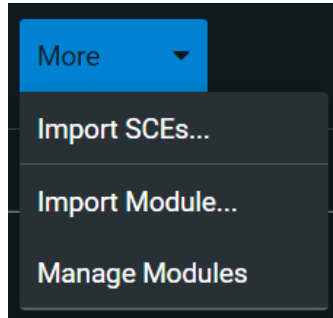
Recently Used, Favorites, All, Preconfigured SCEs, User-created SCEs, CAE Learning Modules, and User-created Modules.

In the **SCE Manager**, users can review, copy, delete, import and export the SCEs they have created.

Note: SCEs purchased from CAE CANNOT be exported.

To import an SCE:

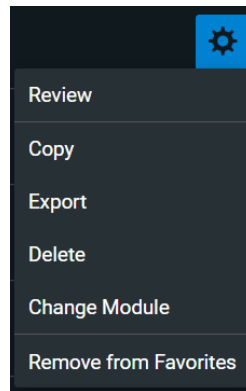
1. In the **SCE Manager**, click the **More** button.
2. Click **Import SCEs** to import an SCE from an external device or the hard drive location where the SCE file is saved. The SCE file extension is **msce**.



More Button

To export an SCE:

1. In the **SCE Manager**, click the gear icon next to the desired SCE.
2. Click **Export** to export an SCE to an external device. The SCE file extension is **msce**.

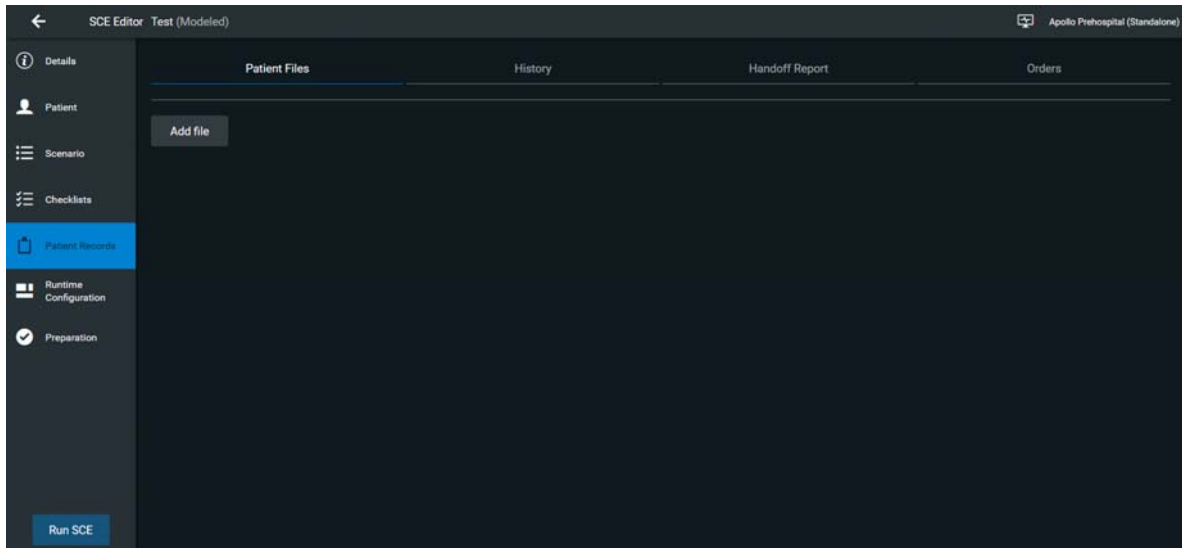


SCE Options

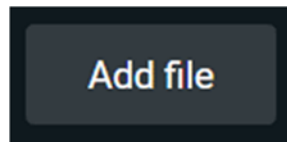
Patient Records

Patient records can be uploaded to Maestro for display in the TouchPro software. Once uploaded, a patient record is available for use with the SCE.

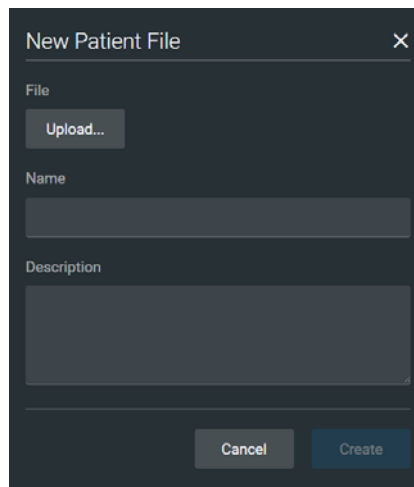
Patient Records are managed from the **Patient Records** panel in the **SCE Editor**.



Patient Records Panel



Add File Button



Patient Record Upload

The following patient record file types can be uploaded to Maestro:

- JPG or JPEG images
- GIF images
- PNG images

- XPS images
- PDF documents
- MPEG videos
- MOV videos
- MP3 audio files

A single patient record file cannot exceed 20MB.

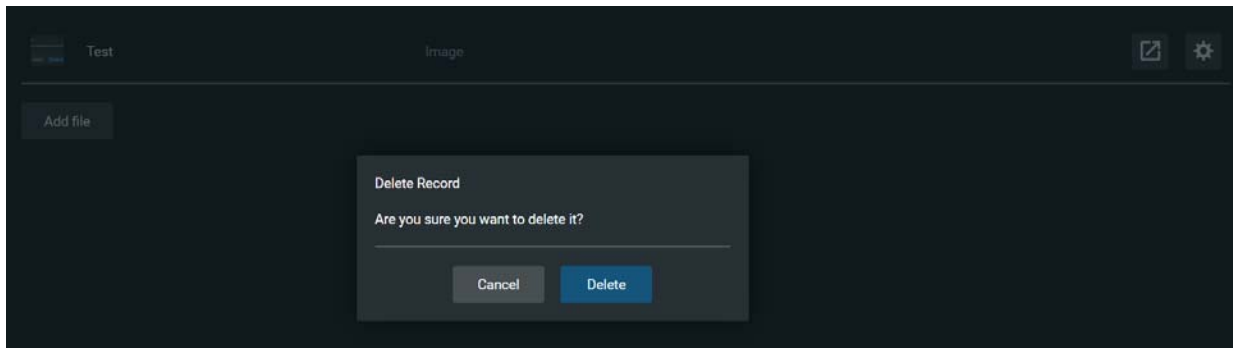
To upload a patient record:

1. Open the **SCE Editor** for the desired SCE.
2. From **Patient Records** panel, click **Add File**.
3. Click **Upload**.
4. Select the desired file and click **Open**.

Maestro can store up to 100GB of patient record files. To ensure adequate space, please delete patient records when they are no longer needed.

To delete a patient record:

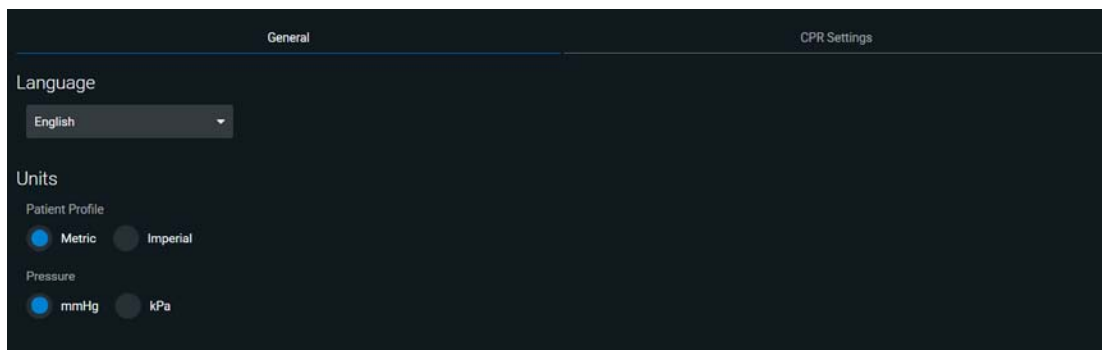
1. From the Patient Records panel, click the gear icon next to a patient record.
2. Click **Delete**.



Deleting a Patient Record

Preferences

To access **Preferences**, from the Home screen, click the gear icon and select **System**. Once this screen is open, select the **Preferences** panel.

**General Preferences**

Acceptable limits for key CPR parameters can be set from the System Settings panel.

**CPR Settings**

TIP: Height and weight can be set to display in Metric or Imperial units.

System Configuration

Under System Configuration, Disk Space and System Time are displayed.

To access **System Configuration**, from the Home screen, click the gear icon and select **System**. Once this screen is open, select the **About** panel.

Data Management

The Data Management feature allows users to back up data to an external device. Users can also restore the backup data.

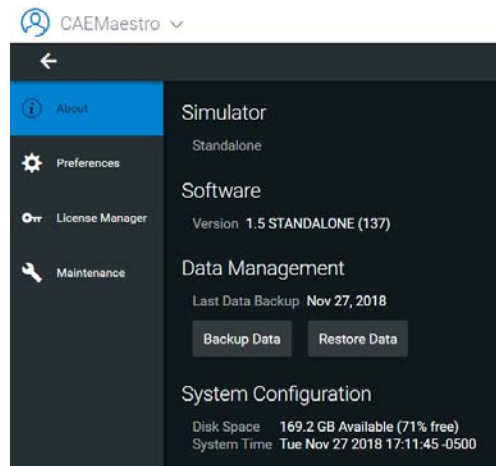
To access **System Configuration**, from the Home screen, click the gear icon and select **System**. Once this screen is open, select the **About** panel. The **Backup Data** and **Restore Data** buttons appear under the **Data Management** header.

Backing Up Data

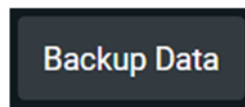
Users should back up data frequently to protect and store content and user data.

To back up data:

1. Click the **Backup Data** button in the **About** panel.



About Panel



Backup Data Button

2. Select a location to save the backed-up data.
3. Click **Save**.

IMPORTANT: *Always back up important content and data. A weekly backup should be done to protect content and user information.*

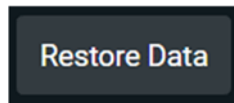
Restoring Data

IMPORTANT: Restoring data ERASES all current data and replaces it with the backed-up data.

Users can restore data when the backed-up data needs to be replaced on the software. Restoring data only restores the last backup and does NOT merge the backup data with the current data.

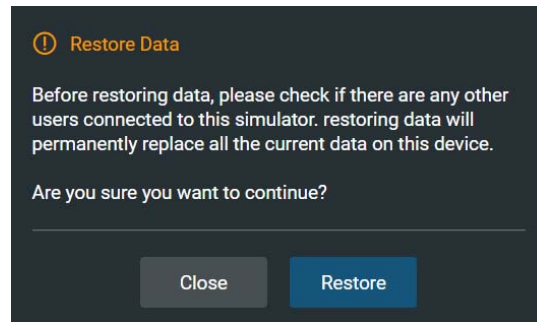
To restore backup data:

1. In the **About** panel, click **Restore Data**.



Restore Data Button

The System Restore warning box appears stating that restoring data erases all current data and asks if you want to continue.



Restore Data Warning

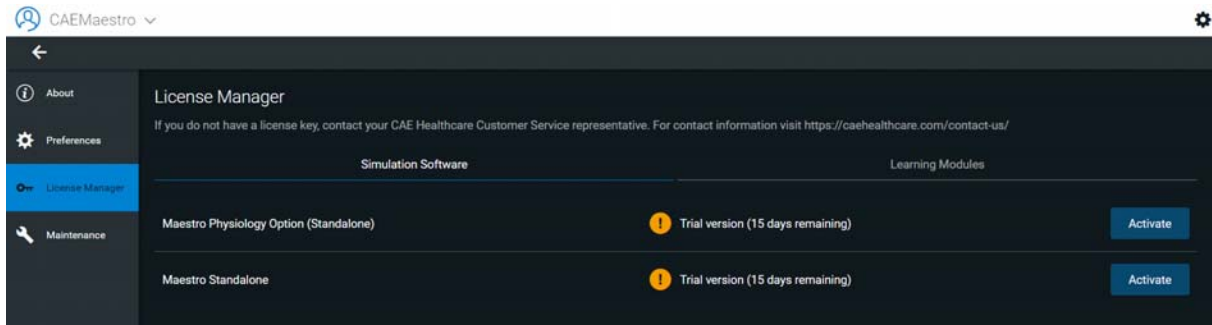
IMPORTANT: Restoring data ERASES all current data and replaces it with the backed-up data.

2. Click **Restore**.
3. Locate the appropriate .mbk backup file to restore.
4. Click Select. The data is restored.

Note: The computer may require a restart.

Product Licensing

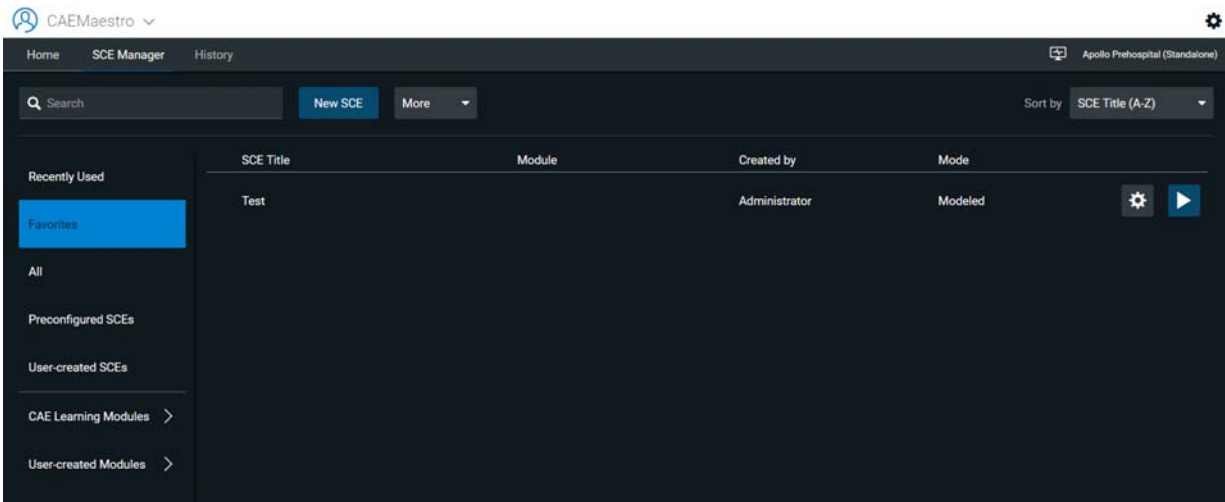
To view product licensing information for your simulator or to enter a license key to activate your software, click the gear icon from the Home page, and select **System**. The **License Manager** can subsequently be selected in the left side of the screen.



License Manager

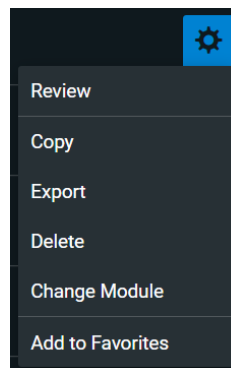
Favorite SCEs

To access the Favorite SCEs panel, click **Favorites** from the **SCE Manager** panel. All of the favorite SCEs appear in the **Favorites** panel.



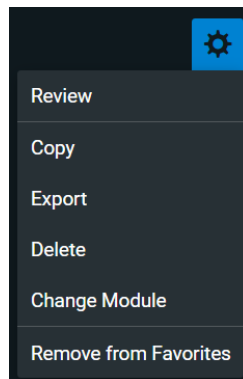
Favorites

To add SCEs to the **Favorites** panel, click the gear icon next to the desired SCE, and select **Add to Favorites**. The SCE will now appear in the **Favorites** tab.



SCE Options – Add to Favorites

To remove SCEs from the **Favorites** tab, click the gear icon next to the desired SCE, and select **Remove from Favorites**. The SCE will now no longer appear in the **Favorites** tab.



SCE Options – Remove from Favorites

USING THE TOUCHPRO PATIENT MONITOR

In this section, you will learn how to use the TouchPro software, which enables users to view the patient's physiology, expressed in waveforms and numeric values.

The TouchPro Patient Monitor software enables users to view patient physiology.

The software can be used from the Instructor Workstation or on another computer provided the computer has joined the simulator's wireless network.

IMPORTANT: *Only one TouchPro software screens can be open at a time.*

Accessing the TouchPro Patient Monitor Software

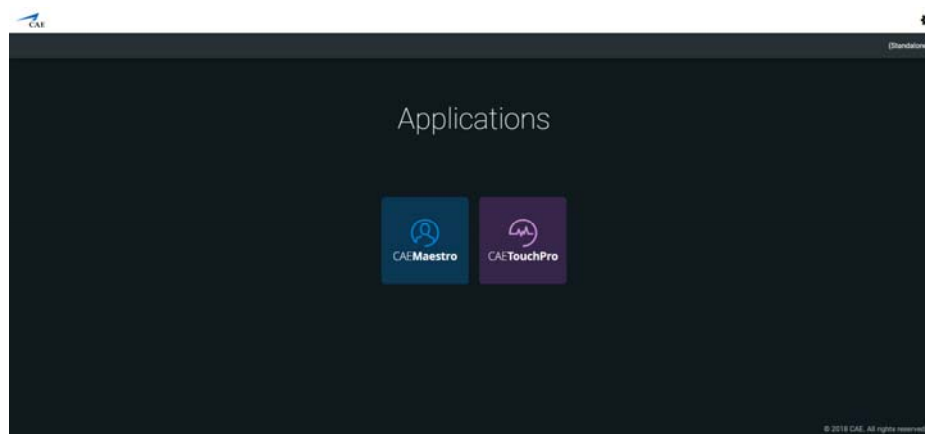
Like the Maestro software, the TouchPro Patient Monitor software is compatible with computers that have touch-screen capabilities.

To run the TouchPro Patient Monitor software, the Instructor Workstation must be connected to the simulator's network.

IMPORTANT: *An SCE must be running on the Maestro software for any physiological data to be displayed on the TouchPro Patient Monitor software. The TouchPro Patient Monitor software can only show one Patient at a time.*

To launch TouchPro Patient Monitor from the Instructor Workstation:

1. With the Maestro software running, open a new tab in the web browser and go to the **Home** page of the web browser



Maestro Start Screen

2. Select the **TouchPro** icon

When TouchPro Patient Monitor software launches, the simulated patient monitor appears.



TouchPro Screen

Modifying the TouchPro Patient Monitor Display

The layout of the waveforms and numeric data shown on the software can be customized. The software can show up to six waveforms plus an additional four numeric readouts.

Selecting a Preconfigured Layout

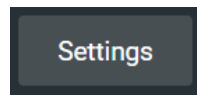
There are five preconfigured CAE Layouts:

- **ICU-Arterial Line Only** - preconfigured with waveform and numeric readouts for ECG Lead II, ECG Lead V, ABP, Pleth, and a numeric readout for Body Temperature

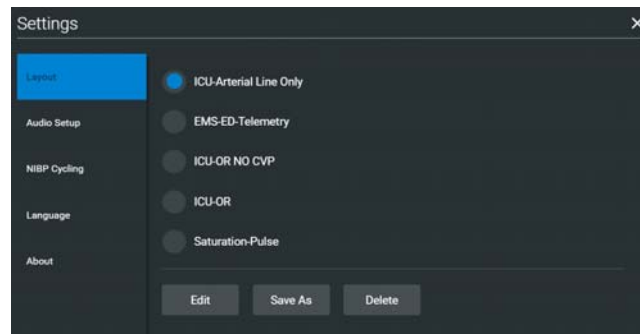
- **EMS-ED-Telemetry** - preconfigured with a waveform and numeric readout for ECG Lead II and numeric readouts for SpO₂, and NIBP (noninvasive blood pressure)
- **ICU-OR No CVP** - preconfigured with waveform and numeric readouts for ECG Lead II, ECG Lead V, ABP, PAP and Pleth, and numeric readouts for NIBP, Blood Temperature, and Body Temperature
- **ICU-OR** - preconfigured with waveform and numeric readouts for ECG Lead II, ECG Lead V, ABP, PAP, CVP and Pleth, and numeric readouts for NIBP, Blood Temperature, and Body Temperature
- **Saturation-Pulse** - preconfigured with numeric readouts for SpO₂ and pulse

To select a preconfigured layout:

1. Click the **Settings** button in the bottom right corner of the display



Settings Button



Layout Tab

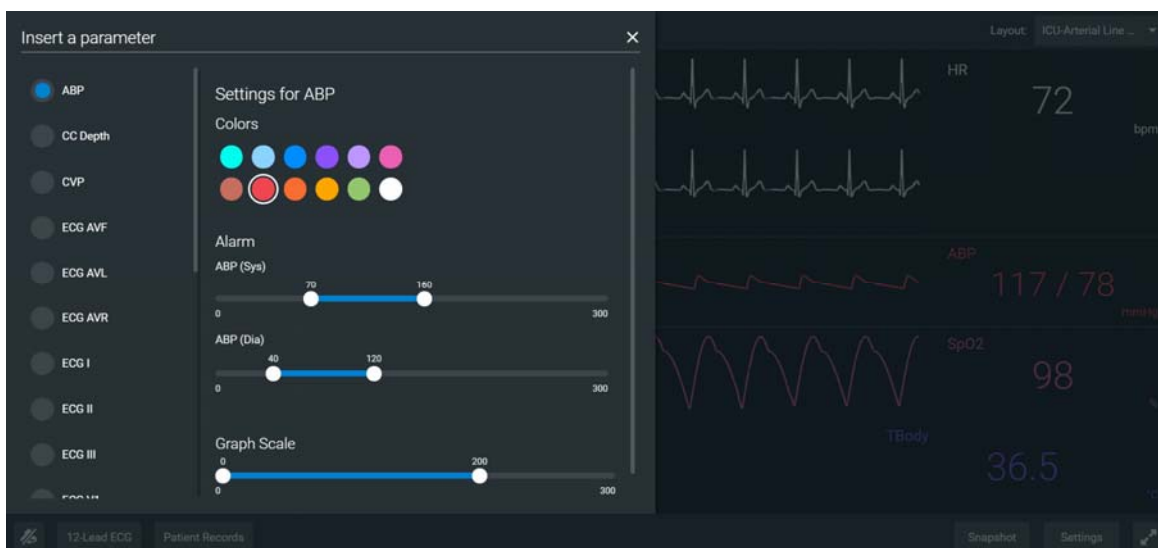
2. Select a layout from the **Layouts** panel
3. Click the **X** button

Changing a Waveform or Numeric Display

Waveforms and numeric displays can be changed to suit the user's needs.

To change a waveform or numeric display:

1. Click the waveform or numeric to be changed.



Waveform Options

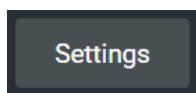
2. Select the desired waveform or numeric
NOTE: The bottom row of the TouchPro screen is used for numeric readouts. A total of four numeric values can be shown.
3. Use the Wave Vital Selection menu to set the alarm, color and scale can be set for the waveform using the **Alarm**, **Colors** and **Graph Scale** sections
4. Use the Numeric Vital Selection (bottom of screen) menu to set the color and alarm for the numeric using the **Alarm** and **Colors** sections

Adding a Waveform

The TouchPro software supports up to six waveforms.

To add a waveform:

1. Click the **Settings** button in the bottom right corner of the TouchPro display

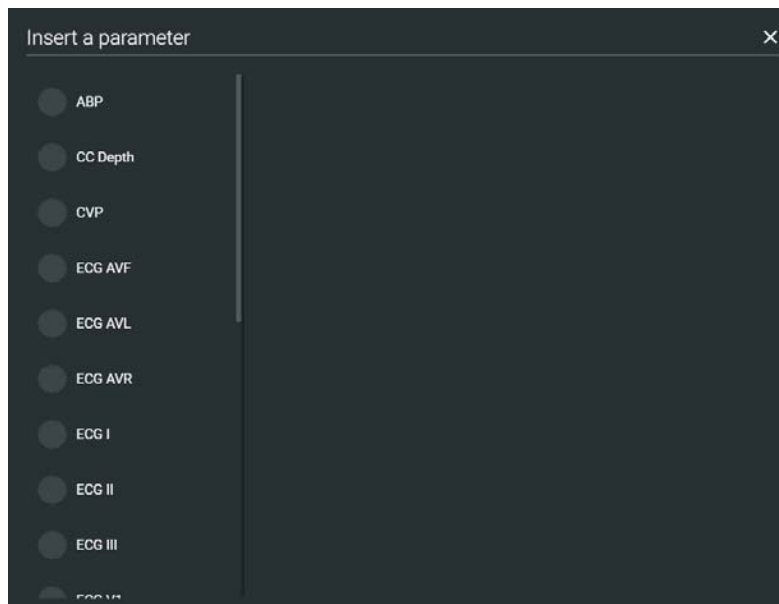


Settings Button



Adding a Waveform

2. Select **Edit**
3. Click the **Add Waveform (+)** button in the location above where you want the empty waveform to appear
4. Click the empty waveform field



Wave Selection Menu

5. Select the desired waveform from the Wave Vital Selection menu
6. Select **Done**

Adding a Numeric Display

The TouchPro software contains four numeric display fields. All four numeric display fields are located on one row beneath the waveform displays.

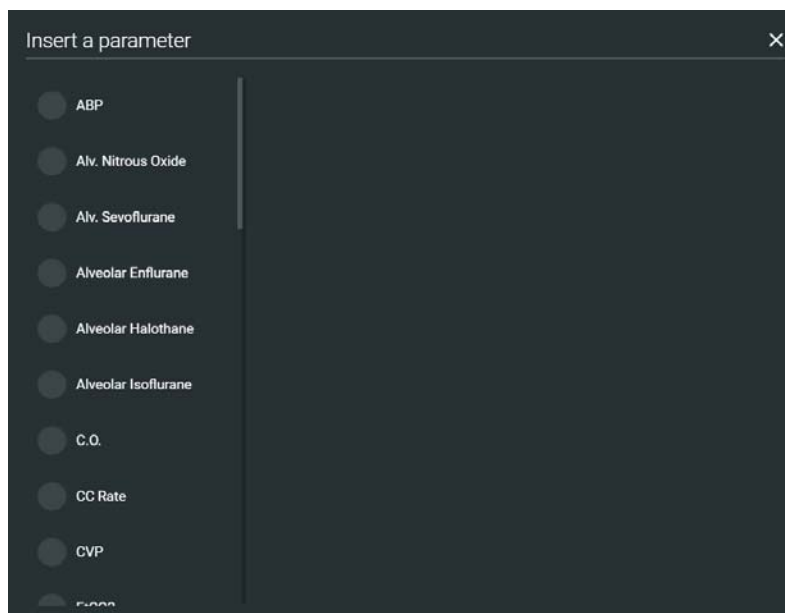
When fewer than four numeric readouts are being displayed, the remaining fields are blank.

To add or change a numeric display field:

1. Click an existing or a blank numeric display field



TouchPro Screen with Empty Numeric Readouts



Numeric Selection Menu

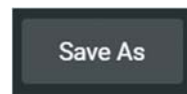
2. Select the desired numeric (scroll for all listings)

Saving a Layout

Once a layout has been configured, it can be saved and reused.

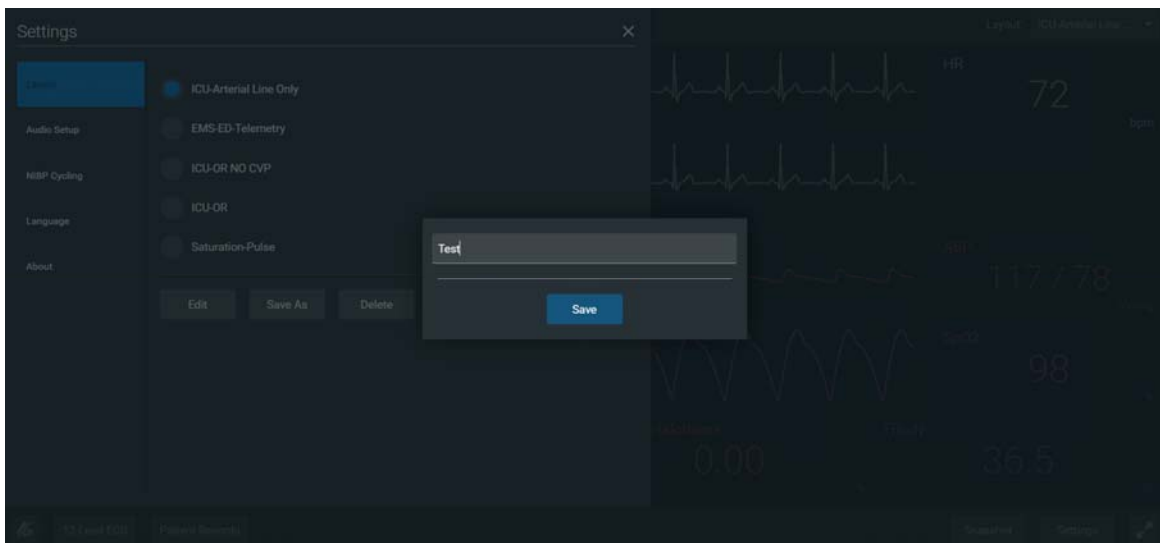
To save a layout:

1. Ensure the desired waveforms and numerics are in place
2. Click **Settings**
3. Click **Save As**



Save As Button

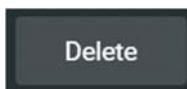
4. In the Save Layout window, enter a name for the layout



Save Layout Window

5. Click **Save**
6. Click the **X** button to exit the Settings menu

Saved layouts can be deleted from the Settings menu by selecting the **Delete** button.



Delete Button

Sounds

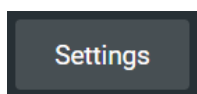
All sounds can be silenced by clicking the **Mute** button in the bottom left corner of the TouchPro display.



Mute Button

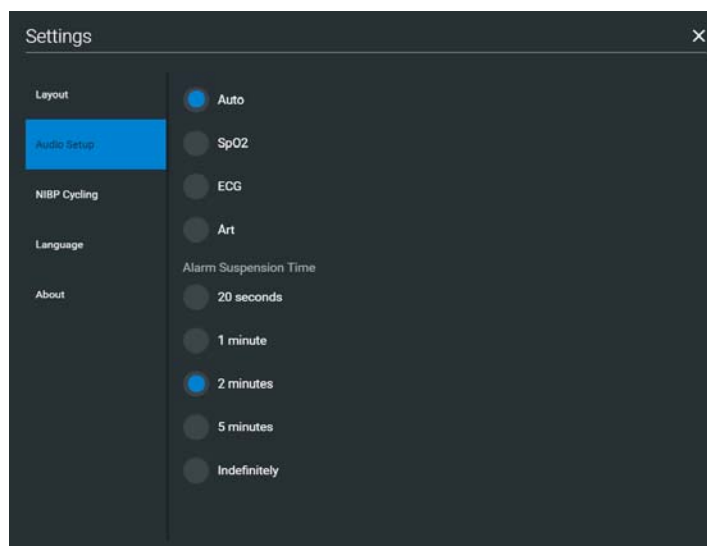
To set up the audio for the TouchPro:

1. Click the **Settings** button in the bottom right corner of the TouchPro display



Settings Button

2. From the Settings menu, click **Audio Setup**

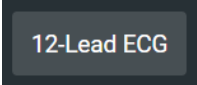


Audio Setup Window

3. From the Audio Setup window, select a waveform to set it as the pulse sound.
4. Click the **Mute** button from the Audio Setup window to mute all alarms. Click the **Mute** button again to return the alarms to their original state.

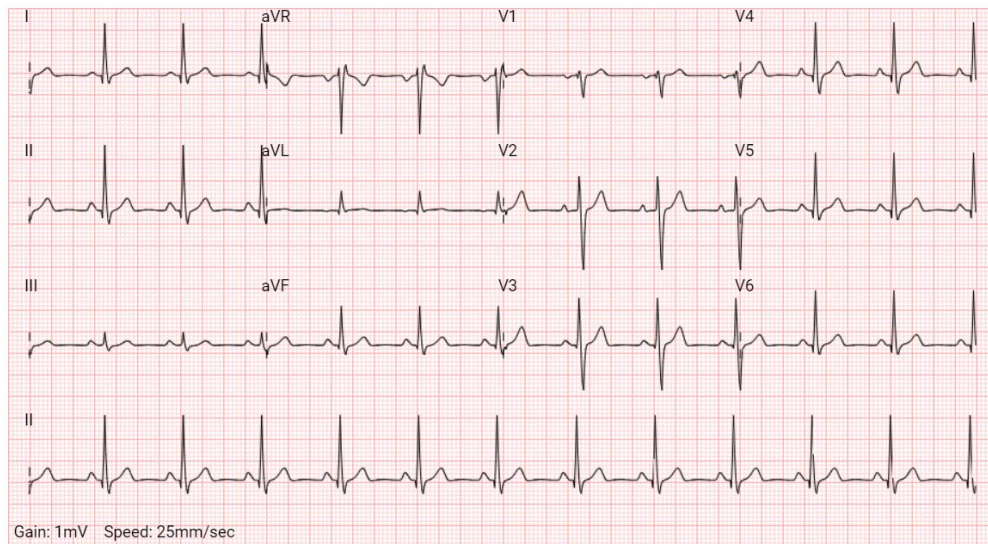
12-Lead ECG

To view a 12-lead ECG report, click the **12-Lead ECG** button at the bottom of the TouchPro screen.



12-Lead ECG

12-Lead ECG Button



12-Lead ECG Report

The report can be printed or saved by clicking the **Print** button in the bottom right corner of the 12-lead ECG report.



Print Button

To close the report, click the **X** button.

IMPORTANT: Prior to saving the report as a PDF or printing to a network printer, the print presets must be adjusted. The page orientation must be set to Landscape and the margins must be set to .25 inches on all sides. These settings vary in location depending on the operating system (i.e., Macintosh or Windows).

To save the report to a PDF file on a Macintosh Instructor Workstation:

1. From the 12-lead ECG report screen, click the **Print** button located in the bottom right corner of the 12-lead ECG report



Print Button

2. Enter a title for the 12-lead report
3. Click **Print**
4. On Page Setup Window, click **OK**

5. From the Print window, click the **PDF** drop-down menu in the lower left corner
6. From the drop-down menu, select the **Save as PDF** option
7. In the Title field, enter the 12-lead report title
8. Click **Save**

The report saves as a PDF on the Macintosh Instructor Workstation.

To save the report to a PDF file on a Windows Instructor Workstation:

1. From the 12-lead ECG report screen, click the **Print** button located in the bottom right corner of the 12-lead ECG report
2. Select **Save as PDF**
3. Click **Print**
4. Select a location to save the pdf in the **File name** field
5. Click **Save**

To print a report:

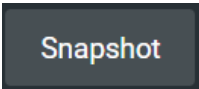
1. From the 12-lead ECG report screen, click the **Print** button located in the bottom right corner of the 12-lead ECG report
2. From the Printer drop-down menu, select the appropriate network printer
Note: A network printer must be configured in order to appear as an option.
3. From the Print window, click the **Print** button

Snapshot

A vital signs history window can be displayed using the **Snapshot** button.

To capture the vital signs history:

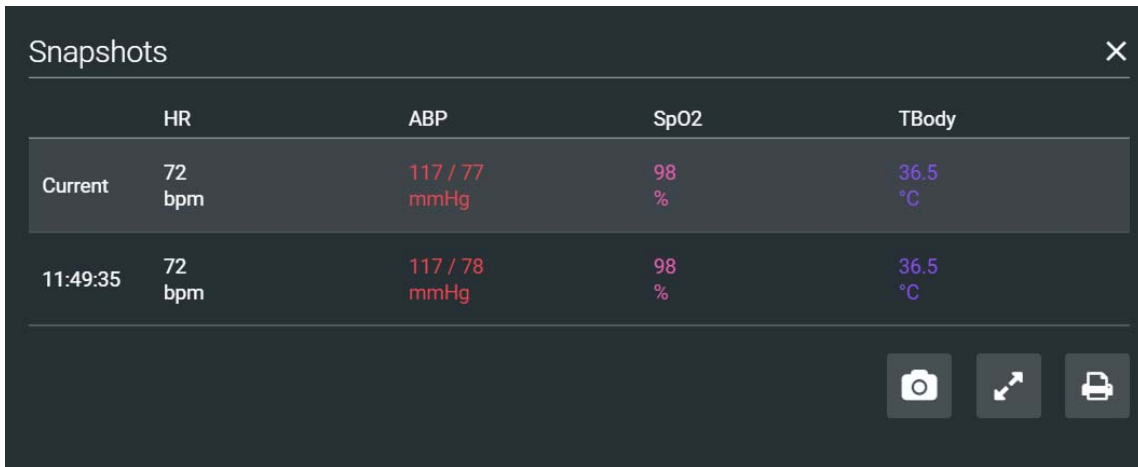
1. Click the **Snapshot** button on the bottom of the TouchPro display



Snapshot

Print Button

The **Snapshot** window appears displaying that snapshot and live data.



	HR	ABP	SpO2	TBody
Current	72 bpm	117 / 77 mmHg	98 %	36.5 °C
11:49:35	72 bpm	117 / 78 mmHg	98 %	36.5 °C

Snapshot Window

- To take another snapshot, click the **Camera** snapshot button
IMPORTANT: *The Camera snapshot button is used to take all subsequent snapshots.*
 The time when the snapshot was taken is displayed in the simulation time column.
- The list of snapshots will appear, with the corresponding time in the first column



	HR	ABP	SpO2	TBody
Current	72 bpm	117 / 78 mmHg	98 %	36.5 °C
16:56:09	72 bpm	117 / 77 mmHg	98 %	36.5 °C
16:56:07	72 bpm	117 / 78 mmHg	98 %	36.5 °C
16:55:04	72 bpm	117 / 77 mmHg	98 %	36.5 °C
16:55:03	72 bpm	117 / 78 mmHg	98 %	36.5 °C
16:55:00	72 bpm	117 / 77 mmHg	98 %	36.5 °C

Snapshot Window

- Click the **X** to close the Snapshot window

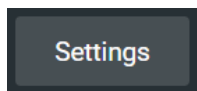
NIBP Cycling and Manual NIBP

When non-invasive blood pressure (NIBP) is displayed, the patient's NIBP can be updated at specified intervals using NIBP Cycling, or the current NIBP can be displayed immediately using the **Manual NIBP** button.

NIBP Cycling can be used to set the patient's NIBP to be updated at regular intervals.

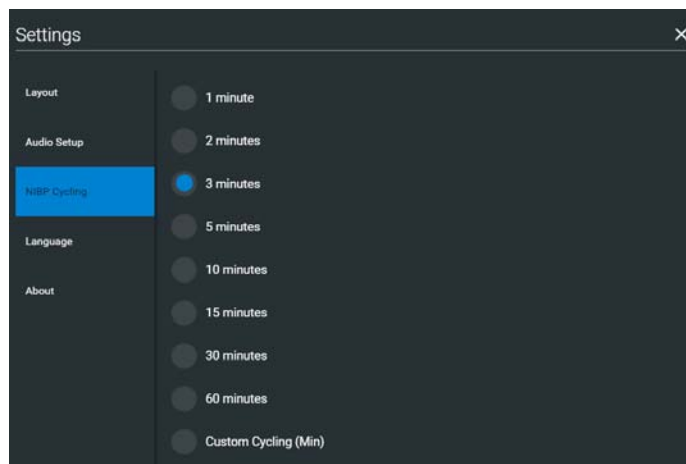
To set NIBP cycling:

1. Click the **Settings** button in the bottom right corner of the TouchPro display



Settings Button

2. From the Settings menu, click **NIBP Cycling**

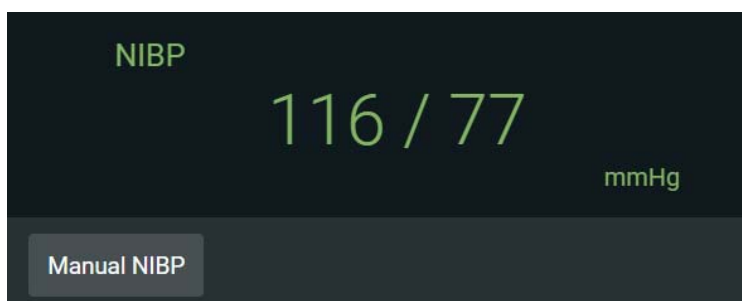


NIBP Cycling Window

3. From the NIBP Cycling window, select the desired interval for the cycling

Note: Custom cycling is also available.

Click the **Manual NIBP** button to display the patient's current NIBP.



Manual NIBP

Note: Manual NIBP can be used at any time during cycling. However, this turns off auto-cycling.



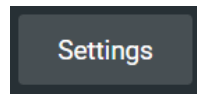
Auto-cycling Icon

Configuring the TouchPro Software

The alarm suspension time can be set from the TouchPro Configure panel.

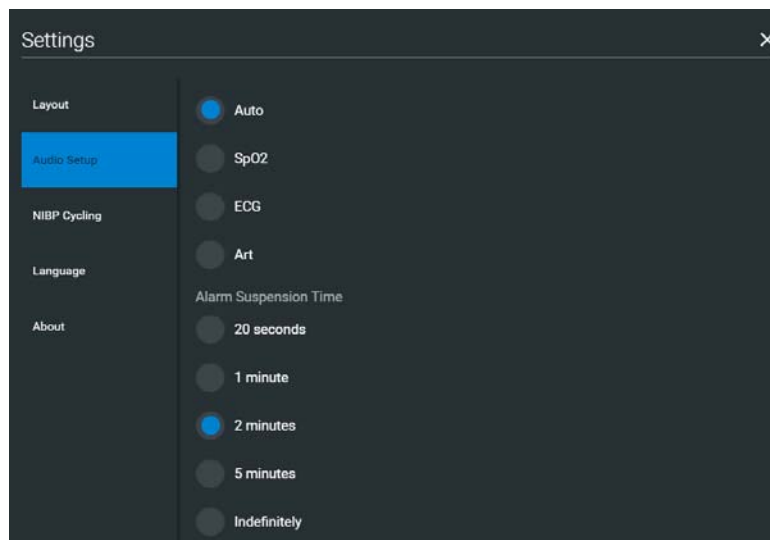
To access the Configure panel:

1. Click the **Settings** button in the bottom, right corner of the TouchPro screen



Settings Button

2. From the Settings menu, click the **Audio Setup** window
3. From the **Audio Setup** window, set the alarm suspension time



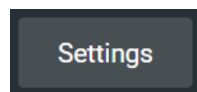
Alarm Suspension Time

4. Click the **X** button to exit the **Audio Setup** Window when finished

Changing the TouchPro Language

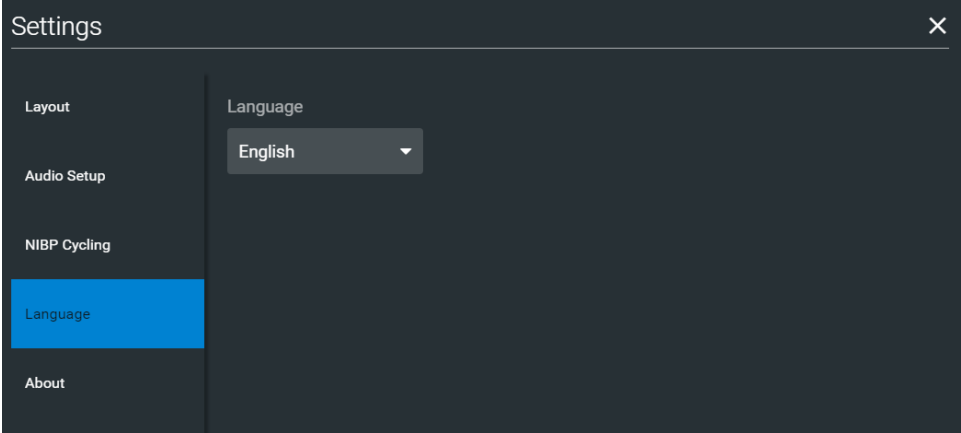
To change the language of the TouchPro software:

1. Click the **Settings** button in the bottom, right corner of the TouchPro screen



Settings Button

2. From the Settings menu, click the **Language** window
3. From the **Language** window, select a language



Language Selection

USING APOLLO

Once Apollo has been set up (see the Setup section) and the software has been launched (see the Using the Software section), the simulator is ready for learner interventions. The features of Apollo are broken down by Neurological, Eyes, Pulse, Sounds, Respiratory, Cardiovascular, Gastrointestinal and Genitourinary systems.

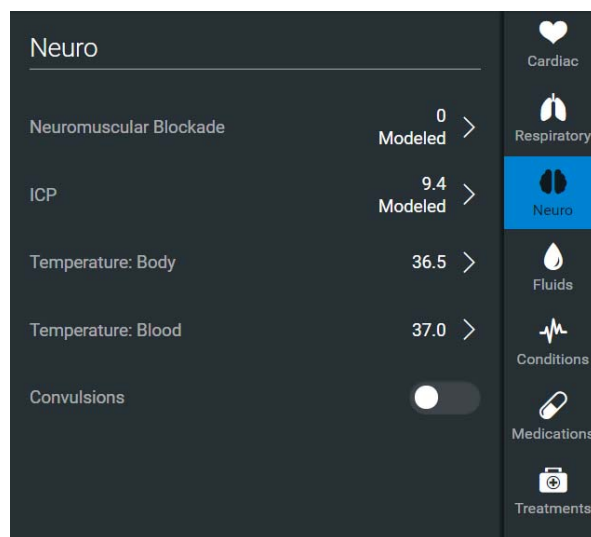


The Run Screen

Neurological

The clinical features that can be controlled from the Neurological Assessment view are Convulsions, Neuromuscular Block, Body and Blood Temperature and Speech.

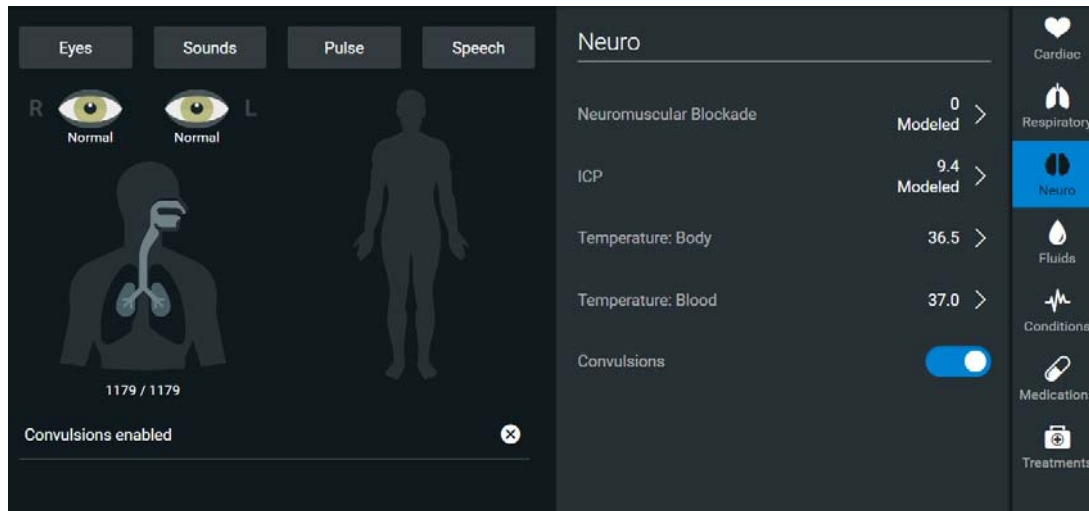
To access the Neurological view, from the Run screen, click the **Neuro** tab on the right side of the screen.



Neurological View

Convulsions

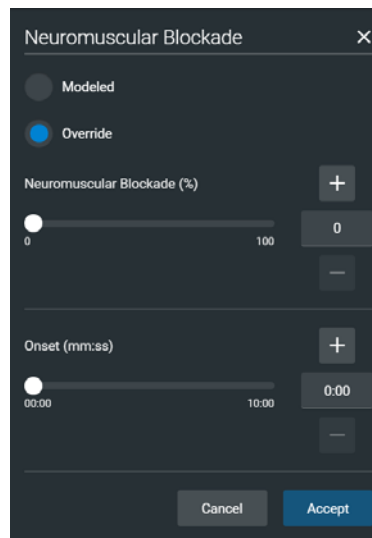
Apollo simulates convulsions when the feature is activated on the software. To activate the Convulsions feature, click the **Convulsions** switch. To deactivate the convulsions feature, click the switch again.



Convulsions Enabled

Neuromuscular Blockade

To manually adjust the Neuromuscular Blockade (NMB), click **Neuromuscular Blockade**. The **Neuromuscular Blockade** slider appears. Set the percentage by dragging the slider left or right. Click **Accept** to exit and save the changes.



NMB Parameter

Body Temperature

To control a patient's body temperature, click **Temperature: Body**. The Body Temperature slider appears. Set the body temperature by dragging the slider left or right.

Click **Accept** to exit and save the changes.

Blood Temperature

To manually control a patient's blood temperature, click **Temperature: Blood**. The Blood Temperature slider appears. Set the temperature by dragging the slider left or right. Click **Accept** to exit and save the changes.

Eyes

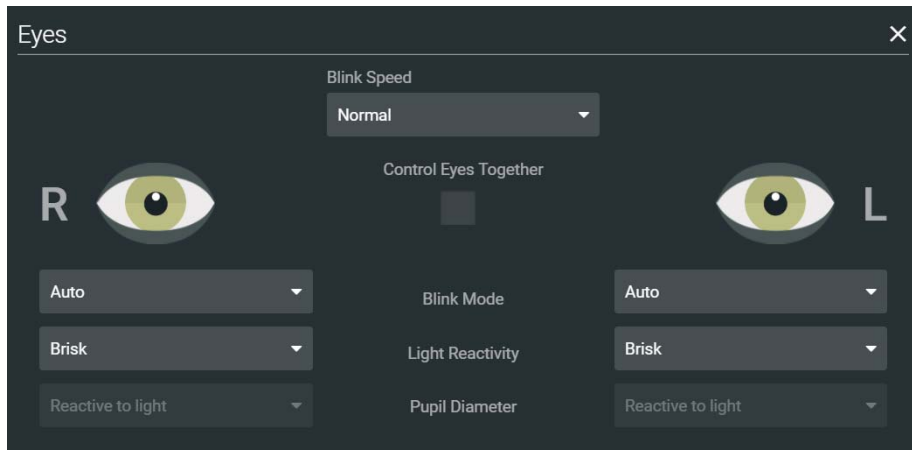
The blink mode, light reactivity, pupil diameter and blink speed of the simulator's eyes can be controlled from the software.

Click the **Light Reactivity** drop-down menus of each eye to determine reactivity. When **Light Reactivity** is set to **Brisk**, the **Pupil Diameter** is set to **Reactive to light** by default.

Click the **Blink Mode** drop-down menus of each eye to select between **Auto**, **Blinking**, or **Closed**. Choose **Auto** to have the eyes blink while the patient is conscious. Click **Closed** to close the eyes. Click **Blinking** to force the eyes to be open and blinking regardless of patient consciousness. These features can be controlled on both eyes.

Click **Slow**, **Normal** or **Fast** in the **Blink Speed** drop-down menu to control the blink speed.

Click **2mm**, **5mm** or **Blown** in the **Pupil Diameter** drop-down menus of each eye to control the pupil diameter.



Eyes

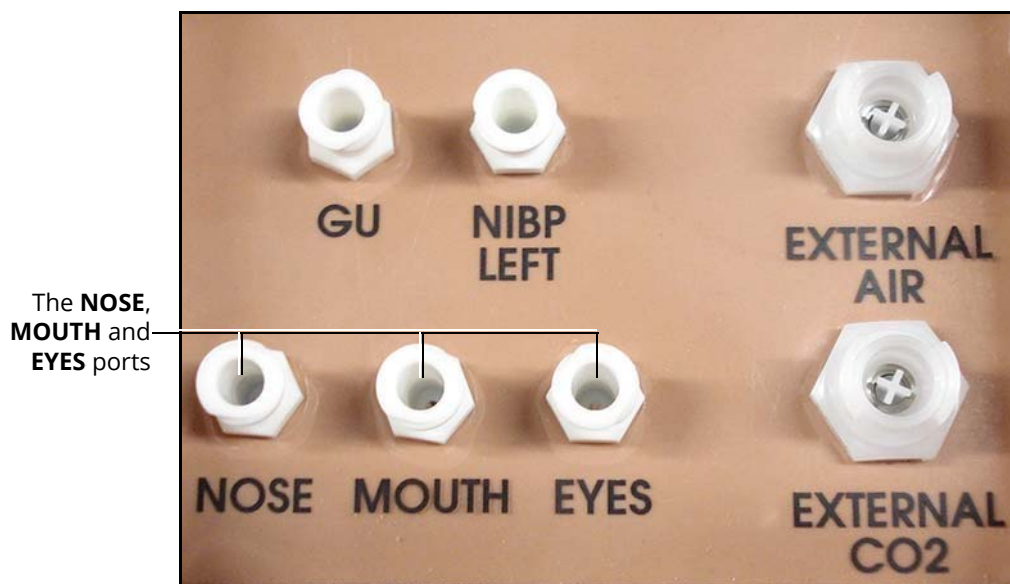
Head Secretions (Prehospital Only)

Secretions of the eyes, nose and mouth are manually controlled with a gravity feed.

Note: An IV bag is needed for each site in use.

To use the head secretion features:

1. Using a 60 mL syringe, prime the line of the desired secretion by injecting fluid into the **NOSE, MOUTH** or **EYES** port on Apollo's left shoulder until fluid emerges from the secretion sites
2. Set up the IV pole near the simulator
3. Fill an IV bag with the clinically appropriate fluid. Use distilled water only, with food coloring, if desired
4. Hang the IV bag on the IV pole
5. Ensure the roller clamp is closed and insert the IV spike into the IV bag
6. Connect to the simulator by attaching the end of the IV spike set tubing to the **NOSE, MOUTH** or **EYES** port on the simulator's left shoulder. Repeat for each site necessary.



Apollo Prehospital's Left Shoulder

7. Open the clamp and allow fluid to flow into the simulator
8. Keep the IV bag attached. Adjust the flow rate manually using the roller clamp

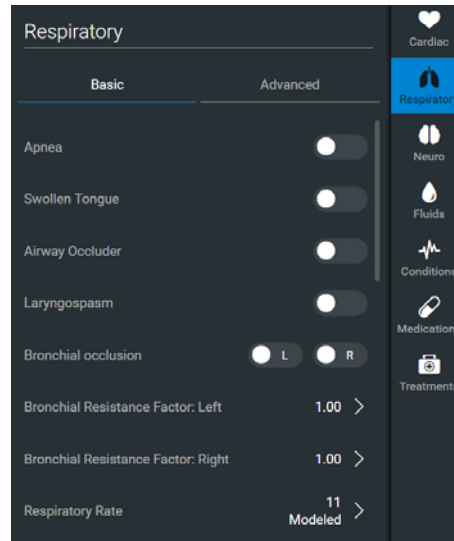
Note: Cleanup is very important when using simulated fluids.

Respiratory

Apollo Prehospital's Respiratory system is comprised of the airway management, spontaneous breathing and ventilation features. On Apollo Nursing, various clinical signs such as breath sounds,

chest excursion and airway patency can be physically demonstrated. A series of speakers inside each simulator can generate a range of breath and throat sounds used in diagnosing conditions.

To access the Respiratory parameters of Apollo, on the Run screen, click the lung on the human form or select the **Respiratory** tab on the right of the screen. The respiratory parameters appear on the Run screen. To view additional parameters, click the Basic/ Additional switch.



Respiratory View

Airway

Various clinical signs such as breath sounds, chest excursion and airway patency can be physically demonstrated. A series of speakers inside the simulator can generate a range of breath and throat sounds used in diagnosing conditions.

Apollo Prehospital’s anatomically realistic upper airway provides for the opportunity to intubate the patient as well as apply other airway interventions. In addition, the Apollo Prehospital airway was designed to be a difficult airway that teaches learners to use the best technique when encountering clinical situations with real patients. The airway is best visualized when using the Sellick maneuver, which is performed when a patient is undergoing the intubation procedure.

The Apollo Nursing airway has the ability to produce secretions to allow for suctioning.

Airway Features			
Anatomy, Physiology and Clinical Signs	Clinical Interventions, Patient Monitoring and Scenarios	Software Control	Manual Control

Realistic Upper Airway (Oropharynx, Nasopharynx and Larynx) (Prehospital only)	Allows direct laryngoscopy, oral and nasal intubation and use of specialty airway devices. Detects right mainstem intubation. Endobronchial intubation results in unilateral chest excursion and breath sounds.	None required.	None required.
Trachea, Left and Right Mainstem Bronchi (Prehospital only)	Tracheal intubation results in bilateral chest excursion and breath sounds.	None required.	None required.
Airway Management and Ventilation	Alveolar and arterial gas concentrations appropriately reflect the efficacy of ventilation and oxygen administration.	Oxygen administration input by the instructor. VIEW: Respiratory	None required.
Gastric Distention (Prehospital only)	Esophageal intubation results in gastric distension and the absence of breath sounds, chest excursion and CO ₂ output.	None required.	None required.
Breakaway Teeth (Prehospital only)	Upper front teeth can be dislodged if laryngoscopy is performed incorrectly.	None required.	<u>See Breakaway Teeth</u>
Airway Features			
Anatomy, Physiology and Clinical Signs	Clinical Interventions, Patient Monitoring and Scenarios	Software Control	Manual Control
Tongue Edema (On/Off)	Hinders, but does not prevent, intubation.	VIEW: Respiratory	None required.
Posterior Pharynx Swelling (Prehospital only)	Obstructs view of larynx to prevent intubation, but allows mask ventilation "can't intubate, can ventilate" scenario.	VIEW: Respiratory	None required.

<p>Laryngospasm (Prehospital only)</p>	<p>Closes vocal cords and prevents intubation and ventilation. When used with posterior pharynx swelling, creates a “can’t intubate, can’t ventilate” scenario.</p>	<p>VIEW: Respiratory</p>	<p>None required.</p>
<p>Cricothyroid Membrane</p>	<p>Allows needle cricothyrotomy, transtracheal jet ventilation, retrograde wire techniques and cricothyrotomy.</p>	<p>None required.</p>	<p><u>See Cricothyrotomy.</u></p>

Swollen Tongue

The swollen tongue feature is activated on the Respiratory view by clicking the **Swollen Tongue** switch.

Posterior Pharynx Swelling (Prehospital Only)

Swelling of the posterior oropharynx (posterior airway occlusion) can be activated to obstruct the view of the larynx and prevent intubation, but allow mask ventilation of the patient’s lungs, thereby creating a “cannot intubate, can ventilate” scenario.

Click the **Airway Occluder** switch to activate the feature.

Realistic Upper Airway (Prehospital Only)

The upper airway of Apollo Prehospital is designed to allow for intubation and laryngoscopy. Oral and nasal intubation can be performed using a variety of airway devices, including LMAs, endotracheal tubes, nasal-pharyngeal airways and oropharyngeal airways.



Intubation

The simulator detects and responds appropriately to right mainstem intubation, and an event is recorded in the Event Log.

Intubation incorrectly applied into the esophagus causes abdominal distension.

IMPORTANT Airways can be damaged by improper insertion of an airway adjunct (e.g. endotracheal tube). To protect the airway, lubricate the adjunct prior to insertion using the silicone spray provided.

Use ONLY the provided SILICONE SPRAY to lubricate the adjunct. NEVER use a water-based lubricant because of resulting residue damage.

Laryngospasm (Prehospital Only)

A laryngospasm actuator closes the patient's vocal cords and prevents both ventilation and intubation. Click the **Laryngospasm** switch to activate the feature.

Teeth with Breakaway Incisors (Prehospital Only)

Apollo Prehospital is equipped with Breakaway Teeth whose front incisors become dislodged with improper handling of a laryngoscope.

The teeth are tied to the upper denture with a lanyard, which prevents losing the teeth down the airway or misplacing them during storage.

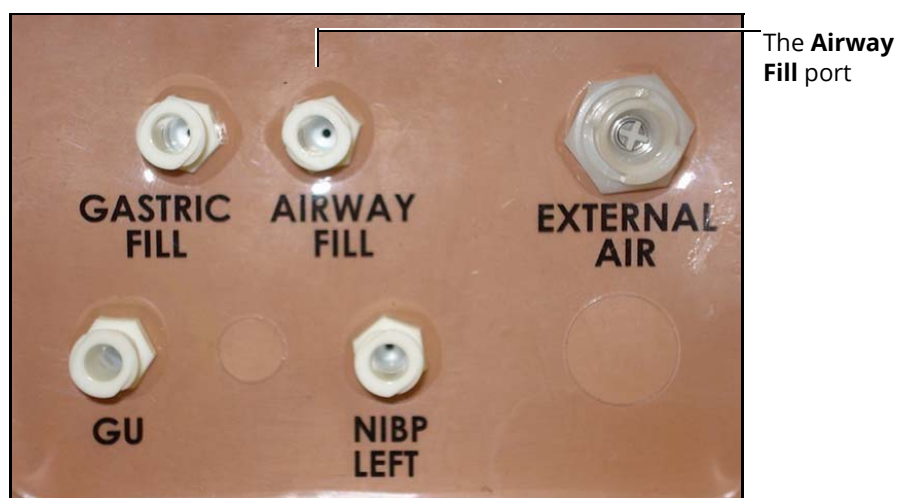
Airway Secretions (Nursing Only)

Apollo Nursing allows for suctioning of fluids from the airway using a manual feed. Ensure all fluids have been removed from previous uses before each new use to prevent overfilling.



Tracheostomy Suction

To use the airway secretion feature, inject up to 40 mL of clinically appropriate colored fluid into the **AIRWAY FILL** port on Apollo Nursing's left shoulder.



Apollo Nursing's Left Shoulder

The trachea is now ready to be suctioned. Using the proper clinical technique, insert the suction catheter until resistance is encountered at the bifurcation.

Withdraw and apply suction. Fluid can be suctioned over a distance of approximately 4 cm distal to the bifurcation.

Note: Use only distilled water with food coloring, if desired.

Note: Cleanup is very important when using simulated fluids.

Cricothyrotomy

Cricothyrotomy can be simulated on Apollo. Before performing a needle cricothyrotomy, the Cricothyrotomy plug must be removed, and a 2.25-inch (6-cm) length of red tape from the roll provided must be placed over the hole.

To replicate a needle cricothyrotomy:

1. Spray the silicone lubricant onto the airway adjunct prior to the simulation session. To prevent damage to the simulator, always spray silicone lubricant into the airway.
2. Locate the simulated cricothyroid membrane sealed with tape underneath the neck skin
3. Follow standard clinical techniques and palpate to find the cricothyroid space
4. Puncture the space through the neck skin of the patient simulator and into the tape “membrane.” This puncture goes all the way through to the “trachea,” simulating the clinical procedure.
5. Users must replace the tape that simulates the cricothyroid membrane after each cricothyrotomy

Note: Replacement components are available in the Inventory Kit.

Note: When ventilating through a surgical airway, the Laryngospasm feature must be deactivated, or the chest rise is not observed.

Note: When finished using the Cricothyrotomy feature, replace the Cricothyrotomy plug.

Replacing the Cricothyrotomy Tape

Remove the old, punctured tape completely from the cricoid feature and use alcohol to clean the glue residue from the surface. (An alcohol prep pad works well.) Allow to dry.

Cut an approximately 2.25-inch (6 cm) length of the double-sided tape from the roll provided.

Carefully remove the paper backing and lightly stretch the newly revealed adhesive side of the tape over the cricoid hole and down the far side of the cricoid feature. Use the non-stick paper backing to press the tape against the cricoid feature.

Cut a 2.5-inch to 3-inch (7 cm to 8 cm) length of red tape and apply it over the cricoid feature and the tape.

Resealing the Membrane After a Puncture

To reseal the cricoid feature, apply a small piece of red tape over the punctured area. This can be repeated a brief number of times, but when the number of layers impedes the cricothyrotomy, all existing tape must be removed and replaced with new tape.

Pulmonary

Apollo uses both physical and mathematical models to achieve an extremely accurate simulation of respiration. Apollo's chest rises and falls, mimicking inspiration and expiration. Apollo Prehospital's lungs also react realistically to intubation as well as to pathophysiologic states.

Pulmonary System			
Anatomy, Physiology and Clinical Signs	Clinical Interventions, Patient Monitoring and Scenarios.	Software Control	Manual Control
Spontaneous Breathing	Normal tidal breathing and pathophysiological conditions such as atelectasis, pneumothorax, asthma and COPD.	None required, but adjustable VIEW: Respiratory	None required.
Exhaled CO₂ (Prehospital only)	Measure the presence or absence of CO ₂ during positive pressure ventilation.	None required.	CO ₂ canister is inserted
Pneumothorax or Hemothorax	Increase in intrapleural volume, leading to asymmetrical breathing.	None required, but adjustable VIEW: Respiratory CONTROL: Intrapleural Volume (Left or Right)	None required.
Chest Excursion	Synchronized with ventilation (spontaneous or positive pressure ventilation). Excursion depth proportional to tidal volume.	None required.	None required.
Lung Sounds	Normal and abnormal breath sounds are independently synchronized with ventilation of the right and left lungs. Breath sounds can be auscultated over anterior and posterior anatomic locations.	None required, but adjustable VIEW: Sounds	None required.
Bronchial Occlusion	Completely obstructs right and/or left mainstem bronchi, simulating a lower airway obstruction (e.g. mucus plug). This yields an inability to	VIEW: Respiratory	None required.

	ventilate the lungs and asymmetric chest excursion.		
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Pulmonary System			
Anatomy, Physiology and Clinical Signs	Clinical Interventions, Patient Monitoring and Scenarios.	Software Control	Manual Control
Pulse Oximetry	Oxyhemoglobin saturation (SpO ₂) automatically correlates with the oxygen concentration in the lungs and the intrapulmonary shunt fraction.	None required, but adjustable	SpO ₂ probe is attached.
Arterial Blood Gases	PaO ₂ , PaCO ₂ and pH are continuously calculated, and the Patient Status Display can be configured to show them.	None required, but adjustable	None required.
Venous Blood Gases	PvO ₂ and PvCO ₂ are continuously calculated, and the Patient Status Display can be configured to show them.	None required, but adjustable	None required.
Needle Decompression (Prehospital Only)	Decompression of a pneumothorax can be performed bilaterally by inserting a needle at the midclavicular line of the second intercostal space.	The instructor must adjust the amount of physiologic intrapleural air present. VIEW: Respiratory CONTROL: Needle Decompression, Intrapleural Vol: Left, Intrapleural Vol: Right	<u>See Needle Decompression setup.</u>

Needle Decompression (Prehospital Only)

Needle decompression can be performed bilaterally into a small hole located in the midclavicular line of the second intercostal space.

To enable the Needle Decompression feature, activate the switch for the appropriate side(s). From the Respiratory view, turn the desired **Needle Decompression** switch to **On**.



Needle Decompression Switch



Needle Decompression

When a needle is inserted in the second intercostal space, along the midclavicular line, air is released while intrapleural volume is present.

Needle Decompression and Chest Tube

When using the Apollo Prehospital system, the Needle Decompression and Chest Tube features can be enabled simultaneously. Intrapleural volume will decrease when both are in use.

Bronchial Occlusion

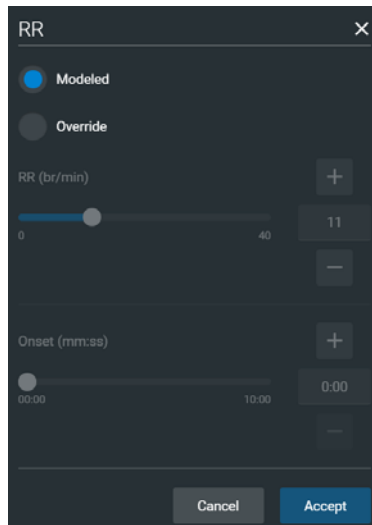
When bronchial occlusion is enabled, unilateral chest excursion is observed during spontaneous breathing or positive pressure ventilation. To stop airflow to the bronchi, creating a bronchial occlusion, the switch for the appropriate side(s) must be activated. From the Respiratory view, turn the desired **Bronchial Occlusion** switch to **On**.



Bronchial Occlusion Switch

Respiratory Rate

To adjust the respiratory rate manually, from the Respiratory view, click **Respiratory Rate**. The Respiratory Rate slider appears. Set the rate by dragging the slider left or right. Click **Accept** to exit and save the changes. The parameter is now orange, indicating a change has been made. To return to the programmed physiologic model, click the switch and turn the **Override** switch to **Modeled**.



Respiratory Rate



Respiratory Rate Override

Pulse Oximetry

To adjust the SpO₂ percentage manually, from the Respiratory view, click **SpO₂**. The SpO₂ slider appears. Set the rate by dragging the slider left or right. Click **Accept** to exit and save the changes. The parameter is now orange, indicating a change has been made. To return to the programmed physiologic model, click the switch and turn the **Override** switch to **Modeled**.



SpO2

CO₂ Exhalation (Prehospital Only)

Whether supplied via a portable canister or from an external source, the simulator exhales CO₂ during positive pressure ventilation.

Note: An optional regulator kit must be purchased to use CO₂ from an external source.

To use the CO₂ Exhalation feature, connect the CO₂ canister to the CO₂ canister socket or connect the external source on the simulator's right shoulder, and Apollo Prehospital exhales CO₂ gas. There are approximately 15 minutes of CO₂ gas available once the canister is connected.

Positive Pressure Ventilation

When positive pressure ventilation is administered, the process is automatically detected by the simulator, and the physiologic model is sensitive to the volume administered.

Gastric Distention (Prehospital Only)

During esophageal intubation or overly aggressive bag valve mask ventilation, gastric distention occurs. Gastric distention is relieved by putting pressure on the abdomen.

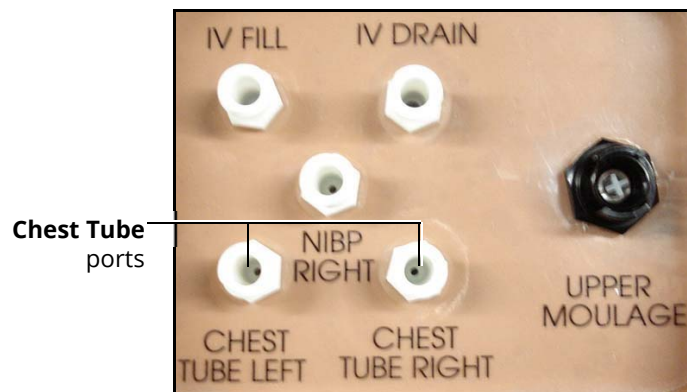
Chest Tube: Apollo Prehospital

Apollo Prehospital has the ability to simulate chest tube drainage. The Chest Tube sites are located bilaterally in the fifth intercostal space.

Ensure all fluids have been removed from previous uses before each new use to prevent overfilling.

To simulate continuous chest tube drainage:

1. Insert the Apollo Priming Tube in the Chest Tube site
2. Set up the IV pole near the simulator
3. Fill an IV bag with the clinically appropriate fluid. Use distilled water only, with food coloring if desired
4. Hang the IV bag on the IV pole
5. Ensure the roller clamp is closed and insert the IV spike into the IV bag
6. Connect to the simulator by attaching the end of the IV spike set tubing to the corresponding **CHEST TUBE** port (**LEFT or RIGHT**) on the simulator's right shoulder



Apollo's Right Shoulder

7. Open the clamp and allow fluid to flow into the simulator until fluid is seen in the Apollo Priming Tube
8. Once fluid appears in the Apollo Priming Tube, remove the Apollo Priming Tube. The simulator is ready for chest tube insertion.
9. Keep the IV bag attached and adjust the flow rate manually using the roller clamp

The chest tube must be fully inserted for the fluid to flow.



Chest Tube Insertion

Note: Cleanup is very important when using simulated fluids.

When the Chest Tube feature is used on Apollo Prehospital, the simulator automatically detects the tube insertion and creates a log entry.

On Apollo Prehospital, if a small volume of fluid is needed to simulate proper chest tube insertion, the internal reservoir may be filled.

To insert a small amount of fluid into the Chest Tube reservoir:

1. Insert the Apollo Priming Tube in the Chest Tube site
2. Using a 60 mL syringe filled with clinically appropriate fluids, inject the contents into the **CHEST TUBE** port (**LEFT or RIGHT**) until fluid is seen in the Apollo Priming Tube. Use distilled water only, with food coloring, if desired.
3. Remove the Apollo Priming Tube
4. Inject the remaining contents of the syringe into the **CHEST TUBE** port
5. Remove the syringe

Chest Tube: Apollo Nursing

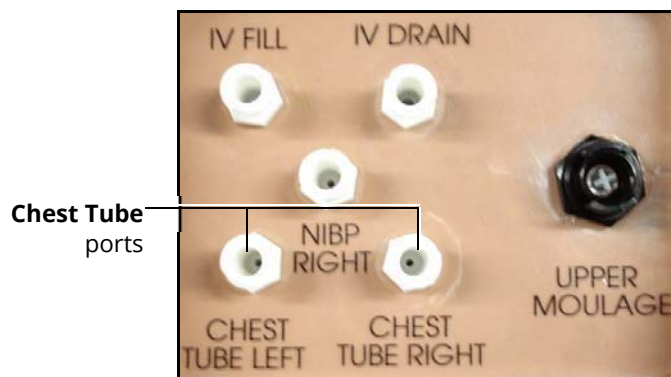
Apollo Nursing has the ability to simulate chest tube drainage. The Chest Tube sites are located bilaterally in the fifth intercostal space.

Ensure all fluids have been removed from previous uses before each new use to prevent overfilling.

To simulate continuous chest tube drainage:

1. Insert the Apollo Priming Tube in the Chest Tube site
2. Set up the IV pole near the simulator
3. Fill an IV bag with the clinically appropriate fluid. Use distilled water only, with food coloring if desired.
4. Hang the IV bag on the IV pole

5. Ensure the roller clamp is closed and insert the IV spike into the IV bag
6. Connect to the simulator by attaching the end of the IV spike set tubing to the corresponding **CHEST TUBE** port (**LEFT or RIGHT**) on the simulator's right shoulder



Apollo's Right Shoulder

7. Open the clamp and allow fluid to flow into the simulator until fluid is seen in the Apollo Priming Tube
8. Once fluid appears in the Apollo Priming Tube, remove the Apollo Priming Tube. The simulator is ready for chest tube insertion.
9. Keep the IV bag attached and adjust the flow rate manually using the roller clamp

The chest tube must be fully inserted for the fluid to flow.

Note: Cleanup is very important when using simulated fluids.

Cardiovascular

With Apollo's Cardiovascular system, users can replicate the clinical signs associated with cardiac activity, including palpable pulses, heart sounds and electrical activity.

Cardiovascular System			
Anatomy, Physiology and Clinical Signs	Clinical Interventions, Patient Monitoring and Scenarios.	Software Control	Manual Control
Heart Sounds	Normal and abnormal heart sounds are synchronized to the cardiac cycle and audible to a standard stethoscope. Heart sounds can be auscultated over the left and right upper sternal border, right lower sternal border and apex.	None required; specific sounds can be selected. VIEW: Sounds	None required.

5-Lead ECG	ECG waveforms can be viewed on a standard monitor and/or on the TouchPro Patient monitor. Normal and abnormal cardiac rhythms are linked to patient physiology (e.g. blood pressure, cardiac output).	None required; specific rhythms can be selected.	ECG monitor may be utilized.
Myocardial Ischemia	Myocardial oxygen supply and demand automatically influence the cardiac rhythm, yielding response to hypoxemia.	None required, but adjustable.	None required.
Palpable Pulses	Carotid, brachial, radial, femoral, popliteal, posterior tibial and dorsalis pedis pulses can be palpated bilaterally and are synchronous with the cardiac cycle. A pulse deficit automatically occurs if the systolic arterial blood pressure falls below specified thresholds.	None required, but adjustable. VIEW: Pulses	None required.
Non-Invasive Blood Pressure Measurement	Systemic blood pressure can be measured using the return-toflow technique. Korotkoff sounds can also be auscultated.	None required.	Use of modified blood pressure cuff.

To access the Cardiovascular parameters of Apollo, on the Run screen, click the **Cardiac** tab on the right side of the screen. The cardiovascular features appear on the Run screen. To view additional parameters, click the Basic/Additional switch.

Cardiac		Cardiac
Basic	Advanced	
Arterial Blood Pressure	117 / 77 Modeled >	Respiratory
Central Venous Pressure	1 Modeled >	Neuro
Pulmonary Artery Pressure	20 / 8 Modeled >	Fluids
Pulmonary Capillary Wedge Pressure	2 Modeled >	Conditions
Heart Rate	71 Modeled >	Medications
Heart Rate Factor	1.00 >	Treatments
Cardiac Output	5.1 Modeled >	
Cardiac Rhythm	Sinus Modeled >	

Cardiovascular View

Pulses: Apollo Prehospital

Apollo Prehospital has 14 pulse sites that are activated by touch.

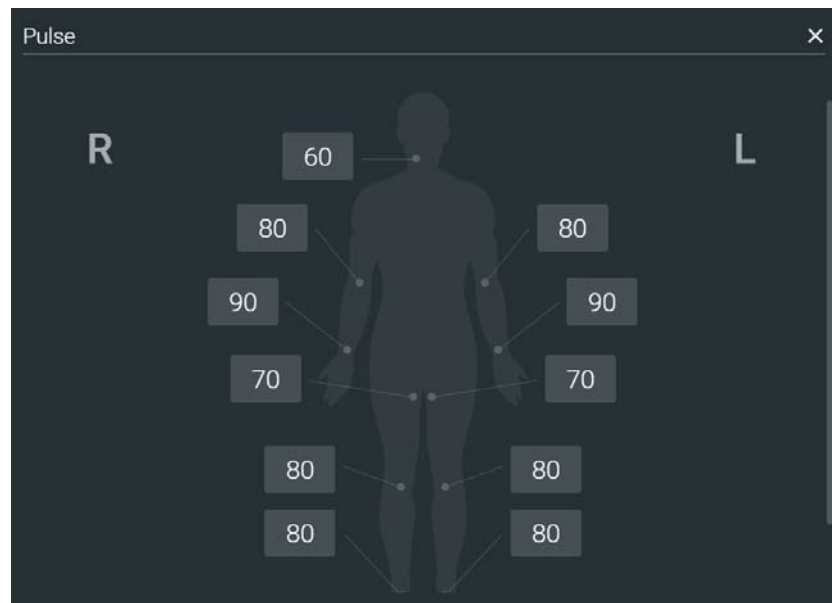
- Carotid (2)
- Brachial (2)
- Radial (2)
- Femoral (2)
- Popliteal (2)
- Posterior Tibial (2)
- Dorsalis Pedis (2)

Note: The Dorsalis Pedis and Posterior Tibial pulses are controlled together. The left and right Carotid pulses are also controlled together.

Pulses are visible and can be controlled from the **Pulse** window.

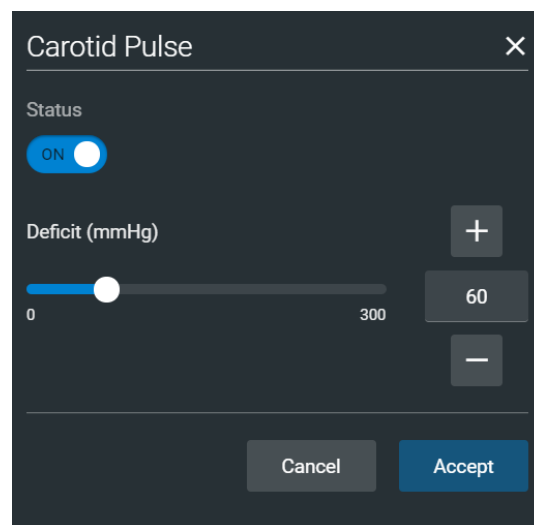
To disable a pulse:

1. Click the pulse location on the human form



Pulses - Apollo Prehospital

2. Click the **Status** switch to turn the pulse **Off**



Carotid Pulse

3. Click **Accept**

Pulses: Apollo Nursing

Apollo Nursing has 14 pulse sites that are activated by touch.

- Carotid (2)
- Brachial (2)
- Radial (2)
- Femoral (2)

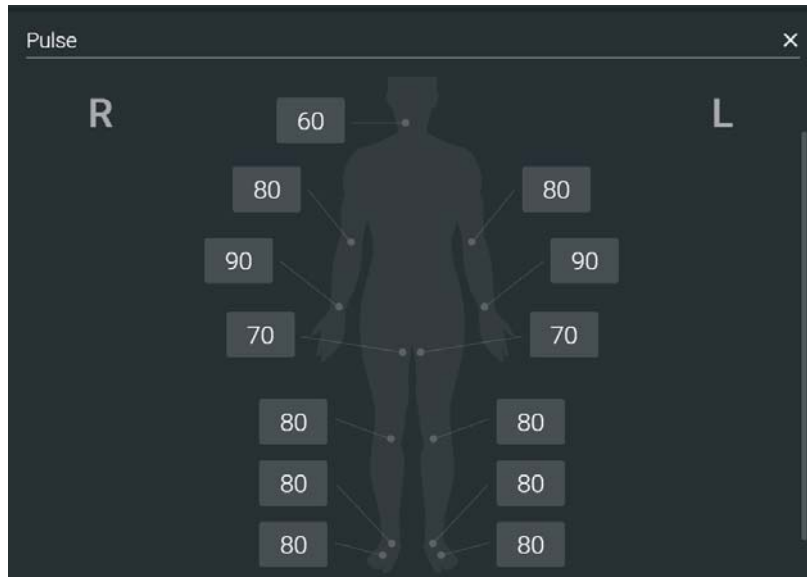
- Popliteal (2)
- Posterior Tibial (2)
- Dorsalis Pedis (2)

Note: The left and right Carotid pulses are controlled together.

Pulses are controlled from the **Pulse** window. All pulses, unless altered by an SCE, are enabled by default.

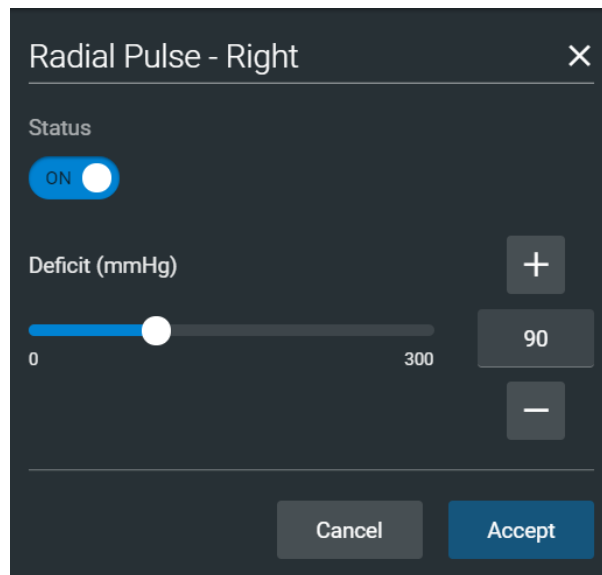
To disable a pulse:

1. Click the pulse location on the human form



Pulses - Apollo Nursing

2. Click the **Status** switch to turn the pulse **Off**



Radial Pulse - Right

3. Click **Accept**

The pulse can be re-enabled with the same steps.

Blood Pressure

Apollo supports non-invasive blood pressure measurements, and systolic and diastolic readings can be obtained and manipulated through the software.

Systolic and Diastolic Blood Pressure

To manually adjust the systolic and/or diastolic blood pressure:

1. From the Cardiovascular view, click the parameter of desired blood pressure
2. Set the pressure by dragging the slider left or right
3. Click **Accept** to exit and save the changes. The switch is now orange, indicating a change has been made.
4. To return to the programmed physiologic model, click the switch and turn the **Override** switch to **Modeled**

Non-Invasive Blood Pressure Measurement

Blood pressure can be taken manually on either arm. Non-invasive blood pressure (NIBP) monitoring techniques can be used by attaching the standard cuff modified with a T-fitting and adapters.

To modify a standard blood pressure cuff:

1. Cut the blood pressure cuff tube approximately 9 cm from the cuff
2. Insert the barbed end tubing connectors into the cut ends of the blood pressure cuff tubes

- 3. Secure the tubing connectors with cable ties



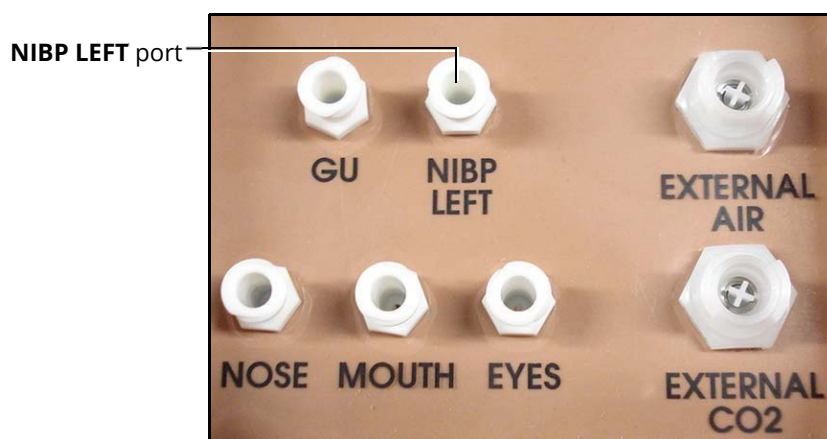
An Attached Tubing Connector

- 4. Attach the blood pressure adapter to the connectors

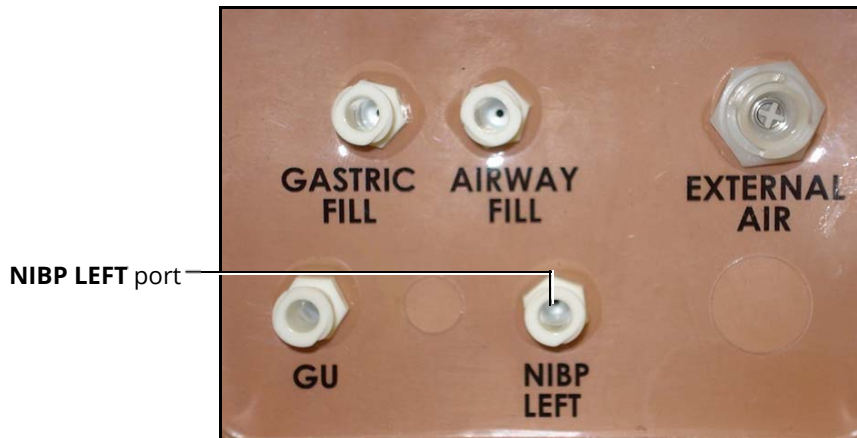


An Attached Blood Pressure Cuff Adapter

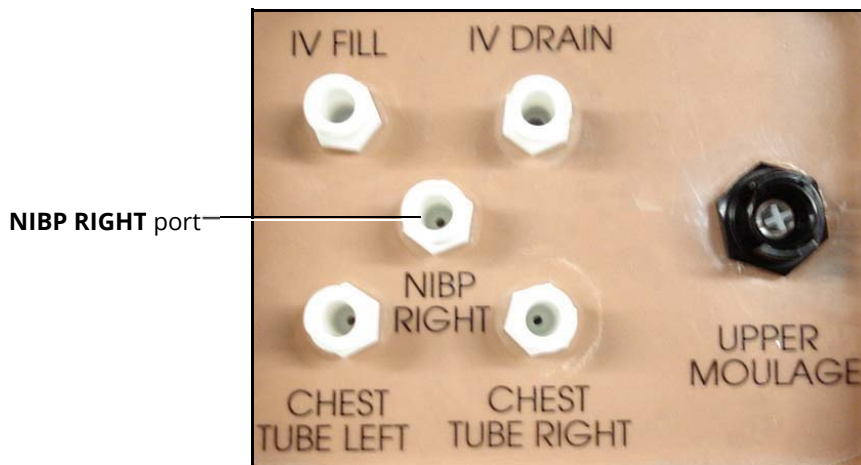
To get a blood pressure reading, connect the extension from the T-fitting on the blood pressure cuff adapter to either of the NIBP ports on Apollo's left and right shoulders.



Apollo Prehospital's Left Shoulder



Apollo Nursing's Left Shoulder



Apollo's Right Shoulder

Connect the T-fitting extension to the hose.

Take the non-invasive blood pressure reading using the return-to-flow technique.



Attached Blood Pressure Cuff

At appropriate cuff pressures, Korotkoff sounds are produced, and the radial pulse disappears.

Heart Rate

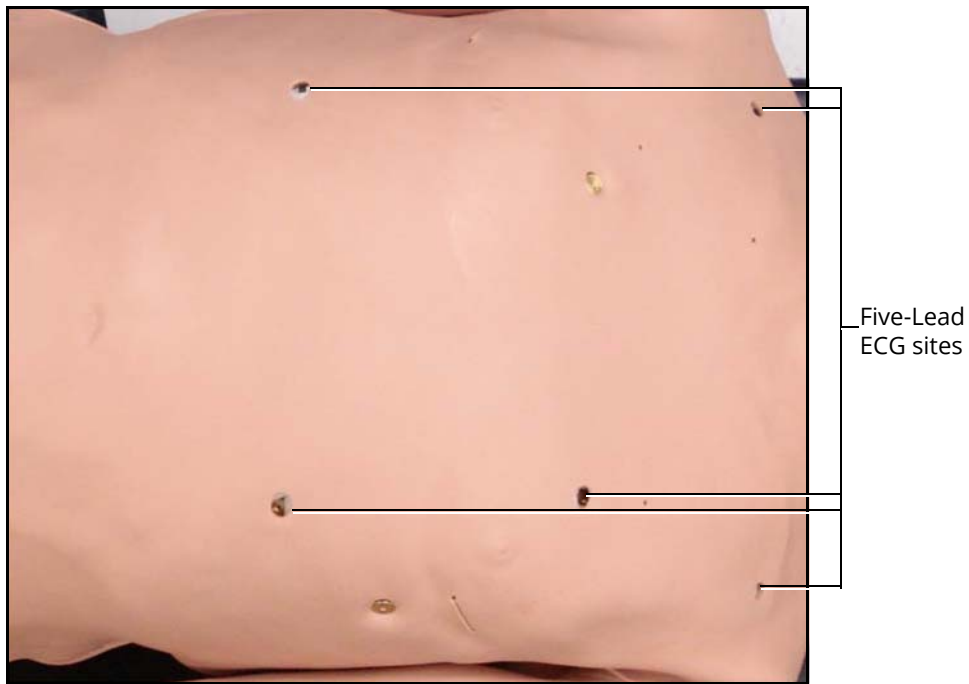
To manually adjust the heart rate, from the Cardiovascular view, click **Heart Rate**. Set the rate by dragging the slider left or right.

Click **Accept** to exit and save the changes. The switch is now orange, indicating a change has been made.

To return to the programmed physiologic model, click the switch and turn the **Override** switch to **Modeled**.

Five-Lead ECG

On Apollo, a 5-lead ECG is emitted from the appropriate positions for display on a standard monitor. A contact is available on Apollo's chest for each of the five cables.



5-Lead ECG Sites

The simulator generates a normal sinus ECG, as well as a broad range of abnormalities such as myocardial ischemia, sinus tachycardia and bradycardia, ventricular fibrillation and asystole. The hemodynamic response to the arrhythmias is physiologically correct. Myocardial oxygen balance and cardiac ischemia automatically influence the cardiac rhythm resulting in a realistic and automatic response of the rhythm to hypoxemia. The degree of influence can be controlled or completely overridden by the instructor.

Cardiovascular Treatments/Therapy

Apollo can simulate chest compressions and three types of electrical therapy: defibrillation, cardioversion and pacing.

Realistic Cardiovascular Interventions			
Anatomy, Physiology and Clinical Signs	Clinical Interventions, Patient Monitoring and Scenarios.	Software Control	Manual Control
Chest Compression	Effective chest compression results in artificial circulation, cardiac output, central and peripheral blood pressures, palpable pulses, and CO ₂ return.	None required, but adjustable.	None required.

Cardiac Monitoring	The desired arrhythmia can be selected.	The response to clinical intervention must be controlled by the instructor. VIEW: Cardiovascular	None required.
Defibrillation	Apollo supports operation with a variety of manual and automatic external defibrillators.	Defibrillation can be simulated by the instructor under the Interventions palette VIEW: Cardiovascular	<i>See Defibrillation below for defibrillation disk locations and instructions.</i>
Cardiac Pacing	Transthoracic cardiac pacemaker can be used with Apollo. Pacing results in appropriate physiological changes in blood pressure and cardiac output.	None required.	<i>See Pacing below for cardiac pacing disk locations and instructions.</i>

Chest Compressions

Apollo supports normal hand placement and standard compression techniques, and chest compressions can be performed. Apollo can detect the compressions, and the physiology responds accordingly.

Cardiovascular Features			
Anatomy, Physiology and Clinical Signs	Description	Software Control	Manual Control
Chest Compression	Effective chest compression results in artificial circulation, cardiac output, central and peripheral blood pressures, palpable pulses, and CO ₂ return. The Maestro CPR Monitor displays key compression parameters in real time.	None required, but adjustable. VIEW: CPR Monitor PARAMETER(S): CPR Monitor	Apply chest compressions.

Defibrillation and Cardioversion

Manual defibrillation and cardioversion can be performed on Apollo. Additionally, defibrillation and cardioversion are available virtually through the software.



Defibrillation Sites

Apollo is designed to safely absorb the energy discharged from manual and automatic defibrillators. Standard defibrillation energy levels should be used for positive learning reinforcement and to avoid negative training transfer. However, please refer to the following cautions.

Use of a defibrillator for training purposes represents an operational hazard equivalent to use of a defibrillator on a real patient. Consequently, ALL SAFETY PRECAUTIONS for the use of defibrillators MUST BE FOLLOWED as if the simulator were a patient. Consult the specific defibrillator's user manual for further information.

The following cautions should be observed:

- Defibrillation should be performed on the defibrillation electrodes only. If defibrillation is performed over any ECG electrode, high voltage may be present on the remaining connectors during the shock. This may also damage ECG circuitry.
- To prevent overheating, do NOT provide more than three (3) defibrillator discharges (maximum 200 joules with a biphasic defibrillator) in a sequence. Do NOT exceed an average of two (2) defibrillator discharges per minute during the training session.
- Avoid a large number of consecutive discharges. For example, 20 or 25 discharges without any recovery interval may damage the system.
- Do NOT let the simulator come in contact with electrically conductive surfaces or objects during defibrillation. A flame-supporting atmosphere, for example, with a high content of oxygen, should be avoided during defibrillation.
- Keep the simulator's chest dry. Special attention should be taken when using the urinary system or the chest tube feature.

- To prevent pitting of the chest skin electrode, do NOT apply conductive gel or conductive defibrillation pads intended for patient use
- Do NOT use cables or connectors having visible damage
- Do NOT spill fluids over any component inside the simulator torso. This could damage the system and may also present a possible hazard for the operator.
- When using a manual defibrillator, the ECG can be monitored via the defibrillator paddles. Coarse ventricular fibrillation and high-rate ventricular tachycardia cardiac rhythms are automatically recognized as “shockable” rhythms.
- With each defibrillation, the Apollo automatically records the amount of energy discharged and the time defibrillation was performed. The simulated patient response to defibrillation is determined by the scenario script or instructor intervention. Thus, cardioversion is not automatically determined by the physiological models.
- The minimum electrical charge recognized by the circuitry within the simulator is 20 joules
- For paddle placement on the chest, the simulator has two anterior defibrillation disks, which can be unscrewed, leaving threaded connections, if required.
- Biphasic defibrillators can be used with either paddles or hands-free connectors

Pacing

Pacing can be achieved virtually by selecting the appropriate treatment in the Treatments palette. A standard transthoracic cardiac pacemaker can be connected to the simulator using the anterior contacts. The simulator automatically detects and responds to pacing signals (from 20 mA to 200 mA, in increments of 10).

Subclavian Catheter (Nursing Only)

The Subclavian Catheter feature allows for cleaning and dressing practice. When using the Subclavian Catheter feature, users can infuse up to 50 mL of distilled water in the line.



Subclavian Catheter

Note: Cleanup is very important when using simulated fluids.

Intramuscular (IM) Injection

Apollo allows for the administration of a deltoid intramuscular (IM) injection. The injection site is located on Apollo's right shoulder.



Intramuscular Injection

Intraosseous (IO) Cannulation

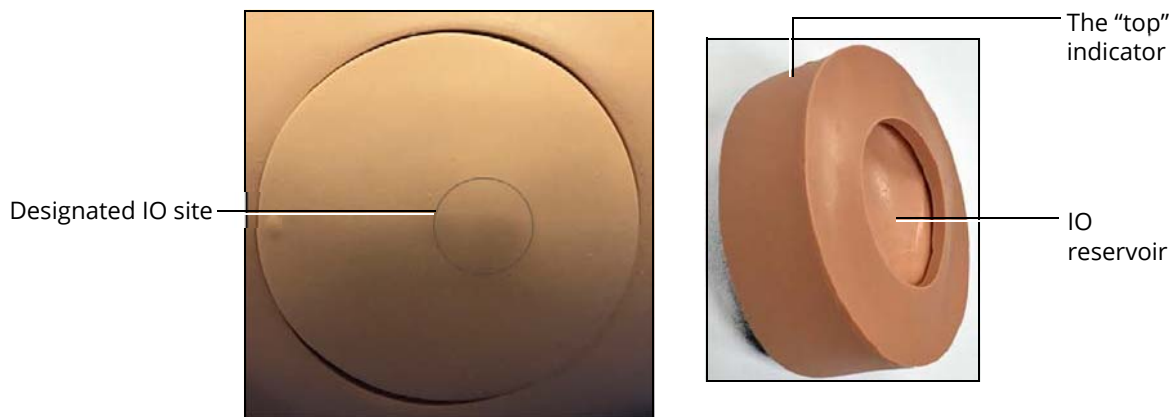
Apollo also allows for the administration of humeral intraosseous (IO) cannulation. The designated IO site is located on Apollo's left shoulder. Use a 25mm needle only with IO cannulation.

No more than 1 mL of fluid should be flushed per cannulation. Ensure all liquid is removed from previous use. Excessive bulging may occur when the IO reservoir is full of fluid. If the site is full or bulging, use an inserted IO needle with a syringe to withdraw and discard 5 - 10 mL of excess fluid.

Note: The IO site is designed to support 10 cannulations and does not support full infusion of fluids.

Ensure the IO site is properly aligned in the shoulder, with the "top" indicator toward the manikin's head.

IMPORTANT: *Never stick or puncture the IO reservoir.*



Intraosseous Cannulation Site

IV Cannulation

Veins for the IV Cannulation feature are located in the dorsum of the hands, forearms and antecubital region of the arms.

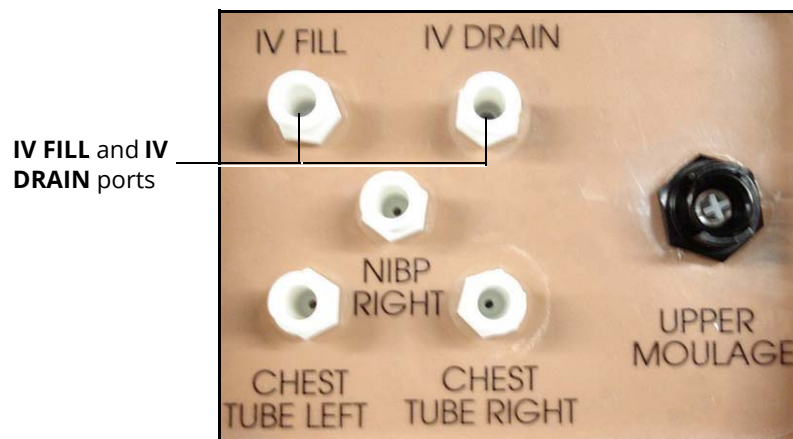
To simulate realistic flashback, the system must be primed prior to use. Ensure all fluids have been removed from previous uses before each new use to prevent overfilling.



IV Cannulation

To prime the IV access ports, connect a 60 mL syringe filled with distilled water (with clinically appropriate food coloring if desired) to the **IV FILL** port on Apollo's right shoulder and firmly inject all 60 mL. This primes the arms and charges the system for Flashback and Venipuncture support.

WARNING: *If a flash does NOT occur, do NOT inject any fluid and remove the needle immediately. Repeat the priming directions and ensure you have injected the needle properly and into the simulated vein.*



Apollo's Right Shoulder

Fluids and medications can be administered intravenously. Approximately 50 mL of fluid may be infused. To support infusion of larger volumes, connect an empty IV bag or other receptacle to the **IV DRAIN** port located on Apollo right shoulder.

Note: Cleanup is very important when using simulated fluids.

Fluids

Apollo is capable of bleeding simultaneously at two sites from an internal tank. **Arterial** and **Venous** bleeding can be simulated.

Venous settings produce a continuous bleed at three user-adjustable flow rates.

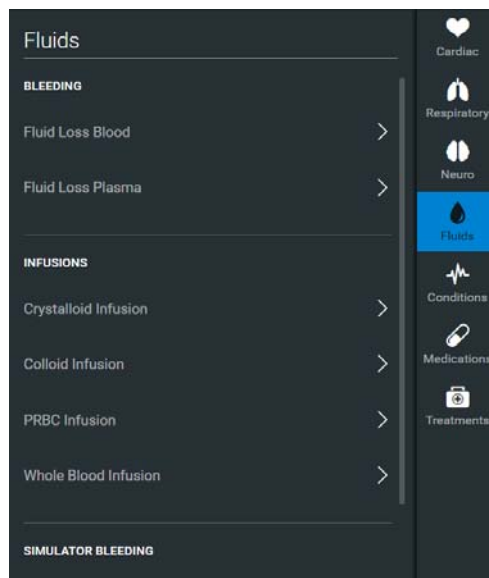
Arterial settings produce a pulsing flow synchronized with the cardiac cycle at three user-adjustable flow rates.

The flow rate is determined by the selected bleeding vessel size and the blood pressure. In addition, the simulator features auto-sensing of hemorrhage control (e.g., tourniquet application or direct pressure).

Bleeding results in an automatic loss of blood from the physiologic models with subsequent changes in hemodynamics. Blood loss occurs at a rate dependent on wound size and Mean Arterial Pressure (MAP).

Setup must be completed before using the bleeding feature.

To enable bleeding, from the Run screen, click the **Fluids** tab from the right side of the screen. The Fluids view appears.



Fluids View

Simulated blood **MUST** be removed from the simulator after each use. Failure to remove simulated blood from the simulator can void the warranty.

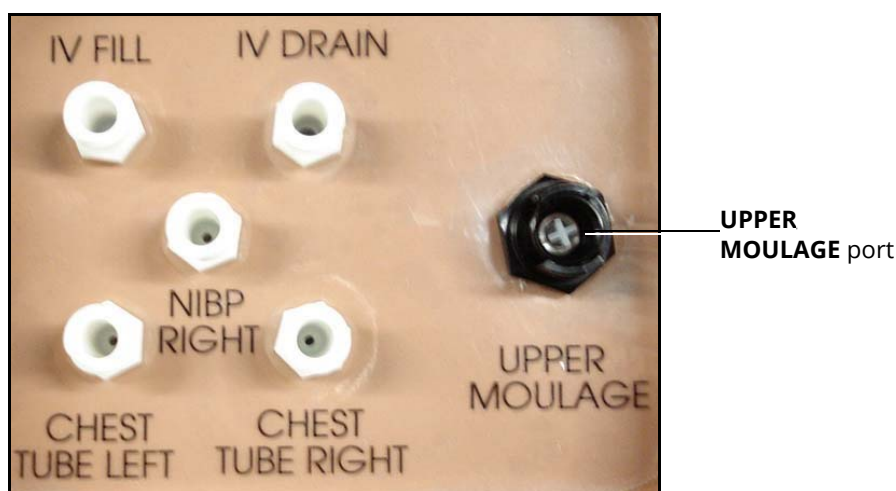
Hemorrhage Setup

The user determines the type and placement of the bleeding moulage for the lesson. An optional Moulage Kit can provide molded gunshot wounds, broken and protruding bones, amputations and an abdominal wound as well as theatrical components.

To decrease the likelihood of staining, apply a thin coat of petroleum to the area of bleeding.

To use one of the moulage wounds from the Moulage Kit:

1. Secure the wound over the simulator using the integrated straps
2. Connect the wound haptic to the one of the moulage ports located on Apollo's right shoulder (**UPPER MOULAGE**) or right hip (**LOWER MOULAGE**)



Apollo's Right Shoulder



Apollo's Right Hip

3. Enable **Bleeding: Upper** or **Bleeding: Lower** on the Fluids view of the Maestro software, as desired

Hemorrhage Control

When bleeding is controlled (e.g., hemostat, tourniquet), the action is detected and logged, and the physiology responds accordingly.

Tourniquet Application

A tourniquet may be applied to stop the flow of blood.

The wound umbilical contains an 18-inch section of soft tubing that allows the use of a tourniquet to stop the flow of blood.

For added realism, the simulator should be dressed in clothing that can be torn to “conform” with the type of injury being demonstrated. Bleeding moulages and the wound umbilical should be concealed under the victim’s clothing with only the wound showing.



Tourniquet Application

Fluid Loss Blood

To manually control a patient’s blood loss, from the Fluids view, click the **Fluid Loss Blood** parameter. The Fluid Loss Blood slider appears. Set the amount of blood loss by dragging the slider left or right. Click **Accept** to exit and save the changes.

Fluid Loss Plasma

To manually control a patient’s plasma loss, from the Fluids view, click the **Fluid Loss Plasma** parameter. The Fluid Loss Plasma slider appears. Set the amount of Plasma loss by dragging the slider left or right.

Click **Accept** to exit and save the changes.

Gastrointestinal

Apollo produces realistic bowel sounds. In addition, on Apollo Nursing, gastric lavage, gavage and suction can be administered.

Gastrointestinal Gavage, Lavage and Suction (Nursing Only)

Apollo Nursing has a gastric reservoir that allows for simulated gavage, lavage and gastric suction. Before each use, ensure the reservoir has been drained completely. The reservoir should be primed with 60 mL of fluid before performing gastric suction (see *Gastric Suction* for more information).

Gavage (Nursing Only)

To perform gastrointestinal gavage, ensure the reservoir is empty and infuse fluid according to procedure using a standard nasogastric tube.

Note: Cleanup is very important when using simulated fluids.

Note: Ice the nasogastric tube if extra rigidity is needed for insertion.

Lavage (Nursing Only)

To perform gastrointestinal lavage, ensure the reservoir is empty and infuse fluid normally using a standard nasogastric tube. Fluids can then be removed according to proper clinical procedure.

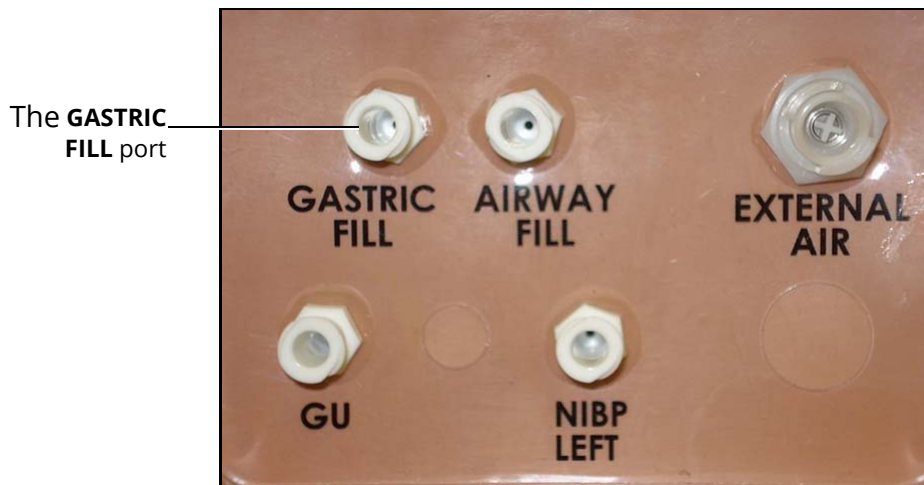


Gastric Lavage

Note: Ice the nasogastric tube if extra rigidity is needed for insertion. Cleanup is very important when using simulated fluids.

Gastric Suction (Nursing Only)

To perform gastric suction, the reservoir must be primed prior to use. To prime the gastrointestinal reservoir, attach a syringe with a luer-lock extension set (provided) and inject 60 mL of distilled water into the **GASTRIC FILL** port on the simulator's left shoulder.



Apollo Nursing's Left Shoulder

Fluids can then be removed according to procedure using a standard nasogastric tube.

Note: Cleanup is very important when using simulated fluids.

Genitourinary System

Apollo may be configured with either male or female genitalia, either of which allows for the insertion of a urinary catheter. The genitourinary system also provides for the excretion of urine.

Urinary Catheterization

Catheterize the simulator using a standard urinary catheter lubricated with silicone spray.



Urinary Catheterization

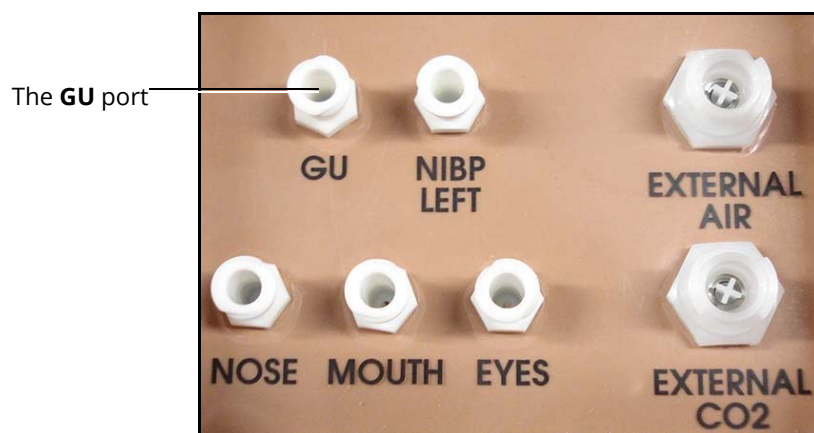
The bladder for the simulated urine is accessed directly via the urethra.

Simulating Urine Output

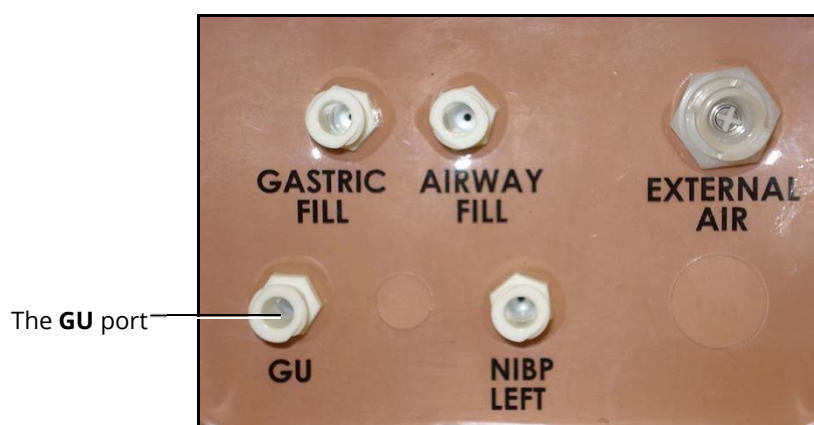
Apollo allows urinary catheterization and simulation of urinary output. Ensure all fluids have been removed from previous uses before each new use to prevent overfilling.

To simulate continuous urinary output:

1. Set up the IV pole near the simulator
2. Fill an IV bag with the clinically appropriate fluid. Use distilled water only, with food coloring if desired.
3. Hang the IV bag on the IV pole
4. Ensure the roller clamp is closed and insert the IV spike into the IV bag
5. Connect to the simulator by attaching the end of the IV spike set tubing to the **GU** port on the simulator's left shoulder



Apollo Prehospital's Left Shoulder



Apollo Nursing's Left Shoulder

6. Open the clamp and allow fluid to flow into the simulator. There is a reservoir inside the simulator that fills up with the fluid.
7. Keep the IV bag attached. Adjust the flow rate manually using the roller clamp.

8. Catheterize the simulator using a urinary catheter lubricated with silicone spray

Note: Cleanup is very important when using simulated fluids.

If a small volume of fluid is needed to simulate proper urinary catheterization in a field location, the internal reservoir may be filled. To fill the genitourinary reservoir, attach a syringe with a Luer-lock extension set (provided) and inject 60 mL of distilled water into the **GU** port on the simulator's left shoulder.

Changing the Simulator's Genitalia

Apollo comes with male and female genitalia.

To switch genitalia:

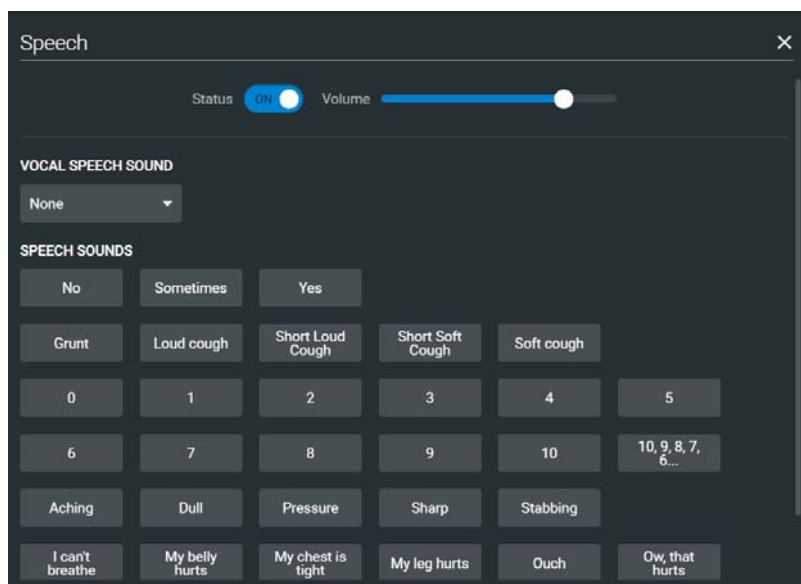
1. Pull apart the Velcro holding the genitalia
2. Loosen and remove the urethra connector. This connection may be tight when genitalia are removed the first time.
3. Remove the genitalia
4. Attach urethra tube to the urethra connector
5. Attach the desired genitalia using the Velcro

Sounds

A variety of simulated sounds are available to enhance realism. A patient must be running on the simulator for any sounds to be available.

Speech

Speech can be added to simulations using the Vocal Speech Sounds and Speech Sounds features on the software. Both the **Vocal Speech Sound** and **Speech Sound** options can be accessed from the **Speech** button on the Maestro run page.

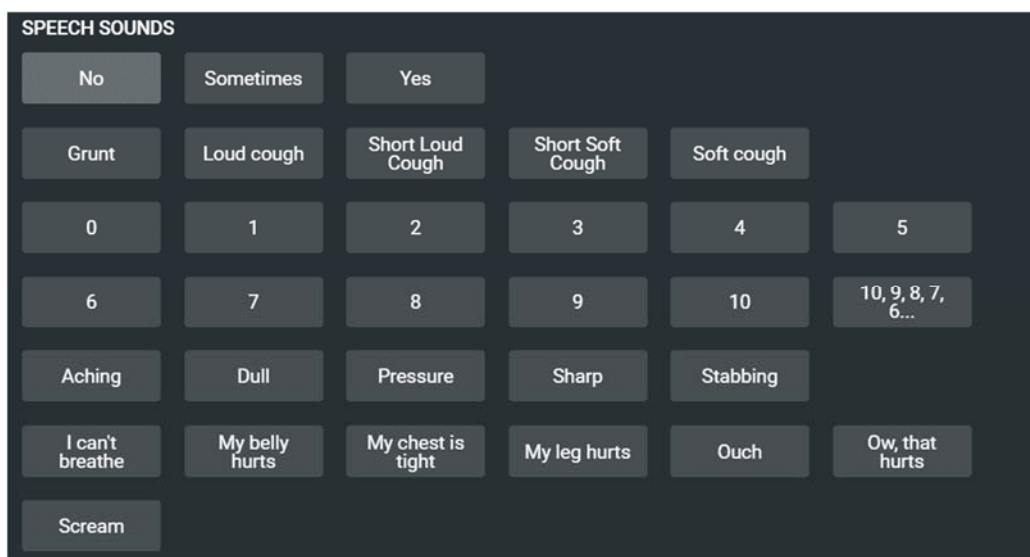


Speech View

Speech Sounds

Speech Sounds include a male or female voice that can utter pain rating indicators from 0 to 10, various phrases and a series of other utterances. Unlike Vocal Speech Sounds, Speech Sounds only play once.

To play a Speech Sound, click the desired **Speech Sounds** button. The desired sound will play once.



Speech Sounds

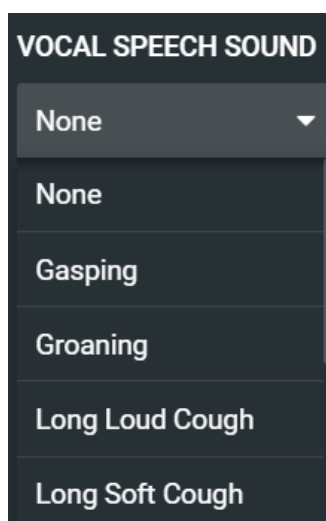
Speech Sounds
"10, 9, 8, 7, 6..."
"0" through "10" - Pain Ratings
"Aching"
"Dull"
"I can't breathe"
"My belly hurts"
"My chest is tight"
"My leg hurts"
"No"
"Ouch"
"Ow, that hurts"
"Pressure"
"Sharp"
"Sometimes"
"Stabbing"
"Yes"
Grunt
Loud Cough
Scream
Short Loud Cough
Short Soft Cough
Soft Cough

Vocal Sounds

A variety of programmable vocal sounds are available. Vocal sounds are male or female based on the gender of the active patient.

Vocal Sounds
None
Crying
Gasping
Groaning
Long loud cough
Long soft cough
Wheezing
Mumbling
Stridor

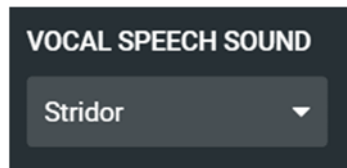
To select a sound from the **Vocal Speech Sound** drop-down menu, click the **Speech** button from the run screen.



Vocal Speech Sound Menu

Click **Vocal Speech Sound** and select the type of sound desired from the drop-down menu. Vocal Sounds play continuously when selected and are emitted immediately when selected from the **Vocal Sounds** drop-down menu. To stop playing one of the vocal sounds, select **None** from the list.

NOTE: **Stridor** sound can be enabled using the software, from the **Vocal Speech Sound** drop-down menu.



Stridor

Lung Sounds

Lung sounds are independently synchronized with ventilation of the left and right lungs. Fourteen speakers, eight anterior and six posterior, provide lung sounds that can be auscultated. Each of the four quadrants of the torso can be set independently to produce a particular lung sound.

Breath Sounds
Normal
Crackles
Diminished
Gurgling
Pleura Rub
Rhonchi
Wheezing

Click any one of the lung Sounds drop-down menus that each control one of four quadrants to change the type of sound. Click and drag the slider for each location to adjust the volume.

A patient must be running on a Apollo simulator for any sounds to be available.

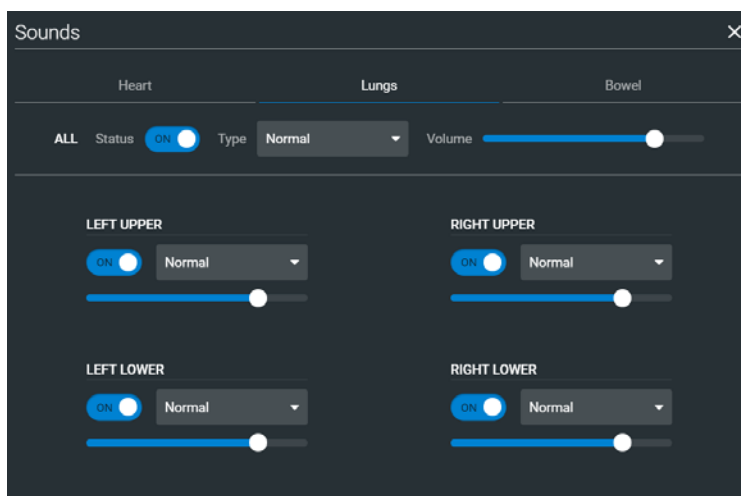
By default, **Normal** lung sounds are heard.

Lung sounds can be adjusted by clicking the **Sounds** button on the Run screen. When the Sounds panel appears, select **Lungs**.

The volume of individual quadrants can be enabled/disabled by toggling the volume switch.



Volume Switch



Lung Sounds Menu

Heart Sounds

Heart sounds emanate from four speakers and are synchronized with the cardiac cycle. Heart sounds can be auscultated over the left and right sternal border, left lower sternal boarder and apex.

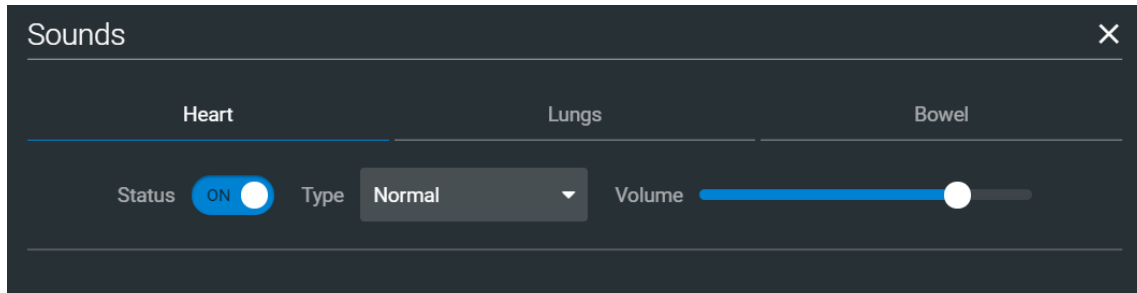
By default, heart sounds are set to the **Normal** sound. The following sounds are available:

Heart Sounds
Normal
S3
S4
S3 and S4
Early Systolic Murmur
Mid Systolic Murmur
Late Systolic Murmur

Pan Systolic Murmur

Late Diastolic Murmur

Heart sounds can be adjusted by clicking the **Sounds** button on the Run screen. When the Sounds panel appears, select **Heart**.



Heart Sounds Menu

Click the **Type** drop-down menu to change the type of sound. Click and drag the slider to adjust the volume.

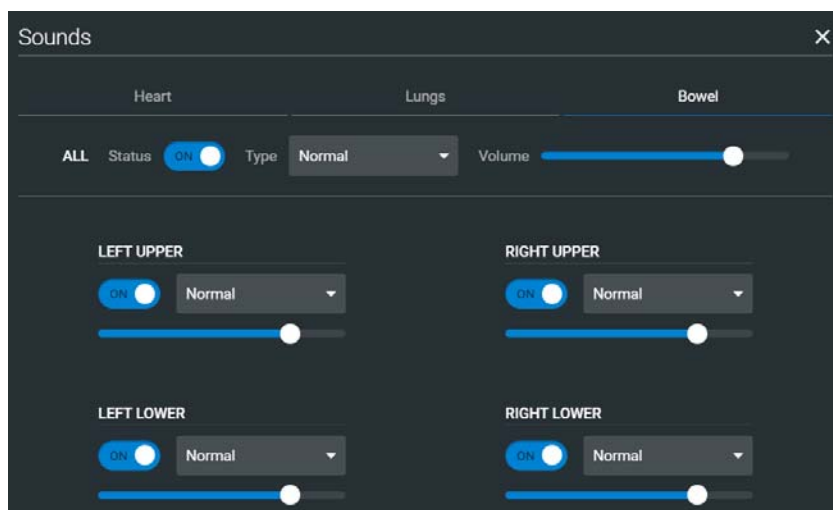
The volume can be enabled/disabled by toggling the volume switch.



Volume Switch

Bowel Sounds

Learners can auscultate bowel sounds over each of four intestinal quadrants: the Upper Right, Upper Left, Lower Right and Lower Left. The sounds can be independently set in each anatomical region to **Normal**, **Hypoactive**, **Hyperactive**.



Bowel Sounds Menu

The volume of individual quadrants can be enabled/disabled by toggling the volume switch.



Volume Switch

Bowel sounds can be adjusted by clicking the **Sounds** button on the Run screen. When the Sounds panel appears, select **Bowel**.

Click any one of the bowel sounds drop-down menus that each control one of four quadrants to change the type of sound.

Click and drag the slider for each location to adjust the volume.

Normal bowel sounds are present by default.

CARE AND MAINTENANCE

Maintaining Apollo requires careful treatment of the electronic and mechanical components. Each time Apollo is assembled or disassembled, make sure all components are properly handled and either removed from or placed into storage correctly.

Apollo Warranty Programs

General Information

CAE patient simulator products come with a one-year Manufacturer's Warranty (excluding batteries and consumables). All warranties begin at date of shipment or CAE installation. You may upgrade your first year Warranty to an Enhanced Warranty and receive remedial and planned maintenance. To prevent equipment downtime and delays after your warranty expires, we encourage you to contract for extended maintenance services for all subsequent years.

Units Out of Agreement

For units no longer under warranty requiring repairs, the Time and Materials service plan will apply.

To place an out-of-warranty unit under a warranty contract, CAE reserves the right to have the patient simulator inspected by a CAE-approved technician at the customer's expense. If necessary, the unit would have to be repaired at the customer's expense prior to issuance of a warranty contract.

The repairs required, as the result of the examination, will be quoted on a time and material basis.

How to Contact Customer Service

CAE Customer Service Headquarters - United States and Latin America

Monday - Friday from 7:00 a.m. to 6:00 p.m. ET

Toll Free +1 (866) 462-7920

24-hour Hotline +1 (941) 342-5605

Fax +1 (941) 342-5600

Email Address: customerservice@caehealthcare.com

Web URL: www.caehealthcare.com

CAE Customer Service - Canada

Monday - Friday from 8:00 a.m. to 5:00 p.m. ET

Toll Free +1 (877) 223-6273

Email Address: can.service@caehealthcare.com

CAE Customer Service - Europe, Middle East and Africa (EMEA)

Monday - Friday from 8:00 a.m. to 5:00 p.m. CET

Phone +49 (0) 6131 4950354

Fax +49 (0) 6131 4950351
Email Address: international.service@caehealthcare.com

CAE Customer Service - UK and Ireland

Monday - Friday from 9:00 a.m. to 5:00 p.m. GMT
Phone +44 (0)800-917-1851
Email Address: uk.service@caehealthcare.com

Principal hours of operation exclude holiday and non-business days.

Contract Period

Warranty contracts are not ordinarily offered for periods of less than one year. However, multiple-year warranty contracts may be arranged for up to an additional three years. Discounts are available for purchase of multiple-year contracts.

Limitations of Agreement

Your exclusive remedy for any defective patient simulator is limited to the repair or replacement of the defective patient simulator.

CAE may elect which remedy or combination of remedies to provide at its sole discretion. CAE shall have a reasonable time after determining that a defective material exists to repair or replace defective material. CAE's replacement material will be manufactured from new and/or serviceable parts. CAE's agreement applies to repaired or replaced materials for the balance of the applicable period of the original warranty or ninety days from the date of shipment of a repaired or replaced material, whichever is longer. CAE warrants its LABOR for 30 days or the balance at the applicable period of the original warranty, whichever is greater.

CAE shall not be liable under this warranty for incidental or consequential damages, or in the event of any unauthorized repairs or modifications have been made or attempted, or when the product, or any part thereof, has been damaged by accident, misuse or abuse. This warranty does not cover normal wear and tear, staining, discoloration or other cosmetic irregularities that do not impede or degrade product performance. Any damage or malfunction as a result of the installation of software or hardware, not authorized by CAE, will be repaired under the Time and Materials service plan (see Time and Materials section).

CAE's warranty does not cover products that have been received improperly packaged, altered or physically damaged. Products will be inspected upon receipt.

Some states in the USA do not allow the exclusion or limitations of incidental or consequential damages, so the limitations above may not apply to you. This warranty gives you specific legal rights and you may also have other rights, which vary from state to state.

Return Materials Authorization (RMA)

No product may be returned directly to CAE without first contacting CAE for an RMA number. If it is determined that the product may be defective, you will be given an RMA number and instructions for product return. An unauthorized return, e.g., one for which an RMA number has not been issued, will be returned at your expense. Authorized shipments are to be shipped prepaid to the address on the RMA. Your original box and packaging materials should be kept for storing or shipping your product. To request an RMA, please contact Customer Service.

System Software Upgrade Support

Customers with current warranty contracts are entitled to receive upgrades to applications software previously purchased. Installation of the system software is the user’s responsibility.

The System Software Upgrades Support includes software upgrades for base software and purchased optional software modules.

This does not apply for major upgrades or technological enhancements.

Pricing Structure

Time and Materials

For those systems not under agreement, service will be provided as required on a Time and Material basis:

Description	In-House	On-Site
Technical Support	As quoted at time of repair	CAE’s prevailing labor rate with a minimum of four hours labor
Material	As quoted at time of repair	As quoted at time of repair
Travel	N/A	Priced at CAE’s fully burdened cost plus fee

Principal period of on-site support (customer’s local time) is:

- Monday through Friday, 8:00 AM to 5:00 PM (customer’s time zone)
- Holiday and non-business days excluded
- Support outside the principle period is billed at the premium rate (hourly rate x 1.5)

A minimum of 48 hours notice is required for scheduling an on-site support call. Urgent on-site support with less than 48 hours notice will be charged at the premium hourly rate.

On-site time is described as the time period commencing from arrival at customer site through departure from customer site.

Breakdown

After each use, Apollo should be properly disassembled and stored in a secure place. To ensure that Apollo remains in good working condition, follow the prescribed CAE breakdown procedures below. These procedures are estimated to take less than 30 minutes.

Breakdown Steps	
1	Stop A Running SCE
2	Clean the Simulator and the Fluid System
3	Shut Down the Software
4	Power off the Simulator

Step 1: Stop A Running SCE

Stop a running SCE using the **Return** button in the upper left corner of the Maestro software, or the **Stop** button next to the timeline.

Step 2: Clean the Simulator and Fluid System

Refer to the Maintenance Advice on the following pages for detailed instructions.

Step 3: Shut Down the Software

To shut down the Maestro software:

- a. Stop any running SCEs
- b. Exit the software

Step 4: Power Off the Simulator

- d. Carefully pull back the skin on Apollo's left hip and hold the power button for two seconds. The light on the button will blink, indicating shutdown is in progress. Allow up to 30 seconds for complete shutdown. The light will turn off when shutdown is complete. If the simulator fails to shut down when these steps are performed correctly, press and hold the power button for five seconds to force the system to shut down.
- e. Carefully put the skin back into place for storage

Maintenance Advice

Simple care and maintenance helps to ensure that Apollo stays in good working condition. Many problems are caused by inadequate or improper maintenance. Perform a thorough check of the various components each time the simulator is used. Failure to follow these guidelines can lead to damage not covered by warranty.

General Simulator Care

Avoid the use of writing instruments and sharp objects near the patient simulator to prevent unattractive markings on or tears in the skin.

Lubricate airway adjuncts, urinary catheters and chest tubes with silicone spray (NOT a water-based lubricant) prior to insertion.

A mild detergent and warm water will remove most marks and stains. Gently rub the soiled area with a soft cloth. Do NOT use solvents or abrasive pads.

Prior to using moulage of any kind, CAE suggests the application of a very light coating of petroleum jelly, followed by a light dusting of baby powder, to the simulator's skin. This application makes cleaning the skin easier.

If any of Apollo's fluid systems have been used, flush out the simulator as described in the following pages. Failure to flush the systems may cause damage to the simulator.

Storage

When in regular use, Apollo's breakdown procedure and general cleanup should be sufficient to prepare the simulator for storage.

In addition, be certain to follow these instructions:

- Storage temperature should not exceed 122° F (50° C) or fall below 41° F (5° C)
- If a soft-sided simulator case is being used, the simulator should lie flat
- The simulator should NEVER be stored or shipped with fluids in the system

Care of Electronic Equipment

Install any CAE software updates as soon as they become available.

Airway Inspection

Apollo is equipped with an anatomically accurate airway that supports the practice of difficult airway management techniques. In the process of performing these techniques improperly or aggressively, the upper airway can be damaged.

Because damage can occur, occasional visual inspection of the airway is recommended. Using the light of a laryngoscope blade or a flashlight, visually examine the airway. While tears in the upper airway resulting from intubation may be obvious, needle holes in the lower trachea resulting from techniques such as transtracheal jet ventilation may not be readily apparent.

If damage to the airway is found, small cuts or tears may be repairable with silicone adhesive. However, for permanent repair of damaged simulators, contact CAE Customer Service.

Replacing the Battery

After approximately four hours of use, the simulator's battery must be removed to be recharged or replaced with a charged battery.

WARNING : *When handling Apollo's batteries, be sure to adhere to all the cautions and warnings.*

To replace the battery:

1. Unzip the chest skin



Unzipping the Chest Skin

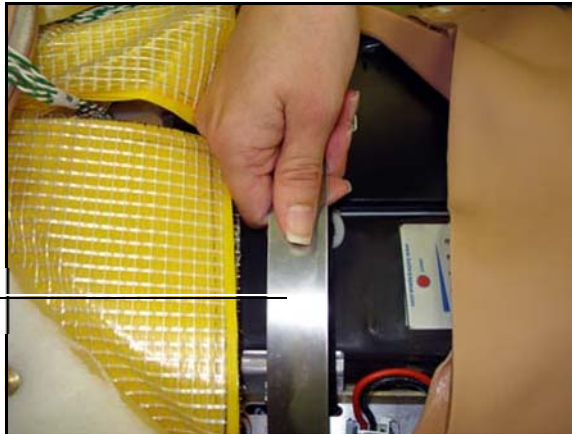
2. Lift the abdominal insert



Lifting the Abdominal Insert

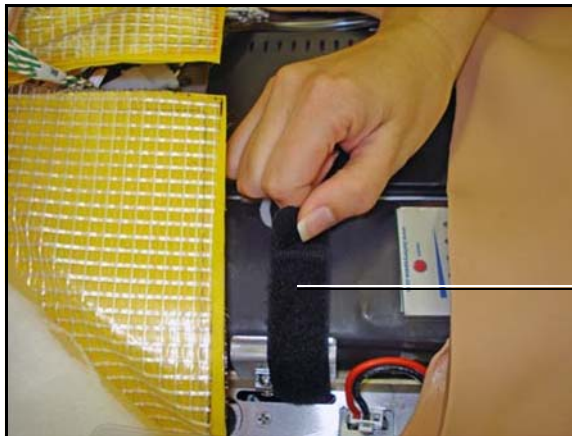
3. Remove the abdominal support

Remove the abdominal support



Removing the Abdominal Support

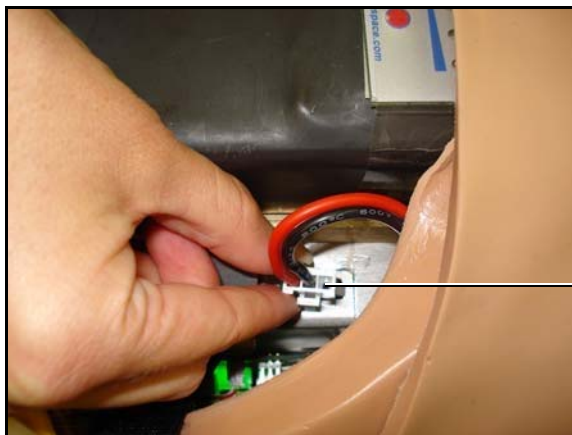
4. Release the Velcro battery tie-down



Release the Velcro battery tie-down

Releasing the Battery Tie-Down

5. Disconnect the battery leads



Disconnect the battery leads

Disconnecting the Battery Leads

6. Remove the uncharged battery



Removing the Battery

7. Insert a charged battery and affix the battery tie-down
8. Connect the battery leads and replace the abdominal support, ensuring both ends are secure in the slits
9. Replace the abdominal insert and chest skin

Recharging the Battery

The battery should be recharged after approximately four hours of use.

To recharge the battery, disconnect and remove the battery from the simulator and connect to the external charger provided.

WARNING: *When handling Apollo's batteries, be sure to adhere to all the cautions and warnings.*

Recharging should take approximately four hours.

IMPORTANT: *Never recharge the battery while it is connected to Apollo.*

Draining Condensation from the Simulator

As part of a regular preventive maintenance schedule, condensation should be drained from the simulator.

Depending on environmental conditions, moisture may condense inside the compressed air lines and tanks within the simulator. It is recommended that this fluid be drained every 40 hours of operation. In outside, high-humidity conditions, the system should be drained more frequently.

To drain condensation:

1. Locate the Condensation Drain Hose included with the Inventory Kit



Condensation Drain Hose

2. Bring the hose and a small bucket to the simulator location
3. Locate the **EXTERNAL AIR** port on Apollo's left shoulder
4. With assistance, place Apollo into a supine position
5. Power on Apollo. Do NOT launch the Maestro software.
6. Allow 60 seconds for the internal compressor to pressurize the system
7. Power down Apollo
8. With assistance, raise the left leg 45 degrees
9. Place the tubing end of the Condensation Drain Hose into the small bucket and then connect the fitting onto the simulator's drain connector. There will be a sudden release of pressure into the bucket. Any condensation within the system drains with this exhaust.
10. Disconnect the Condensation Drain Hose from the simulator

Clean the Simulator and On-Board Bleeding System

Note: A small bucket is recommended to collect wastewater during cleaning and flushing operations.

To clean and maintain the simulator and On-Board Bleeding system:

1. Remove and clean the wound haptics
2. Connect the beige-colored "fill" connector from the Trauma Fill Tank to the hip, but do not connect the white "vent" connection
3. Open the yellow Pressure Relief knob clockwise on the Trauma Fill Tank or loosen its Fill Lid so the tank is able to vent during this draining process
4. With the wound umbilicals in place, put the ends of both wound umbilicals into a wastewater bucket
5. From the Maestro home screen, click the gear icon in the top right of the screen
6. Select **System** from the drop-down list
7. From the **Maintenance** screen, click **Flush System**. The fluid begins to drain
8. Verify both channels produce a high, steady flow

9. When fluid stops flowing from either wound umbilical, detach the Fill Tank from the simulator
10. When fluid stops flowing from the lower wound umbilical, detach from the simulator
11. When fluid stops flowing from the upper wound umbilical, detach from the simulator
12. Click **Done** on the Maintenance screen. The fluids are now drained.
13. Empty the wastewater bucket
14. Rinse out the Trauma Fill Tank and fill with approximately 1 liter of clean, distilled water
15. Pump this fluid into the simulator
16. Repeat Steps 3 through 7 and 9 through 15 until the fluid exiting the simulator runs clear
17. Empty the Fill Tank and dry the wound umbilicals with a towel before storage

Note: It takes two to three minutes for this final flush.

Once a month, it is advised to flush the system with a mix of 50% distilled water and 50% white vinegar to keep mineral and algae buildup to a minimum. Always perform the steps for Flushing the Simulator afterward to remove vinegar.

Cleaning the Trauma Fill Tank

To prolong the life of the Trauma Fill Tank assembly and the fluid reservoirs, wash and flush the tank and connections after each use with clean distilled water.

Note: A small bucket is recommended to collect wastewater during cleaning and flushing operations.

Do NOT store liquids in the Trauma Fill Tank. If simulated blood mixtures are stored in the tank, they may clog the system when they dry and possibly damage the seals, filter and other components.

1. Remove and rinse the Overflow Bottle
2. Remove and rinse the Pump Assembly
3. Rinse the tank to remove all traces of the simulated blood
4. Pour 480mL (16 oz) of distilled water into the tank and reinstall the Pump Assembly. The Overflow Bottle holds 16 ounces.
5. Place the Overflow Bottle lid with umbilical attached into the wastewater bucket
6. Attach the fill (blue-labeled) and vent (yellow-labeled) fittings together at the other end of the umbilical
7. Pump the tank 25 times while making sure the wastewater is going into the bucket
8. Allow the tank to empty completely (the remaining air pressure will purge the fluid from the lines)
9. Reinstall the lid onto the Overflow Bottle and place the bottle back onto the tank assembly
10. Remove the Pump Assembly and pour any remaining fluid out of the tank. Then, reinstall the pump.

11. Disconnect the fill and vent fittings from each other and wrap the Trauma Tank Umbilical around the neck of the tank

Always depressurize the tank, remove trauma fluid and clean the tank before performing maintenance. The pump assembly may need periodic lubrication. Call CAE Customer Service for details if the pump loses the ability to create pressure, squeaks loudly or is difficult to move.

Cleaning the In-Line Filter

To clean the in-line filter:

1. Grasp both ends of the in-line filter and twist counterclockwise
2. Pull apart both ends of the filter to separate
3. Remove the blue filter cone from the encasement. Do NOT remove the black rubber seal
4. Using a 60 mL syringe with distilled water, push fluid from the outside of the blue filter cone to the inside, removing all debris
5. Repeat process until all debris is removed
6. Re-assemble the in-line filter, ensuring the black rubber seal is in place at the base of the blue filter cone



The In-Line Filter

Troubleshooting the Trauma Fill Tank

Before making any repairs, ALWAYS depressurize the tank, remove all trauma solution and clean the tank.

Problem	Cause	Solution
Tank can be pressurized, but only air comes out.	Siphon tube has detached from insert.	Remove hose from tank and reinsert siphon tube.
Pressure does not build up. No fluid is transported to simulator.	(1) Pump assembly not sealed tightly into tank or (2) Damaged pump cylinder gasket or o-ring or (3) Tank pressure relief valve is set to "open."	(1) Thoroughly clean pump cylinder gasket or o-ring and surrounding area and apply a light coating of silicone to pump gasket or o-ring. (2) Contact CAE for service. (3) Turn valve until it returns to a "sealed" position.
Simulator fill time is too long (more than 5 minutes).	(1) Not enough strokes applied to create pressure or (2) The in-line filter is dirty or (3) The umbilical is disconnected at Overflow Bottle or (4) Too much fluid in fill tank.	(1) Pump 25 to 35 times for best performance. (2) Clean filter. (3) Reconnect the overflow fitting. (4) The Trauma Fill Tank works best with 1 gallon (3.6 liters) of fluid inside. If greater amounts of fluid are used, tank may require additional pumps as fluid is transported to simulator.

Empty and Flush the Chest Tube Reservoir

Removing fluids from the Chest Tube reservoir and the Chest Tube system requires the same steps.

To empty the Chest Tube reservoir or flush the Chest Tube system, have a chest tube and a basin to catch fluid in place. Use a syringe to slowly push air through the appropriate **CHEST TUBE** port until only air flows through the chest tube.

Flush the IV Lines

To flush the IV lines:

1. Connect an empty IV bag to the **IV DRAIN** port
2. Using a syringe, slowly push air into the **IV FILL** port. The fluid drains out of the **IV DRAIN** port.
3. Continue to push air until empty

Emptying the Genitourinary Reservoir

To empty the Genitourinary reservoir, have a catheter in place and a basin to catch fluid. Use a syringe to slowly push air through the **GU** port until only air flows through the catheter.

Empty the Head Secretions Lines (Prehospital Only)

To remove fluid from the Head Secretions lines, connect a syringe to the **NOSE** port and vacuum out fluid until empty. Repeat this process for the **MOUTH** and **EYES** ports.

Empty the Airway Secretions Reservoir (Nursing Only)

To empty the Airway Secretions reservoir, connect a 60mL syringe to the **AIRWAY FILL** port and vacuum out fluid until empty.

Flush the Subclavian Catheter (Nursing Only)

When flushing the Subclavian Catheter, the catheter must be in place.

To flush the Subclavian Catheter:

1. Connect an external drain to the **IV DRAIN** port and place a basin to catch fluid
2. Using a syringe, slowly push air into the **IV FILL** port. The fluid drains out of the **IV DRAIN** port.
3. Continue to push air until empty
4. Using the same syringe, push air through the Subclavian Catheter until empty

Handling CO₂ Canisters (Prehospital Only)

Careful handling is required in the use of CO₂ canisters. Please read and follow all appropriate cautions and warnings.

Remove the CO₂ Canister from the Regulator

The following instructions describe how to safely remove the CO₂ canister from the regulator assembly for replacement or shipping.

CAUTION: If unsure that CO₂ canister is empty, eye and hand protection must be worn to protect from release of freezing gas or liquid.

1. Remove the CO₂ regulator assembly from the simulator
2. While holding the regulator assembly firmly, slowly unscrew the CO₂ canister from the regulator. There is a small relief hole in the side of the regulator from which any remaining CO₂ will bleed. If this should happen, no harm will be done to system, but it is rather noisy and the rapid release of CO₂ gas can freeze the canister's surface and cause frostbite to unprotected skin.
3. Continue unscrewing the canister until it is free from the assembly

Important Canister Information

The 16 Gram CO₂ Canister with threaded neck is available at most sports equipment retailers - most often used for bicycle tire inflators. We recommend purchasing Leland brand canisters (P/N 82122Z), which are also available from CAE.

Punctured canisters are considered to be empty. No residue remains in the canister after use. The steel used is a low carbon type, which rusts if disposed in a landfill. If your community requires recycling, then place with normal household recycling.



CO₂ Canisters are considered by the U.S. Department of Transportation to be "Other Regulated Materials - Domestic" (ORM-D). Ground shipping containers must be clearly marked with this label. CO₂ Canisters are considered hazardous material when offered for air transportation, so different rules apply. Contact carrier for details and instructions.



Related Cautions & Warnings

CO₂ Canister

- Store the CO₂ canisters in a dry location between 32° and 104° F (0 to 40°C)
- Do not expose the CO₂ canister to heat above 140° F, as rupture may occur
- Never point the CO₂ canister towards your face or someone nearby
- Use only CAE specified CO₂ canisters

CO₂ Regulator Assembly

- Care must always be taken when using high-pressure equipment
- Do not disassemble or alter regulator
- Dry completely if the regulator becomes wet
- Discontinue use of this equipment if leakage or visible damage is evident

Use of Equipment

- Canister end becomes punctured when screwed into regulator base and therefore should not be removed until empty
- Unscrewing canister before it is empty will result in sudden release of all high-pressure gas with a possibility of liquid CO₂ spray. Unprotected skin could receive freezing burns.
- Wear protective gloves and eye protection when removing canister from regulator assembly
- Remove CO₂ canister from regulator assembly when shipping simulator

Recommended Clinical Supply Sizes

RECOMMENDED CLINICAL SUPPLY SIZES

The following clinical supply sizes are recommended for use with Apollo. Other sizes may cause damage to the simulator and should not be used.

Table 1:

Recommended Tube, Needle and Airway Sizes	Apollo Prehospital	Apollo Nursing
Urinary Catheter	16 Fr	16 to 16 Fr
Nasogastric Tube (NGT)	14 Fr**	12 to 14 FR*
Gastric Lavage/Gavage	Not Supported	12 to 14 FR*
Airway Suctioning	Not Supported	12 to 14 FR*
ETT	7.0 to 7.5mm	Not Supported
LMA Unique	#4	Not Supported
King LTS-D LT-D	#4	Not Supported
Combitude	37 Fr	Not Supported
Oropharyngeal Airway	90 mm	90 mm
Nasopharyngeal Airway	30 Fr, 7.5 mm	30 Fr, 7.5 mm
Tracheostomy Tube	6 mm	6 mm
IV Cannula	18 to 22 gauge	18 to 22 gauge
Chest Tube	28 Fr	26 to 28 Fr

Needle Decompression	14 gauge, 6 cm	Not Supported
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* With fluid return

** Insertion only

CONDITION GUIDELINES FOR PROGRAMMING APOLLO

This section is intended to help you select Maestro conditions to achieve desired vital signs within each programmed state. All four conditions should be programmed into each state in the order presented below:

- Respiratory: Desaturation
- Cardiovascular: Blood Pressure
- Cardiovascular Heart Rate
- Respiratory: Respiratory Rate

The Maestro software is physiologically driven. When using multiple conditions (e.g., Desaturation + Hypertension + Tachycardia + Tachypnea), physiological regulatory mechanisms such as the baroreceptor reflex and ventilatory control cause compensatory changes within parameters. To achieve the desired vital sign, select one condition level, above (greater) or below (less), to achieve the desired physiological effect.

Respiratory: Desaturation

Desaturation	SpO ₂ Value
Reset	98%
High 90s	96-97%
Mid 90s	94-96%
Low 90s	91-93%
High 80s	87-90%
Mid 80s	84-86%

Low 80s	80-83%
High 70s	77-80%
Mid 70s	74-77%
Low 70s	69-71%
Less than 70	<69%

Cardiovascular: Blood Pressure

Hypertension		Hypotension	
Reset	110s/70s	Reset	110s/70s
Increased	120s/80s	Decreased	100s/70s
Pre-Borderline	130s/80s	Pre-Borderline	100s/60s
Borderline	140s/90s	Borderline	90s/50s
Mild	150s/90s	Mild	80s/40s
Moderate	160s/100s	Moderate	70s/40s
Severe	170s/100s	Severe	60s/30s
Profound	190s/110s	Profound	50s/30s
Extreme	220s/120s	Extreme	40s/30s

Cardiovascular: Heart Rate

Tachycardia		Bradycardia	
Reset	70s	Reset	70s
Increased	High 70s	Decreased	Mid 60s
Elevated	80s	Pre-Borderline	Low 60s
Pre-Borderline	90s	Borderline	Mid 50s
Borderline	100s	Intermediate	Low 50s

Intermediate	110s	Mild	High 40s
Mild	120s	Moderate	Mid 40s
Moderate	130s	Severe	Low 40s
Severe	140s	Extreme	Mid 30s
Supra	150s	Acute	Low 30s
Profound	160s		
Extreme	170s		
Acute	High 170s		

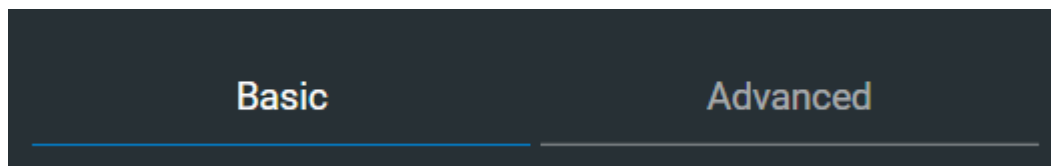
Respiratory: Respiratory Rate

Tachypnea		Bradypnea	
Reset	11	Reset	11
Increased	15	Increased	10
Elevated	18	Intermediate	9
Borderline	20	Mild	7
Intermediate	22	Moderate	6
Mild	25	Severe	5
Moderate	28	Profound	3
Severe	31	Extreme	2
Profound	33		
Extreme	36		

Maestro PARAMETER DESCRIPTIONS

The Maestro software has a number of parameters that control the physiological features of the simulator. The parameters are grouped by category: Neurological, Eyes, Respiratory, Cardiovascular, Pulse, Fluids and Sounds.

Each physiological view lists the Basic parameters by default. However, when the **Basic/Additional** switch is activated, additional parameters become available.



Basic/Additional Switch

The following is a brief description of each parameter. Each parameter description lists the default settings for modeled patients.

Neurological - Parameters

The Apollo simulator can simulate a variety of neurological clinical indicators.

Neurological Parameters
Apply to Both Eyes
Eyes: Pupil Control
Eyes: Blinking
Eyes: Blink Speed
Reactive Pupils
Light Reactivity Speed
Secretions: Tearing
Secretions: Ears
Secretions: Nose
Secretions: Mouth
Diaphoresis
Convulsions
Seizures
ICP
NMB
Temperature: Body
Temperature: Blood

Convulsions

The **Convulsions** parameter is used to simulate the presence of convulsions. It is either **ON** or **OFF**.

Default: Off

Intracranial Pressure (ICP)

The ICP parameter is used to set the ICP displayed as a numeric value on the Patient Status Display and on the TouchPro monitor. The value is **Modeled** by default.

Default: Modeled

Range: 0 mmHg - 65.0 mmHg

Neuromuscular Blockade (NMB)

The pharmacokinetic and pharmacodynamic models based on the neuromuscular blocking agents administered and the time course of their injection automatically determines the degree of NMB. For some educational applications, however, the instructor may wish to set a fixed degree of neuromuscular blockade that remains stable for an indefinite period. This can be accomplished using the **NMB** parameter. The default setting instructs the pharmacologic models to determine the degree of neuromuscular blockade based upon the drugs injected and their pharmacologic properties.

When a numeric value is assigned to this parameter, the degree of NMB is set to that level. For example, 80% NMB causes the simulator to set the degree of NMB to 80%, regardless of the presence (or absence) of neuromuscular blocking drugs. Clinically, the spontaneous tidal volume is markedly reduced. If NMB is set to greater than 30%, the eyes will automatically close when in the Auto mode.

Default: Modeled

Range: 0% - 100%

Temperature: Body

The temperature measured at the body surface can be set using this parameter and can be displayed on the Patient Status Display and TouchPro software.

The body temperature is not linked to the physiologic models. However, changes can be made “on the fly” or scripted using the Scenario Editor.

Default: 36.5° C

Range: 32.0° C - 42.0°C

Temperature: Blood

The arterial blood temperature can be set using the **Temperature: Blood** parameter. The arterial blood temperature can then be displayed on the Patient Status Display and TouchPro software. Note that changes in arterial temperature may alter the position of the standard oxyhemoglobin dissociation curve (shift). As temperature increases or pH decreases, more oxygen is released from hemoglobin and thus the patient’s saturation decreases. The inverse is also true.

Default: 37° C

Range: 32.0° C - 42.0° C

Eyes – Parameters

Blink Speed

The **Blink Speed** parameter controls the eyelid blinking frequency and can be set to **Slow**, **Normal**, or **Fast**. The response can be done “on the fly” or scripted using the **Scenario Editor** (along with **Live Scenario Editor**).

Default: Normal

Apply to Both Eyes

Both eyes can be controlled together by selecting the **Control Eyes Together** option. When this option is selected, any change made to one eye, will automatically be made to the other eye.

Default: Off

Blink Mode

In **Auto** mode the eyes are normally blinking. However, the eyes will automatically close under any of the following conditions:

SpO₂ < 75%

Spontaneous minute ventilation < 1500 mL

Neuromuscular blockade (NMB) > 30% Non-pulsatile cardiac rhythm

The **Blinking** and **Closed** settings allow the user to have one or both eyes either blinking or closed and override the automatic response.

Default: Auto

Light Reactivity

Currently, two options can be selected from the Light Reactivity control: **Brisk** and **None**.

Default: Brisk

Pupil Diameter

The pupil control parameters are used to control the diameter of the pupils in the eyes. Each eye has reactive pupils and functional eyelids that blink.

Currently, there are four pupil options that are used to control the diameter of the pupils in both eyes: **Reactive to light**, **Blown** or a Fixed Pupil Size (**2 mm** and **5 mm**).

When the Eyes are set to **Brisk** (in the **Light Reactivity** section), the pupils re-size in response to changes in lighting condition. If both pupils are set to **Brisk**, both pupils re-size in a consensual manner.

The pupil diameter is automatically set to **Reactive to light** for this option. Pupil diameter can be modified when Light Reactivity is set to **None**, where the pupil diameter can be fixed to **2 mm**, **5 mm**, or **Blown**.

Default: Reactive to light

Respiratory – Basic Parameters

Respiratory Parameters – Basic
Apnea
Swollen Tongue
Airway Occluder
Laryngospasm
Needle Decompression
Bronchial Occlusion (Left and Right)
Bronchial Resistance Factor: Left Bronchial Resistance Factor: Right
Respiratory Rate
Respiratory Rate Factor
Shunt Fraction
EtCO ₂
SpO ₂
Tidal Volume
Tidal Volume Factor
I to E Ratio (1 : X)
Needle Decompression: Left Needle Decompression: Right
Intrapleural Volume: Left Intrapleural Volume: Right
Fraction of Inspired O ₂

Chest Tube Flow: Left
Chest Tube Flow: Right

Apnea

This parameter sets the respiratory rate to zero and sets both eyes to closed: **On/Off**.

Default: Off

Swollen Tongue

This parameter is used to create two degrees of tongue swelling: **On/Off**.

Default: Off

Airway Occluder

Using the **Airway Occluder** parameter, swelling of the posterior oropharynx can be activated to obstruct the view of the larynx and prevent intubation but allow mask ventilation of the patient's lungs, thereby creating a "cannot intubate, can ventilate" scenario.

Default: Off

Laryngospasm

Use the **Laryngospasm** parameter to simulate a laryngospasm. A laryngospasm actuator closes the patient's vocal cords and prevents both ventilation and intubation. When activated with the **Airway Occluder** parameter, a "cannot intubate, cannot ventilate" crisis scenario is achieved.

Default: Off

Needle Decompression (Left and Right)

The **Needle Decompression** parameter is used to activate the **Needle Decompression** hardware in the simulator to relieve a pneumothorax in the simulator. This causes a rush of air to be heard on successful decompression. The amount of decompression is automatically subtracted from the **Intrapleural Volume** set.

Default: Off

Bronchial Occlusion (Left and Right)

Turning on the **Bronchial Occlusion** parameter completely obstructs the right or left bronchi, simulating a lower airway obstruction (e.g., mucus plug).

Right and left bronchi can be occluded individually.

Default: Off

Bronchial Resistance Factor (Left and Right)

The **Bronchial Resistance Factor** parameter can be used to set the rate of left and right bronchial resistance individually. The rate of resistance can also be set to occur over time.

Default: 1

Range: 0.00 - 250,000.00

Respiratory Rate

The **Respiratory Rate** parameter is used to set the respiratory rate to a given number of breaths per minute. Once set, arterial oxygen and carbon dioxide values have no effect on the resulting respiratory rate, but continue to influence other components of the physiological models. The patient continues to breathe at the set number of breaths per minute, regardless of the arterial oxygen or carbon dioxide levels.

For example, when the respiratory rate is set to 10 breaths per minute, the respiratory rate remains at 10 breaths per minute, regardless of arterial oxygen or carbon dioxide levels. In such situations, the patient can only respond to arterial oxygen or carbon dioxide levels by altering the tidal volume, either automatically via the model-driven controls or when the **Tidal Volume** parameter is adjusted.

Default: Modeled

Range: 0 breaths per minute - 40 breaths per minute

Respiratory Rate Factor

The **Respiratory Rate Factor** parameter (along with the **Tidal Volume Factor** parameter) is used to change the baseline respiratory rate (before the control-of-breathing and drug influences are taken into account). A value of 2 doubles the baseline respiratory rate. A value of 0.5 decreases the baseline respiratory rate by 50%. Changing the respiratory rate using this parameter maintains the physiological models.

Default: 1

Range: 0.01 - 6.00

TIP: First decrease the respiratory gain factor to reduce the influence of the respiratory control mechanism on the respiratory rate and tidal volume.

Shunt Fraction

The Shunt Fraction parameter is frequently used to assist in desaturating a patient. This parameter creates a physiologic “bypass” of the normal pulmonary circulation, resulting in changes in O₂, CO₂ and anesthetic gases at the alveolar level. Typically, values of 0.1 to 0.4 are needed to create large alveolar-arterial oxygen gradients sufficient to cause arterial hypoxemia.

Default: 0.02

Range: 0.00 - 0.50

TIP: *If the parameter is set high (0.5), the patient desaturates rapidly and responds negatively to the administration of supplemental O₂.*

EtCO₂

The **EtCO₂** parameter is used to set the end-tidal CO₂ to a fixed numeric value, measured in mmHg, regardless of the minute ventilation. The end exhalation point of the capnogram waveform will also reflect the set end-tidal CO₂ value. Setting the EtCO₂ has no effect on the arterial carbon dioxide values (PaCO₂), respiratory rate or tidal volume.

For example, when the EtCO₂ is set to 50 mmHg, the numeric end-tidal CO₂ will display a value of 50 mmHg and the capnogram waveform rises to an end-tidal of 50 mmHg. However, the respiratory rate and tidal volume will remain the same unless the **Respiratory Rate** and/or the **Tidal Volume** parameter(s) is adjusted.

Default: Modeled

Range: 0 mmHg – 100 mmHg

SpO₂

The SpO₂ parameter is used to override the normal pulmonary circulation and set the SpO₂ at a fixed numeric value, regardless of the oxygen applied. Resetting to **Modeled** returns control of the underlying SpO₂ to the physiological models. If SpO₂ is set to less than 75%, the eyes will automatically close when in the Auto mode.

Default: Modeled

Range: 0% - 100%

Tidal Volume

The **Tidal Volume** parameter is used to set the tidal volume to a given volume per breath. Once Tidal Volume is set to a numeric value, arterial oxygen and carbon dioxide values have no effect on the tidal volume, but continue to influence other components of the physiological models.

For example, with the tidal volume set to 600 mL in the adult simulator, the tidal volume remains a constant (set) 600 mL even in the event of falling arterial oxygen levels. In such situations, the patient can only respond to arterial oxygen or carbon dioxide levels by altering the respiratory rate, either automatically via the model-driven controls or when the **Respiratory Rate** parameter is adjusted.

Default: Modeled

Range: 0 mL- 2500 mL

Tidal Volume Factor

The **Tidal Volume Factor** (along with the **Respiratory Rate Factor**) parameter is used to change the baseline tidal volume (before the control-of-breathing and drug influences are taken into account). A value of 2 doubles the baseline tidal volume. A value of 0.5 decreases the baseline tidal volume by 50%.

Default: 1

Range: 0.10 - 4.00

TIP: First decrease the respiratory gain factor to reduce the influence of the respiratory control mechanism on the respiratory rate and tidal volume.

I to E Ratio (1:X)

The **I to E Ratio (1:X)** parameter sets the inspiratory-expiratory (I:E) ratio for spontaneous ventilation. At the default setting, the time for exhalation is twice that of inhalation.

Default: 2

Range: 0.50 - 7.00

Intrapleural Volume (Vol): (Left and Right)

The **Intrapleural Vol** parameters allow intrapleural volume to accumulate, for example, as happens during pneumothorax, hydrothorax or hemothorax.

To simulate a pneumothorax, set the corresponding **Intrapleural Vol** to a value greater than 0 mL. Values more than 1500 mL reduce the corresponding lung volume significantly. Breath sounds and chest rise are automatically diminished on the appropriate side due to decreased ventilation of the affected lung.

Default: 0

Range: 0 mL - 2500 mL

Fraction of Inspired O₂ (FiO₂)

This parameter is used to simulate changes in the **FiO₂**, such as would occur with the administration of supplemental oxygen.

Default: 21%

Range: 0% - 100%

Chest Tube

The **Chest Tube** parameter is used to activate the chest tube hardware in the simulator. The **Prime** option has no physiologic impact. Instead, it is used to prepare the feature by allowing fluid to flow through the apparatus, thereby removing air from the line.

When a chest tube is placed into the simulator, this is sensed and recorded in the Event Log. It is also possible to have a scenario transition on chest tube placement, which can be scripted using the Scenario Designer.

Default: Disable

Note: The Chest Tube and Needle Decompression features cannot be enabled simultaneously.

Chest Tube Flow: (Left and Right)

The **Chest Tube Flow** parameter is used with the chest tube feature of the simulator. The Chest Tube Flow specifies the rate at which fluid can be removed from the simulated pleural space via a chest tube drainage system. As the chest tube drains, the volume is automatically subtracted from the set amount of Intrapleural Volume.

Default: 50 mL/min

Range: 0 mL/min - 50 mL/min

Respiratory – Additional Parameters

Respiratory Parameters – Additional
pH Shift
PEEP
O2 Consumption
CO2 Production Factor
PaCO2 Set-point
PaO2 Set-point
PetCO2-PaCO2 Factor
Respiratory Gain Factor
Respiratory Quotient
Volume/Rate Control Factor
Chest Wall Capacity
Chest Wall Compliance Factor
Distended Chest Wall Compliance Factor
Functional Residual Capacity
Lung Compliance Factor: Left Lung Compliance Factor: Right
Venous CO2 Shift
Alveolar Enflurane
Fraction of Inspired Enflurane
Alveolar Halothane
Fraction of Inspired Halothane
Alveolar Isoflurane
Fraction of Inspired Isoflurane

Alveolar Nitrous Oxide
Fraction of Inspired Nitrous Oxide
Alveolar Sevoflurane
Fraction of Inspired Sevoflurane

pH Shift

The **pH Shift** parameter is used to create a metabolic acidosis or metabolic alkalosis under script control.

The default pH value displayed on the Patient Status Display or TouchPro software is dependent on respiratory arterial CO₂ values. Under default conditions (PaCO₂ = 40 mmHg), the pH is approximately 7.4. Rising arterial CO₂ produces a subsequent drop in pH, while falling arterial CO₂ levels result in rising pH values.

To simulate pH changes with metabolic changes (acidosis or alkalosis), the **pH Shift** value is a mathematical addition to (or subtraction) from the displayed pH value to that which is desired.

Default: 0

Range: -(0.50) - 0.50

Positive End Expiratory Pressure (PEEP)

The PEEP parameter specifies the amount of positive end expiratory pressure applied during mechanical ventilation. Setting this parameter results in clinically appropriate intrathoracic pressures and hemodynamic responses.

Default: 0.0 cmH₂O

Range: 0.0 cmH₂O - 25.0 cmH₂O

O₂ Consumption

The **O₂ Consumption** parameter is used to change the rate of consumption of oxygen and production of carbon dioxide. When **O₂ Consumption** is increased and used with increased **Shunt Fraction**, profound levels of hypoxia can be achieved rapidly.

Default: 250 mL per minute

Range: 0 mL per minute - 2000 mL per minute

CO₂ Production Factor

The **CO₂ Production Factor** parameter allows for the manipulation of metabolic CO₂ production to simulate a variety of pathophysiological conditions. CO₂ production is determined by the **O₂ Consumption** and **Respiratory Quotient** settings. A CO₂ Production Factor value of 2 doubles the CO₂ production, while a value of 0.5 decreases the CO₂ production by 50%.

Default: 1

Range: 0.50 - 4.00

PaCO₂ Set-point

The **PaCO₂ Set-point** parameter is a set-point for PaCO₂. The control-of-breathing model adjusts tidal volume and respiratory rate in order to bring the PaCO₂ toward this set-point. Factors that influence the success of this control effort include baseline tidal volume, baseline respiratory rate, respiratory gain, O₂ consumption, respiratory quotient, lung compliances, chest wall compliance, bronchial resistances, the presence of artificial airways in the simulator and the inspired gas mixture.

When the **PaCO₂ Set-point** is set to a new value, the physiological controls adjust the simulator's respiratory pattern in an attempt to attain the desired set-point. For example, when the set-point is raised from 40 to 50 mmHg, there is a transitory decrease in respiratory rate and tidal volume, as the physiological controls attempt to drive the PaCO₂ toward 50 mmHg. When the PaCO₂ reaches the new set-point, the simulator's respiratory rate and tidal volume should return to normal values.

Default: 40 mmHg

Range: 20.0 mmHg - 70.0 mmHg

PaO₂ Set-point

The **PaO₂ Set-point** parameter is a set-point for PaO₂. When PaO₂ is below the set-point value, progressive stimulation of spontaneous minute ventilation occurs. Both tidal volume and respiratory rate rise, which under appropriate conditions results in PaO₂ moving closer to the set-point. Factors that influence this control effort include baseline tidal volume, baseline respiratory rate, respiratory gain, O₂ consumption, respiratory quotient, lung compliances, chest wall compliance, bronchial resistances, the presence of artificial airways in the simulator and the inspired gas mixture. Minute ventilation is not affected for PaO₂ above the set-point.

For example, if **PaO₂ Set-point** is set to 100 mmHg and PaO₂ drops to 90 mmHg, ventilatory stimulation occurs. When the PaO₂ reaches the new set-point, the simulator's respiratory rate and tidal volume are again controlled to maintain PaCO₂ at the PaCO₂ set-point. Also, see **PaCO₂ Setpoint**.

Default: 100.00 mmHg

Range: 20.0 mmHg - 100.0 mmHg

PetCO₂ - PaCO₂ Factor

The **PetCO₂ - PaCO₂ Factor** adjusts the end-tidal CO₂ relative to the PaCO₂. At the default value of 1, PetCO₂ very closely approximates PaCO₂. When **PetCO₂ - PaCO₂ Factor** is set at a value of 2, PetCO₂ is approximately one half of PaCO₂. PetCO₂ depends on CO₂ production and alveolar ventilation. Because the alveolar dead space is not modeled physically in the hardware, the responses to changes in mechanical ventilation settings may not be exact. The use of the Onset feature (e.g., onset over a 1-minute period) is recommended for this parameter.

Default: 1

Range: 0.9 - 10.0

Respiratory Gain Factor

The **Respiratory Gain Factor** determines how strong an influence arterial CO₂ levels have on the simulated patient's tidal volume and respiratory rate. Under default conditions (value = 1), when arterial CO₂ levels rise, the patient's respiratory rate and tidal volume show a transitory increase in an attempt to return the patient to the physiological control CO₂ set-point. If the **Respiratory Gain Factor** is increased to more than 1, the patient has a more pronounced response, while values less than 1 correspond to a blunted response.

Default: 1

Range: 0.0 - 10.0

Respiratory Quotient

Respiratory Quotient is the rate of carbon dioxide production divided by the rate of oxygen consumption. Changes to the **Respiratory Quotient** parameter alter the rate of carbon dioxide production relative to the rate of oxygen consumption.

Default: 0.8

Range: 0.70 - 1.10

Volume/Rate Control Factor

Ventilatory responses to increased arterial carbon dioxide or decreased arterial oxygen may take the form of increased tidal volume, increased respiratory rate, or both. The **Volume/Rate Control Factor** determines these relative changes. At a value of 1, increased and decreased ventilatory drive affect tidal volume and respiratory rate equally. When the **Volume/Rate Control Factor** is greater than 1, increased or decreased minute ventilation is predominantly achieved by changes in tidal

volume. When the **Volume/Rate Control Factor** is less than 1, ventilatory changes are affected primarily by changes in respiratory rate.

For example, set the **Volume/Rate Control Factor** to 0.1 and increase the shunt fraction to 0.4 to decrease the arterial O₂. The patient responds to falling arterial oxygen levels with increased minute ventilation. Increasing the respiratory rate with minimal increase in tidal volume produces this.

Default: 1

Range: 0.1 - 10.0

Chest Wall Capacity

The **Chest Wall Capacity** parameter sets the total (combined) intrapleural and lung volumes at which the chest wall is considered distended. Also, see **Chest Wall Compliance Factor** and **Distended Chest Wall Compliance Factor**.

Default: 3900

Range: 1500 - 3900

Chest Wall Compliance Factor

The **Chest Wall Compliance Factor** parameter describes the interaction of the chest wall with the lungs. The **Chest Wall Compliance Factor** parameter defines the volume-pressure relationship in the normal operating lung volumes. Once distended, however, the chest wall rapidly becomes much less compliant (i.e., much “stiffer”) and resistant to further inflation.

Default: 1

Range: 0.15 - 10.00

Distended Chest Wall Compliance Factor

The **Distended Chest Wall Compliance Factor** parameter, along with the **Chest Wall Compliance Factor** parameter, describes the interaction of the chest wall with the lungs. The **Chest Wall Compliance Factor** parameter defines the volume-pressure relationship in normal lung volumes. Once distended, however, the chest wall rapidly becomes much “stiffer” and resistant to further inflation.

The **Distended Chest Wall Compliance Factor** parameter must be set to a low value for increased intrapleural volumes to result in elevated inspiratory pressures with positive pressure ventilation. Also, see **Intrapleural Volume (Vol): (Left and Right)**.

Default: 1

Range: 0.10 - 10.00

Functional Residual Capacity

The **Functional Residual Capacity** parameter sets the combined left and right lung volume remaining at the end of a normal, spontaneous exhalation. This parameter influences the speed of desaturation during apnea.

Default: 2300 mL **Range:**
500 mL - 4000 mL

Lung Compliance Factor: (Left and Right)

These two parameters independently set the left and right lung compliance. **Lung Compliance Factor** determines how easily the lungs inflate. Low compliance factors (less than 1) create “stiff” lungs (such as in acute respiratory distress syndrome or pulmonary edema) requiring more pressure for expansion. High compliance factors (greater than 1) create “loose” lungs that easily inflate with less pressure.

Default: 1 **Range:**
0.15 - 10.00

Venous CO₂ Shift

The **Venous CO₂ Shift** parameter affects the partial pressure of CO₂ in the venous blood. Changing this parameter allows large and rapid shifts in total body CO₂ concentration. Increases in alveolar and arterial CO₂ follow rapidly in a physiologically correct magnitude and time course.

This parameter is useful for giving a “bolus” of CO₂ to the venous system. The alveolar and arterial CO₂ levels rise rapidly in response to the added carbon dioxide but soon return to “pre-bolus” levels as increased ventilation efforts work to eliminate the added CO₂. Therefore, the rise in CO₂ levels is only transitory. This parameter can be used to simulate external CO₂ administration such as that used during laparoscopy.

Default: 0 mmHg
Range: 0.0 mmHg - 60.0 mmHg

Alveolar Enflurane

The **Alveolar Enflurane** parameter is used to simulate the presence of enflurane in the alveolar space without using real anesthetic vapors. The enflurane percentage is input to the drug models to achieve the expected pharmacodynamic effects (e.g., respiratory depression).

Using this parameter bypasses pharmacokinetics, real and instructor-specified inspired fractions, venous content, lung perfusion and ventilation. This parameter can be used to focus on cardiorespiratory effects (pharmacodynamics).

Note: Maestro does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: Modeled

Range: 0.00% - 5.00%

Fraction of Inspired Enflurane

The **Fraction of Inspired Enflurane** parameter is used to simulate the amount of enflurane set in the anesthetic vaporizer and is used to calculate alveolar enflurane.

This parameter has a faster effect on physiology than anesthesia machine settings, because mixing in the breathing circuit is not simulated.

Note: Maestro does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: Modeled

Range: 0.00% - 5.00%

Alveolar Halothane

The **Alveolar Halothane** parameter is used to simulate the presence of halothane in the alveolar space without using real anesthetic vapors. The halothane percentage is input to the drug models to achieve the expected pharmacodynamic effects (e.g., respiratory depression).

Using this parameter bypasses pharmacokinetics, real and instructor-specified inspired fractions, venous content, lung perfusion and ventilation. This parameter can be used to focus on cardiorespiratory effects (pharmacodynamics).

Note: Maestro does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: Modeled

Range: 0.00% - 5.00%

Fraction of Inspired Halothane

The **Fraction of Inspired Halothane** parameter is used to simulate the amount of halothane set in the anesthetic vaporizer and is used to calculate alveolar halothane.

This parameter has a faster effect on physiology than anesthesia machine settings, because mixing in the breathing circuit is not simulated.

Note: Maestro does not verify a 100% sum of all fractions, because this would require all fractions to be set.

Default: 0%

Range: 0.00% - 5.00%

Alveolar Isoflurane

The **Alveolar Isoflurane** parameter is used to simulate the presence of isoflurane in the alveolar space without using real anesthetic vapors. The isoflurane percentage is input to the drug models to achieve the expected pharmacodynamic effects (e.g., respiratory depression).

Using this parameter bypasses pharmacokinetics, real and instructor-specified inspired fractions, venous content, lung perfusion and ventilation. This parameter can be used to focus on cardiorespiratory effects (pharmacodynamics).

Note: Maestro does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: Modeled

Range: 0.00% - 5.00%

Fraction of Inspired Isoflurane

The **Fraction of Inspired Isoflurane** parameter is used to simulate the amount of isoflurane set in the anesthetic vaporizer and is used to calculate alveolar isoflurane.

This parameter has a faster effect on physiology than anesthesia machine settings, because mixing in the breathing circuit is not simulated.

Note: Maestro does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: 0%

Range: 0.00% - 5.00%

Alveolar Nitrous Oxide

The **Alveolar Nitrous Oxide** parameter is used to simulate the amount of nitrous oxide set in the anesthetic vaporizer and is used to calculate alveolar nitrous oxide.

Using this parameter bypasses pharmacokinetics, real and instructor-specified inspired fractions, venous content, lung perfusion and ventilation. This parameter can be used to focus on cardiorespiratory effects (pharmacodynamics).

Note: Maestro does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: 0.00%

Range: 0.00% - 80.0%

Fraction of Inspired Nitrous Oxide

The **Fraction of Inspired Nitrous Oxide** parameter is used to simulate the amount of nitrous oxide set in the anesthetic vaporizer and is used to calculate alveolar nitrous oxide.

This parameter has a faster effect on physiology than anesthesia machine settings, because mixing in the breathing circuit is not simulated.

Note: Maestro does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: 0.00%

Range: 0.00% - 80.0%

Alveolar Sevoflurane

The **Alveolar Sevoflurane** parameter is used to simulate the presence of sevoflurane in the alveolar space without using real anesthetic vapors. The sevoflurane percentage is input to the drug models to achieve the expected pharmacodynamic effects (e.g., respiratory depression).

Using this parameter bypasses pharmacokinetics, real and instructor-specified inspired fractions, venous content, lung perfusion and ventilation. This parameter can be used to focus on cardiorespiratory effects (pharmacodynamics).

Note: Maestro does not verify a 100% sum of all fractions, because this would require all fractions to be set.

Default: Modeled

Range: 0.00% - 8.00%

Fraction of Inspired Sevoflurane

The **Fraction of Inspired Sevoflurane** parameter is used to simulate the amount of sevoflurane set in the anesthetic vaporizer and is used to calculate alveolar sevoflurane.

This parameter has a faster effect on physiology than anesthesia machine settings, because mixing in the breathing circuit is not simulated.

Note: Maestro does not verify a 100 % sum of all fractions, because this would require all fractions to be set.

Default: 0%

Range: 0.00% - 8.00%

Cardiovascular – Basic Parameters

Cardiovascular Parameters – Basic
Blood Pressure
CVP
PAP
PCWP (Pulmonary Capillary Wedge Pressure)
Heart Rate
Heart Rate Factor
Cardiac Output
Cardiac Rhythm
Pulseless Electrical Activity
PVC Probability
Hemoglobin

Blood Pressure

The **Blood Pressure** parameter is used to override the physiological modeling for blood pressure. The systolic and diastolic blood pressures can both be set to fixed numeric values, regardless of interventions performed. Resetting the parameter to **Modeled** returns control of the underlying blood pressure to the physiological models.

Default: Modeled

Range: Systolic 0 mmHg - 300 mmHg

Diastolic 0 mmHg - 300 mmHg

Central Venous Pressure (CVP)

The **CVP** parameter is used to set the CVP baseline and atrial contraction amplitude to fixed numeric values, thereby overriding the physiologic modeling for central venous pressure. Once set, intravascular volume changes have no effect on the CVP. In addition, once an override is applied, changes in tidal volume have no effect on the CVP waveform with the exception of an apneic patient where the minimum and maximum would be the same value since there is no inspiration or expiration. Depending on the volume status of the patient, the minimum/maximum value can be shifted up or down.

The available CVP controls are as follows:

- Minimum Diastolic: Baseline of the CVP at the end of an inspiration
- Maximum Diastolic: Baseline of the CVP at the end of an exhalation
- Pulse Amplitude: Size of the CVP wave during atrial contraction

For the override to take effect, the **Central Venous Catheter** must be set to the *Intrathoracic Vein*.

For example, with the minimum diastolic set to 5 mmHg, maximum diastolic set to 15 mmHg and pulse amplitude set to 2 mmHg, the CVP baseline is 15 mmHg, dipping to 5 mmHg with each inhalation, and the amplitude of the wave is 2 mmHg with each atrial contraction. The CVP baseline remains the same even in the event of intravascular volume changes and the depth of each dip due to inhalation remains at 5 mmHg even in the event of tidal volume changes. However, if the respiratory rate increases or decreases, the frequency of the dips will show a corresponding increase or decrease.

Default: Modeled

Range: Minimum Diastolic -10 mmHg – 25 mmHg
Maximum Diastolic -10 mmHg – 25 mmHg
Pulse Amplitude 0 mmHg – 50 mmHg

Pulmonary Artery Pressure (PAP)

The **PAP** parameter is used to override the physiological modeling for pulmonary artery pressure. The systolic and diastolic pressures can both be set to fixed numeric values, regardless of interventions performed. Resetting the parameter to **Modeled** returns control of the underlying pulmonary artery pressure to the physiological models.

Default: Modeled

Range: Systolic 0 mmHg - 50 mmHg
Diastolic 0 mmHg - 50 mmHg

Pulmonary Capillary Wedge Pressure (PCWP)

The **PCWP** parameter is used to display the patient's pulmonary capillary wedge pressure. It is used to simulate the pressure as measured by wedging a pulmonary catheter with an inflated balloon into a small pulmonary arterial branch.

Default: Modeled

Range: -10 mmHg - 100 mmHg

Heart Rate

The **Heart Rate** parameter is used to set the heart rate to a given (fixed) number of beats per minute. Once the heart rate is set to a numeric value, administered drugs or intravascular volume changes have no effect on the heart rate, but continue to influence other components of the physiological models. Use this parameter to “fix” or set the heart rate to a specific number.

Default: Modeled

Range: 30 beats per minute - 220 beats per minute

Heart Rate Factor

The **Heart Rate Factor** parameter is used to change the baseline heart rate before physiological controls are taken into account. A value of 2 doubles the baseline heart rate, while a value of 0.5 decreases the heart rate by 50%. Use this parameter to raise or lower the heart rate.

Default: 1

Range: 0.10 - 4.00

Cardiac Output

The **Cardiac Output** parameter displays the volume of blood pumped by the heart per minute.

Cardiac Output is a function of heart rate (the number of heart beats per minute) and stroke volume (the volume of blood pumped out of the heart with each beat). **Cardiac Output** does not affect the rest of the physiology. For example, if cardiac output is set to zero, it will be shown on the TouchPro as zero, but the patient will still have a blood pressure and pulses.

Default: Modeled

Range: 0.0 L/min – 30.0 L/min

Cardiac Rhythm

The **Cardiac Rhythm** parameter is used to change the patient's underlying cardiac rhythm displayed on the Patient Status Display or TouchPro patient monitor. To change the cardiac rhythm, click the **Cardiac Rhythm** parameter and select the desired rhythm from the available list. If a number appears following the cardiac rhythm on the list, this overrides the heart rate to the rate indicated.

Default: Modeled

Options:

Modeled

Asystole

Atrial Enlargement, Left

Atrial Enlargement, Right

Atrial Fibrillation

Atrial Flutter

Atrial Tachycardia

AV Block, First-Degree

AV Block, Second-Degree, Mobitz I

AV Block, Second-Degree, Mobitz II

AV Block, Third-Degree (ventricular escape)

AV Block, Third-Degree (wide)

Bundle Branch Block, Incomplete Right

Bundle Branch Block, Left

Bundle Branch Block, Right
Hypercalcemia
Hyperkalemia
Hyperkalemia, Mild
Hyperkalemia, Severe
Hypertrophy, Biventricular
Hypertrophy, Left Ventricular
Hypertrophy, Right Ventricular
Hypocalcemia
Hypokalemia
Hypothermia
Junctional
Long QT Syndrome
Myocardial Ischemia, Mild
Myocardial Ischemia, Moderate
Myocardial Ischemia, Severe
NSTEMI
Paroxysmal Junctional Tachycardia
Pericarditis
Premature Atrial Contraction
Sinus
ST Elevation with Chest Pain
STEMI Anterior
STEMI Anterolateral
STEMI Inferior
STEMI Lateral
STEMI LBB
STEMI Posterior
STEMI Septal
Torsade de Pointes
Trifascicular Block
Ventricular Fibrillation, Coarse
Ventricular Fibrillation, Fine
Ventricular Tachycardia (variance)
Ventricular Tachycardia, RV Outflow Tract
Wellen's Syndrome
WPW Syndrome, Left Lateral Pathway

Pulseless Electrical Activity

The **Pulseless Electrical Activity** parameter triggers a clinical condition characterized by unresponsiveness and lack of palpable pulse in the presence of organized cardiac electrical activity. It is either ON or OFF.

Default: Off

PVC Probability

The **PVC Probability** parameter represents the percentage of cardiac cycles containing a premature ventricular contraction (contraction of the ventricles that occurs earlier than usual because of abnormal electrical activity of the ventricles).

Default: Modeled

Range: 0% - 90%

Cardiovascular – Additional Parameters

Cardiovascular Parameters – Additional
Baroreceptor Maximum Pressure
Baroreceptor Minimum Pressure
Left Ventricle Contractility Factor
Right Ventricle Contractility Factor
Systemic Vascular Resistance Factor
Venous Capacity Factor
Systemic Arteries Compliance Factor
Pulmonary Arteries Compliance Factor
Left Ventricle Compliance Factor
Pulmonary Arteries Compliance Factor
Pulmonary Vasculature Resistance Factor
Venous Return Resistance Factor

Baroreceptor Gain (Overall) Factor
Baroreceptor Gain (Cardiac) Factor
Baroreceptor Gain (Peripheral) Factor
Chest Compression Efficacy
Tamponade Volume
Ischemic Index Sensitivity
Ischemic Index Averaging
Aortic Valve Resistance Factor
Mitral Valve Resistance Factor
Pulmonic Valve Resistance Factor
Defibrillation
Pacing Current
Pacing Rate
Pacing Capture Threshold

Baroreceptor Maximum Pressure

Baroreceptor maximum pressure defines the mean arterial pressure (MAP) at which the baroreceptor inhibitory activity on the heart and systemic vasculature is maximal. When a simulated patient's MAP increases above baseline pressure, the baroreceptor response exerts greater inhibitory controls on the MAP (e.g., reduction in heart rate) in an attempt to return the MAP to the patient's baseline pressure. However, these controls have an upper limit, and this "maximum pressure" is defined as the baroreceptor maximum pressure.

In other words, as the MAP increases, the physiological controls (i.e., baroreceptor response) work to bring the pressure back toward baseline, primarily by reducing the heart rate. For every 5 mmHg increase in MAP, the heart rate may decrease by 2 beats per minute in an attempt to keep the MAP in check. However, there is an upper limit ("maximum pressure"), after which these controls are no longer effective. Once the MAP reaches the baroreceptor maximum pressure, there is no additional reduction in heart rate if the pressure continues to rise. For example, should the pressure continue to rise, the heart rate would not show a corresponding slowing.

The MAP set-point is exactly between baroreceptor maximum pressure and baroreceptor minimum pressure.

Default: 112 mmHg

Range: 40 mmHg - 220 mmHg

Baroreceptor Minimum Pressure

Baroreceptor minimum pressure defines the mean arterial pressure (MAP) at which the baroreceptor inhibitory activity on the heart and systemic vasculature is minimal. When a simulated patient's MAP decreases below baseline pressure, the baroreceptor response exerts inhibitory controls on the MAP (e.g., increase in heart rate) in an attempt to return the MAP to the patient's baseline pressure. However, these controls have a lower limit, and this "minimum pressure" is defined as the baroreceptor minimum pressure.

In other words, as the MAP decreases, the physiological controls (i.e., baroreceptor response) work to bring the pressure back toward baseline, primarily by increasing the heart rate. For every 5 mmHg decrease in MAP, the heart rate may increase by 2 beats per minute in an attempt to keep the MAP in check. However, there is a lower limit ("minimum pressure"), after which these controls are no longer effective. Once the MAP reaches the baroreceptor minimum pressure, there is no additional increase in heart rate if the pressure continues to fall. For example, should the pressure continue to fall, the heart rate would not show a corresponding increase.

The MAP set-point is exactly between baroreceptor maximum pressure and baroreceptor minimum pressure.

Default: 72 mmHg

Range: 20 mmHg - 160 mmHg

Left Ventricle Contractility Factor

The **Left Ventricle Contractility Factor** parameter adjusts the contractility of the left ventricle and has a direct effect on cardiac output and blood pressure. Use this parameter to raise or lower the cardiac output.

Default: 1

Range: 0 - 10.00

Right Ventricle Contractility Factor

The **Right Ventricle Contractility Factor** parameter adjusts the contractility of the right ventricle and has a direct effect on pulmonary artery pressure and an inverse effect on central venous pressure. Use this parameter to raise or lower pulmonary artery pressure (PAP) or to change the central venous pressure (CVP).

Default: 1

Range: 0 - 10.00

Systemic Vascular Resistance Factor

The Systemic Vascular Resistance Factor parameter adjusts the baseline systemic vascular resistance. Raising the value increases the systemic vascular resistance while lowering the value decreases the vascular resistance.

Raising the parameter value is analogous to increasing the resistance to blood flow through the systemic vasculature. Under such conditions, the arterial blood pressure (ABP) increases, and the heart rate may decrease due to feedback from the physiological control mechanisms.

Default: 1

Range: 0.10 - 10.00

Venous Capacity Factor

The **Venous Capacity Factor** parameter adjusts the volume of blood contained in the unstretched venous system without an increase in venous pressure. Raising the value decreases the venous capacitance (vasodilatation and decreased vascular tone), while lowering the value increases the venous capacitance (vasoconstriction and increased vascular tone).

The volume of blood in the venous system has an inverse relationship to the blood pressure. Lowering the value is analogous to a “shift” in blood from the venous system to the arterial system, and this shift, when coordinated with increased systemic vascular resistance, results in an increase in blood pressure [arterial blood pressure (ABP), pulmonary artery pressure (PAP) and central venous pressure (CVP)].

Default: 1

Range: 0.10 - 100.00

Systemic Arteries Compliance Factor

The **Systemic Arteries Compliance Factor** parameter adjusts the pulse pressure (difference between systolic and diastolic pressures) of the simulated patient’s systemic blood pressure. Increases in the compliance factor result in a decreased (narrower) pulse pressure, while smaller values increase the pulse pressure. Additionally, when the pulse pressure increases as a result of a reduced compliance factor, both systolic and diastolic pressures increase. Conversely, with a narrower pulse pressure (higher compliance factor), both the systolic and diastolic blood pressures also drop.

Default: 1

Range: 0.20 - 5.00

Pulmonary Arteries Compliance Factor

The **Pulmonary Arteries Compliance Factor** parameter adjusts the pulse pressure (difference between systolic and diastolic pressures) of the simulated patient’s pulmonary blood pressure. Increases in the compliance factor decrease (narrow) the pulse pressure, while smaller values

increase the pulse pressure. Additionally, when the pulse pressure increases as a result of a reduced compliance factor, both systolic and diastolic pulmonary pressures increase. Conversely, with a narrower pulse pressure (higher compliance factor) both the systolic and diastolic pulmonary pressures also drop.

Default: 1

Range: 0.20 - 5.00

Left Ventricle Compliance Factor

The **Left Ventricle Compliance Factor** parameter adjusts the pulse pressure (difference between systolic and diastolic pressures) of the simulated patient's left ventricle.

Default: 1

Range: 0.20 - 5.00

Right Ventricle Compliance Factor

The **Right Ventricle Compliance Factor** parameter adjusts the pulse pressure (difference between systolic and diastolic pressures) of the simulated patient's right ventricle.

Default: 1

Range: 0.20 - 5.00

Pulmonary Vasculature Resistance Factor

The **Pulmonary Vasculature Resistance Factor** parameter adjusts the baseline pulmonary vascular resistance. Raising the value increases the pulmonary vascular resistance, while lowering the value decreases the vascular resistance.

Raising the parameter value is analogous to increasing the resistance to blood flow through the pulmonary vasculature. Under such conditions, the pulmonary artery pressure (PAP) and central venous pressure (CVP) increase due to back-pressure through the right side of the heart.

Default: 1

Range: 0.10 - 10.00

Venous Return Resistance Factor

The **Venous Return Resistance Factor** parameter adjusts the resistance between the extrathoracic and intrathoracic venous compartments. Raising the value increases the resistance, while lowering the value decreases the resistance.

With less blood returning to the heart, there is a reduced volume entering the ventricles prior to ventricular contraction. This results in a drop in the cardiac output and decrease in arterial blood pressures. The heart rate increases due to feedback from the physiological control mechanisms in an attempt to maintain adequate blood pressures.

Default: 1

Range: 0.10 - 100.00

Baroreceptor Gain (Overall) Factor

The **Baroreceptor Gain (Overall) Factor** parameter adjusts the influence of mean arterial pressure (MAP) on heart rate, contractility, systemic vascular resistance and venous capacity. Use this parameter to adjust how vigorously the heart and vasculature respond to blood pressure changes. The degree of increase in heart rate or vascular response is influenced by the baroreceptor gain (overall) factor.

For example, when blood pressure falls, the heart rate increases, the arteries increase their vascular tone (resistance) and there is less pooling of the blood in the venous system, all in an attempt to maintain adequate blood pressure. A baroreceptor gain (overall) factor value of less than 1 corresponds to baroreceptor depression. A baroreceptor gain (overall) factor value greater than 1 leads to a stronger response to MAP changes.

Default: 1

Range: 0.00 - 100.00

Baroreceptor Gain (Cardiac) Factor

The **Baroreceptor Gain (Cardiac) Factor** parameter selectively adjusts the influence of mean arterial pressure (MAP) on the heart rate and contractility, influencing how much the heart rate increases or decreases with changes in blood pressure. Use this parameter to adjust how vigorously the heart responds to blood pressure changes.

A baroreceptor gain (cardiac) factor of less than 1 corresponds to baroreflex depression (e.g., less heart rate response to MAP changes). A value greater than 1 leads to a stronger response to MAP changes.

Default: 1

Range: 0.00 - 10.00

Baroreceptor Gain (Peripheral) Factor

The **Baroreceptor Gain (Peripheral) Factor** parameter adjusts the influence of mean arterial pressure (MAP) on systemic vascular resistance and venous capacity, influencing how much the vasculature responds to changes in blood pressure.

For example, when blood pressure falls, the arteries increase their vascular tone (resistance), and there is less pooling of the blood in the venous system, in an attempt to maintain adequate blood

pressure. A factor of less than 1 corresponds to baroreflex depression (e.g., less systemic vascular resistance response to MAP changes). A value greater than 1 leads to a stronger response to MAP changes.

Default: 1

Range: 1.00 - 10.00

Chest Compression Efficacy

The **Chest Compression Efficacy** parameter is used to determine the effectiveness of chest compressions administered by the caregiver. The 100% setting (**On**) indicates that chest compressions are completely effective, while the 0% (**Off**) setting prevents them from having any effect on intrathoracic pressure.

Default: On

Options: On

Off

Tamponade Volume

The Tamponade Volume parameter is used to set the amount of fluid or blood that is building up in the space between the myocardium and the pericardium, causing a cardiac tamponade.

Default: 0 mL

Range: 0 mL - 500 mL

Ischemic Index Sensitivity

The **Ischemic Index Sensitivity** parameter determines the relative sensitivity of the simulated patient to myocardial ischemia. A lower ischemic index sensitivity value corresponds to less sensitivity to an unfavorable oxygen supply/demand ratio (i.e., poor oxygenation with high heart rate). A patient with a low value is less sensitive to poor oxygenation, takes longer to go into the “death spiral” and, therefore, survives longer.

Default: 0.45

Range: 0.10 - 5.00

Model-Driven ECG Rhythm	Ischemic Index (I.I.)
Normal Sinus Rhythm (NSR)	$I.I. \geq 0.90$
Mild ST Segment Depression	$0.90 > I.I. \geq 0.70$
Moderate ST Segment Depression	$0.70 > I.I. \geq 0.60$
Premature Ventricular Contractions (PVCs)	$0.60 > I.I. \geq 0.40$
Ventricular Tachycardia (VTach)	$0.40 > I.I.$

Ventricular Fibrillation (VFib)	1 minute after VTach
Asystole	1 minute after VFib

The patient's response to myocardial ischemia may be altered using the **Ischemic Index Sensitivity** parameter found on the Cardiovascular view. To make the patient less sensitive to ischemia, lower the value below the default setting. To make the patient more sensitive, increase the value above the default setting. These changes are then reflected in the patient's Ischemic Index, as shown in the table above.

Ischemic Index Averaging

Ischemic index averaging determines how quickly myocardial ischemia develops in the presence of an unfavorable oxygen supply/demand ratio or how rapidly it resolves when myocardial oxygenation becomes favorable. By decreasing the averaging time (i.e., value toward 0.5), ischemia has a faster onset if there is a poor oxygen supply to the heart or a faster resolution with favorable oxygenation. Increasing the averaging time (i.e., value toward 0.99) means ischemia takes longer to develop or longer to resolve.

Use this parameter to speed up the recovery from the model-driven "death spiral." By setting the parameter to 0.5, a patient pulls out of the "death spiral" at a faster rate than with a setting of 0.99. However, the favorable conditions (i.e., better oxygenation and/or lower heart rate) must exist before the number is made smaller. If not, the patient's descent increases at a faster rate.

Default: 0.99

Range: 0.50 - 1.00

Aortic Valve Resistance Factor

The **Aortic Valve Resistance Factor** parameter is used to adjust the resistance to blood flow across the aortic valve. Increasing the value to greater than 1 corresponds to increased resistance to blood flow through the aortic valve.

Default: 1

Range: 1 - 1000

Mitral Valve Resistance Factor

The **Mitral Valve Resistance Factor** parameter is used to adjust the resistance to blood flow across the mitral valve. Increasing the value to greater than 1 corresponds to increased resistance to blood flow through the mitral valve.

Default: 1

Range: 1 - 1000

Pulmonary Vasculature Resistance Factor

The **Pulmonary Vasculature Resistance Factor** parameter adjusts the baseline pulmonary vascular resistance. Raising the value increases the pulmonary vascular resistance, while lowering the value decreases the vascular resistance.

Raising the parameter value is analogous to increasing the resistance to blood flow through the pulmonary vasculature. Under such conditions, the pulmonary artery pressure (PAP) and central venous pressure (CVP) increase due to back-pressure through the right side of the heart.

Default: 1

Range: 0.10 - 10.00

Defibrillation (Defib)

The **Defib** parameter is used to simulate a specified amount of energy discharged via an external cardiac defibrillator. Setting this parameter results in the characteristic spike in the ECG, followed by a return to the pre-defibrillation rhythm. **Defib** has no direct effect on the electrical conduction system of the heart. Thus, synchronized cardioversion may be done “on the fly” or scripted using the Scenario Designer.

Default: 0 Joules

Range: 0 Joules - 360 Joules

Pacing Current

The **Pacing Current** parameter is used to simulate a specified amount of current discharged via an external cardiac pacer. Setting this parameter results in the characteristic pacing signal on the ECG waveform when the pacing current is at or above the capture threshold. Also, see **Pacing Capture Threshold**.

Default: 0 mA

Range: 0 mA - 200 mA

Pacing Rate

The **Pacing Rate** parameter determines the cardiac rate (in beats/minute) when the pacing current is at or above the pacing capture threshold. Also, see **Pacing Current** and **Pacing Capture Threshold**.

Default: 80 beats per minute

Range: 0 beats per minute - 120 beats per minute

Pacing Capture Threshold

The **Pacing Capture Threshold** parameter determines the minimum pacing current necessary to pace the heart via an external cardiac pacer. Also see **Pacing Current**. Pacing current values below the pacing capture threshold have no effect on the patient’s heart rate.

Default: 50 mA

Range: 0 mA - 190 mA

Monitor Signals - Parameters

Arterial Catheter

The arterial pressure displayed on the Patient Status Display or TouchPro software is set using this parameter. A non-pulsatile, “zero” pressure signal is emitted when the **Atmosphere** position is selected and can be used to simulate zeroing a pressure transducer. This may also be used to remove the arterial pressure waveform, if desired. The **Left Ventricle** position is useful for simulating cardiac catheterization procedures, or for demonstrating left ventricular end-diastolic pressure and its relationship to pulmonary artery occlusion (“wedge”) and central venous pressure.

Default: Peripheral Artery

Options: Atmosphere

Peripheral Artery

Left Ventricle

None

Central Venous Catheter

The venous pressure displayed on the Patient Status Display or TouchPro software is set using this parameter. A non-pulsatile, “zero” pressure signal is emitted when the **Atmosphere** position is selected and can be used to simulate zeroing a pressure transducer. This may also be used to remove the central venous pressure waveform, if desired (e.g., beginning of an SCE with an “unmonitored” patient).

Default: Right Atrium

Options: Atmosphere

Extrathoracic Vein

Intrathoracic Vein

Right Atrium

None

Pulmonary Artery (PA) Catheter

The pulmonary artery pressure displayed on the Patient Status Display or TouchPro software is set using this parameter. A non-pulsatile, “zero” pressure signal is emitted when the **Atmosphere** position is selected and can be used to simulate zeroing a pressure transducer. This may also be used to remove the pulmonary artery pressure waveform, if desired (e.g., beginning of an SCE with an “unmonitored” patient). The pulmonary artery catheter can be “floated” into position by sequencing through the right heart positions. This may also be scripted into a scenario using the Scenario Designer.

Default: Pulmonary Artery

Options: Atmosphere

Intrathoracic Vein

Right Atrium

Right Ventricle

Pulmonary Artery

Pulmonary Artery (PA) Balloon

Inflation of the pulmonary artery catheter balloon is simulated by switching to the **Inflated** option of the **PA Balloon** parameter. The appropriate pulmonary artery occlusion or “wedge” waveform is then displayed on the Patient Status Display or TouchPro software.

Default: Deflated

Options: Deflated

Inflated

Cold Fluid Inject

The Cold Fluid Inject parameter is used to simulate the injection of 10 mL saline into the pulmonary artery (PA) catheter. The appropriate Thermodilution waveform and cardiac output measurement are then displayed on the TouchPro software.

Pulses

The table(s) below shows the defaults and ranges for the pulses and pulse deficits.

Pulse	Default	Range
Carotid (Left and Right)	On	N/A
Carotid Deficit	60	0 - 300
Left Brachial	On	N/A
Right Brachial	On	N/A
Brachial Deficit	80	0 - 300
Left Radial	On	N/A
Right Radial	On	N/A
Radial Deficit	90	0 - 300
Left Femoral	On	N/A
Right Femoral	On	N/A
Femoral Deficit	70	0 - 300
Left Popliteal	On	N/A
Right Popliteal	On	N/A
Popliteal Deficit	80	0 - 300
Right Tibial Pulse	On	N/A
Left Tibial Pulse	On	N/A
Tibial Deficit	80	0 - 300

Apollo Prehospital

Pulse	Default	Range
Left Carotid	On	N/A

Right Carotid	On	N/A
Carotid Deficit	60	0 - 300
Left Brachial	On	N/A
Right Brachial	On	N/A
Brachial Deficit	80	0 - 300
Left Radial	On	N/A
Right Radial	On	N/A
Radial Deficit	90	0 - 300
Left Femoral	On	N/A
Right Femoral	On	N/A
Femoral Deficit	70	0 - 300
Left Popliteal	On	N/A
Right Popliteal	On	N/A
Popliteal Deficit	80	0 - 300
Left Dorsalis Pedis/ Left Posterior Tibial	On	N/A
Right Dorsalis Pedis/ Right Posterior Tibial	On	N/A
Dorsalis Pedis/ Posterior Tibial Deficit	80	0 - 300

Apollo Nursing

Pulse	Default	Range
Left Carotid	On	N/A
Right Carotid	On	N/A
Carotid Deficit	60	0 - 300

Left Brachial	On	N/A
Right Brachial	On	N/A
Brachial Deficit	80	0 - 300
Left Radial	On	N/A
Right Radial	On	N/A
Radial Deficit	90	0 - 300
Left Femoral	On	N/A
Right Femoral	On	N/A
Femoral Deficit	70	0 - 300
Left Popliteal	On	N/A
Right Popliteal	On	N/A
Popliteal Deficit	80	0 - 300
Left Dorsalis Pedis	On	N/A
Right Dorsalis Pedis	On	N/A
Dorsalis Pedis Deficit	80	0 - 300
Left Posterior Tibial	On	N/A
Right Posterior Tibial	On	N/A
Posterior Tibial Deficit	80	0 - 300

Fluids

The Fluids icon provides a means of controlling the amount of fluid lost by or infused into the patient. The amount of fluid to be lost or infused can be entered as a **One-time** value or a **Rate**. If the **Rate** option is selected, the duration of fluid loss or infusion can be entered. Fluid loss or infusion can also occur indefinitely by selecting the **Indefinitely** option.

Fluid Parameters

Fluid Loss Blood
Fluid Loss Plasma
Colloid Infusion
Crystalloid Infusion
PRBC Infusion
Whole Blood Infusion
Bleeding: Upper
Bleeding: Lower

Duration Range: 1:00 min to 60:00 min, or **Indefinitely**

Fluid Loss Blood

When used, the **Fluid Loss Blood** parameter reflects a decrease in total blood volume. Blood loss proportionally decreases both the red blood cell volume and the plasma volume according to the current hematocrit.

One-time Values

Options	Range
100 mL	N/A
250 mL	N/A
500 mL	N/A
1000 mL	N/A
2000 mL	N/A
4000 mL	N/A
Custom	0 - 60000 mL

Rate Values

Options	Range
---------	-------

100 mL/hr	N/A
250 mL/hr	N/A
500 mL/hr	N/A
1000 mL/hr	N/A
2000 mL/hr	N/A
4000 mL/hr	N/A
Custom	0 - 60000 mL/hr

Fluid Loss Plasma

When used, the **Fluid Loss Plasma** parameter reflects a decrease in plasma volume. Plasma loss decreases the plasma volume without changing the red blood cell volume. It refers collectively and generically to all fluid losses, including evaporative, transcellular, bowel and third space fluid losses.

One-time Values

Options	Range
100 mL	N/A
250 mL	N/A
500 mL	N/A
1000 mL	N/A
2000 mL	N/A
4000 mL	N/A
Custom	0 - 60000 mL

Rate Values

Options	Range
100 mL/hr	N/A

250 mL/hr	N/A
500 mL/hr	N/A
1000 mL/hr	N/A
2000 mL/hr	N/A
4000 mL/hr	N/A
Custom	0 - 60000 mL/hr

Colloid Infusion

When used, the **Colloid Infusion** parameter reflects an addition to the plasma volume without changing the red blood cell volume. Colloids include modified fluid gelatin starch solutions, dextran and human albumin.

Bolus Values

Options	Range
50 mL	N/A
100 mL	N/A
250 mL	N/A
500 mL	N/A
1000 mL	N/A
Custom	0 - 60000 mL

Infusion Values

Options	Range
50 mL/hr	N/A
100 mL/hr	N/A
250 mL/hr	N/A
500 mL/hr	N/A

1000 mL/hr	N/A
Custom	0 - 60000 mL/hr

Crystalloid Infusion

When used, the **Crystalloid Infusion** parameter reflects an addition to the plasma volume without changing the red blood cell volume. The term crystalloid is used to describe salt solutions for infusion (e.g., normal saline, dextrose in water, Ringer's Lactate).

Bolus Values

Options	Range
50 mL	N/A
100 mL	N/A
250 mL	N/A
500 mL	N/A
1000 mL	N/A
Custom	0 - 60000 mL

Infusion Values

Options	Range
50 mL/hr	N/A
100 mL/hr	N/A
250 mL/hr	N/A
500 mL/hr	N/A
1000 mL/hr	N/A
Custom	0 - 60000 mL/hr

PRBC Infusion

Packed red blood cells are a preparation of 70% red blood cells and 30% liquid plasma, often administered in severe anemia to restore adequate levels of hemoglobin and red cells without overloading the vascular system with excess fluids.

Bolus Values

Options	Range
50 mL	N/A
100 mL	N/A
250 mL	N/A
500 mL	N/A
1000 mL	N/A
Custom	0 - 60000 mL

Infusion Values

Options	Range
50 mL/hr	N/A
100 mL/hr	N/A
250 mL/hr	N/A
500 mL/hr	N/A
1000 mL/hr	N/A
Custom	0 - 60000 mL/hr

Whole Blood Infusion

The term whole blood is used to refer to blood that has not been separated into its various components. It represents a preparation of 40% red blood cells and 60% liquid plasma.

Bolus Values

Options	Range
50 mL	N/A
100 mL	N/A
250 mL	N/A
500 mL	N/A
1000 mL	N/A
Custom	0 – 60000 mL

Infusion Values

Options	Range
50 mL/hr	N/A
100 mL/hr	N/A
250 mL/hr	N/A
500 mL/hr	N/A
1000 mL/hr	N/A
Custom	0 – 60000 mL/hr

Bleeding: Upper

The **Bleeding: Upper** parameter is used to activate bleeding from the Upper Moulage port (located in the right shoulder). Bleeding can be selected as either **Venous** or **Arterial**. The **Size** of bleeding can also be modified. These selections are made from the **Fluids** tab of the run screen.

Venous bleeding sizes:

- None
- Small
- Medium

- Large

Arterial bleeding sizes:

- None
- Small
- Medium
- Large

Default: None

Bleeding: Lower

The **Bleeding: Lower** parameter is used to activate bleeding from the Lower Moulage port (located in the right hip).

Venous bleeding sizes:

- None
- Small
- Medium
- Large

Arterial bleeding sizes:

- None
- Small
- Medium
- Large

Default: None

Sounds

A variety of simulated sounds are available to enhance realism. A patient must be running in Maestro for any sounds to be available.

Speech

Speech can be added to simulations using the Vocal Speech Sounds and Speech Sounds features on the software. Both the **Vocal Speech Sound** and **Speech Sound** options can be accessed from the **Speech** button on the Maestro run page.

Speech Sounds

Speech Sounds include a male or female voice that can utter pain rating indicators from 0 to 10, various phrases and a series of other utterances. Unlike Vocal Speech Sounds, Speech Sounds only play once.

To play a Speech Sound, click the desired **Speech Sounds** button. The desired sound will play once.

Speech Sounds
"10, 9, 8, 7, 6..."
"0" through "10" - Pain Ratings
"Aching"
"Dull"
"I can't breathe"
"My belly hurts"
"My chest is tight"
"My leg hurts"
"No"
"Ouch"
"Ow, that hurts"
"Pressure"
"Sharp"
"Sometimes"
"Stabbing"
"Yes"
Grunt
Loud Cough
Scream
Short Loud Cough
Short Soft Cough
Soft Cough

Vocal Sounds

A variety of programmable vocal sounds are available. Vocal sounds are male or female based on the gender of the active patient.

Vocal Sounds
None
Crying
Gasping
Groaning
Long loud cough
Long soft cough
Wheezing
Mumbling
Stridor

To select a sound from the **Vocal Speech Sound** drop-down menu, click the **Speech** button from the run screen.

Click **Vocal Speech Sound** and select the type of sound desired from the drop-down menu. Vocal Sounds play continuously when selected and are emitted immediately when selected from the **Vocal Sounds** drop-down menu. To stop playing one of the vocal sounds, select **None** from the list.

NOTE: **Stridor** sound can be enabled using the software, from the **Vocal Speech Sound** drop-down menu.

Bowel Sounds

Bowel sounds can be adjusted by clicking on the **Sounds** icon on the Run screen. When the Sounds panel appears, select **Bowel**. The Bowel Sounds menu will appear.

Normal, Hypoactive, Hyperactive are selected using this parameter.

Bowel Sounds
Normal
Hypoactive
Hyperactive

Independent control of the type and volume of bowel sounds may be selected in each anatomical region.

Bowel Sounds Locations
All
Left Upper
Right upper
Left Lower
Right Lower

To affect the bowel sounds simultaneously in all anatomical regions, select the desired sound and volume in the **All** row.

Default: Normal

Note: The volume control slider underneath each area may be used to adjust the amplitude of the sound. The volume control slider is only enabled while connected to a simulator.

Lung Sounds

Normal and abnormal lung sounds are selected using this parameter. Lung sounds are synchronized with ventilation of the left and right lungs.

Lung sounds can be adjusted by clicking on the **Sounds** button on the Run screen. When the **Sounds** panel appears, select **Lungs**. The Lung Sounds menu will appear.

Independent control of the type and volume of lung sounds may be selected in each anatomical region.

Lung Sounds Locations
All
Left Upper
Right Upper
Left Lower
Right Lower

To affect the lung sounds simultaneously in all anatomical regions, the desired sound and/or volume in the **All** row.

To change lung sounds, select a sound from the drop-down menu next to the desired anatomical region.

Default: Normal

Options: Normal

- Crackles
- Diminished
- Gurgling
- Pleural Rub
- Rhonchi
- Wheezing

Note: The volume control slider can be used to adjust the amplitude of the sound.

Heart Sounds

Heart sounds are synchronized with the cardiac cycle and can be auscultated over the left and right sternal border, left lower sternal border and apex.

Heart sounds can be adjusted by clicking on the **Sounds** button on the Run screen. When the Sounds panel appears, select **Heart**. The Heart Sounds menu will appear.

Default: Normal

Options: Normal

- S4
- S3 and S4
- Early Systolic Murmur
- Mid Systolic Murmur
- Late Systolic Murmur
- Pan Systolic Murmur
- Late Diastolic Murmur

Note: The volume control slider can be used to adjust the amplitude of the sound.



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