NENA Sim

SIMULATOR FOR NEONATAL TRAINING

Infant HPS Xtreme

USER MANUAL

MEDICAL X

Thank you for purchasing NENASim.

The purpose of this manual is to provide you with all essential information on how to use NENASim HPS Xtreme.

This manual consists of information about the NENASim simulator, parts, and software.

Good care and caution are taken to make this manual. Nevertheless, mistakes could have slipped through. In case any mistakes or ambiguities are found, please notify Medical-X.

Support

Contact Medical-X headquarters in Rotterdam, The Netherlands, for support.

- info@medical-x.com
- +31 10 341 5927
- www.medical-x.com

Trademarks

CONTENTS

1 SAFETY PRECAUTIONS

1.1 GENERAL

Always check the condition of the body, connectors and wires of NENASim. In case of any damage, do not use NENASim until repair is completed.

Do not disassemble or manipulate NENASim and the included instruments.

WARNING: Any evidence of an attempt to open or modify any parts of NENASim, including peeling, or removal of any of the labels, is a violation of your warranty, and renders NENASim ineligible for authorized repair.

If any part is damaged or malfunctioning, stop using the device immediately and contact your dealer or Medical-X for support.

1.2 NENASIM USAGE

To ensure long lasting functioning of NENASim, observe the following guidelines:

Use NENASim with care.

Use Medical-X **lubricant spray** for a smoother oral and nasal intubation.

	The **operating temperatures** of NENASim should be between 0 and 40 degrees Celsius (32 -104 degrees Fahrenheit).
	Use NENASim in a room with **low humidity conditions**, to prevent condensation to form on NENASim's electronic and mechanical components.
	Do not walk on, pinch, bend or otherwise abuse the power cords. Remove the power cable from the socket by taking out the plug. Do not pull the cable.

1.3 CLEANING AND STORAGE

To clean NENASim, use a light soap solution or mild domestic cleaners without alcohol. Use a damp cloth with the selected solution and carefully wipe dirt and dust from the product.

Warning: Do not allow liquid to leak inside the manikin.

Store NENASim in a dry environment at room temperature, out of direct sunlight. Preferably in the included suitcase.

2 GETTING STARTED

NENASim is the world's most realistic high-fidelity baby manikin simulator. NENASim is born to complement realistic multidisciplinary team and/or individual baby patient simulation training. NENASim offers an ideal training solution for a wide range of healthcare professionals. Including but not limited to patient care, emergency medical intervention and resuscitation training for dynamic team or individual training.

2.1 COMPONENTS

After opening the suitcase, check that all listed items are included in the case. If items are missing, contact your dealer.

Note: The actual appearance of the product components may be different.

NENASim HPS Xtreme

Stethoscope simulator

Charger cable for stethoscope simulator

Charger

IO sleeve (3x)

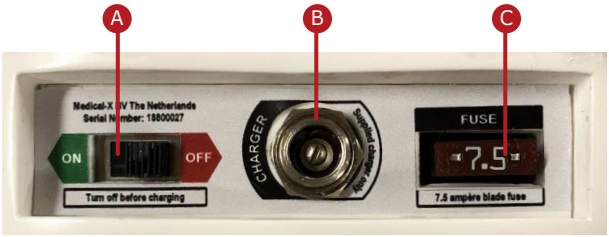
Charger cable

Umbilical cord simulator

2.2 CHARGING NENASIM

Charging the NENASim manikin

Take NENASim out of the suitcase. The **power panel** is placed on the back-side of NENASim.



Power panel

A	On/off switch.
B	Power connector
C	Fuse

Turn off NENASim before charging. The power is off when the switch is directed towards '**OFF**'. There is an **LED indicator** on the charger. Follow the next steps to charge NENASim:

LED indicator

1. Connect the charger to the power socket. .....
2. Connect the charger to the NENASim power panel. It is now charging. .....
3. NENASim is fully charged. .....

A fully charged NENASim can be used for several hours continuously.

Note: The battery will only charge when NENASim is turned off.

Battery life

NENASim has a maximum **battery runtime** of approximately 4 hours. Total runtime is dependent on the usage of sounds, movements, breathing rate, etc.

The **battery life indicator** is displayed on the software panel after establishing a Wi-Fi connection with NENASim. This is highlighted with the red rectangle in the image below.

Battery life indicator

Fuse replacement

A blown fuse is replaced by flipping it out and exchanging it with a new one. NENASim requires a 5 ampere blade fuse which can be acquired through most hardware stores.

2.3 SYSTEM REQUIREMENTS

For a smooth software experience the following system properties are required:

Optimal screen resolution	HD (1920x1080)
CPU	Minimum i5, i7 recommended (especially for camera capture)
Operating system	Windows 10 (64 bit)
Memory	Minimum 2GB, 8GB recommended

2.4 SOFTWARE INSTALLATION

NENASim is controlled with the Medical-X software package: **CommandX**. CommandX will be delivered in a compressed (zipped) file.

Extract CommandX from the compressed folder on the computer. The folder will contain the following applications:

CommandX Tutor is used to control NENASim and run scenarios. From the CommandX Tutor homescreen the other CommandX applications can be opened. Learn more in section 4 'CommandX Tutor'

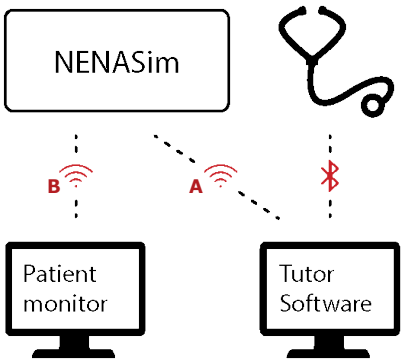
CommandX Monitor is the application that simulates the patient monitor. It displays the vital signs and can be controlled through CommandX Tutor. Learn more in section 5 'CommandX Monitor'

CommandX Scenario Editor is used to create and customize scenarios. Learn more in section 7 'CommandX Scenario Editor'

CommandX Auscultation Client is used to view the detection position of the stethoscope simulator and for settings of the stethoscope simulator. Learn more in section 6 'CommandX Auscultation Client'

2.5 CONNECTING NENASIM

A **Wi-Fi connection** needs to be established between the NENASim Wi-Fi network and the computers. At least two computers are required for training with NENASim.



Connections overview

A	One computer is used by the trainer/educator with CommandX Tutor to control the NENASim scenario and training.
B	The second computer is dedicated to display vital signs as a **patient monitor** with CommandX Monitor.
	Additionally, a Bluetooth connection is required between the CommandX Tutor computer and the **stethoscope simulator**.

It is also possible to connect multiple computers with the NENASim Wi-Fi network, this allows multiple trainers to control NENASim and the scenario and to display the vital signs on multiple computers.

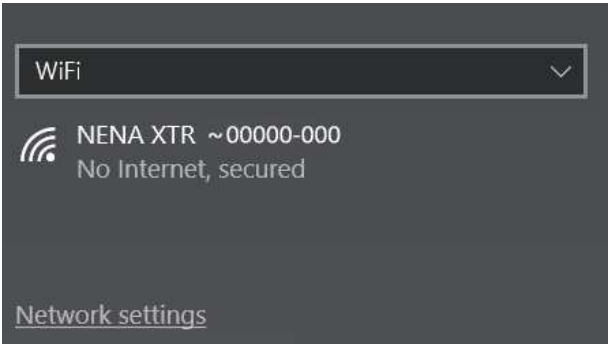
Learn more about connecting the computers and the stethoscope in section 'Connect the computers' and section 'Connect the stethoscope simulator'.

Connect the computers

It is possible to connect NENASim to multiple computers. It is recommended to use at least two.

One or more computers can be used by the trainer(s) to control NENASim and the scenario with CommandX Tutor.
One or more computers can be used with CommandX Monitor as patient monitor for the trainee(s) during the training.

1. Unplug NENASim from the power and turn it on. A distinct beeping sound and a voice saying 'Online' indicates that the manikin is on.
2. The NENASim Wi-Fi network will be visible with the computer's network connections. In this menu, NENASim's Wi-Fi network will appear as 'NENA XTR 0000-000'. The '0000-000' is different for each simulator.

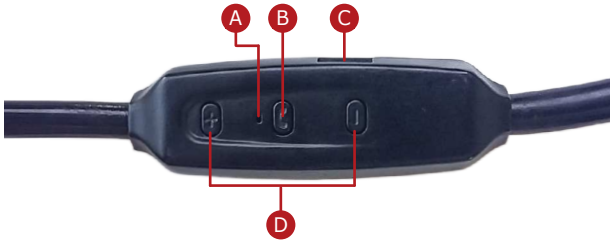


NENASim Wi-Fi network

3. Login to the network using the following (capital sensitive) password: COMMAND_X
4. Repeat these steps for the other computers.

Connect the stethoscope simulator

The on/off switch, the power connection and the LED indicator are on the control panel of the stethoscope. Bluetooth is used for the connection between the stethoscope and the CommandX Tutor computer.

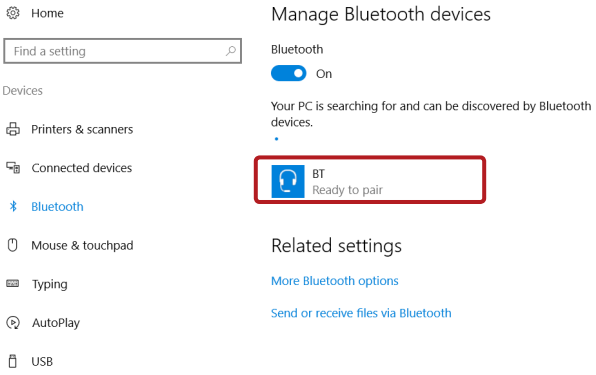


Stethoscope control panel

A	LED indicator
B	On/off button
C	Power connector
D	Volume control

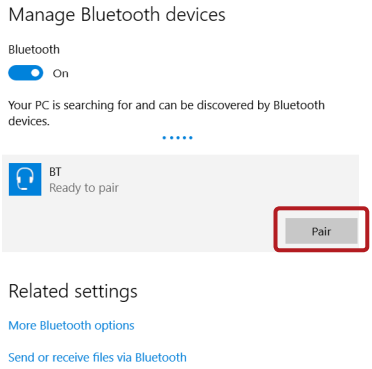
1. Connect the USB cable to a charger and the stethoscope. The red light indicator turns on while **charging**. It can take up to approximately 1 hour to fully charge.
2. The stethoscope is fully charged when the red light turns off.
3. Hold the **on/off button** for several seconds to turn on the stethoscope simulator. A voice saying 'Power on, pairing' is audible through the stethoscope.
4. To **connect** the stethoscope simulator with the computer, go to Bluetooth settings in Windows. The Bluetooth device with the subscript

'Ready to pair' can be seen.



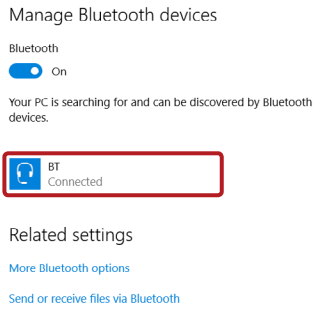
Bluetooth settings

5 Select the Bluetooth device and click the Pair button. A voice in the stethoscope simulator will say 'Pairing successful, connected'.



Pair device

6 The connection will be shown in the settings.



Connected to Bluetooth

7. The **+** button increases the **volume** and the **-** button lowers the volume.

8. Hold the on/off button again for several seconds to turn off the stethoscope simulator. A voice saying 'Power off' is audible through the stethoscope.

3 NENASIM HARDWARE

This section gives information about the hardware functionalities of NENASim. NENASim is designed to undergo various procedures.

3.1 HEAD

Eyelids actuator

The eyes can be set to 'Open', 'Close', and 'Blink realistically' with CommandX Tutor. Learn more about the eye settings in section 7.2 'Actuators'.

Neck actuator

The head movement can be set to move in different speeds; full or slight wobble, etc. The head movement can be customized with CommandX Scenario Editor. More on this can be found in section 7.2 'Actuators'.

Fontanelle actuator

The fontanelle of NENASim can be controlled as normal, bulging and sunken fontanelle. The NENASim fontanelle has a pulse function. How to set up this can be found in section 7.2 'Actuators'.

Pupillary response

Pupillary response can be checked by shining a light in the eyes. NENASim uses light sensors to detect the surrounding illumination to automatically adjust the pupil sizes. Learn how to set the pupillary response in section 7.10 'Reflexes'.

Dilated pupil

Constricted pupil

3.2 TORSO

Pulses

NENASim has palpable bilateral axillary and femoral pulses. The umbilical cord has a pulse when connected to the belly button. Learn more in section 3.4 'Umbilical cord'.

Palpable axillary and femoral pulses
Indicated with red circles

Airway system

NENASim has an anatomically correct airway system with realistic landmarks, such as the tongue, epiglottis, vocal cords, trachea and esophagus. This allows for the following procedures:

- Ventilation with a **bag valve mask**, which will result in chest rise.
- Nasal and oral intubation to the **trachea**. Recommended tube size is 4,5 mm. Intubate to a depth of 12 cm.
- **Pneumothorax** can be simulated during ventilation with unilateral chest rise, by turning off one (left or right) lung.
- NENASim has an **esophagus**, when NENASim is intubated incorrectly the stomach may get inflated.

NENASim can perform the following breathing patterns:

- Breathing through **chest only**.
- Breathing in **see-saw motion.**
- Breathing using both the chest and belly **simultaneously.**
- Breathing through **belly only**.

Needle decompression

Needle decompression can be performed on both sides of NENASim. The chest of NENASim has palpable ribs, the software can detect when a needle is inserted between the ribs.

Needle decompression locations
Indicated with red circles

Thorax drainage

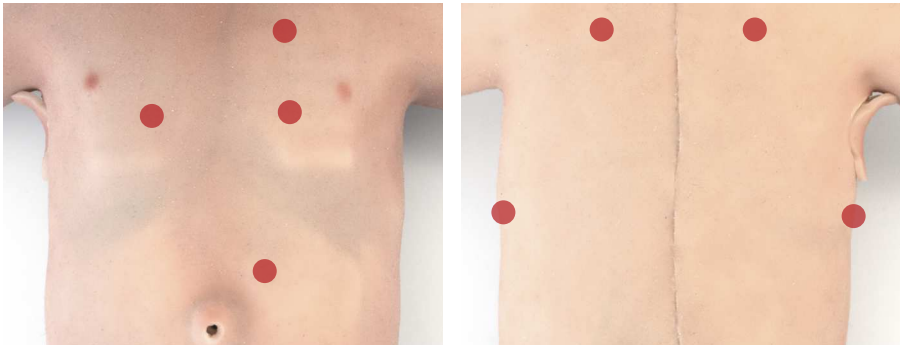
The area for the thorax drain procedure is located below the right arm.

Thorax drain location

A sensor detects the chest tube insertion. This will be visible in CommandX Tutor. After being used multiple times, the skin insert has a chance to tear. It can be replaced with a new one, contact your dealer or Medical-X for more information.

Sounds

NENASim can make vocal sounds such as crying and g. Internal sounds can be heard with the stethoscope simulator. Learn how to connect the stethoscope simulator in section 2.5 ‘Connecting NENASim’. The sounds can be listened to, at specific auscultation locations on the torso.



Auscultation locations
Indicated with red circles

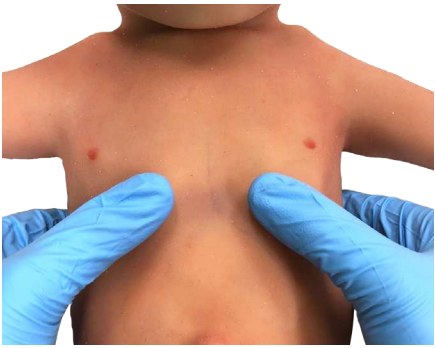
The stethoscope simulator can be used with both sides, the diaphragm and the bell. The bell allows low frequency sounds, which enables hearing gallops and rumbles. The diaphragm filters those out. Learn more about the setup of sounds in section 7.6 ‘Auscultation sounds’.

Temperature measurement

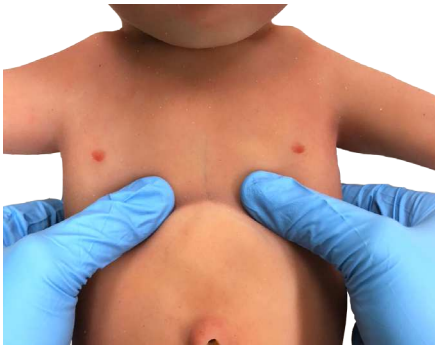
It is possible to insert a thermometer rectally. Note that NENASim does not simulate a body temperature.

CPR

The chest of NENASim can be compressed to perform CPR. Learn more about how this is registered by CommandX in ‘CPR’ in section 4.2 ‘Running a scenario’.



Decompressed chest



Compressed chest

3.3 LIMBS

IV injection

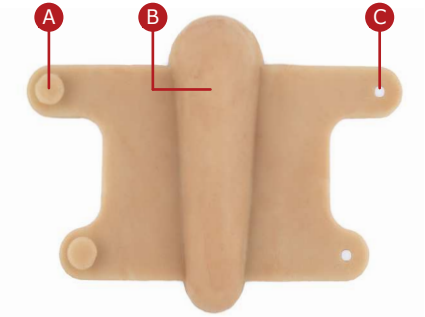
NENASim has two IV ports in the elbow cavities. IV lines can be inserted into the IV ports.

Caution: Applying IV must only be done WITHOUT fluids.

IV locations
Indicated with red circles

IO drilling

The IO sleeve comes with NENASim. The IO sleeve can easily be applied around the leg to be used for IO infusion.



A	Closing buttons
B	Shin
C	Closing loops

IO sleeve

1. Place the IO sleeve on top of the shin.
2. Close the sleeve around the shin by using the buttons on the backside.
3. Properly align the IO sleeve before use.

Limb actuators

The arms and legs can be set to move in different speeds. The movement can be customized in the CommandX Scenario Editor. Learn more about the setup of the limb movement in section 7.2 'Actuators'.

Skin color

NENASim can have cyanosis, jaundice, paleness or redness. The skin color can be changed in the hands, feet and face. Beside changing the color of the skin, the intensity of the color can also be adjusted. Learn more about the setup of skin coloration in section 7.9 'Skin'.

Skin coloration locations
Indicated with red circles

Feet reflex

NENASim allows to have its feet reflexes tested. Slightly touch the bottom side of the foot to initiate the foot reflex. Learn more about the setup in section 7.10 'Reflexes'.

Foot reflex

3.4 UMBILICAL CORD

Components

To be able to use the umbilical cord to its full functionality, one should acquire the following items:

Umbilical cord simulator
Included wiht NENASim HPS Xtreme

Umbilical clamp
Standard

Syringe 20 ml
Standard

Artificial blood
To be purchased from Medical-X

Preparation

1. Fill the syringe with 3 ml of simulated blood.

Syringe with simulated blood

2. Hold the umbilical cord with one hand at the height of the reservoir. Gently press the reservoir to discard all air inside.

3. Insert the syringe into the red vein.

Insert syringe

4. Gently insert the liquid into the umbilical cord. Meanwhile slowly release pressure on the reservoir of the umbilical cord.
   Note: When adding the liquid too fast or decompressing the reservoir too slow, the liquid may run along the syringe.

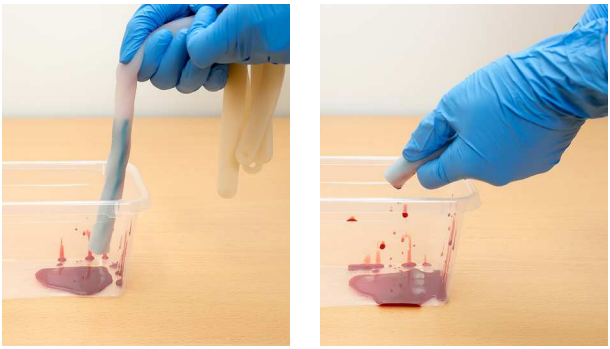

Gently release pressure

5. Attach the umbilical clamp to the top of the umbilical cord. Secure the clamp of the umbilical cord by pressing the ends together. The reservoir is now ready for usage.


Secure umbilical clamp

Cleaning

1. Provide a container or sink to dispose the content of the reservoir. Empty the reservoir by gently pressing the umbilical cord.



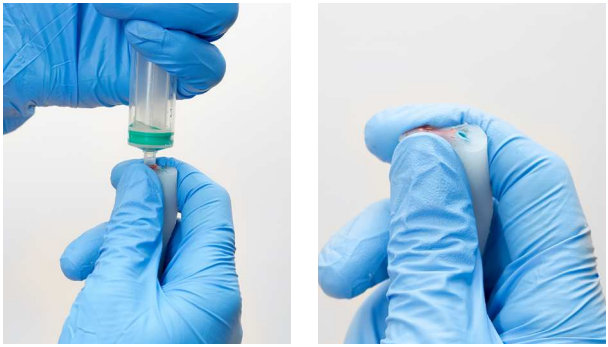
Press from back to front

2. Fill a syringe with clean water.

3. Insert the syringe into the red vein. Gently insert the water into the umbilical cord. Meanwhile slowly release pressure on the reservoir of the umbilical cord.

   Note: When adding the liquid too fast or decompressing the reservoir too slow, the liquid may run along the syringe.

4. When filled with water, close off the vein by pressing the umbilical cord together with one hand.



Fill and close off the vein

5. Knead the umbilical cord to dissolve all remaining liquid.

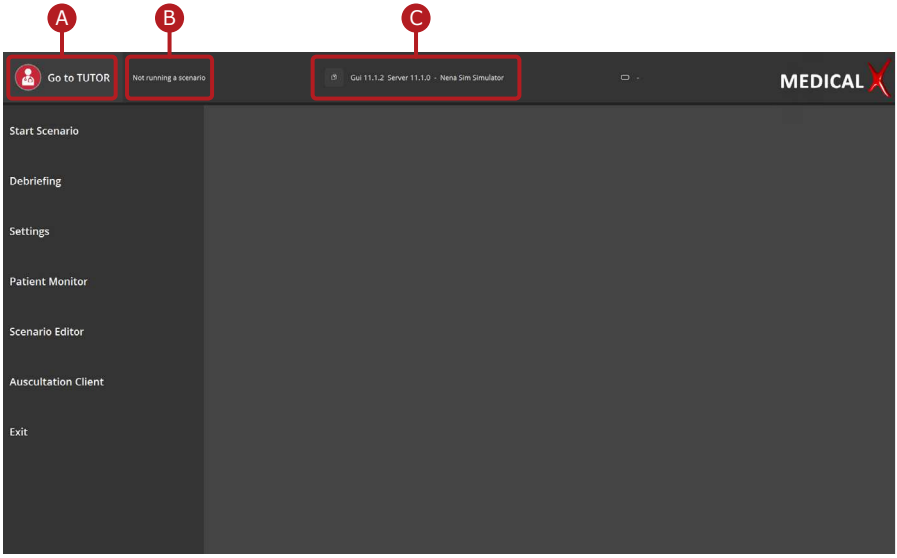
Let the water sink into the reservoir

6. Empty the reservoir again by gently pressing the umbilical cord from the back to the front.
7. Repeat these steps until the umbilical cord is properly cleaned.
8. Make sure the inside of the umbilical cord is as good as dry. If not, try to vacuum it until it is empty with the syringe. A little wetness will dry by itself when the umbilical cord is left in open air.
9. Dry off the outside of the umbilical cord.

The umbilical cord is now ready to be stored or reused.

4 COMMANDX TUTOR

This section gives a detailed explanation on how to control NENASim with CommandX Tutor. The main menu of CommandX Tutor shows several fields.



CommandX Tutor main menu

A	Access the CommandX Tutor **control screen**. Here the user can control NENASim and the scenario.
B	The text '**Not running a scenario**' indicates that no scenario has been started. When a scenario is running it will show its name, current status, passed time and the option to pause or continue the scenario.

C The text '**Gui XX.X.X**' (example: Gui 11.1.2) and '**Server XX.X.X**' (example: Server 11.1.0) shows the software version of CommandX Tutor and the software version of the NENASim server.

Note: CommandX Tutor and NENASim are only compatible if the first two numbers, separated by a dot, correspond to each other.

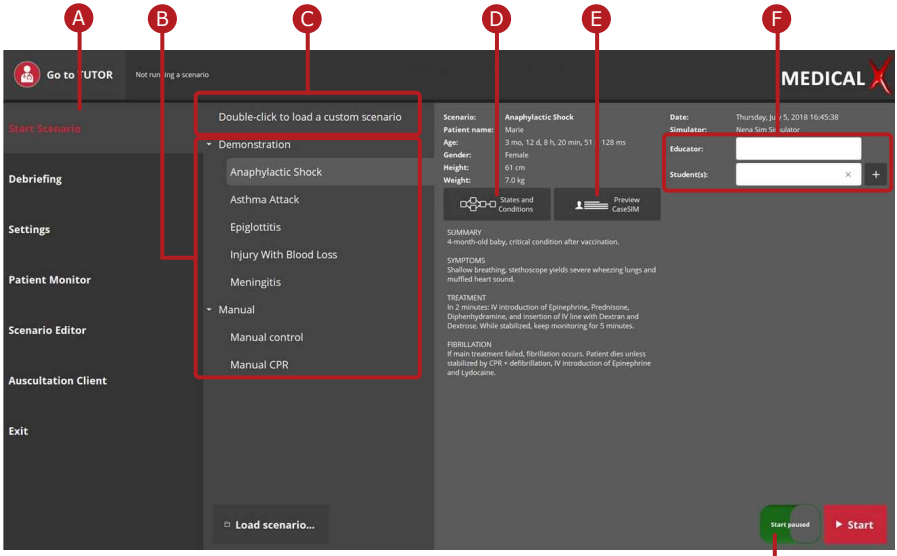
There are several menu buttons available beneath the 

button:

Start Scenario	Here a scenario can be selected to start a training. Learn more about this in section 4.1 'Start scenario' and section 4.2 'Running a scenario'
Debriefing	This function allows the user to debrief after the training. Learn more about this in section 4.3 'Debriefing'
Settings	Learn more about this in section 4.4 'Settings'
Patient Monitor	This button opens the simulated patient monitor. Learn more about this in section 5 'CommandX Monitor'
Scenario Editor	Customize scenarios. Learn more about this in section 7 'CommandX Scenario Editor'
Auscultation Client	Learn more about this in section 6 'CommandX Auscultation Client'
Exit	Click here to exit CommandX Tutor.

4.1 START SCENARIO

When selecting 'start scenario' in the main menu the scenario menu will open. The options in the menu are explained below.



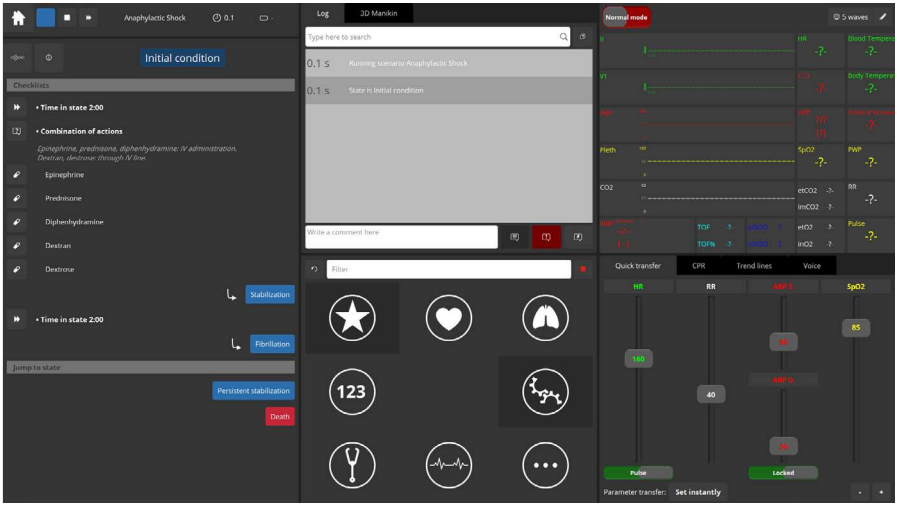
Scenario menu

A	Scenarios can be started from the '**Start Scenario'** menu.
B	Choose one of the standard scenarios.
C	**Load a custom scenario** from the local files by either double clicking the 'Double-click to load a custom Scenario' button or by clicking Load scenario... in the bottom.
D	View all **states and conditions** of this specific scenario by clicking 'States and Conditions'.

E	**Preview** the patient information in a simulated EMR software environment: CaseSIM, by clicking 'Preview CaseSIM'. The trainee can access the information in CaseSIM through CommandX Monitor. Learn more about this in section 5 'CommandX Monitor'.
F	Register the educator's name and trainee(s) name(s) for evaluation purposes afterwards.
G	The '**Start paused/Don't start paused**' switch in the bottom right corner of the screen allows to start in a paused state or have the timer starting to run right away.

4.2 RUNNING A SCENARIO

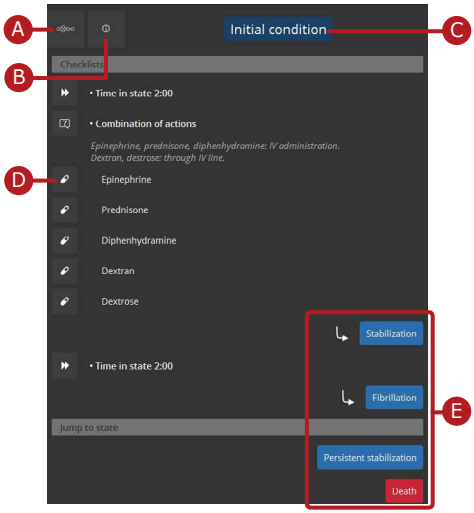
After starting a scenario, the CommandX Tutor control screen is shown. For this example, the 'Anaphylactic Shock' scenario is shown. All sections of the control screen will be explained below.



CommandX Tutor control screen

Scenario checklist

On the left-hand side, the user can see the states of the scenario.



Scenario checklist

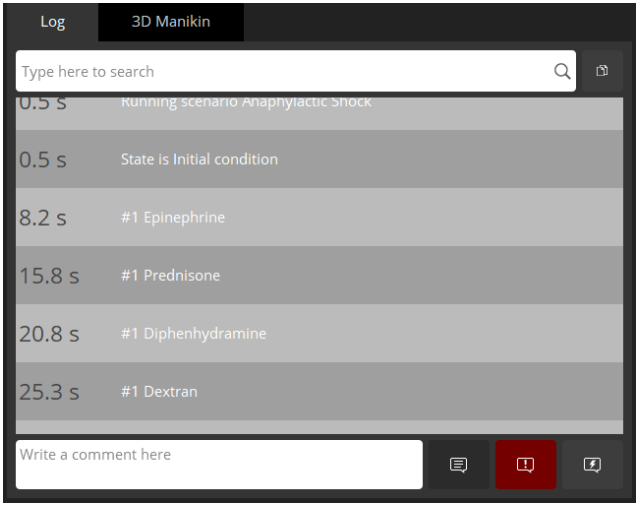
A	The '**States and Conditions**' overview shows all states and the associated conditions.
B	'**Session Info**' shows a summary of the active session.
C	In the top bar the **currently active state** is shown.
D	By clicking the buttons in front of the action or medication the user can mark it as complete. When all actions are completed, the scenario will automatically continue to its next state. The icons on the buttons are explained below.
E	The user has the ability to **overrule state changes** by manually clicking the blue or red buttons on the right side of the check list.

The buttons in front of each action show icons corresponding to the type of action:

	'**Performed Action**', a standard action.
	'**Evaluable Action**', must be reviewed and manually approved or declined by the teacher in the 'Activity Log'.
	'**Medication**', action that does not need the teacher to approve/ decline manually.
	'**Time**', amount of time to pass before moving to the next state. Click this button to move the scenario 1 minute forward in time.

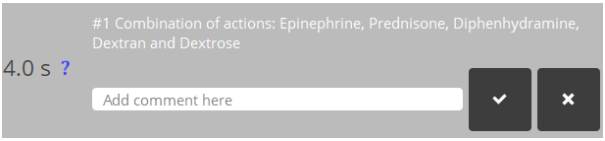
Activity Log

The 'Log' is located at the top center of the control screen, first tab. The 'Log' shows all executed actions that are recognized by NENASim's sensors or marked in the 'Scenario checklist'.



Activiy Log

Some actions are evaluable and will therefore need an additional approval in the ‘Log’. A brief comment on how the trainee performed the action can be added.



Evaluable action

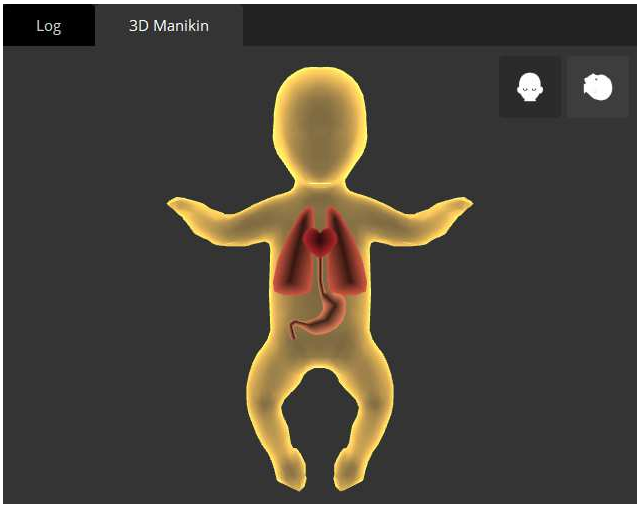
In the ‘**Log**’, three buttons are available in the bottom-right corner:

	Add a regular comment.
	Add an important comment.
	Manually add an action.

Learn more about actions in section 7.1 ‘States and transitions’.

3D manikin

The second tab located at top-center of the control screen, ‘3D Manikin’, displays an interactive 3D model of the manikin.



3D Manikin

Two buttons are available at the top-right corner:

	Front view
	Side view

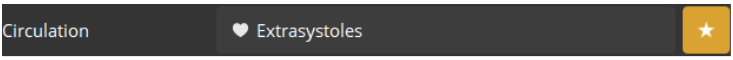
This 3D model of the manikin can be rotated by selecting and dragging it to any direction. The 3D manikin can also be used as a quick transfer to settings of particular parts of the body by clicking the corresponding limbs or organs.

During a scenario, the 3D model will show the actions that are recognized by NENASim's sensors. Such as examining pupillary light reflex and pulses, performing auscultation, CPR, ventilation, needle decompression and chest tube insertion, or when NENASim's skin is colorized.

Manikin settings

The bottom-center shows the settings area of the manikin. All settings are categorized. Below is explained what each button/section represents:

Manikin settings

	**Return** to the main menu.
	The user can add a **filter** to quickly find a specific setting (e.g. when the user types in 'Heart', the settings area displays all heart related settings)
	Each setting can be set to **favorite** by clicking the ★ button on the right of each setting. Below, an example is displayed. This setting is viewable in the favorites section.  **Favorite setting**

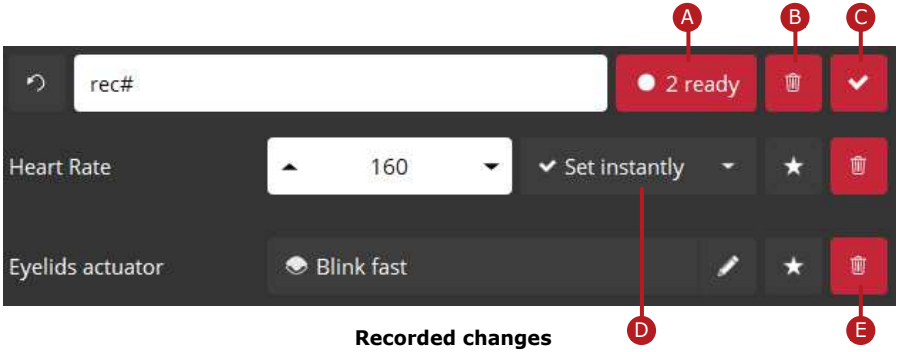
	Heart-related settings.
	Lung-related settings.
	Numeric-related settings, e.g. heart rate and SpO2 values.
	Actuator settings. All movable parts can be adjusted in this section, e.g. limbs and chest.
	Auscultation settings. Lungs, heart and bowel sounds can be changed in this section.
	Waveform presets. Waveforms can be adjusted here.
	All of the above settings.
	This button records all adjusted settings and applies the changes simultaneously when the user confirms them.

Record setting changes

The **record settings** function can be used to change manikin settings simultaneously or over time, instead of instantly. Below is displayed what happens when the record button is clicked.

Record settings

Example: Change the numeric setting 'Heart Rate' from '120' to '160' and 'Eyelids Actuator' from 'Lively' to 'Blink fast'. The changes are saved to the recorder, waiting to be confirmed by the user.



Recorded changes

A	Click 2 ready to **view all recorded changes**.
B	**Cancel all recorded changes** by clicking the button in the top bar.
C	**Apply all recorded changes** by clicking the button.
D	This drop-down menu gives options to **changes settings over time**, instead of instantly. The time will start from the moment the recorded changes are applied.
E	**Cancel** the recorded setting.

Patient monitor

In the top-right corner the patient monitor is shown. This monitor is synchronized with the CommandX Monitor, learn more in section 5 'CommandX Monitor'. There are some options to control the patient monitor:

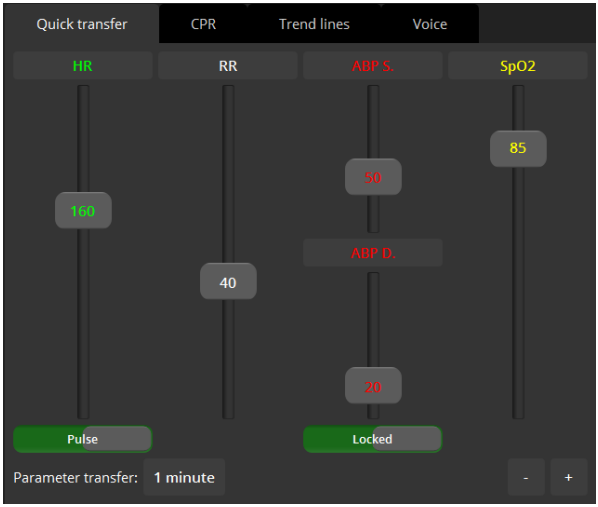
Patient monitor

		In '**Normal Mode'**, when clicking the leads, it acts as a short cut to change the parameters or waveforms in the bottom center section.
A		In '**Connect Mode'**, when clicking the leads, they will become (in)visible on the CommandX monitor. Learn more about the **CommandX Monitor** in section 5 'CommandX Monitor'.
B		With '**All are OFF**' in 'Connect Mode' the leads are all invisible on the CommandX Monitor.
		With '**All are ON**' in 'Connect Mode' the leads are all visible on the CommandX Monitor.

C	Clicking the leads results in two possible actions, depending on the active mode. This is explained at point A.
D	In the top right corner of the patient monitor the button  can be found. Click this button to select different patient monitor layout presets.
E	Click the  button to customize the current layout of the patient monitor. Learn more in section 5 'CommandX Monitor' and section 7.8 'Patient monitor layout'.

Quick transfer

In the lower right section of the control screen, the user can adjust the vital signs parameters with the sliders in the '**Quick Transfer**' tab.



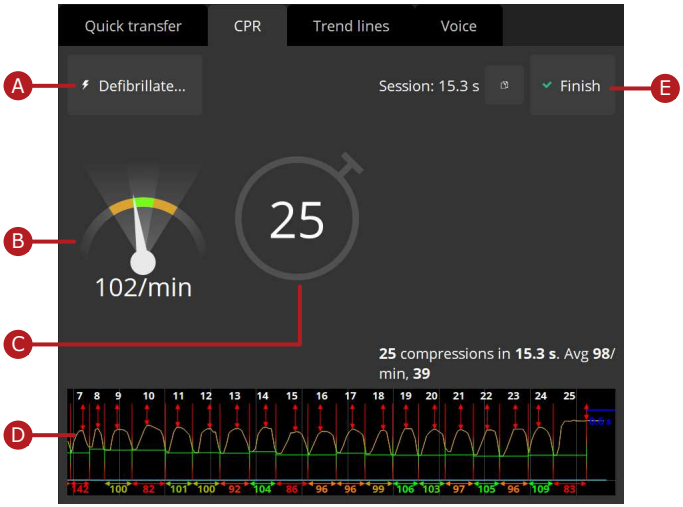
Parameter sliders

Add or remove parameter sliders by clicking the  buttons in the

lower right corner. Set the parameter transfer time in the lower left corner.

CPR

With the **CPR tab,** in the bottom right section of the control screen, the user can review the quality of the CPR.

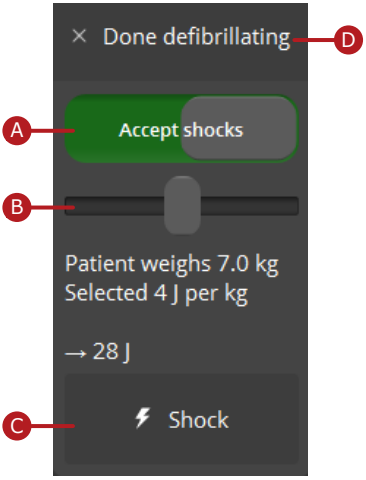


CPR tab

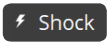
A	Click the Defibrillate... button to activate the defibrillation function. Learn more about this function below.
B	The amount of compressions per minute.
C	The total amount of compressions.
D	An overview of the position of the chest over time.
E	Click the Finish button to finalize the CPR session.

After finalizing, the CPR session is shown in the 'Log' as an 'Evaluable Action'. Requiring the teacher's approval. A summary of the CPR session can be viewed by clicking the  button.

Defibrillation



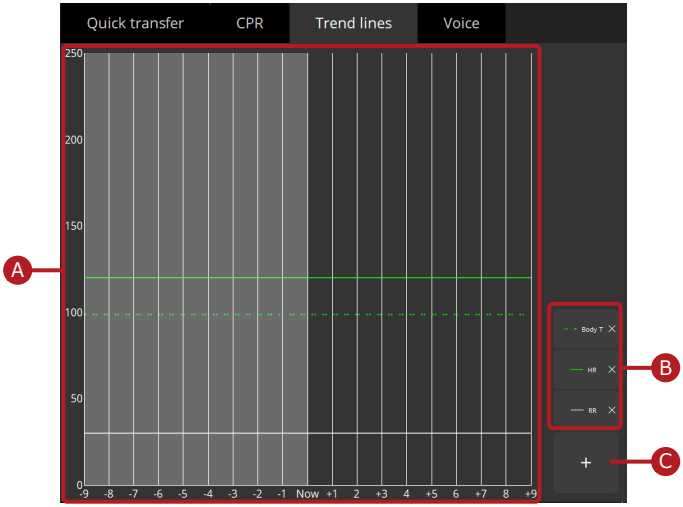
Defibrillation menu

A		Shocks must be evaluated in the 'Log'.
		Shocks are approved automatically.
B		The slider can be used to set the amount of Joules per bodyweight in kilograms/pounds (metric/imperial system can be changed in Settings, learn more in section 4.4 'Settings').
C		To apply a shock, press the  button. When a shock has been applied, the spike can be seen on the patient monitor ECG.

D Press the × Done defibrillating button to finish defibrillation.

Trend lines

The '**Trend lines**' tab in the bottom right section of the control screen shows the trend lines of the vital signs.

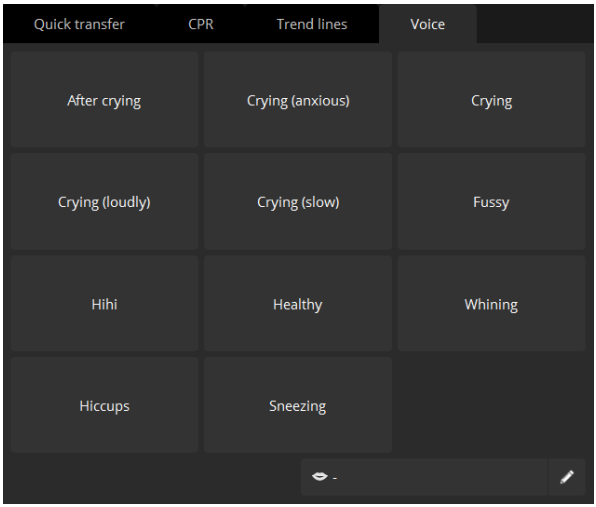


Trend lines tab

A	Graph showing the value of vital signs over time. Hovering the lines will show the corresponding value of the trendline on that time.
B	**Legend** of the parameters. A parameter can be deleted from the graph by clicking the parameter's button in the legend.
C	**Add parameters** to the graph by clicking the + button. A list will appear showing all available parameters.

Voice

The '**Voice**' tab, at the bottom right section of the control screen, allows the user to play and/or add customized vocal sounds.

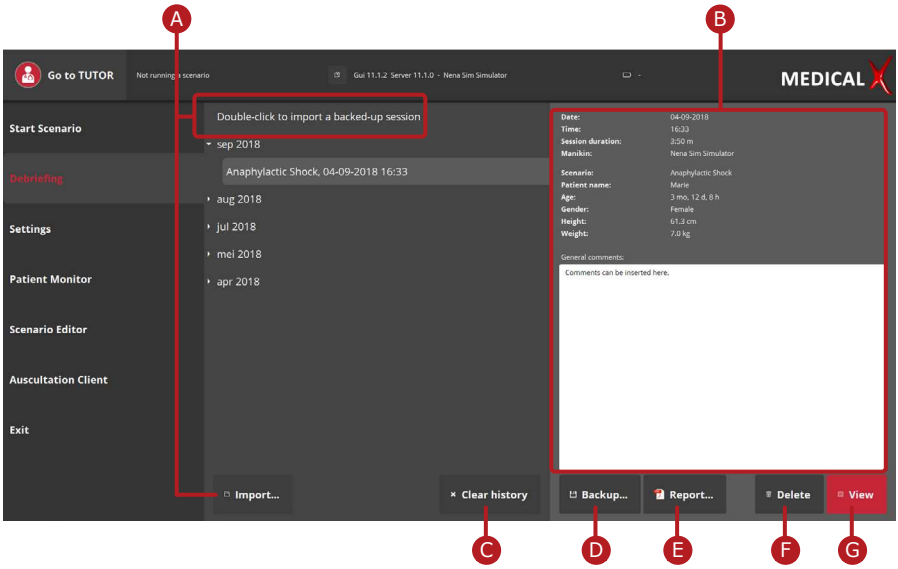


Voice tab

To play a voice sound, click one of the buttons. To play a custom sound, click the  button in the bottom right corner. A new window will appear; in here the user can utilize the existing vocal sounds from the database. The user can also add their own vocal sounds by clicking the '**Load**' button. Learn more about vocal sound in section 7.5 'Voice'.

4.3 DEBRIEFING

The 'Debriefing' function allows to review recorded training sessions. One can navigate through the menu by browsing through the recording history. The case details are displayed on the right-hand side.

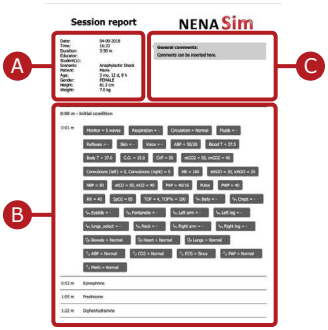


Debriefing menu

A	To import the debriefing of recorded scenarios saved on this computer, one can either double click on the the **'Double-click to import a backed-up Session'** button, or click **Import...**.
B	Comments can be written in the **'General Comments'** section.
C	The **× Clear history** button will delete all debriefings that were saved in CommandX Tutor.
D	Use the **Backup...** button to save the selected debriefing to the computer.
E	Use the **Report...** button to create and save a PDF report file of the selected debriefing and review it. Learn more in the 'Report' section below.

F	Delete the selected case by clicking the Delete button.
G	By clicking the View button, the debriefing will be shown in detail. Learn more about the debriefing in section 'Debriefing mode'.

Report



PDF Session report

A	Details about the scenario and the patient's information.
B	The states, conditions and actions, marked with a timestamp.
C	The general comments from the debriefing menu.

Debriefing mode

After clicking View in the debriefing menu, a new window appears showing all details of the recorded scenario.

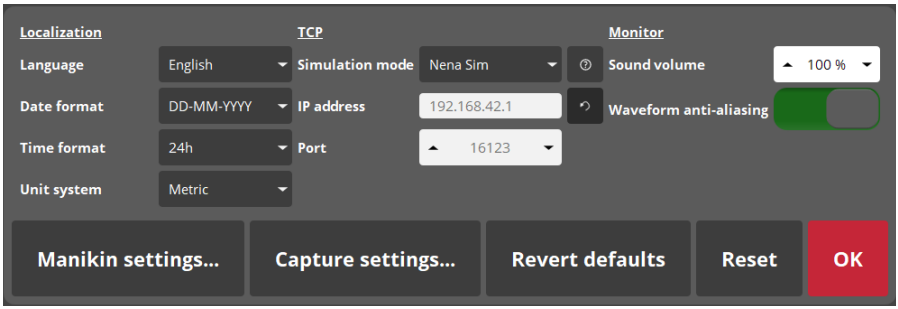
Debriefing mode

A	Go back home by clicking the **home** button. With the buttons on the right of it the user can **play/pause** the debriefing, **skip** to the start/end, adjust the **speed** and **zoom** in/out.
B	This is the **timeline**. The graphs indicate the value of the parameters over time. **Action symbols** are displayed in the bottom of the timeline, indicating when the action has taken place during the scenario.
C	This is the legend. The user can add different **parameters** by clicking the + button. The user can remove them again by clicking the parameter buttons in the legend.

D	This section is called the '**Log**'. When clicking an action symbol in the, the user is immediately referred to that specific moment of the training. A description of that certain action is shown in the table on the bottom-left. This 'Log' corresponds with the 'Activity Log'of section 4.2 'Running a scenario'.
E	On the bottom right, four different channels are displayed. This can be used to display the **patient monitor** as well as **video recordings**. Learn more about recording and capture settings in section 'Capture settings'.

4.4 SETTINGS

The settings are subdivided into several sections.



CommandX Tutor Settings

Localization

At '**Localization**', language, date format, time format (12h or 24h) and unit system (imperial or metric) can be changed.

TCP (Transmission Control Protocol)

When **'Simulation Mode'** is enabled under 'TCP', CommandX Tutor will run a scenario without connecting to a NENASim manikin. Voice sounds will be played through the computer's speakers. Features which require the physical simulator, like auscultation, CPR and movements will be unavailable.

When simulating with a physical simulator it is possible to connect it to multiple devices. This is also possible in simulation mode. To do this, edit the connection settings on those devices. Set port to 16123. Set IP address to 192.168.0.9.

Note: Make sure that all computers are connected to the same Wi-Fi network. This can even be the Wi-Fi network of a cell phone.

This is a powerful feature to control the simulated patient monitor, without having to connect to a manikin.

Monitor

Sound volume of the monitor can either be adjusted through clicking the two arrows or by entering a percentage on a keyboard.

When the waveform anti-aliasing is enabled the graph of the ECG will be displayed in higher quality, this function affects the processing power of the computer.

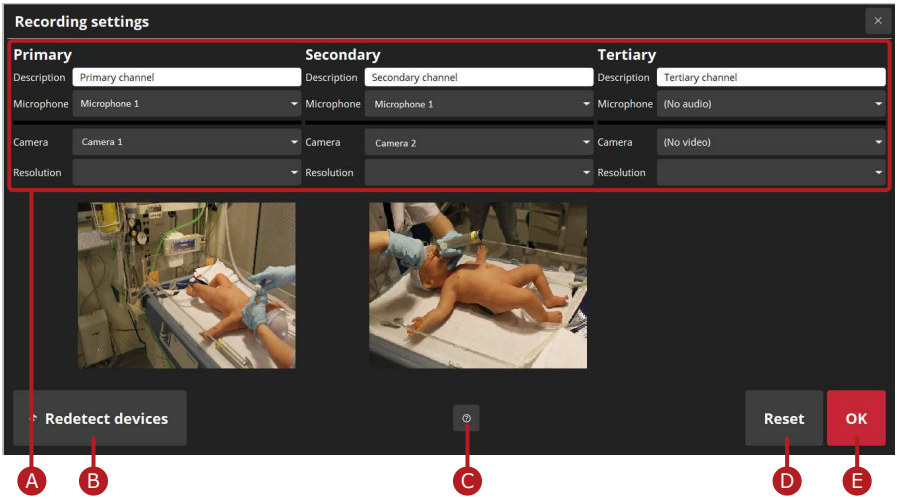
Manikin settings

The '**Manikin Settings**' allow the user to change the Wi-Fi channel of NENASim.

Note: After changing the Wi-Fi channel, please restart NENASim; this can take up to 30-60 seconds. After hearing a distinct beeping sound, the user is able to continue working with the manikin.

Capture settings

The '**Capture Settings**' allow the user to define the connected microphones and webcams.

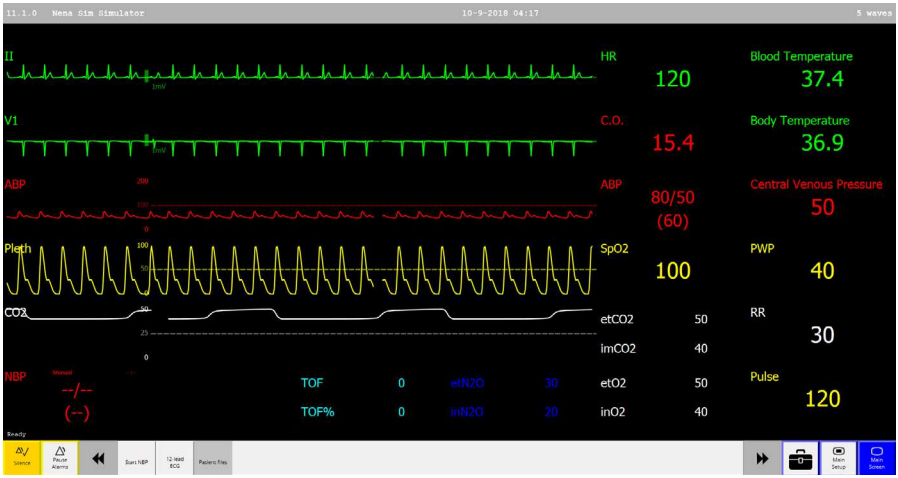


Capture Settings

A	The user can **select up to three cameras** and microphones to record. Resolution of the camera can be selected.
B	In case the software does not detect the cameras, click the Redetect devices button below.
C	For **more information** about live capture, click the ? button.
D	Click **Reset** to reset all recording setting.
E	Click Ok to confirm all settings and return to the settings menu.

5 COMMANDX MONITOR

The **CommandX Monitor** can be launched from the CommandX folder or from the CommandX Tutor main menu. After launching, a new window opens where the CommandX Monitor is displayed.



CommandX Monitor

5.1 CONTROL PANEL

At the bottom bar of the screen, the user can find the **control panel**. This control panel gives the user the ability to use certain features. Explaining from left to right, starting with the main screen:

	Silence alarm
	Pause the alarm for 1 minute

	Go to the previous menu page (only applicable when not all menu buttons fit in one menu page).
	Activate non-invasive blood pressure.
	Display the 12-lead ECG. Clicking this button, a new window appears in the patient monitor.
	Display the **patient information** in the 'CaseSim' software. The attached files which the user has uploaded into the scenario can be viewed, for example X-ray pictures.
	Go to next menu page (only applicable when not all menu buttons fit in one menu page).
	Clicking the '**Toolkit**' button reveals a metronome and stopwatch. Learn more about this below.
	The '**Main Setup**' reveals the volume and layout menu. Learn more about this below.
	Return to the main screen of the menu.

Toolkit

When clicking the '**Tookit'** button in the main menu the user can set a metronome and stopwatch.

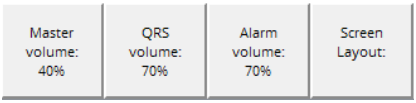
CommandX Monitor Tookit

Explaining from left to right:

	Activate the **metronome** to guide CPR. Click the button again to deactivate the metronome.
80 bpm	Set the BPM for the metronome with the slider that shows when clicking the button. Click the ⌃⌃ and ⌄⌄ buttons on either side of the BPM to adjust the value with one BPM per click.
	Start the **stopwatch**. Click again to pause the stopwatch.
00:00.4	This button shows the time related to the stopwatch. Click to **reset** the stopwatch.

Main setup

The '**Main Setup**' button in the main menu reveals the volume and layout menu.



Main Setup Menu

Master volume: 40%	Set the master volume
QRS volume: 70%	Set the QRS volume
Alarm volume: 70%	Set the Alarm volume

The '**Screen Layout**' button gives the user the option to select '**5 Waves**', '**Big Numbers**' and '**CPR Monitor**'.

5.2 ALARMS

Click a **numeric parameter** in the main screen to display the **alarm menu**. Set an alarm by setting a high and/or low limit for one or multiple numeric parameters.

When the numeric parameter reaches above or below the threshold, the alarm goes off. To silence the alarm, click the '**Silence**' button. The '**Pause Alarm**' button pauses the alarm for 1 minute.

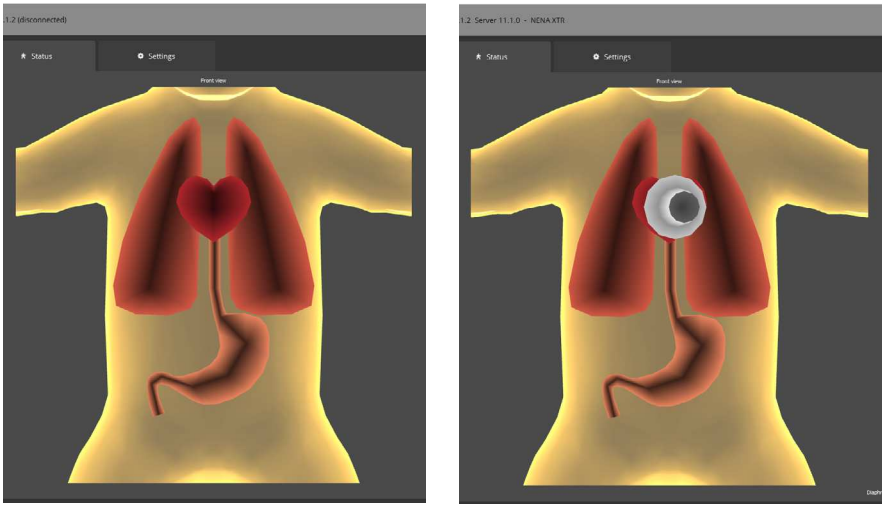
5.3 WAVEFORMS

Click a **waveform** in the main screen to display the **setup menu**. Here you can set the size of the waveform and the speed of all waveforms. For ECG waveforms the lead can also be set.

6 COMMANDX AUSCULTATION CLIENT

The **CommandX Auscultation Client** can be launched from the CommandX folder or from the CommandX Tutor main menu.

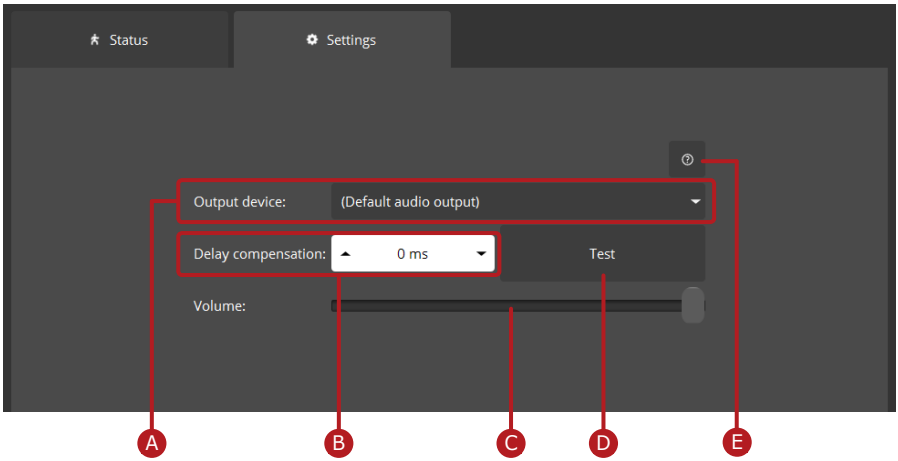
The Auscultation Client gives **feedback** where the stethoscope is placed on the manikin for the user's reference. The software detects whether the diaphragm or the bell of the stethoscope is being used.



The stethoscope is detected

The displayed front and back images in the Status tab show the heart, lungs and stomach of NENASim. The mentioned organs can be heard through the stethoscope simulator. Learn how to connect the stethoscope in 'Connect the stethoscope simulator' in section 2.5 'Connecting NENASim'.

In the Settings tab, the user can adjust the settings.

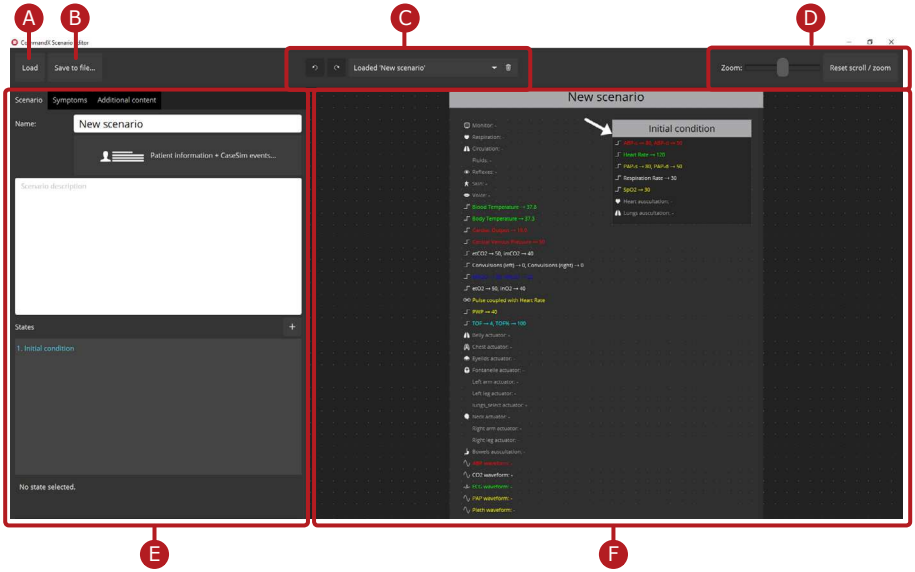


CommandX Auscultation Client Settings

A	Select an **output device**. Make sure that the **stethoscope simulator** is selected.
B	Set a **delay compensation** if there's a delay in transmitting sound to the playback device, this setting will compensate for it.
C	Set the desired **volume**.
D	Click Test to see if the value is correct. Verify that the beeps are synchronous with the flashing red button.
E	Find additional information about the Auscultation Client's settings.

7 COMMANDX SCENARIO EDITOR

The **CommandX Scenario Editor** enables the user to adjust or customize existing scenarios or create scenarios from scratch. Launch the Scenario Editor from the CommandX folder or from the CommandX Tutor main menu.



CommandX Scenario Editor

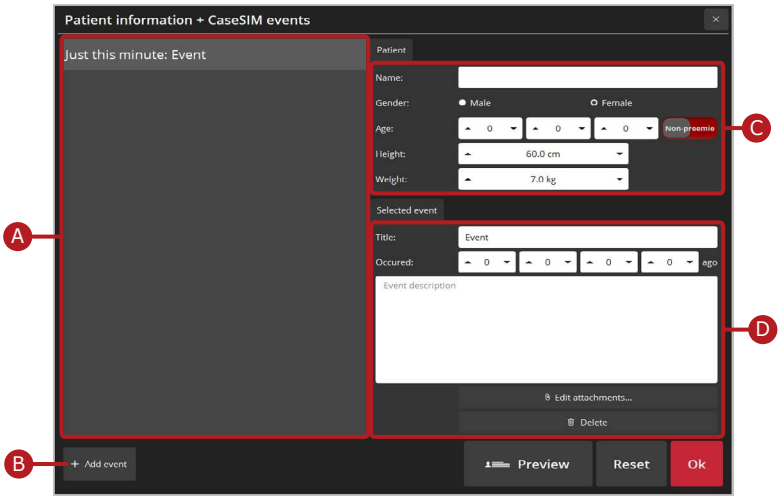
A	**Load** existing scenarios.
B	**Save** scenario.
C	Changes made are summarized in '**History**' in the top center. This function can be used to undo changes.
D	Set the view of the scenario field to a desired size with the **zoom slider.** Click 'Reset Scroll/Zoom' to return to the original view. The scroll wheel on a mouse can also be used to zoom in and out.

E	On the left-hand side there are three different tabs: 'Scenario', 'Symptoms' and 'Additional content'. These are explained below.
F	The **scenario field** is used to determine and describe various states and the transitions between these states with their parameters and their conditions. This will be explained in more detail in section 7.1 'States and transitions'.

Scenario

In the first tab, '**Scenario**', the user can name and describe the scenario, add new states and set transitions. Learn more about states and transitions in section 7.1 'States and transitions'.

The '**Patient Information + CaseSim Events...**' button opens a window where information about the patient can be given.



Patient Information + CaseSim Events

A	The left window shows an overview of the patient's medical record.
B	Add new events to the patient's medical record.
C	Add general information about the patient.
D	When an event is selected in the medical record overview from A, the user can set details for this event. One can set when the event happened, add a description and add an attachment such as an X-ray picture.

Preview the patient information in a simulated Electronic Medical Record (EMR) software environment: CaseSIM, by clicking '**Preview CaseSIM**'. The trainee can access the information in CaseSIM through CommandX Monitor during the scenario, learn more about this in section 5 'CommandX Monitor'.

Reset the changes made since the user last applied all changes.

Click **Ok** to apply all changes and return to the Scenario Editor.

Symptoms

The second tab, '**Symptoms'**, allows the user to edit and modify symptom parameters. Click the '**Edit State dependent Symptoms**' button to set symptoms to be state-dependent or independent. The **state-independent symptoms** are conditions that are constant throughout the scenario. **State-dependent symptoms** are conditions that are only effective in a particular state.

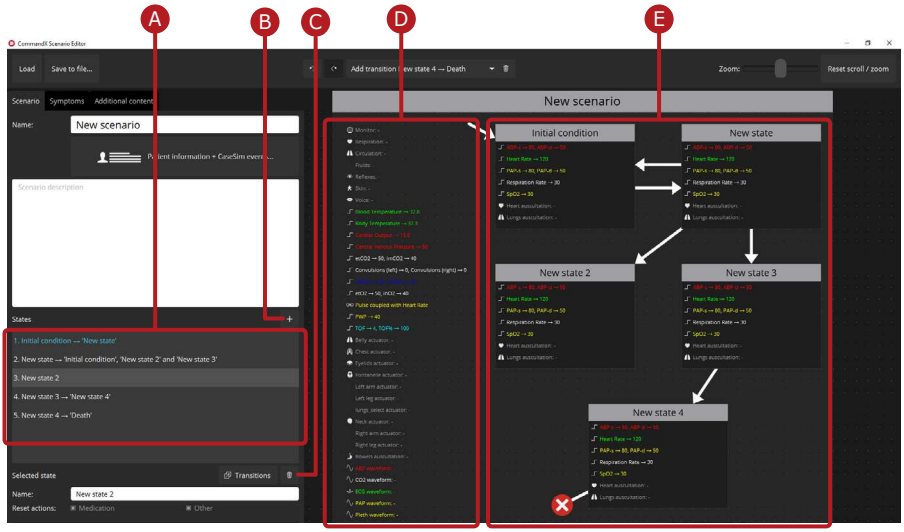
Additional content

More features are available in the third tab: '**Additional Content'**. Learn

more about these features in section 7.3 'Waveforms', section 7.5 'Voice', section 7.7 'Actions', section 1.1 'General', section 7.9 'Skin' and section 7.10 'Reflexes'.

7.1 STATES AND TRANSITIONS

This section describes how the states are created and described, and how the transition conditions between the states are defined in a scenario. A scenario can be regarded as a decision tree or a decision flowchart, where one goes from one state to another state depending on actions that are taken or conditions that are met, an example is drawn below.

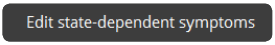


Scenario example

A	View all states. Learn more in section 'States' below.
B	**Create a new state** by clicking the + button or by clicking anywhere in the scenario field.

C	**Deleting a state** can be done by clicking the  button that shows when a state is selected or by holding the CTRL-key while left clicking a state in the scenario field.
D	The left column in the 'New scenario' field shows the symptoms and features that are **state independent**. These symptoms are constant during the scenario, except if the teacher manually changes these symptoms and features during the scenario.
	Each state, depicted as a rectangular field in the figure, has its own **state dependent** symptoms such as vital signs values, sounds, movements, ECG graphs, etc. The symptoms inside the rectangular field are state dependent.
E	To **move a state** in the scenario field, hover the mouse over the name of the state, the mouse will turn from a hand icon to a 4-way arrow icon. Now click and hold the left mouse button on the name of the state and drag the state to a desired position. The white arrows indicate the possible transitions from one state to another.

Symptoms

To **change a symptom from state dependent to state independent**, click one of the available parameters in the Initial condition and/or in the available states. Or click the 

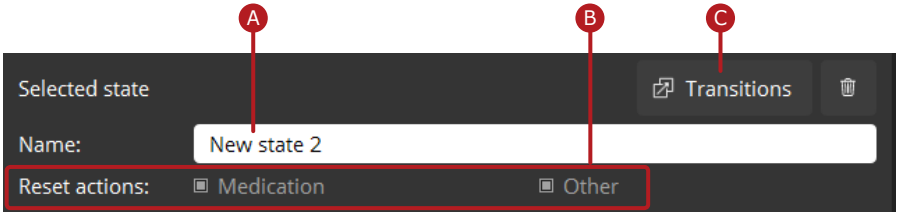
button, in here the user can swap the parameters by clicking the arrows.

To **change the value of a parameter** click it once. It will be listed on the left side alongside all other parameters with the same dependency. Here the parameters can be adjusted.

Transfer time of a symptom can be either set at 'Set instantly' or from '5 Seconds' up to '5 Minutes'. This can be done in the drop-down menu next to the parameter.

States

At the bottom of the left menu additional functions of the selected state can be edited.



Renaming state and reset actions

A	The state can be (re)named. The Scenario Editor automatically names a new state with a consecutive number if no name is given.
B	**Reset actions,** for medication and other, means that when the scenario arrives in that state, previous actions taken or medication given are reset. If the 'Reset Actions' are unchecked, medications or actions given in an earlier state are still valid.
C	The **Transition** button allows the user to edit the conditions to go from the selected state to another state(s). The transition conditions window can also be opened by directly double clicking the white transition arrows in the scenario field.

Transitions

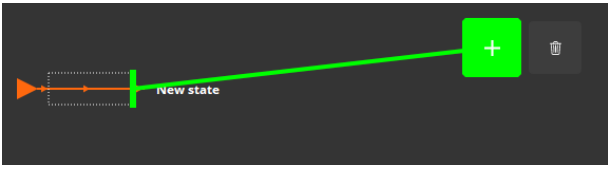
A state can have transitions to more than one other state. It is also possible

to have a transition that goes back to the previous state.

When a transition is made to the background it will go to '**Death**' state, depicted as a . In the 'Death' state the manikin will stop all movements, sounds, and parameters will go to zero and/or flatlined.

When clicking the Transitions button, a new window opens that allows to create and edit transition conditions.

1. To **add transition conditions**, click and hold the + button and drag it to the dotted rectangle. A transition can be dependent on multiple conditions at the same time. Learn more on the following pages.



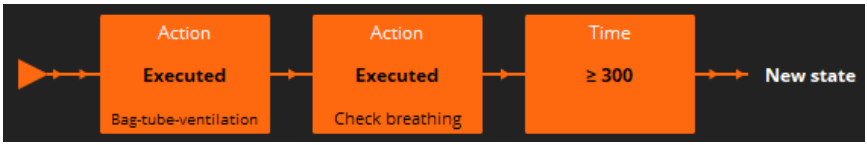
Add transition conditions

2. A new window appears. In this window it is possible to **describe the transitions conditions**.

3. A **type** can then be chosen from the following four options: 'Time', 'Sensor', 'Parameter', or 'Action/Medication'. Learn more in section 'Transition condition types' below.

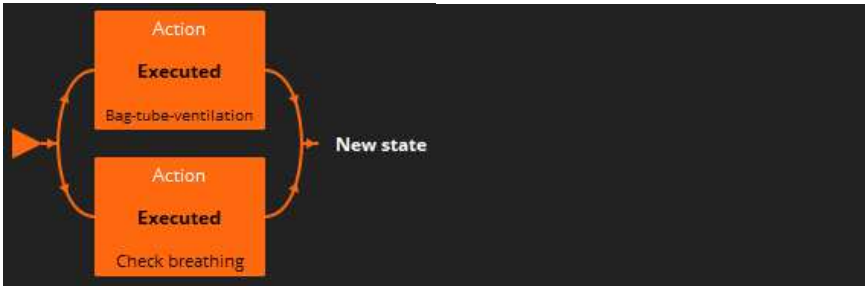
Transition conditions

As stated earlier one transition can depend on multiple conditions. With the **+** button another condition can be dragged and added left or right to the first one to make AND-conditions.



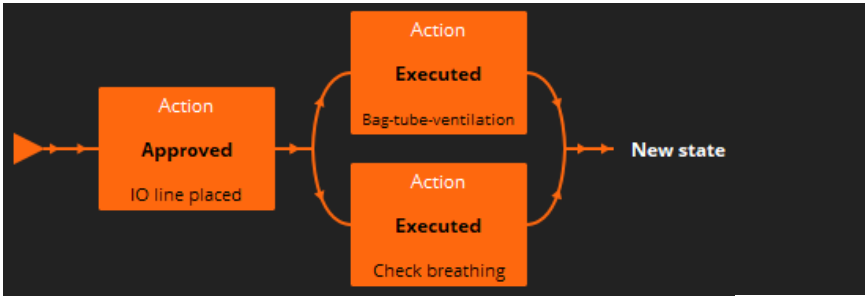
AND-conditions

With the **+** button another condition can be dragged and added above or below to the first one to make OR-conditions. The order of the conditions does not matter in this case.



OR-conditions

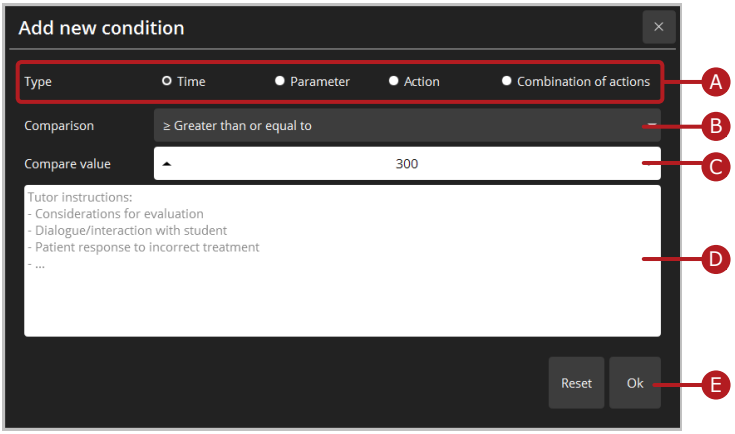
A combination of AND- and OR-conditions can be made as well. The transition conditions combinations are not limited to these examples, it can be expanded with much more conditions and combinations.



Combination of AND and OR-conditions

Transition condition types

When a new condition is created, a new window opens and allows the user to set this condition. A condition can always be edited by clicking on it.



'Add new condition' menu

A	Select the **type** of transition condition.
B	For condition types 'Time', 'Parameter' and 'Action' the following **comparison conditions** can be chosen: ≥ greater than or equal to, > greater than, < less than, ≤ less than or equal to, = equal to, ≠ not equal to.
C	The **value** to compare with has to be inserted. This does not apply for condition type 'Combination of Actions'.
D	Add **instructions**. These will be shown with the transition condition during the scenario.
E	**Apply** changes and return to the transitions window.

The '**Time**' condition depends on the amount of time that has passed.

The '**Parameter**' condition depends on the selected vital sign: ABP Diastolic, ABP Systolic, Cardiac Output, CVP, Heart rate, PAP Diastolic, PAP Systolic, PWP, Pulse, Respiratory Rate, SpO2, Blood Temperature, Body Temperature, TOF, TOF%, etCO2, etN2O, etO2, imCO2, inN2O, and inO2.

In '**Action**' or '**Combination of Actions**' the user can select an action from the '**Pick Action/Medication**' window by clicking respectively the Pick... button and the + button. The actions are sorted in different categories: ABC, Medication, Auto-detected, Miscellaneous and Scenario.

The icons shown on the left of each action correspond to a type of action. These types are explained in 4.2 'Running a scenario' section 'Scenario checklist'

The '**Combination of Actions**' transition condition allows the user to add a description, for example the dosage amount for medication. This instruction will be shown in the checklist during a scenario.

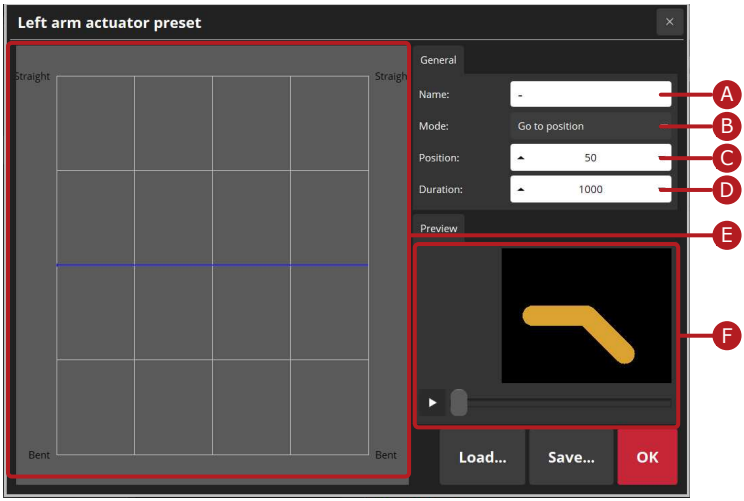
7.2 ACTUATORS

The actuators control the movements of NENASim. NENASim has nine controllable actuators.

The **belly** and the **chest** actuators simulate the breathing patterns. The **neck** actuator allows turning of the head to left and right. The **eyelids** actuator opens and closes the eyes. The **fontanelle** actuator allows to have normal or abnormal fontanelle. The **arms** and **legs** actuators can simulate seizures or normal movements. The movements can be controlled manually or automatically and they can be state dependent in a scenario.

Edit the actuators, within 'Actuators' at the 'Additional Content' tab. Click the + button next to the corresponding actuator to create custom patterns, a

pop-up window will appear.



Actuator editor

A	Add a **name** to the pattern.
B	Different **modes** can be chosen: 'Go to Position', 'Move Path (once)', 'Move Path (repeating)'.
C	**Set position** to which the arm should move. Only available if the mode is set to 'go to position'
D	Change **duration** of the pattern.
E	The **pattern graph** can be drawn with the mouse, by selecting a point on the line and moving and dragging it. Learn more in the section 'Pattern graph'
F	It is possible to **playback** in the 'Preview' field the customized pattern by clicking the ▶ button.

Load a previously saved pattern.

Save the custom pattern locally on the computer, so it can be loaded in any scenario.

Click Ok to apply all changes and return to the Scenario Editor.

Pattern graph

The movements are described in a **graph**, where it is possible to create movements that look natural. The graph is only available if the mode is set to 'Move Path (once)' or 'Repeating'.

The **top and bottom** position of the graph can be defined as a specific position of the selected actuator namely 'Straight', 'Bent' and 'Middle'.

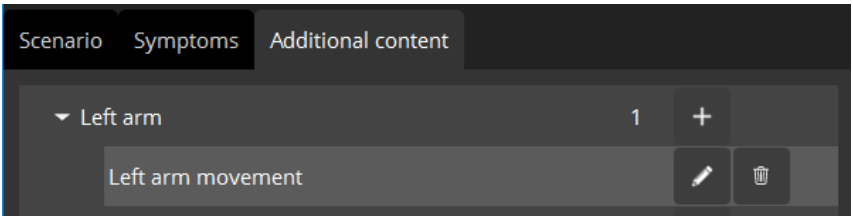
The **slope** of the graph indicates the speed of the movement, the steeper the slope the faster the movement will be.

Notice: If the slope is red it is too steep, indicating the movement is too fast for the actuator and cannot be applied. This can be solved by increasing the duration or decreasing the movement until the lines are no longer red.

Notice: In a repeating pattern the start and end position of the graph must have the same value.

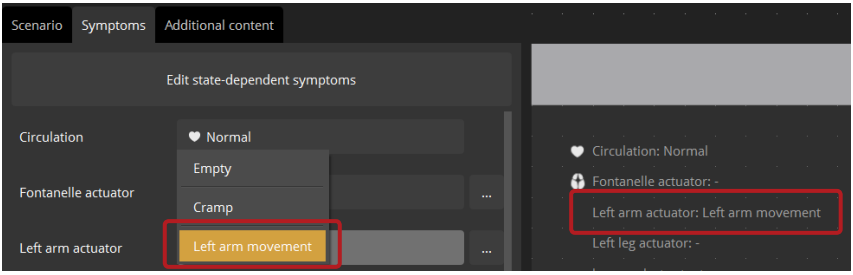
Apply customized movement

When saved, the customized movement will be shown in the 'Actuators' list.



Custom movement in the 'Actuators' list

To apply this customized movement into the scenario, go to the 'Symptoms' tab and select the movement from the drop-down list belonging to 'Left arm actuator'. The changed parameter can be viewed in the scenario field.



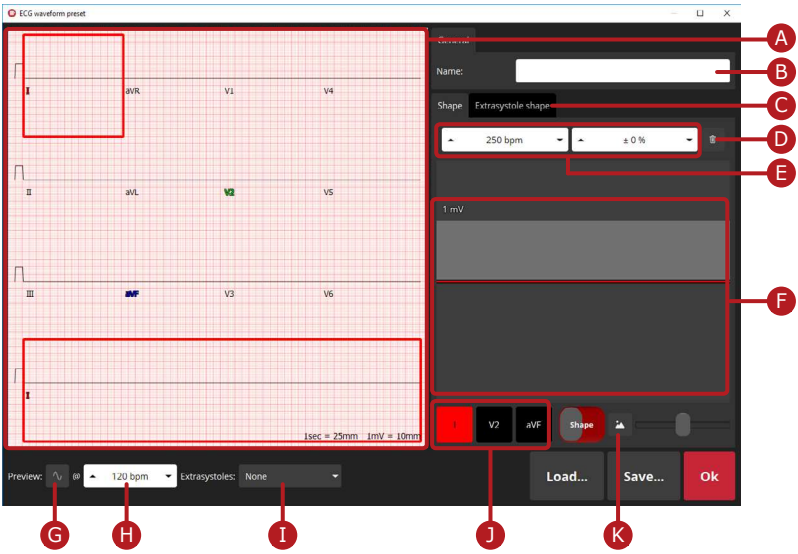
Using the customized movement

7.3 WAVEFORMS

The CommandX Scenario Editor has a waveforms editor within 'Waveforms' at the 'Additional Content' tab. The ECG, ABP, PAP, CO2 and Pleth waveforms can be created from scratch, or existing waveforms can be modified.

ECG Waveforms

To add an **ECG waveform**, click the + button. A new window, the ECG waveform editor, will appear.



ECG waveform editor

A	On the left-hand side, the ECG waveform preset area can be found. Learn more in section 'ECG waveform preset'
B	A **name** can be given in the 'Name' field.
C	The user can add an **extrasystole** to the waveform in the 'Extrasystole Shape' section. This is done the same as drawing a waveform in the 'Shape' tab.
D	Clicking the button **resets** the waveform.
E	Adjust the '**Designed Rate**' (left) and the '**Perlin Noise**' (right) to add a more natural effect to the waveform.
F	**Edit a waveform** in the 'Shape' section. A waveform can be shaped by selecting and dragging the line.

G	Click the  button to randomize the point in time of the waveform.
H	Adjust the number of **BPM**.
I	**Preview the extrasystole** shape in the preset area by setting the extrasystole on 'Single'.
J	Selecting one of the twelve leads will highlight the **indicator**. In this case lead **I** is selected, which will highlight just indicator **I**. Selecting lead **V4**, which will measure the average waveform based on lead **I**, **V2** and **aVF**, all three indicators are highlighted.
K	A background picture of a real ECG printout can be used as a reference to trace in the ECG setup screen. Use the  button to start the **'Waveform Background Image Picker'**. Learn more about this in section 'Background picture'

Load a previously saved waveform.

Save the custom waveform locally on the computer, so it can be loaded in any scenario.

Click Ok to apply all changes and return to the Scenario Editor.

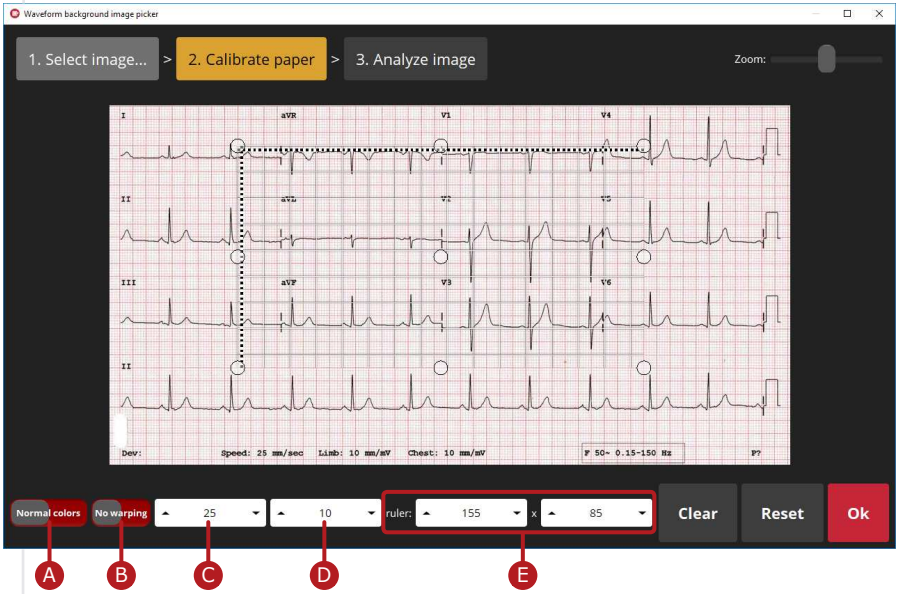
ECG waveform preset

The field on the left is the ECG waveform preset area containing twelve leads. Leads **I**, **V2** and **aVF** are editable from the preset area by selecting one of them. The remaining leads are being calculated and drawn automatically. Selecting lead **I** allows the user to edit a waveform in the 'Shape' section. A line can be drawn by selecting and holding the (red/lead **I**) line and drag it into the desired shape.

Background picture

A background picture of a real ECG printout can be used as a reference to trace in the ECG setup screen. Use the button to start the '**Waveform Background Image Picker**' and follow these four steps.

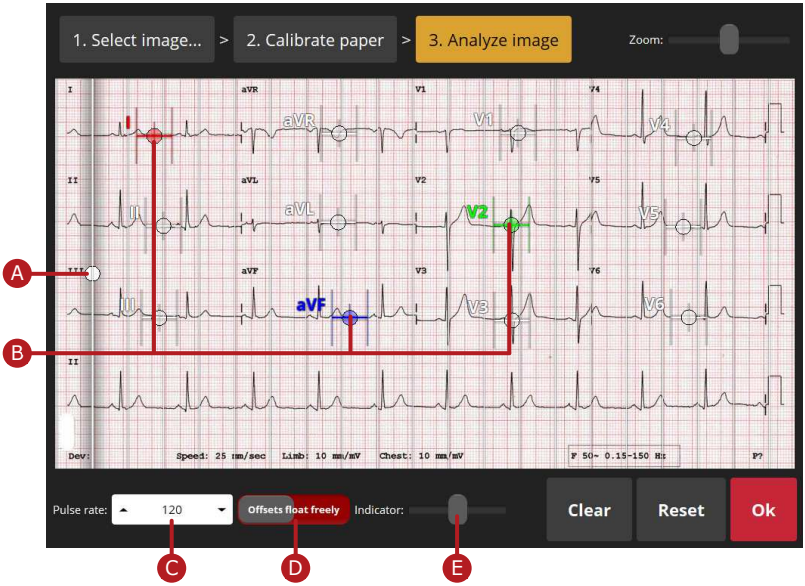
1. Select an existing ECG printout image located on the user's computer.
2. Calibrate the ECG printout with a ruler. Match the white lines of the grid with the darker red lines of the ECG printout. The amount of space in between the white (grid) lines has to be ten millimeters horizontally and vertically.
   After appropriately aligning the grid, the software can measure the true scale of the ECG printout.



Step 2 - Using background image

A	The user can change the color of the ECG from normal colors to **negative colors**, in case the lines are not clear. The user has to click the Normal colors button to toggle it to Negative colors.
B	Warping the ruler grid can be done by toggling the No warping to Warp. This function is used in case the red grid of the ECG printout are not aligned straight.
C	Adjust the ECG speed in mm/sec (millimeter per second).
D	Adjust the number of mm/mV (millimeter per millivoltage).
E	Adjust the ruler dimensions with the '**Ruler**' fields.

3 Analyze the image.



Analyzing the ECG

A Shift the vertical line to mark a landmark across three leads.

B Align the red, green and blue offsets with leads **I**, **V2** and **aVF**. First align the left vertical line of the offset with the beginning of the first electrical pulse and the right vertical line with the beginning of the next electrical pulse. Doing this, the user has marked one heartbeat.

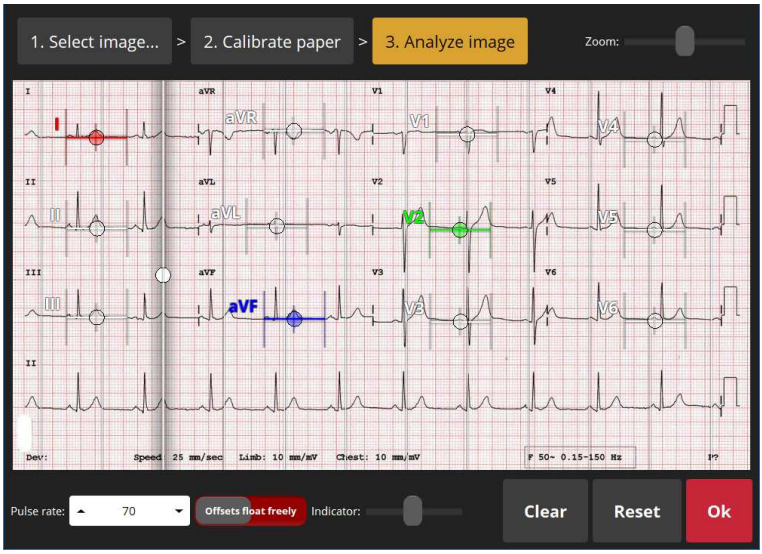
Aligning the offset with a lead

C Using the '**Pulse rate**' field in the bottom, the user can increase or decrease the offset length. Increasing shortens the offset and decreasing elongate the offset.

D **Offsets** can float freely or snap to waves. The user can toggle the button to switch between the two modes.

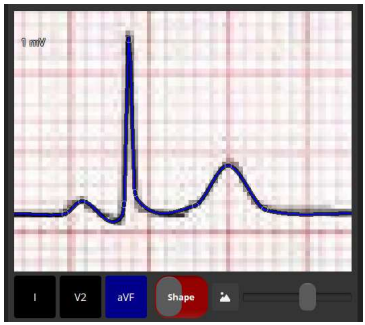
E The '**Indicator**' adjusts the offset's center vertical line. Its purpose is to mark a peak within the heartbeat as shown in step B. Set these for all leads accordingly.

Note: Making adjustments to the remaining offsets is obsolete after properly adjusting the first lead.



Completed analysis

4 Click Ok to complete the setup. The user is now able to trace the waveform leads **I**, **V2** and **aVF**. Below, an example is given of the traced **aVF** waveform.



Tracing the waveform

If a waveform happens to not align correctly with the background image, the user can shift it by selecting and dragging the highlighted indicator A left or right.

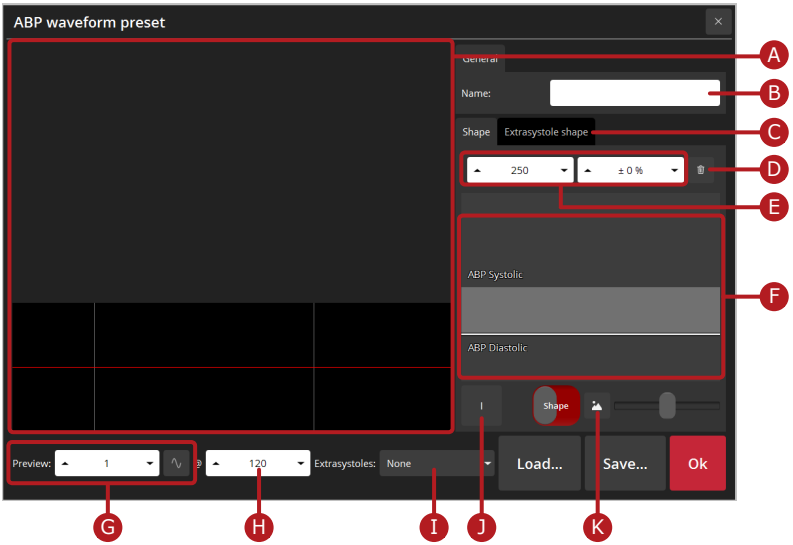
Align the waveform properly

When finished, click the Ok button. The customized waveform can now be found in 'Symptoms' list.

Custom ECG in the 'Symptoms' list

ABP, PAP, CO2 and Pleth waveforms

To edit the ABP, PAP, CO2 and Pleth waveforms, click the + button in the 'Additional Content' tab. The ABP, PAP, CO2 and Pleth editors uses the same principle as the ECG editor.



Waveform preset

A	On the left-hand side, the preview window can be found.
B	Add a **name** can be given in the 'Name' field.
C	The user can add an **extrasystole** to the waveform in the 'Extrasystole shape' section. This is done the same as drawing a waveform in the 'Shape' tab.
D	Clicking the button **resets** the waveform.
E	The user has the ability to adjust the '**Designed rate**' (left) as well as the '**Perlin noise**' (right) to add a more natural effect to the waveform.
F	**Edit a waveform** in the 'Shape' tab. A line can be shaped by selecting and dragging it.

G	Select the desired amount of waveforms. Click the  button to randomize the point in time of the waveform.
H	Adjust the amount of **BPM**.
I	**Preview the extrasystole** shape in the preset area by setting the extrasystole on 'Single'.
J	Shift the waveform to the left or right by selecting and dragging the button left or right.
K	A background image can be utilized to trace a waveform. Click the  button to upload a background image Learn more about this in section 'Background picture'

Load a previously saved waveform.

Save the custom waveform locally on the computer, so it can be loaded in any scenario.

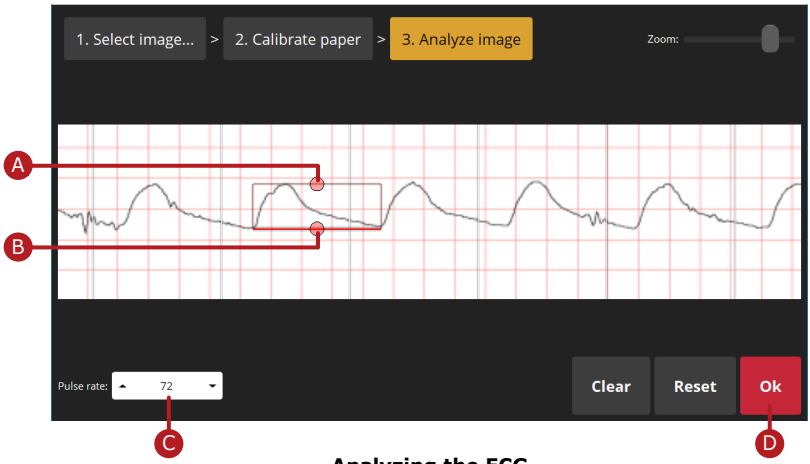
Click Ok to apply all changes and return to the Scenario Editor.

Background image

Like the ECG editor, the user has to follow 3 steps to properly calibrate and analyze the background image.

1. Select an existing ABP printout image located on the user's computer.
2. Follow the same steps as point 2 at page 73.
3. Analyze the image. Mark the ABP, PAP, CO2 and Pleth waveform with the indicator. The left side should mark the beginning of the waveform and the right side the end of the waveform. Top and bottom line, the

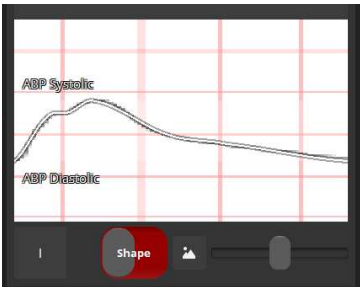
peak and base of the waveform.



Analyzing the ECG

A	The top circle is used to stretch or shrink the indicator vertically.
B	The bottom circle is to move the indicator around.
C	Adjust the pulse rate by stretching or shrinking the indicator horizontally.
D	When the background analysis is complete, click the **Ok** button to confirm.

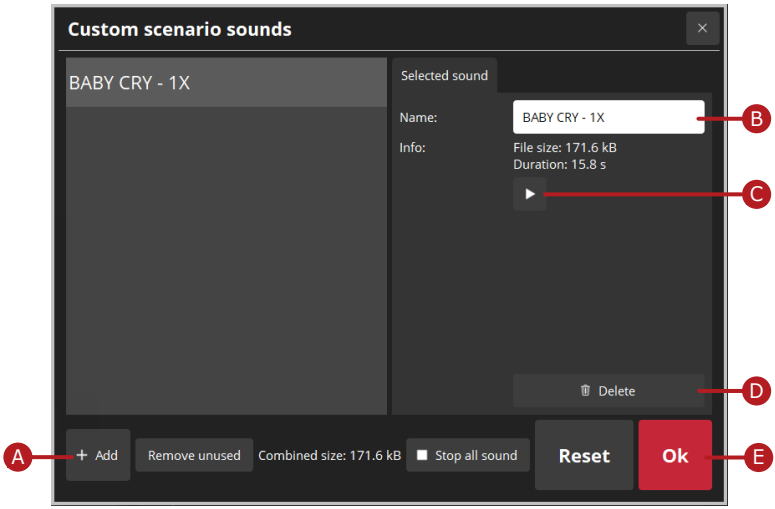
4. The user is now able to trace the background image. When finished, click the **Ok** button. The customized waveform can now be found in 'Symptoms' list.



Tracing the ABP waveform

7.4 AUDIO FILES

The option '**Audio Files**', within 'Other Presets' at the 'Additional Content' tab allows the user to upload custom sounds, that are not in NENASim sound library. Add custom sounds for the voice or internal sounds of NENASim. To **select custom sounds**, click the button. This opens a new window. For this guide, the custom sound is called 'BABY CRY – 1X'



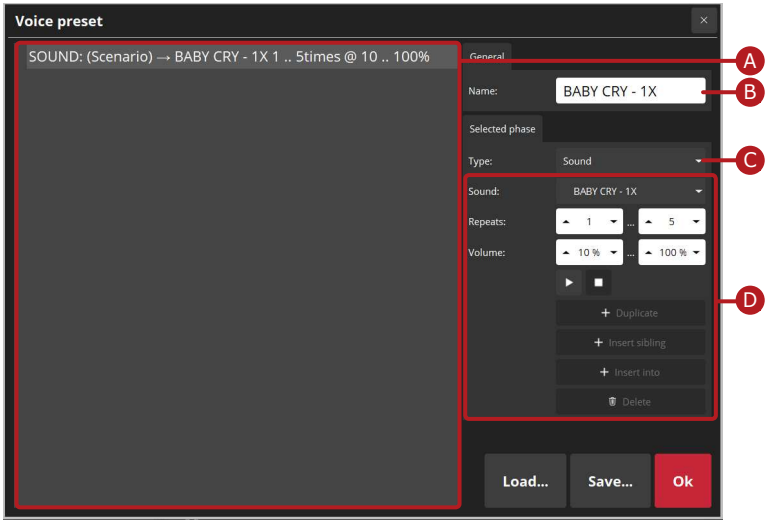
ABP indicator explained

A	Click the + Add button to add new sounds. **Note: The sound files must be in one of the following formats: .ogg, .mp3, or .wav.**
B	**Name** the selected sound.
C	Prelisten the selected sound file.
D	**Delete** selected sound file, this is only possible if the sound file is not yet used in a scenario.
E	**Apply** all changes

7.5 VOICE

The vocal sounds can be controlled manually or automatically, and they can be state dependent in a scenario.

Go to 'Additional Content' and find '**Voice**' with 'Other Presets'. Click the + button to add voice presets. The window '**Voice Preset**' will appear.



Voice pattern type: Sound

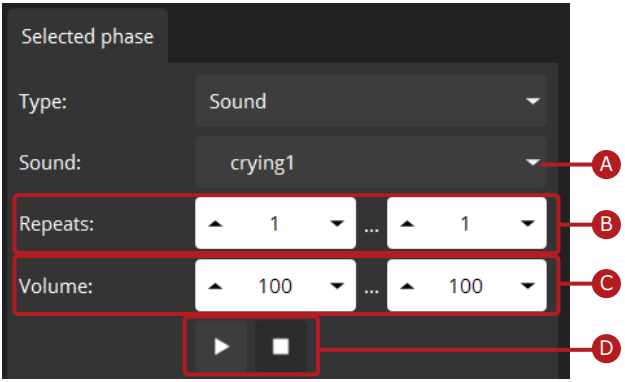
A	In the **preview window** all added phases that form the voice preset are shown.
B	**Name** the voice preset.
C	Select the **type** of sound to be added to the voice preset. Learn more about the types below.
D	**Settings** for the selected phase.

Load a previously saved voice preset or standard voice preset.

Save the custom voice preset locally on the computer, so it can be loaded in any scenario.

Click **Ok** to apply all changes. The voice file can now be used in the scenario.

Type: Sound



Type: Sound

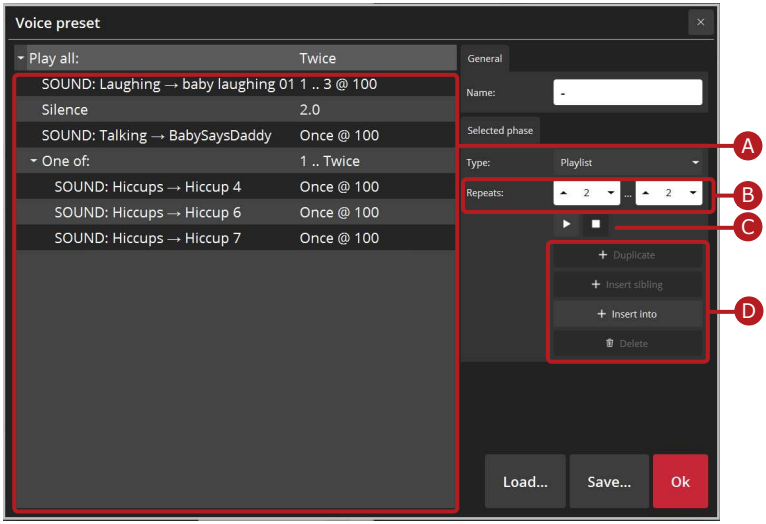
A	**Select the sound** to be played. Both the custom sounds uploaded in 'Audio Files' as well as the library files can be chosen from here.
B	The user can set the minimum and maximum number of **repeats**, the sound will be played in the pattern. It will be a random number of repeats between these two values. If the two numbers are the same, the sound will be played that number of times.
C	Set the minimum and maximum **volume** for the sound. If the two are the same, the sound will always play at that volume.
D	Play the sound by clicking the ▶ button. Stop listening by clicking the ■ button

Type: Silence

No sounds will be played in this phase. Silence type is useful if the user wants NENASim to be quiet for a period between two audio files in a playlist.

Type: Playlist

Create a playlist of sounds. In this example it will first play ‘Baby Laughing 01’ one, two or three times, followed by two seconds of silence and ‘BabySaysDaddy’ one time, ending with one or two of the added hiccup sounds.



Voice pattern type: Sound

A	The **preview window** shows an overview of the phases, which together form the playlist. Click and drag phases to **change the order**.
B	The user can determine the **number of times** the playlist should be played. The example playlist will be played twice.
C	Preview the playlist by clicking the ▶ button. Stop listening by clicking the ■ button

	These actions can be executed with the sound phases. When highlighted, they are available for the selected phase:
	'**Duplicate**' creates a copy of an exisiting action.
D	'**Insert Sibling**' adds a new sound phase after the selected phase.
	'**Insert into**' is only available for the 'Playlist' types or 'Pick One randomly'. With this action a new phase within the selected list is added.
	The user can also **delete** the selected action.

Load a previously saved sound or standard sound.

Save the custom sound locally on the computer, so it can be loaded in any scenario.

Click Ok to apply all changes. The sound file can now be used in the scenario.

Type: Playlist (shuffled)

Allows all the sounds and/or silences within the playlist to be played in a randomized order.

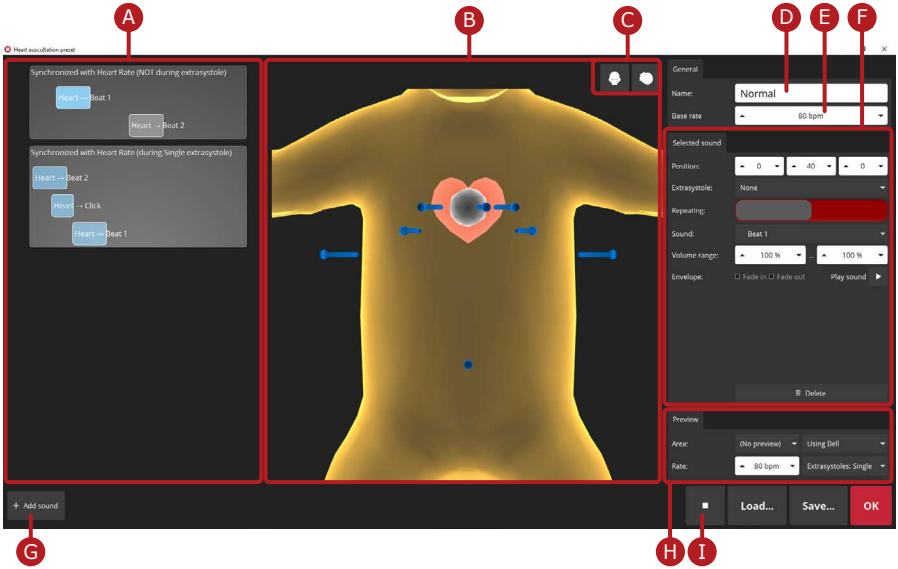
Type: Pick one randomly

It will pick one random sound from the list.

7.6 AUSCULTATION SOUNDS

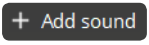
For the heart, lungs and bowels sounds, the Scenario Editor provides an auscultation editor which can be found at the 'Additional Content' tab.

With the auscultation editor the user has the possibility to create an unlimited number of soundtracks. By clicking the + button a new window opens, here the heart sounds can be added or modified.



Auscultation editor of heart sounds

A	The **preview window** shows an overview of the created auscultation sounds. Each blue rectangle represents the length of an audio file. Shift rectangles left or right to play the sounds earlier or later. The sounds joined together form the soundtrack.

B	The middle window shows a 3D model of NENASim. This **interactive 3D model** of the manikin can be rotated by clicking and dragging it to any direction. With the green/grey ball the user can determine the position of the **sound sources** by clicking and dragging it. The blue pins are the **auscultatable areas**.
C	Set the **3D model** to a standard view. Click  for a front view, click  for a side view.
D	**Name** the auscultation sound.
E	'**Base Rate**' determines the design rate of the sound or soundtrack.
F	In the '**Selected Sound**' sections, five options can be modified: '**Extrasystole**' means the sound is synchronized with heart rate during extrasystole. This is only available for heart sounds. '**Repeating**' means the sound will continuously repeat itself. The repeating sound will be synchronized with the heart rate (heart), respiratory rate (lungs) or it will be continuous (bowels). Select the audio file at '**Sound**'. The volume can be defined and also the range of the volume can be adjusted. Let the sounds '**Fade in**' and/or '**Fade out**'.
G	To add a sound to the soundtrack, click the  button or double click in the overview window.

In the '**Preview**' section the soundtrack can be played by clicking  .

H

The '**Area**' allows the user to select a position (blue pin) on the torso to listen to.

A simulated stethoscope will be displayed on the screen, whereas the user can select to simulate the **bell** or **diaphragm** of the stethoscope.

I

'**Rate**' allows the user to adjust the beats per minute (BPM) whether with a single extrasystole or without an extrasystoles.

Note: 'Rate' is only applicable within the Heart- and Lungs Auscultation, 'Extrasystoles' is only applicable within the Heart Auscultation.

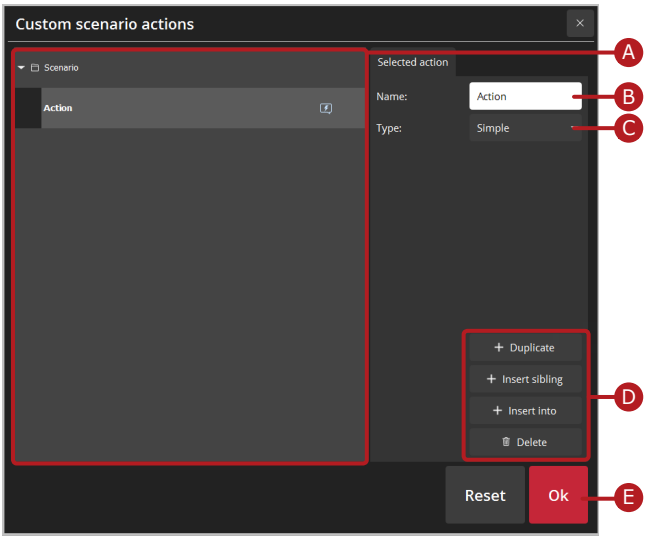
Load a previously saved sound or standard sound.

Save the custom sound locally on the computer, so it can be loaded in any scenario.

Click Ok to apply all changes. The sound file can now be used in the scenario.

7.7 ACTIONS

The **'Actions'** button allows the user to create custom (evaluable) actions and medications. This can be found within 'Other Presets' at the 'Additional Content' tab. Click the  button next to 'actions' to create a new action. The **'Custom Scenario Actions'** window will appear.

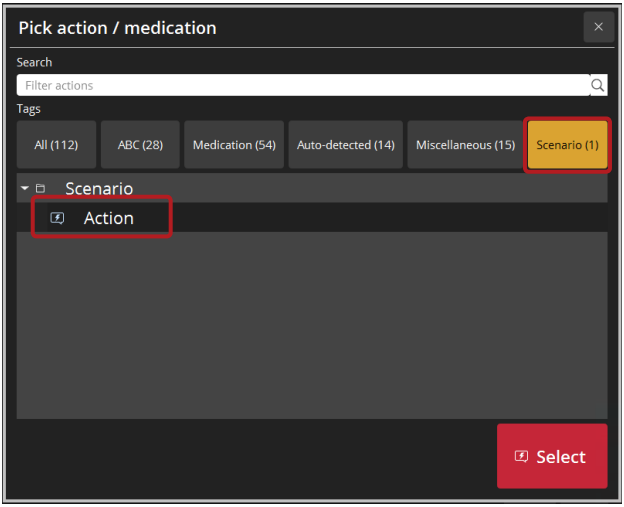


Custom scenario actions

A	The **preview window** shows an overview of all added actions.
B	Add a **name** to the action.
C	The action can be one of the following **types**: 'Simple', 'Evaluable' or 'Medication'. Learn more in section 7.1 'States and transitions'.
D	'**Duplicate**' is available for each phase in a playlist. It duplicates the phase with its properties.
	'**Insert Sibling**' adds a new action at the same level.
	'**Insert Into**' inserts an action in a sub-folder.
	The user can also **delete** the selected phase.

E Click Ok to apply all changes. The customized actions can now be used in the scenario.

As explained in section 7.1 'States and transitions', the customized action can be found in the 'Scenario' tab. The number in the brackets displays the amount of customized actions.

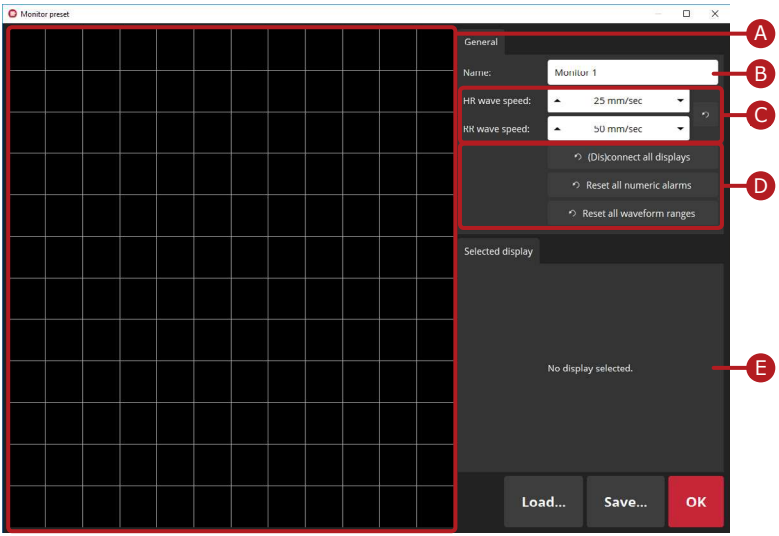


Custom action location

7.8 PATIENT MONITOR LAYOUT

With the '**Monitor**' button custom monitor layouts can be created, and existing layouts can be adjusted and modified. This can be found within 'Other Presets' at the 'Additional Content' tab.

Clicking the + button opens a new window where the patient monitor layout can be made.



Monitor preset

A	The preview window shows the **monitor layout**.
B	Add a **name** to the monitor layout.
C	Change the HR (heart rate) wave speed in mm/sec as well as for the RR (respiratory rate) wave speed.
D	**Reset** settings for multiple displays.
E	View and edit the options for the **selected display**.

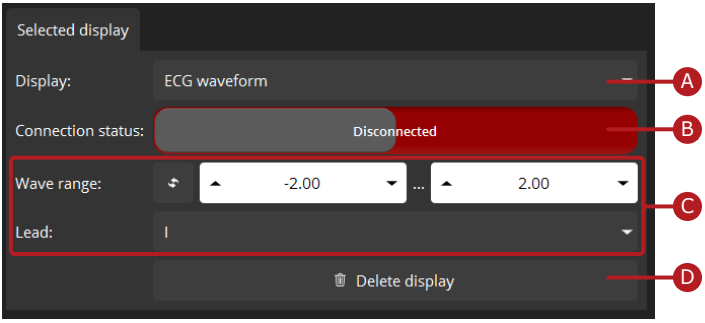
Existing monitor layouts can be selected by clicking '**Load**' the button. A drop-down menu will show three monitor presets, 'Empty' and 'Load File'.

Save the custom monitor layout locally on the computer, so it can be loaded in any scenario.

Click the **Ok** button to apply all changes. The customized monitor layout can now be used.

To **add a parameter display**, select an area in the preview window by clicking and dragging it at a desired location. New parameter displays are indicated with a purple color.

After creating the display, a new menu appears in the '**Selected Display**' area. Here a waveform or a numeric display and its parameters can be selected.



Selected display options

A	**Select** the waveform or numeric parameter to be displayed.
B	The option '**Connection Status**' is meant to make the parameter (in)visible for the trainee during the training, but can be changed on the fly during scenario training. This is being depicted as when disconnected (invisible) and when connected (visible).
C	Select the desired options for the display. Note that each parameter has its own different options to edit from. For example, when selecting 'ECG Waveform', the 'Lead' can be modified. When selecting 'ABP Numeric' the 'Alarm Range' can be modified.
D	**Delete** the display.

7.9 SKIN

The 'Skin' button, within 'Other Presets', allows the user to edit the **skin coloration** of NENASim. This is used to mimic pigmentation and coloration of the skin. By clicking the + button, a new window appears:

Color table

A	**Name** the preset.
B	The '**Fade Duration**' is the transition in seconds from normal skin to coloration.
C	Select the **color** for the skin.
D	Select the **intensity** of the coloring.

Load a previously saved or standard skin coloring.

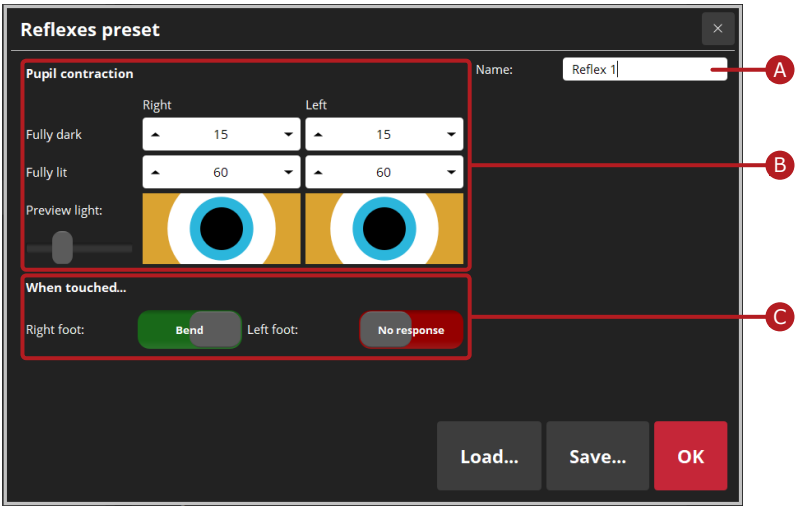
Save the custom coloring locally on the computer, so it can be loaded in any scenario.

After clicking the Ok button, the customized skin color can be found in the 'Symptoms' tab.

7.10 REFLEXES

The **'Reflexes'** button allows the user to edit the pupil contraction and feet reflexes of NENASim. This can be found within 'Other Presets' at the 'Additional Content' tab.

By clicking the + button, a new window appears where the user can edit the pupil contraction and feet reflexes.



Reflexes options

A	**Name** the reflex preset.
B	Edit the right- and left **pupil contraction**. A higher percentage represents a bigger the pupil size. The set parameters can be previewed by using the 'Preview Light' slider.
C	Turn the **feet reflexes** for each foot on or off with the  or  button.

Load a previously saved or standard reflex.

Save the custom reflex locally on the computer, so it can be loaded in any scenario.

After clicking the Ok button, the customized reflex can be used in the scenario.

8 TROUBLESHOOTING

A number of possible issues with solutions are given here. In case of any doubt please contact your dealer or Medical-X for further assistance.

Issue:	**Cannot run the CommandX software, windows notifies a 'DLL' error.**
Possible cause:	Windows is missing a 'DLL' file.
Solution:	Please install the Microsoft Visual C++ Runtime from the following links: 32 bit: https://download.microsoft.com/download/9/3/F/93FCF1E7-E6A4-478B-96E7-D4B285925B00/vc_redist.x86.exe. 64 bit: https://download.microsoft.com/download/0/6/4/064F84EA-D1DB-4EAA-9A5C-CC2F0FF6A638/vc_redist.x64.exe. If this does not solve the problem, please contact your dealer or Medical-X for further assistance.

Issue:	**The computer Wi-Fi connections cannot find the NENASim network.**
Possible cause:	NENASim is not switched on.
Solution:	Check if NENASim is turned on, when turning on NENASim a distinct beeping sound and a voice saying 'Online' can be heard. After a few seconds the NENASim network should be visible in the Wi-Fi connections of the computer. Learn more about connecting NENASim to the Wi-Fi network in section 2.5 'Connecting NENASim'.

Issue:	**NENASim does not react to controls in the CommandX Tutor software.**
Possible cause:	CommandX Tutor software is in simulation mode.
Solution:	Go to settings in the main menu, select 'Disable' in simulation mode at the 'TCP' section. Learn more about settings in section 4.4 'Settings'.
Issue:	**The computer is connected to the NENASim server trough Wi-Fi, but the CommandX Tutor software shows no connection.**
Possible cause:	CommandX Tutor is set to the wrong IP adress.
Solution:	Go to settings in the main menu. At the 'TCP section, set the IP Adress to: '192.168.42.1'.
Issue:	**A connection between NENASim and a computer is established, however some software functions are not available or are not working properly.**
Possible cause:	The CommandX Tutor software version and the NENASim server software version are not compatible.
Solution:	Check the compatibility of NENASim by looking at the connection info at the top bar of the main menu of CommandX Tutor. The first two numbers, separated by a comma, after 'Gui' and 'Server' should be the same. If the numbers do not match, please contact your dealer or Medical-X for the correct software package.
Issue:	**When using the stethoscope simulator, the sounds comes from the computer speakers.**

Possible cause:	The stethoscope simulator is not turned on and/or connected to the computer
Solution:	Open Bluetooth connections of the computer and turn on the stethoscope simulator to establish a connection. Make sure the stethoscope simulator Bluetooth device is set as the default audio device. Use 'NENASim Auscultation Client' to set the correct device, as explained in section 6 'CommandX Auscultation Client'.

Issue:	**NENASim has little or low battery even after charging for several hours.**
Possible cause:	The charging procedure was followed incorrectly.
Solution:	NENASim has to be turned off before charging. To charge NENASim, first connect the charger to the power socket. There is a LED indicator on the charger, after connecting to the power socket the indicator will have a green color. Then connect the charger to NENASim and the LED indicator will turn red. This means that NENASim is charging. When NENASim is fully charged the LED indicator will turn green again.

Issue:	**A blown fuse.**
Possible cause:	The current is higher than the fuse rating, short circuit or servos are overloaded.
Solution:	A blown fuse is replaced by flipping it out and exchanging it with a new one. NENASim requires a 5 ampere blade fuse which can be acquired through most hardware stores. In case of doubt, please contact your dealer or Medical-X for support.

USER MANUAL