RIGEL MEDICAL
TESTED. TRUSTED... WORLDWIDE.

PatSim 400

USER MANUAL

Warning of electrical danger!
Warnung vor elektrischer Gefahr!
Avertissement: Danger electrique!
Advertencia de riesgo eléctrico!
Ryzyko porażenia elektrycznego!
Avvertimento di pericolo elettrico!
警告电气危险！

Important, follow the documentation!
Wichtig, Anweisungen befolgen!
Important, suivez la documentation!
Importante, ¡Siga la documentación!
Ważne, postępuj zgodnie z dokumentacją!
Importante, seguire la documentazione!
重要事项, 参照文档！

rigelmedical.com

Rigel Medical 5 year Warranty Statement

To activate your 5 year warranty, register your product at the below link. Terms and conditions apply.

www.rigelmedical.com/register

Calibration Statement

The PatSim 400 Patient Simulator is fully calibrated and found to be within the specified performance and accuracy at the time of production. The Seaward Group provides its products through a variety of channels; therefore it may be possible that the calibration date on the provided certificate may not represent the actual date of first use.

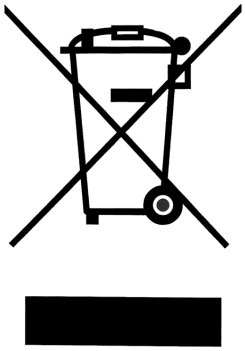
Experience has indicated that the calibration of this instrument is not affected by storage prior to receipt by the user. We therefore recommend that the recalibration period be based on a 12-month interval from the first date the unit is placed in to service.

For information on service or calibration please go to the link below.

www.rigelmedical.com/calibration

Date received into service; / /

Disposal of old product



The PatSim 400 Patient Simulator has been designed and manufactured with high quality materials and components, which can be recycled and reused.

Please familiarise yourself with the appropriate local separate collection system for electrical and electronic products or contact your local supplier for further information.

Please dispose of this product according to local regulations. Do not dispose of this product along with normal waste material. By offering your old products for recycling, you will help prevent potential negative consequences for the environment and human health.

User Notes

These operating instructions are intended for the use of adequately trained personnel.

Important, follow the documentation! This symbol indicates that the operating instructions must be adhered to in order to avoid danger.

If the PatSim 400 is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

This product contains a lithium ion battery:

Do not disassemble, crush, or puncture a battery
Do not short the external contacts on a battery
Do not dispose of a battery in fire or water
Do not expose a battery to temperatures above 60 ˚C (140 ˚F)
Keep the battery away from children
Avoid exposing the battery to excessive shock or vibration
Do not use a damaged battery
If a battery pack has leaking fluids, do not touch any fluids.
Dispose of the leaking battery pack.

1. Introduction

The PatSim 400 from Rigel was designed to make every patient simulation quicker.

Unlike other Patient Simulators, the PatSim 400 uses a home and recall function to easily move between tests and store your most used sequences, no more clicking and scrolling through 'tree style' hierarchy to perform each test.

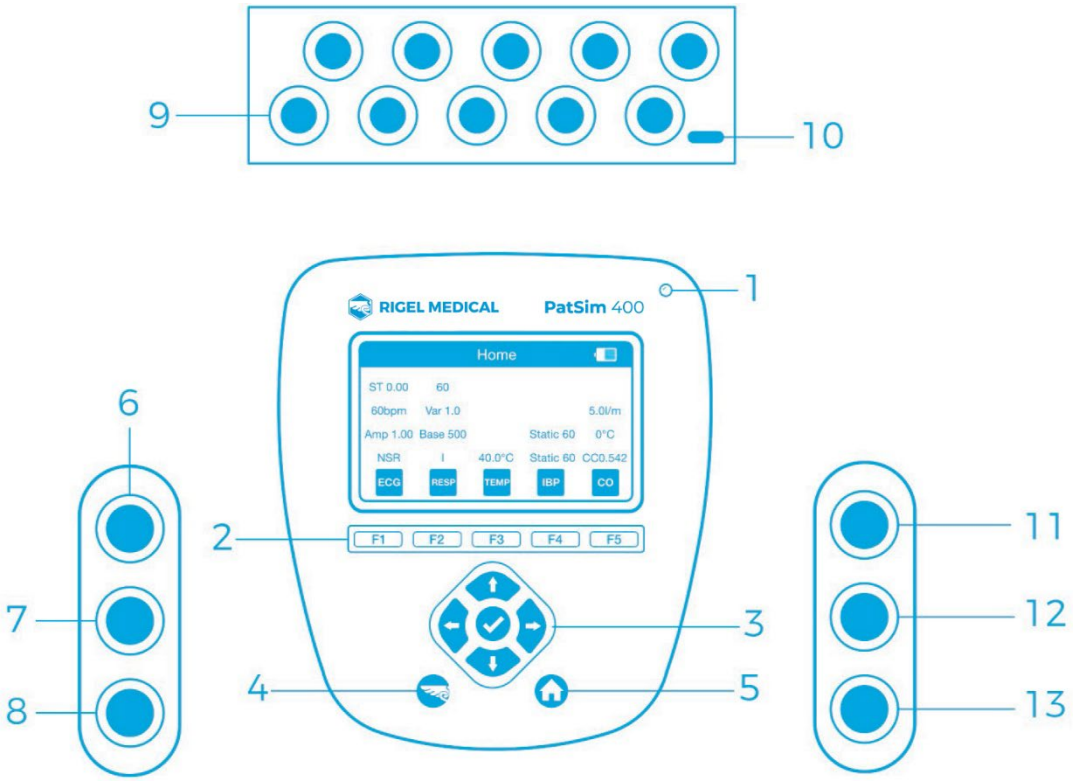
The handheld PatSim 400 is capable of the below simulations:

- ECG
  - ECG wave forms
  - Arrhythmia's
  - Performance Waveform
  - Pacer Waveforms
  - Fetal Maternal
- Respiration
- Temperature
- Invasive blood pressure (4 channel)
- Cardiac output

The PatSim 400 forms part of a comprehensive range of high-performance specialist biomedical test equipment supplied by Rigel Medical, part of the Seaward Group.

For further information go to www.rigelmedical.com

1.1. Getting to Know Your PatSim 400



1. Charging LED status
2. Function keys F1-F5
3. Navigation keys
4. Rigel key – on/off
5. Home screen button
6. Temperature output
7. IBP1 output
8. IBP2 output
9. Universal ECG connections x10
10. Micro USB power input
11. Cardiac Output
12. IBP3 output
13. IBP4 output

1.2. In the Box

- Quick start guide
- Universal USB Power Supply
- 10 x Applied Part Adaptors
- Calibration Certificate
- PatSim 400 Simulator
- PatSim 400 carry case

1.3. Additional & Optional Accessories

Replacement Battery	404A954
Temperature Cable (unterminated)	404A955
IBP Cable (unterminated)	404A956
CO Cable (unterminated)	404A957
CO Output Box	404A953
Replacement Carry Case	404A950
Applied Part Adaptors	404A951
Universal USB Power Supply	404A952

1.4. Charging

The PatSim 400 is supplied with a universal USB charger. You should only use the supplied charger with your PatSim 400.

Whilst the charger is connected to the unit and energised, the LED light on the top right of the top fascia will be illuminated.

Note: The LED does not indicate the charging status.

Whilst the PatSim 400 is powered on, you will also see the below symbols on the display.

 **Bulk charging**

 **Trickle charging**

The PatSim 400 may be used whilst charging, however, displayed signal quality may be reduced on some monitor types.

1.5. Battery Status

During normal use, the PatSim 400 automatically checks the battery status and shows the closest representation using the symbols below.


Fully charged


Battery empty

When the battery is completely empty the unit will warn the user that it is about to turn off before shutting down.

1.6. Powering On/Off

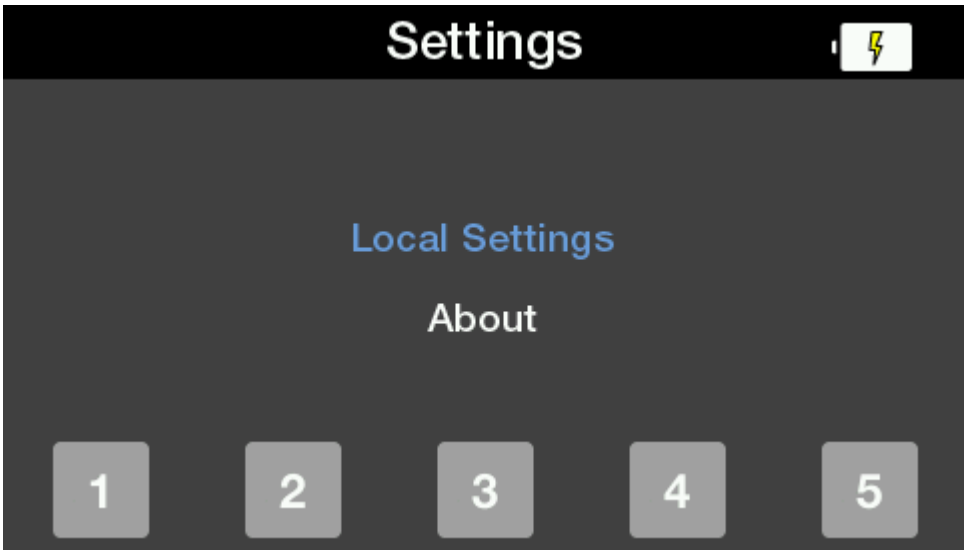
Turn your PatSim 400 on or off by pressing and holding the 'Rigel' button for 3 seconds.

2. Getting Started

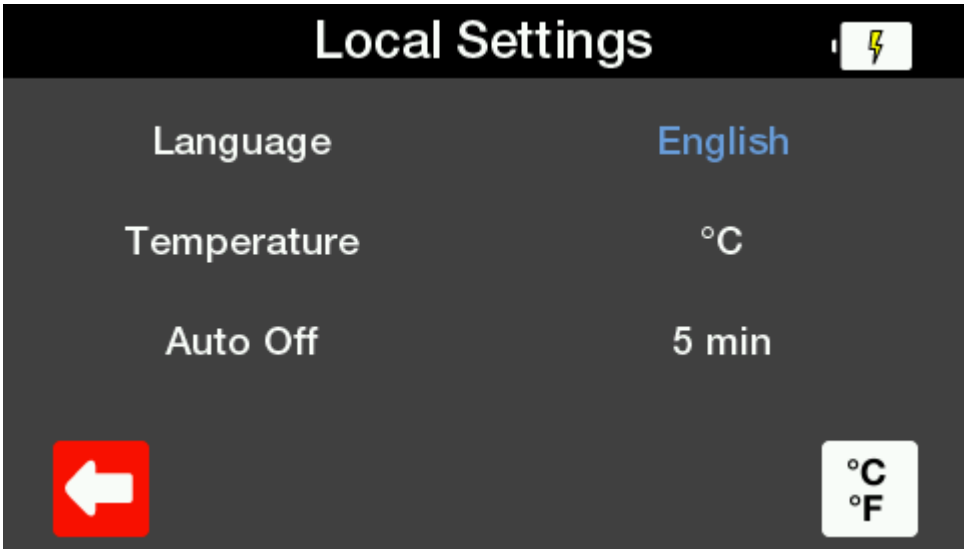
2.1. Setup

In the PatSim 400 you have the option to change the language, temperature units and auto off time of the unit.

Selecting the **Rigel** key in any screen will display the **Settings** menu.



The up & down navigation keys can be used to highlight **Local Settings** and selected using the tick button.



The up & down navigation keys can be used to highlight the parameter to change and the left & right navigation keys to change this parameter. The fast key, **F5**, can be used to switch between ˚C & ˚F.

Selecting **Home** or back, **F1**, will automatically save these settings. The settings will remain when the unit is powered down and back on.

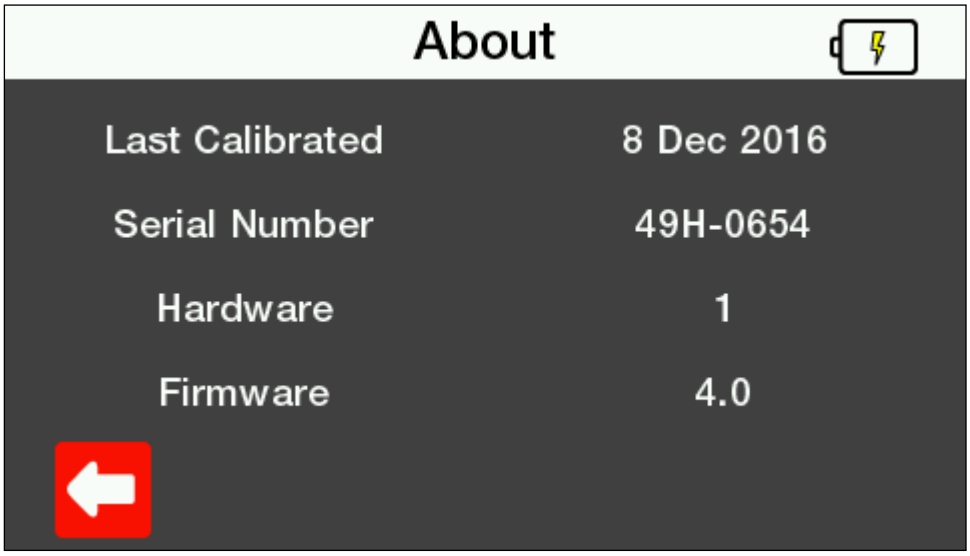
Available Settings

Language	English German French Spanish Polish Simplified Chinese
Temperature	˚C ˚F
Auto Off	Off 2 min 5 min 10 min 30 min 60 min

2.2. About

From the **Settings** screen information about the tester can be viewed. Highlight **About** using the up and down navigation keys and select using the tick button.

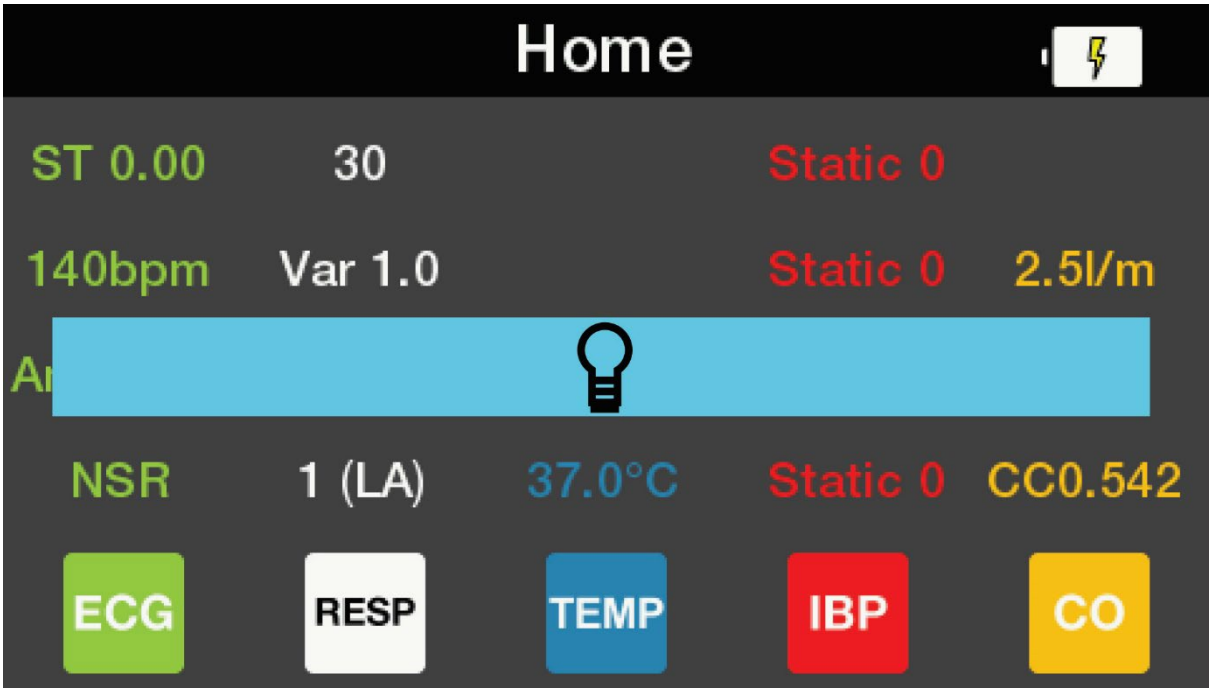
The **About** screen shows information on when the unit was last calibrated, the serial number, hardware and firmware versions.



To leave this screen you can select the back button, **F1**, to go back to the **Settings** menu or the **Home** button to go back to the **Home** screen.

2.3. Screen Brightness

The screen brightness can be altered using the left or right navigation keys whilst in the **Home** screen.



2.4. Favourite Simulations

Up to five favourite simulation settings can be saved for recall at any time.

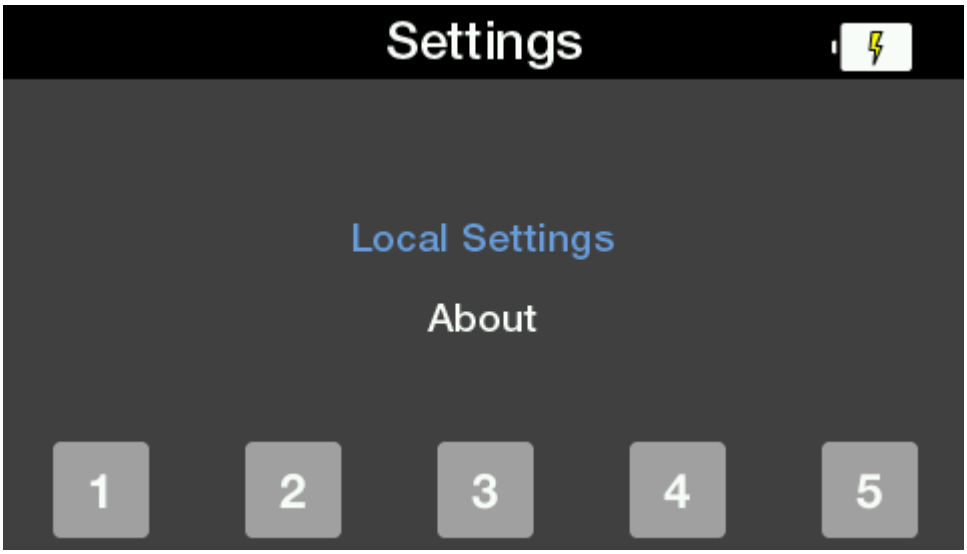
2.4.1. Default Settings

The unit will be delivered with five default settings as detailed below.

Memory	Location	1	2	3	4	5
ECG	Patient	Child	Adult	Adult	Adult	Adult
	Waveform	NSR	NSR	VTACH	AFIB-C	VFIB-C
	Amplitude	1.00mV	1.00mV	1.00mV	1.00mV	1.00mV
	HR	140 bpm	60 bpm	N/A	N/A	N/A
	ST	0.00mV	0.00mV	N/A	N/A	N/A
RESP	Rate	30brpm	15brpm	30brpm	40brpm	60brpm
	Variation	1.0 Ω	1.0 Ω	1.0 Ω	1.0 Ω	1.0 Ω
	Baseline	500 Ω	500 Ω	500 Ω	500 Ω	500 Ω
	Lead	1 (LA)	1 (LA)	2 (LL)	1 (LA)	1 (LA)
	Apnea	Off	Off	Off	Off	Off
TEMP	Temperature	37 ˚C (98.6 ˚F)	37 ˚C (98.6 ˚F)	37 ˚C (98.6 ˚F)	40 ˚C (104.0 ˚F)	40 ˚C (104.0 ˚F)
IBP 1	Static	0mmHg	0mmHg	0mmHg	0mmHg	0mmHg
	Dynamic	Off	Off	Off	Off	Off
	Artifact	Off	Off	Off	Off	Off
	Mode	Manual	Manual	Manual	Manual	Manual
	Sensitivity	5µV	5µV	5µV	5µV	5µV
IBP 2	Static	0mmHg	0mmHg	0mmHg	0mmHg	0mmHg
	Dynamic	Off	Off	Off	Off	Off
	Artifact	Off	Off	Off	Off	Off
	Sensitivity	5µV	5µV	5µV	5µV	5µV
IBP 3	Static	0mmHg	0mmHg	0mmHg	0mmHg	0mmHg
	Dynamic	Off	Off	Off	Off	Off
	Artifact	Off	Off	Off	Off	Off
	Sensitivity	5µV	5µV	5µV	5µV	5µV
IBP 4	Static	0mmHg	0mmHg	0mmHg	0mmHg	0mmHg
	Dynamic	Off	Off	Off	Off	Off
	Artifact	Off	Off	Off	Off	Off
	Sensitivity	5µV	5µV	5µV	5µV	5µV
CO	Output	2.5 l/min	2.5 l/min	2.5 l/min	5.0 l/min	5.0 l/min
	Injectate temp	0 ˚C (32.0 ˚F)	0 ˚C (32.0 ˚F)	0 ˚C (32.0 ˚F)	0 ˚C (32.0 ˚F)	0 ˚C (32.0 ˚F)

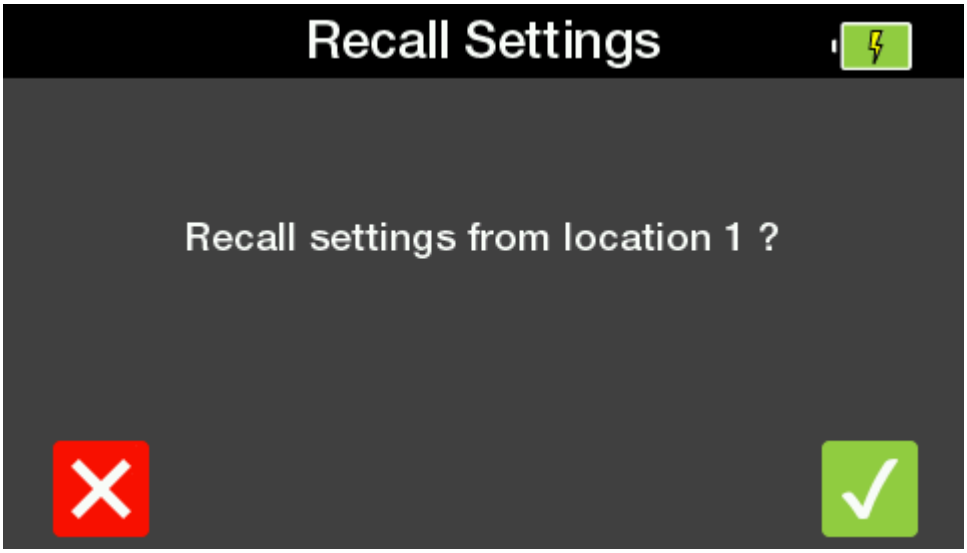
2.4.2. Recalling a Favourite Setting

Selecting the **Rigel** key in any screen will display the **Settings** menu.



Selecting one of the five function keys allows access to the corresponding / default settings.

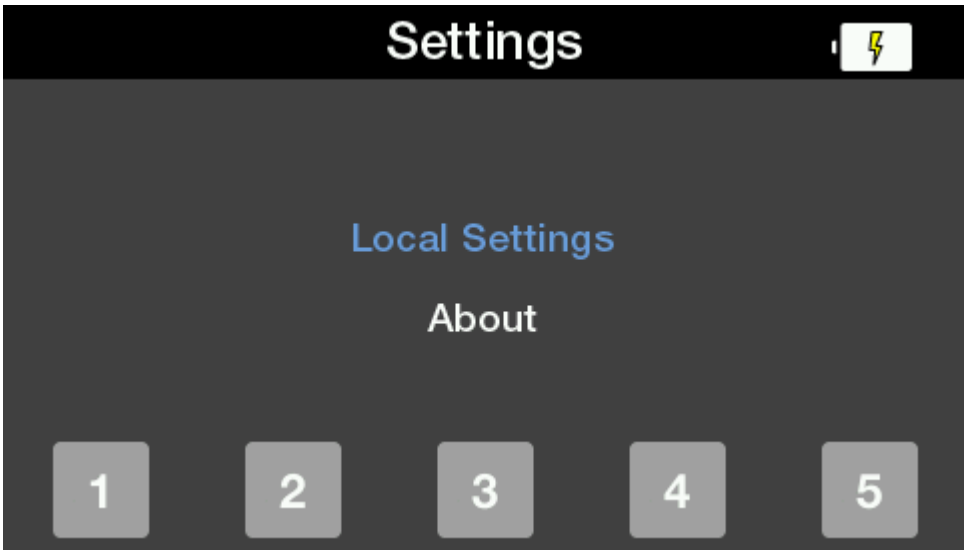
In the **Recall Settings** screen a message asking if you are sure is displayed.



Select **F5** and the instrument will switch to the **Home** screen with the recalled settings selected. Select **F1** to go back to the **Settings** menu without recalling settings.

2.4.3. Adding a New Favourite Setting

Selecting the **Rigel** key in any screen will display the **Settings** menu.



Holding one of the function keys for 3 seconds will save the current settings to that memory location. A message asking if you are sure will be displayed.

Select **F5** and the instrument displays a message **Saving settings**...., then **Settings saved** before returning to the **Home** screen. Select **F1** to go back to the **Settings** menu without saving settings.

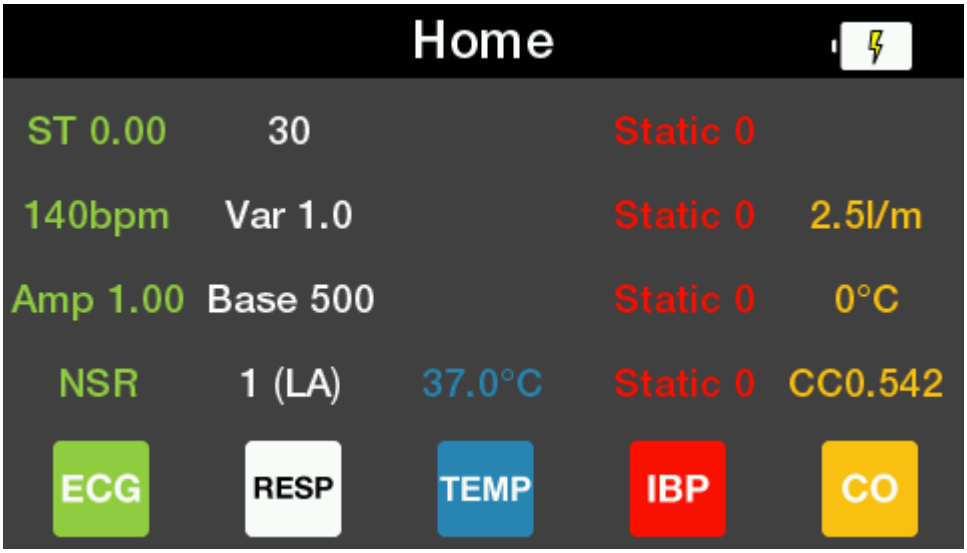
3. Simulation Settings

The PatSim 400 is capable of the below simulations:

- ECG
  - ECG wave forms
  - Arrhythmia's
  - Performance Waveform
  - Pacer Waveforms
  - Fetal Maternal
- Respiration
- Temperature
- Invasive blood pressure (4 channel)
- Cardiac output

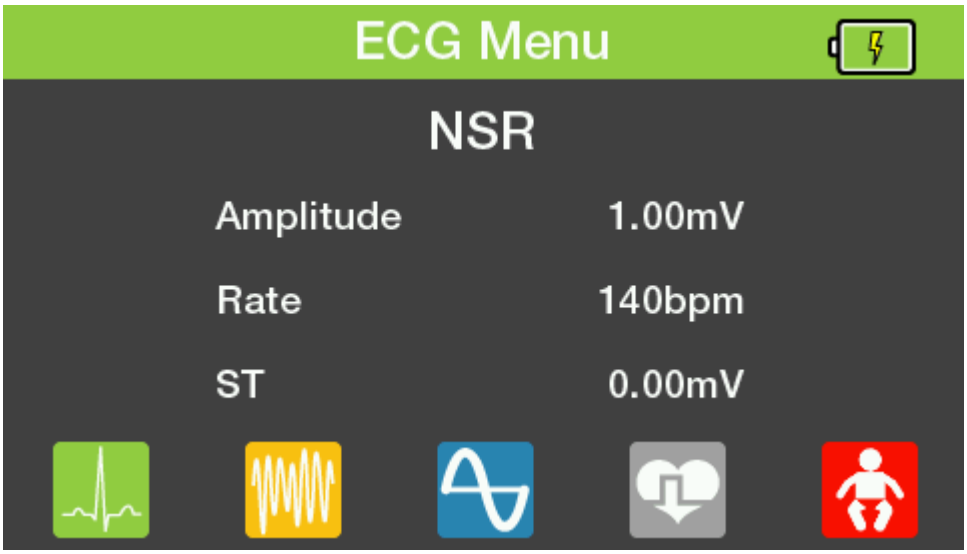
A list of the full settings available for each simulation is available at the end of each section.

Upon power-up, the **Home** screen is displayed showing the simulation menus on function keys **F1** to **F5** and a summary of the current settings.



3.1. ECG Settings

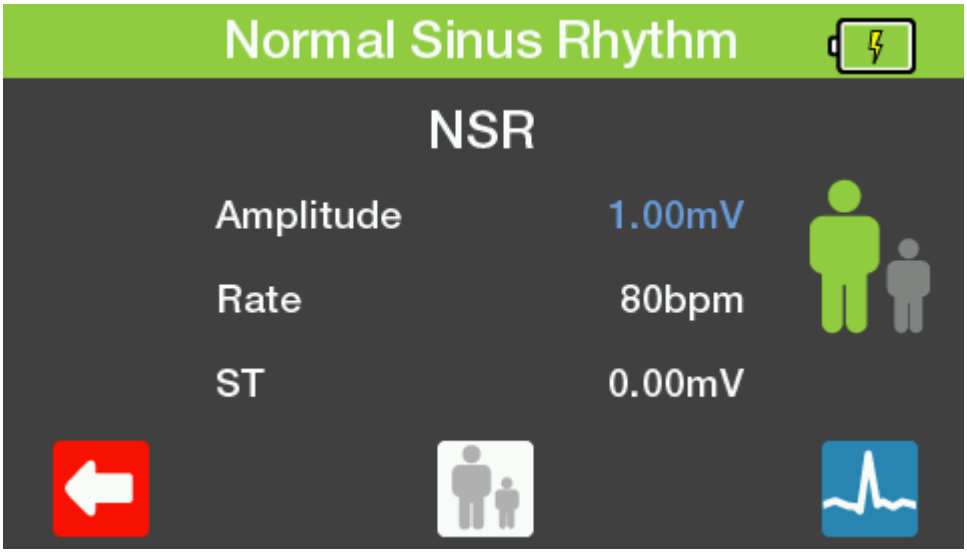
Selecting **F1** from the **Home** screen selects the **ECG Menu** with the current settings displayed.



Note: All ECG waveform images are representations specifically for Lead II

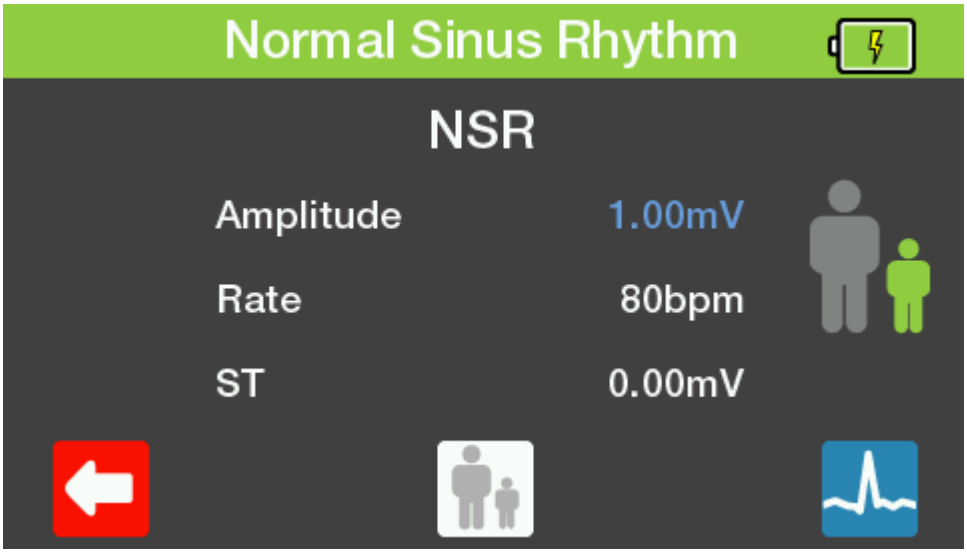
3.1.1. Normal Sinus Rhythm

Selecting **F1** in the **ECG Menu** displays the **Normal Sinus Rhythm** menu. This screen shows the current settings. The up & down navigation keys can be used to highlight the parameter to change and the left & right navigation keys to select the required parameter.

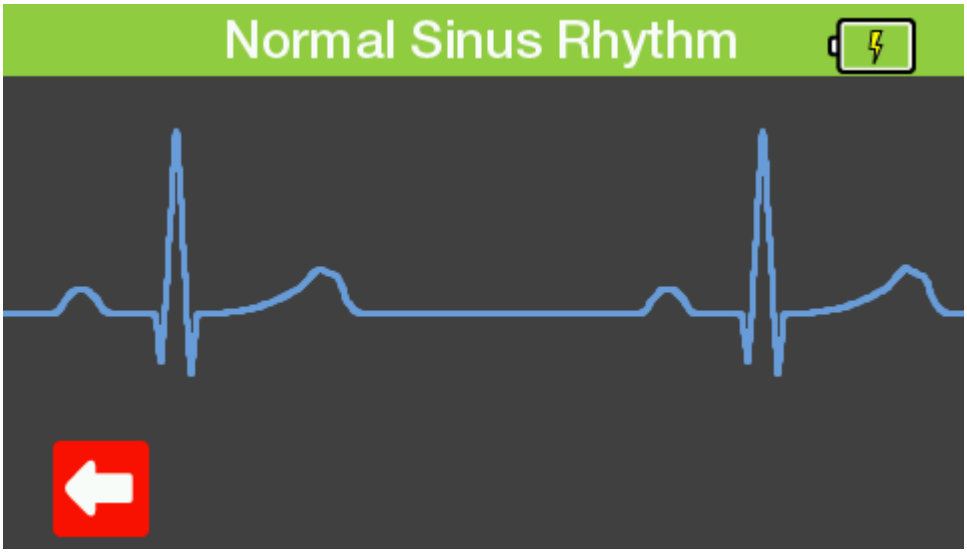


Selecting **F3** switches between adult and neonatal settings.

The figure highlighted in green, on the right hand of this menu, represents the current selection.



Selecting **F5** displays a visual representation of the waveform expected on the monitor using the current settings.



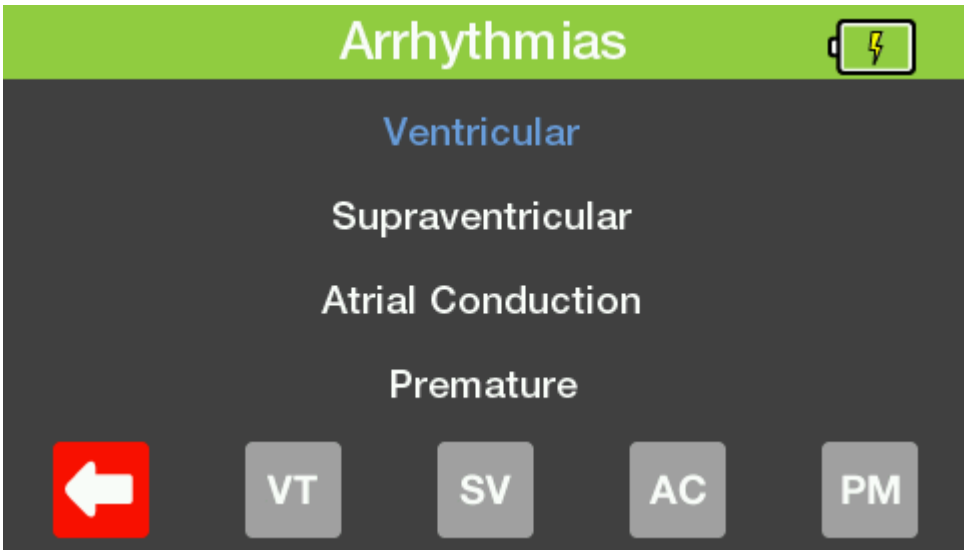
To leave any of these screens select the back button, **F1**, to go back to the previous menu or the **Home** button to go back to the **Home** screen.

Available Normal Sinus Rhythm Simulations

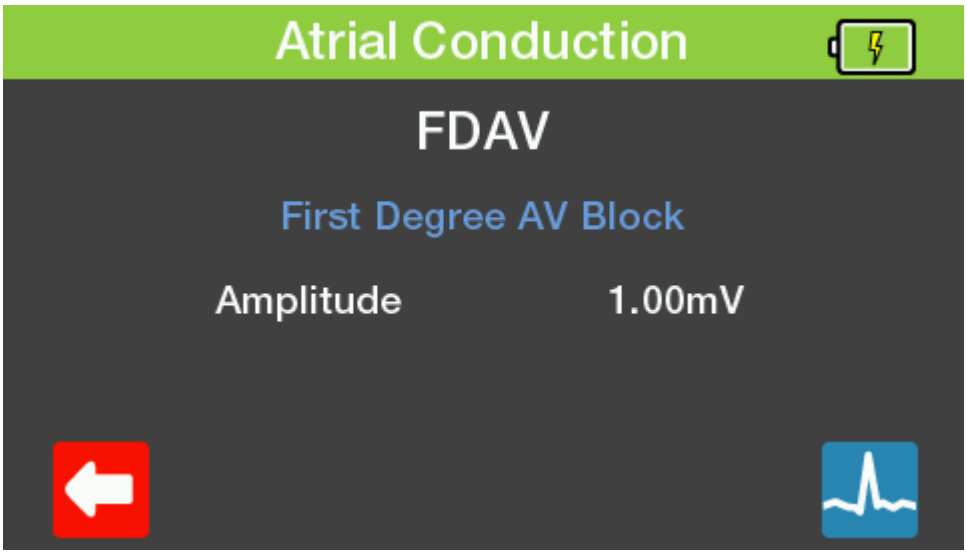
Amplitude (lead II)	0.05 mV to 0.45 mV (0.05 mV steps) 0.5 mV to 5.5 mV (0.5 mV steps)
Rates	30, 40, 50, 60, 70, 80, 90, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280, 300 bpm
ST Segments	-0.8 mV to +0.8 mV in 0.1 mV steps and +0.05mV and -0.05mV on Lead II

3.1.2. Arrhythmias

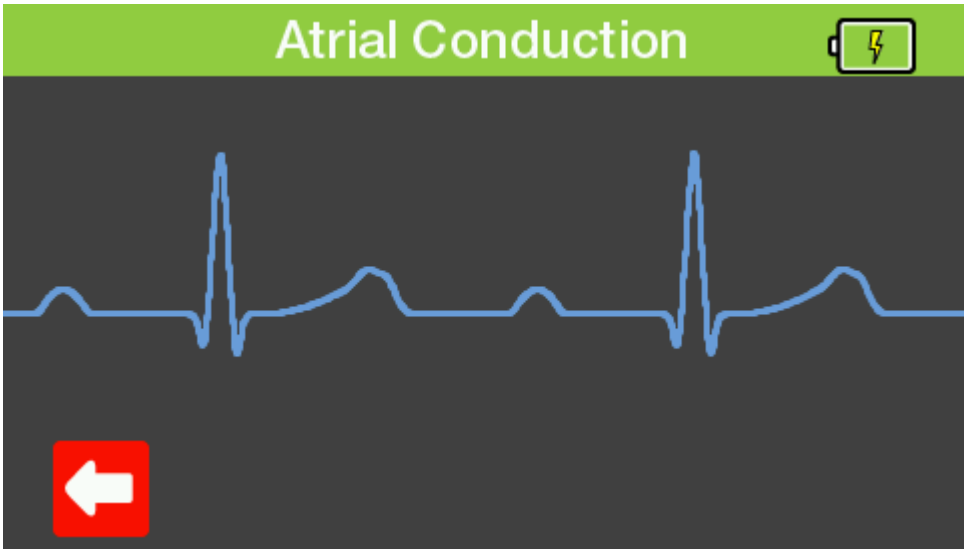
Selecting **F2** in the **ECG Menu** displays the **Arrhythmias** menu. The up & down arrow keys can be used to highlight the type of arrhythmia to simulate and selected using the tick button. Alternatively, the function keys, **F2 to F4**, can be used as fast keys to select the corresponding arrhythmia type.



The left and right navigation keys can be used to highlight the specific arrhythmia to be used in the simulation. The navigation keys are used to select the amplitude.



Selecting **F5** displays a visual representation of the waveform expected to be found on the monitor with the current settings.



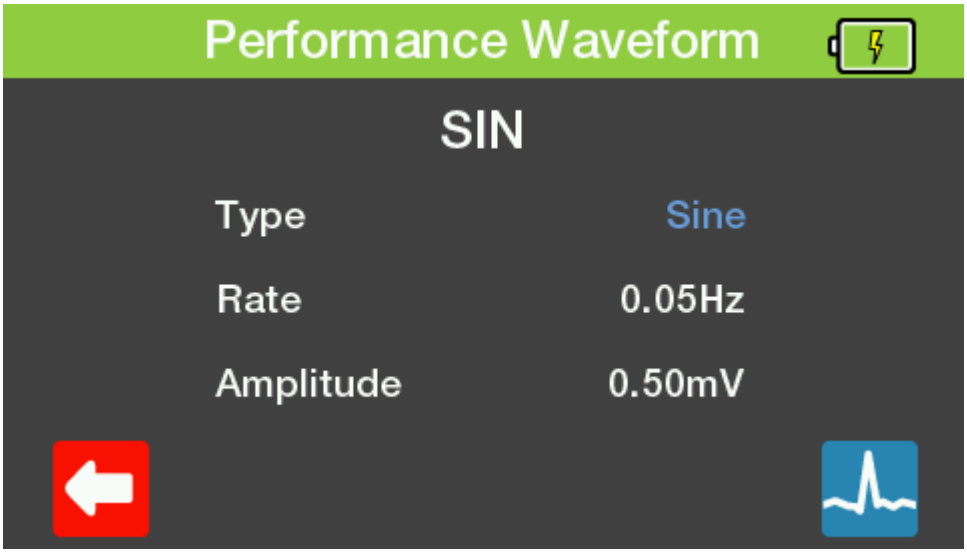
To leave any of these screens select the back button, **F1**, to go back to the previous menu or the **Home** button to go back to the **Home** screen.

Available Arrhythmia Setting

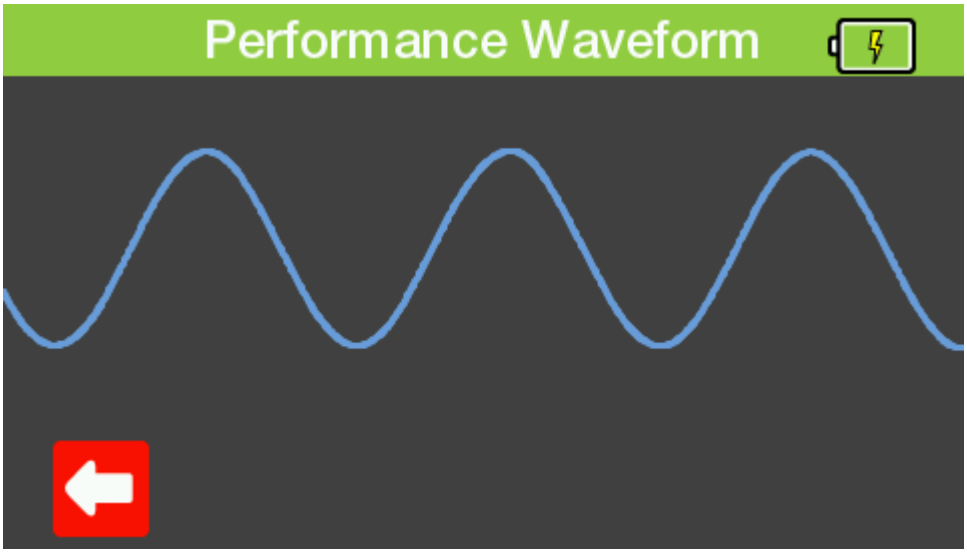
Ventricular	Asystole Bigeminy Trigeminy Ventricular Tachycardia Ventricular Fibrillation - Coarse Ventricular Fibrillation - Fine
Supraventricular	Atrial Fibrillation - Coarse Atrial Fibrillation - Fine Atrial Flutter Sinus Arrhythmia Missing Beat Atrial Tachycardia Paroxysmal Tachycardia Nodal Rhythm Supraventricular Tachycardia
Atrial conduction	First Degree AV Block Left Bundle Branch Block Right Bundle Branch Block Second Degree AV Block - Mobitz I Second Degree AV Block - Mobitz II Third Degree AV Block
Premature	Premature Atrial Contraction Premature Nodal Contraction Premature Left Ventricle Contraction Premature Left Ventricle Contraction - Early Premature Left Ventricle Contraction - R on T Premature Right Ventricle Contraction Premature Right Ventricle Contraction - Early Premature Right Ventricle Contraction - R on T Premature Ventricular Contraction - Frequent Multifocal Premature Ventricular Contraction - 6 / min Premature Ventricular Contraction - 12 / min Premature Ventricular Contraction - 24 / min
Amplitude (lead II)	0.05 mV to 0.45 mV (0.05 mV steps) 0.5 mV to 5.5 mV (0.5 mV steps)

3.1.3. Performance Waveform

Selecting **F3** in the **ECG Menu** displays the **Performance Waveform** menu. This screen shows the current settings. The up & down navigation keys can be used to highlight the parameter to change and the left & right navigation keys to select the required parameter.



Selecting **F5** displays a visual representation of the waveform expected to be found on the monitor with the current settings.



To leave any of these screens select the back button, **F1**, to go back to the previous menu or the **Home** button to go back to the **Home** screen.

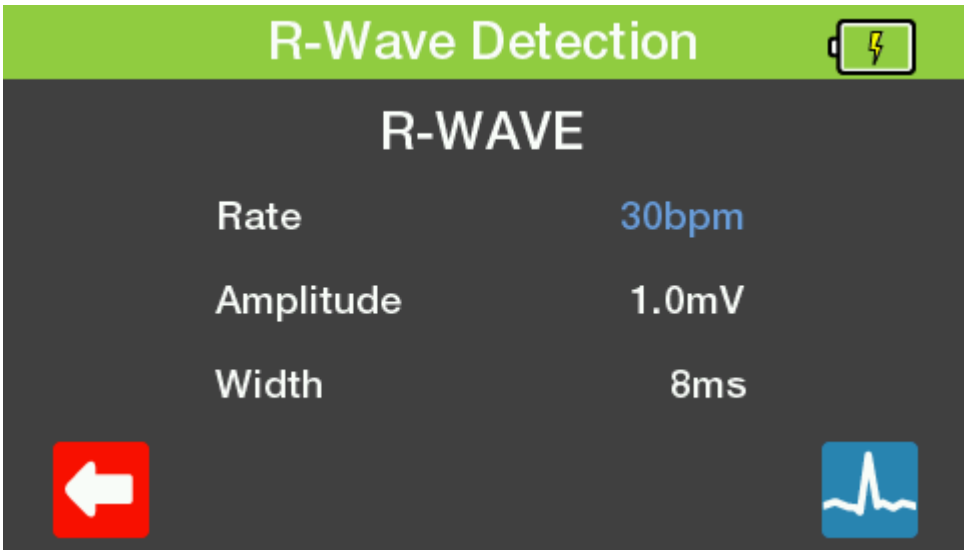
Available Performance Waveforms

Sine Waves	0.05, 0.5, 1, 10, 25, 30, 40, 50, 60, and 100 Hz
Square Waves	0.125, 2 Hz
Pulse	60bpm or 240bpm
Triangle Wave	2 Hz
Performance amplitude	0.5 to 5.0 mV in 0.5 mV steps

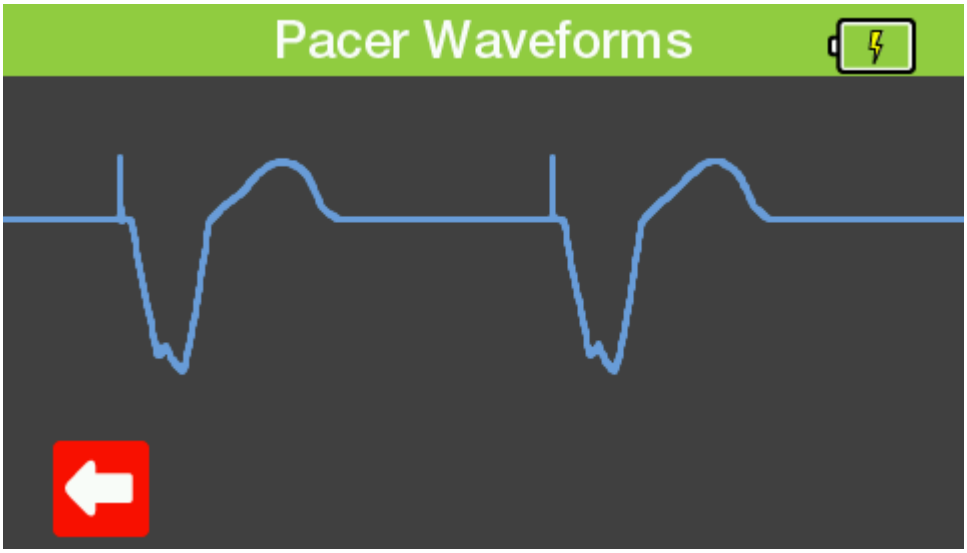
3.1.4. Pacer Waveforms

Selecting **F4** in the **ECG Menu** displays the **Pacer Waveforms** menu. This screen shows the current settings. The up & down navigation keys can be used to highlight the parameter to change and the left & right navigation keys to select the required parameter.

Selecting **F3** displays the **R-Wave Detection** menu. The up & down navigation keys can be used to highlight the parameter to change and the left & right navigation keys to select the required parameter.



Selecting **F5**, in either screen, displays a visual representation of the waveform expected to be found on the monitor with the current settings.



To leave any of these screens select the back button, **F1**, to go back to the previous menu or the **Home** button to go back to the **Home** screen.

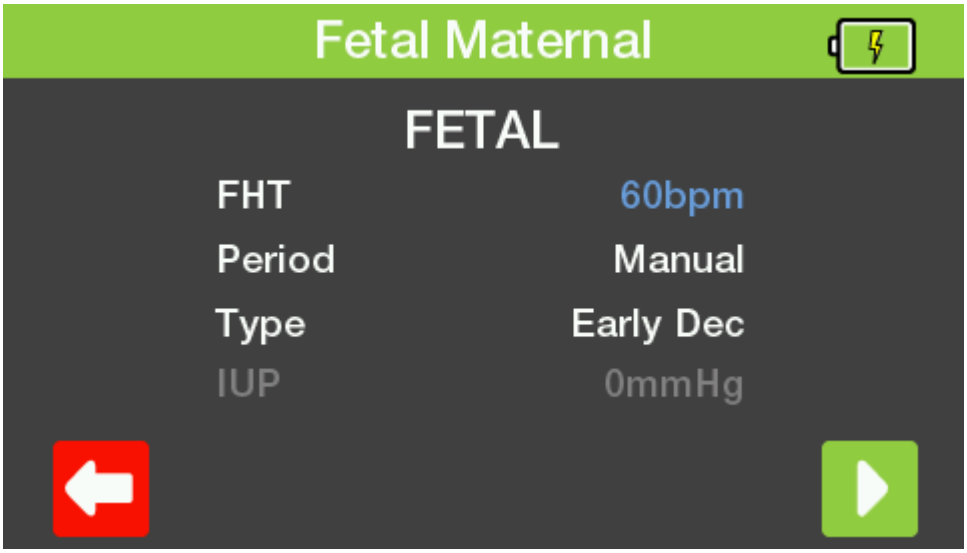
Available Pacer Waveforms

Simulated Rhythms	Asynchronous at 75 bpm Demand with frequent Sinus beats Demand with occasional Sinus beat Atrioventricular sequential Non-Capture Non-Function
Amplitude	1.0, 2.0, 5.0, 10.0 mV
Width	0.1, 0.2, 0.5, 1.0, 2.0 ms

R-Wave Detector Rate	30, 60, 80, 120, 200, 250 bpm
R-Wave Amplitude	0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0 mV
R- Wave Width	8, 10, 12, 20, 40, 60, 80, 100, 120, 140, 160, 180, 200 ms

3.1.5. Fetal Maternal

Selecting **F5** in the **ECG Menu** displays the **Fetal Maternal** menu. This screen shows the current settings. The up & down navigation keys can be used to highlight the parameter to change and the left & right navigation keys to select the required parameter.



Selecting **F5** starts the timer and selecting **F5** again stops the timer.

Note: IUP is displayed for information only during the Fetal Simulation.

To leave any of these screens select the back button, **F1**, to go back to the previous menu or the **Home** button to go back to the **Home** screen.

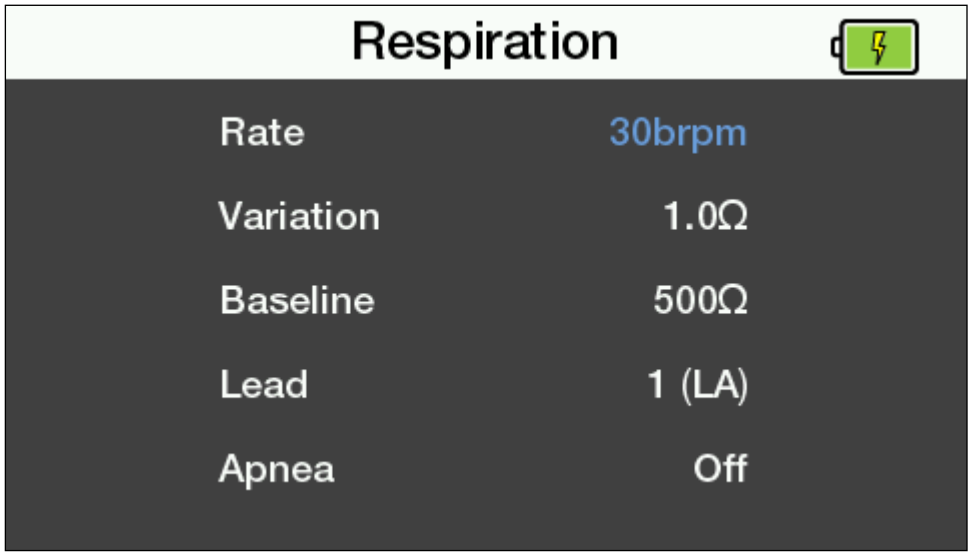
Note: The Fetal simulation is output on IBP1.

Available Fetal Simulation Settings

Maternal heart rate (fixed)	80 bpm
Fetal heart rate (selectable)	60, 90, 120, 140, 150, 210 and 240 bpm
Fetal heart rate (IUP)	140 bpm at beginning, then varying with pressure
Intrauterine-pressure waveforms (IBP1)	Early deceleration, late deceleration, and uniform acceleration
Simulation period	Manual or 2, 3, or 5 minutes

3.2. Respiration Settings

Selecting **F2** from the **Home** screen displays the **Respiration** menu. This screen shows the current settings. The up & down navigation keys can be used to highlight the parameter to change and the left & right navigation keys to select the required parameter.



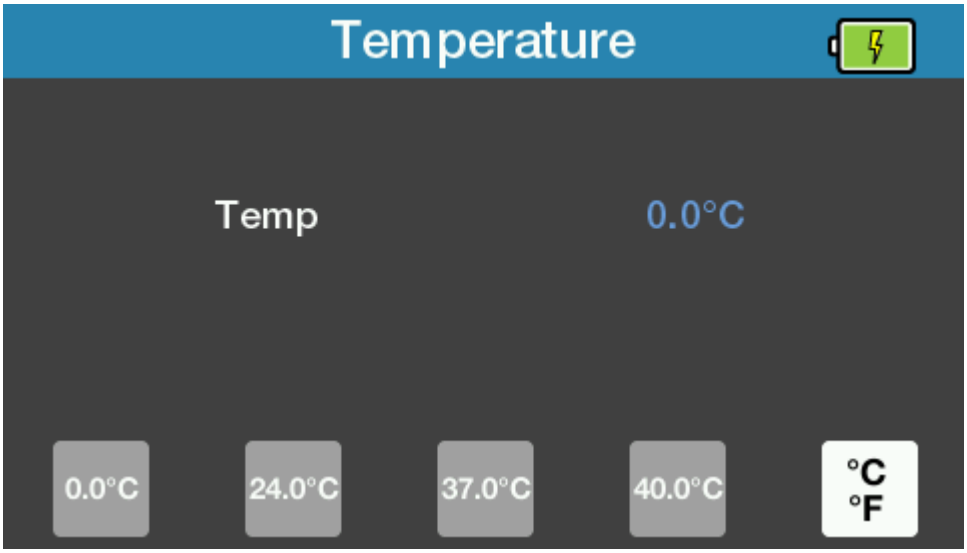
To leave this menu select the **Home** button to go back to the **Home** screen.

Available Respiration Settings

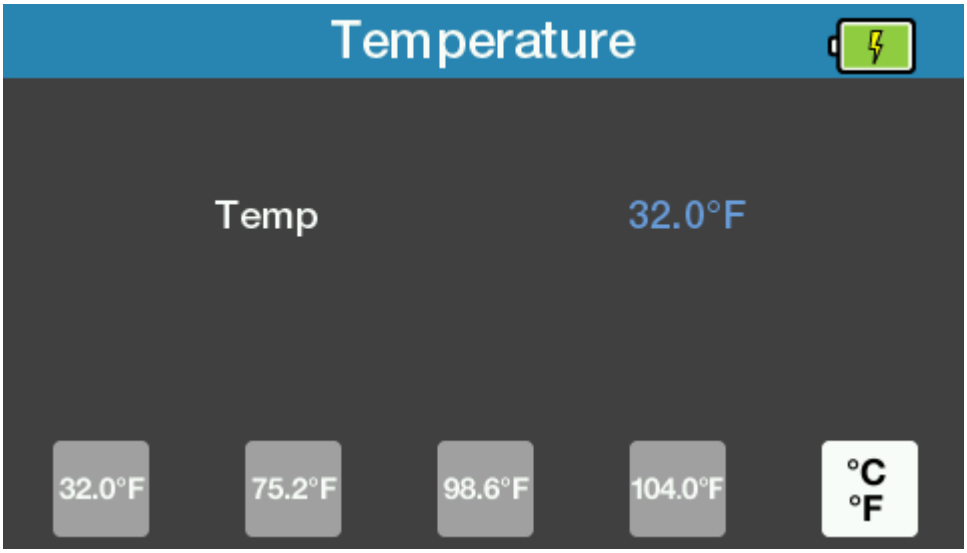
Rate	0, 5, 10, 15, 30, 40, 60, 80, 120, 180 brpm
Resistance Variations	0.2, 0.5, 1.0, 3.0 Ω
Base Resistances	500, 1000, 1500 and 2000 Ω
Lead selection	Lead 1 (LA) and 2 (LL), user selectable
Apnea Simulation	ON / OFF

3.3. Temperature Settings

Selecting **F3** from the **Home** screen displays the **Temperature** menu. This screen shows the current settings. The left & right navigation keys can be used to select a preferred setting. Alternatively, the function keys, **F1 to F4**, can be used as fast keys to select a corresponding temperature.



The function key **F5** can be used to switch between ˚C & ˚F.



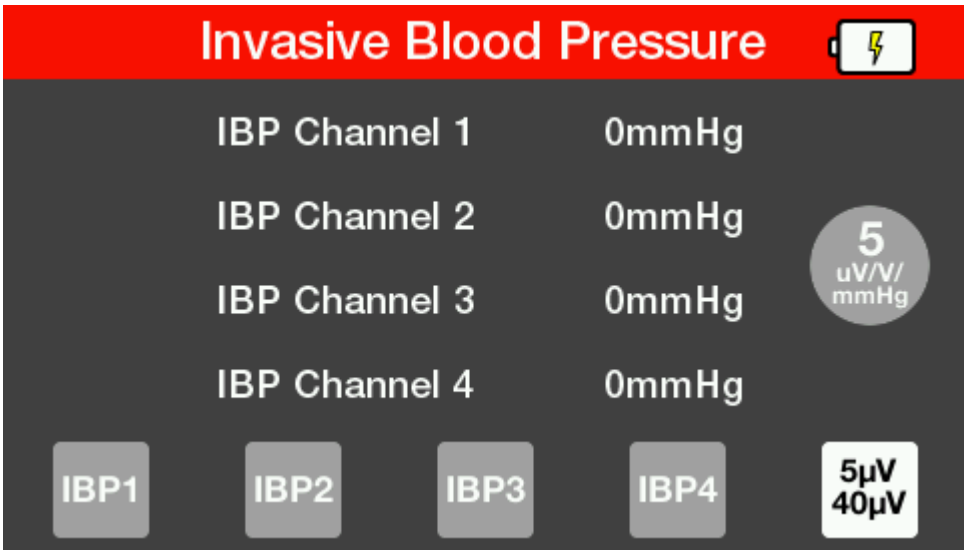
To leave this menu select the **Home** button to go back to the **Home** screen.

Available Temperature Settings

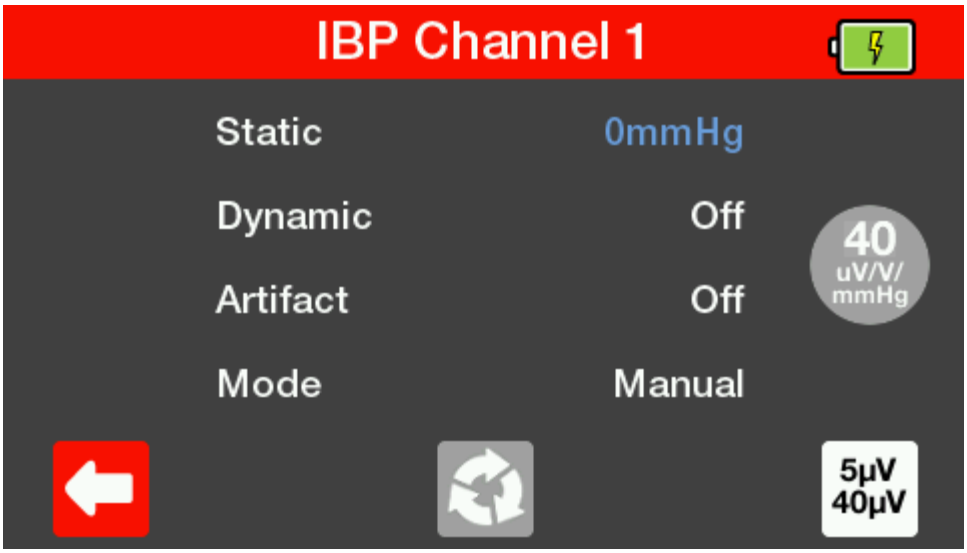
Simulation	YSI 400 / 700A / 700B Static
Temperature unit	˚C or ˚F, user selectable
Range	pre-set 4 values at 0.0, 24.0, 37.0, and 40.0˚C pre-set 4 values at 32.0, 75.2, 98.6, 104.0˚F
Accuracy	± 0.1 ˚C / ˚F
Connector	mini DIN style

3.4. Invasive Blood Pressure Settings

Selecting **F4** from the **Home** screen displays the **Invasive Blood Pressure** menu. This screen shows the current settings.



Use function keys **F1 to F4** to select the required channel. The up & down navigation keys can be used to highlight the parameter to change and the left & right navigation keys to select the required parameter.

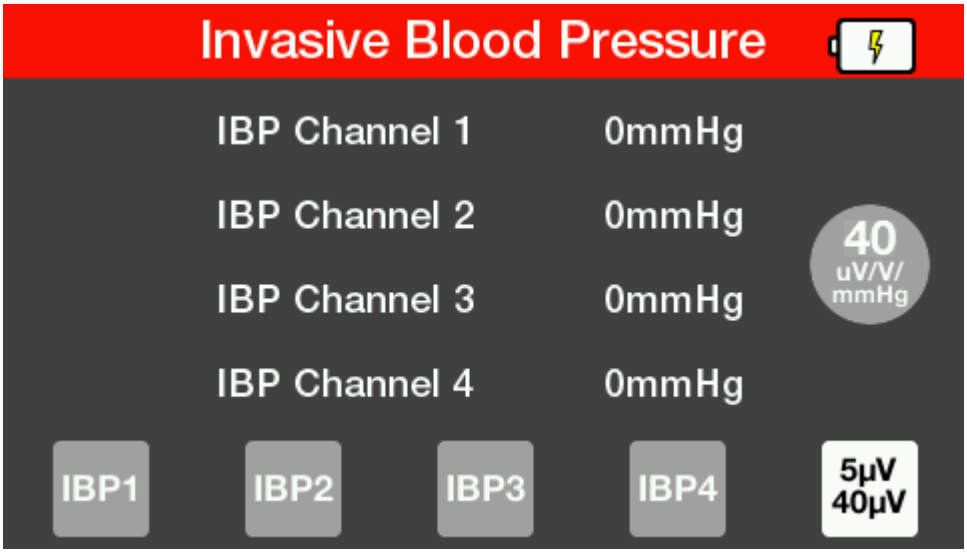


Setting **Auto** in **Mode** will cycle through all of the Dynamic settings one by one for 15 seconds each.

Note: Auto mode is only available on channel 1.

Selecting **F3** resets all values back to zero.

The function key **F5** can be used to switch the simulated sensitivity between 5µV and 40µV.



To leave this menu select the **Home** button to go back to the **Home** screen.

Available IBP Settings

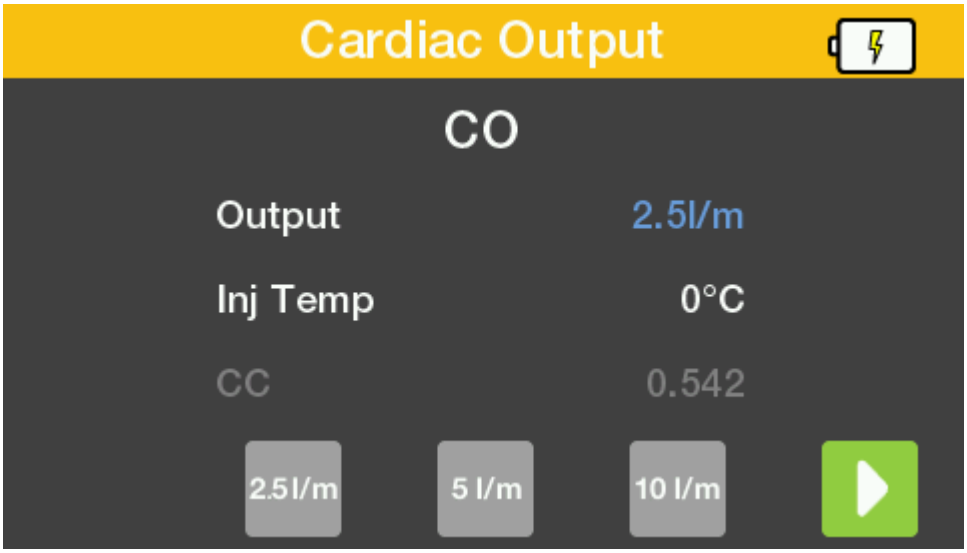
Channels	4
Static Pressure	-10,-5,0,20,40,50,60,80,100,150,160,200,240,320,400mmHg
Dynamic Simulation	Arterial [ART] 120/80 Radial Artery [RA] 120/80 Left Ventricle [LV] 120/00 Right Ventricle [RV] 25/00 Left Atrium [LA] 14/4 Pulmonary Artery Wedge [PAW] 10/2 Pulmonary Artery [PA] 25/10 Right Atrium (central venous) [CVP] 15/10
Auto sequence (Channel 1 only)	Cycle through simulations with 15 second step duration: Arterial [ART] 120/80 Radial Artery [RA] 120/80 Left Ventricle [LV] 120/00 Right Ventricle [RV] 25/00 Pulmonary Artery Wedge [PAW] 10/2 Pulmonary Artery [PA] 25/10 Right Atrium (central venous) [CVP] 15/10
Simulated sensitivity	5µV/V/mmHg or 40µV/V/mmHg (user selectable)

3.5. Cardiac Output Settings

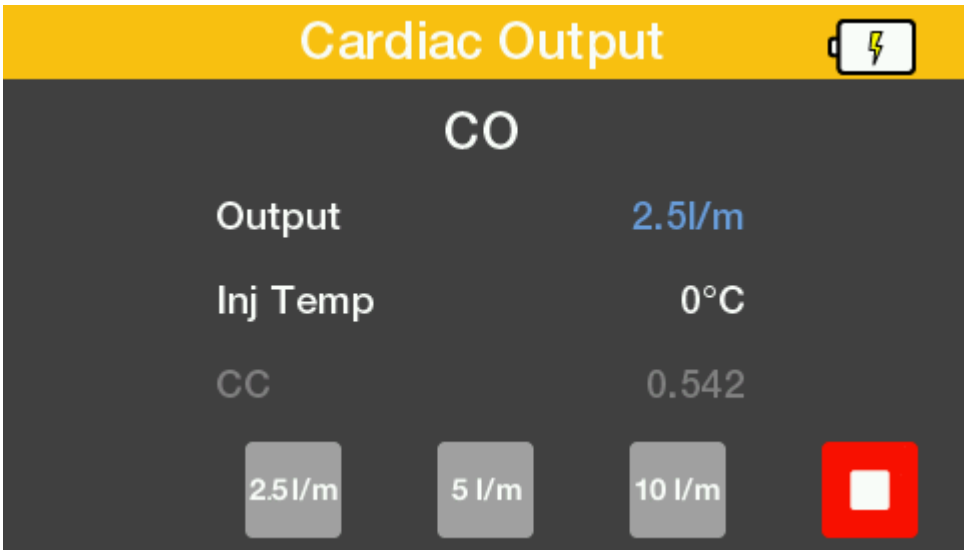
Selecting **F5** from the **Home** screen displays the **Cardiac Output** menu. This screen shows the current settings. The up & down navigation keys can be used to highlight the output and the left & right navigation keys to select the required output rate. Alternatively, the function keys **F2 to F4** can be used.

Note: The blood temperature must be set to 37˚C.

In addition, the up & down arrow keys can be used to highlight the Injection temperature and the left & right navigation keys to select the preferred temperature. Note, the Calibration Coefficient is set by the temperature.



Selecting **F5** starts the timer and selecting **F5** again stops the timer.



Available Cardiac Output Settings

Output	2.5, 5.0 and 10.0 l/min Faulty Injectate, L to R Shunt and Cal Pulse
Injectate temperature	pre-set values at 0 ˚C (32.0 ˚F) and 24 ˚C (75.2 ˚F)
Calibration Coefficient (set by temperature)	0.542 (0˚C / 32.0 ˚F injectate), 0.595 (24 ˚C / 75.2 ˚F injectate)

4. Maintaining the PatSim 400

4.1. Cleaning the PatSim 400

The PatSim 400 case can be cleaned with a damp cloth with, if necessary, a small amount of mild detergent. However, care must be taken to prevent excessive moisture around the socket panel or in the lead storage area.

Do not allow liquid inside the PatSim 400 or near the sockets. Do not use abrasives, solvents or alcohol.

If any liquid is spilt into the PatSim 400 case, the simulator should be returned for repair, stating the cause of the defect.

4.2. User Maintenance

The PatSim 400 is a rugged quality instrument. However, care should always be taken when using, transporting and storing this type of equipment. Failure to treat the product with care will reduce both the life of the instrument and its reliability.
If the PatSim 400 is subject to condensation, allow the tester to completely dry before use.

- Always check the PatSim 400 and supplied accessories for signs of damage and wear before use.
- Do not open the PatSim 400 under any circumstances.
- Keep the instrument clean and dry.
- Avoid testing in conditions of high electrostatic or electromagnetic fields.
- Maintenance should only be performed by authorised personnel.
- There are no user replaceable parts in the PatSim 400.
- The unit should be regularly calibrated (at least annually).

5. Specifications

5.1 Technical Specifications

General ECG

Simulation	Full 12 lead ECG with independent outputs for each signal lead
Lead I	70%
Lead II	100%
Lead III	30%
Lead V1	24%
Lead V2	48%
Lead V3	100%
Lead V4	120%
Lead V5	112%
Lead V6	80%

ECG Normal Sinus Rhythm

Simulation	Full 12 lead ECG with independent outputs for each signal lead
Heart rate	18 selectable values 30-300 bpm
Accuracy	±1bpm or 1%
Amplitude (lead II) 0.5 mV to 5.5 mV (0.5 mV steps)	0.05 mV to 0.45 mV (0.05 mV steps)
Amplitude Accuracy	± 2%
ST Segments	18 selectable values, 8 elevated & 8 depressed
Neonatal Mode	ECG R wave width is reduced to 40ms

Arrhythmia Waveforms (Atrial)

Amplitude (lead II) 0.5 mV to 5.5 mV (0.5 mV steps)	0.05 mV to 0.45 mV (0.05 mV steps)
Amplitude Accuracy	± 2%
Ventricular Waveforms	Asystole
Bigeminy	
Trigeminy	
Ventricular Fibrillation (coarse)	
Ventricular Fibrillation (fine)	
Ventricular Tachycardia	
Supraventricular Waveforms	Atrial Fibrillation coarse
Atrial Fibrillation fine	
Atrial Flutter	
Atrial Tachycardia	
Missing beat	
Nodal rhythm	
Paroxysmal Atrial Tachycardia	
Sinus Arrhythmia	
Supraventricular Tachycardia	

Atrial Conduction Waveforms	First Degree AV Block Left Bundle Branch Block Right Bundle Branch Block Second Degree AV Block - Mobitz I Second Degree AV Block - Mobitz II Third Degree AV Block
Premature Waveforms	Premature Atrial Contraction Premature Nodal Contraction Premature Left Ventricle Contraction Premature Left Ventricle Contraction - early Premature Left Ventricle Contraction - R on T Premature Right Ventricle Contraction Premature Right Ventricle Contraction - early Premature Right Ventricle Contraction - R on T Premature Ventricular Contraction - 6 / min Premature Ventricular Contraction – 12 / min Premature Ventricular Contraction - 24 / min Premature Ventricular Contraction – frequent multifocal

Performance Waveforms

Square Waves	2 Hz, 0.125 Hz
Triangle Wave	2 Hz
Pulse	60bpm or 240bpm
Sine Waves	0.05, 0.5, 1, 10, 25, 30, 40, 50, 60, and 100 Hz
R-Wave Detector Test	60 BPM haver-triangle wave with selectable width and amplitude
Haver-triangle Width	12 selectable values between 8 and 200 msec
Performance amplitude	0.5 to 5.0 mV in 0.5 mV steps

Pacer Waveforms

Simulated Rhythms	Asynchronous at 75 bpm Demand with frequent sinus beat Demand with occasional sinus beat A-V sequential Non-capture Non-function
Pulse amplitude	1.0, 2.0, 5.0, 10.0 mV
Accuracy	±10%
Width	5 selectable values 0.1-2.0 ms.
Accuracy	± 5%.

R Wave Detection

Heart Rate	6 selectable values 30-250 BPM
Amplitude	0.05 mV to 0.50 mV (0.05 mV steps)
R wave width	13 selectable values 8-200ms

Cardiac Output

Catheter type	Baxter Edwards, 93a-131-7f
Calibration coefficient	0.542 (0 ˚C injectate), 0.595 (24 ˚C injectate)
Blood Temperature	37 ˚C (98.6 ˚F) ± 2 %
Injectate volume	10 cc
Injectate Temperature	0 ˚C or 24 ˚C ± 2 % value
Cardiac output	2.5 l/min, 5 l/min, 10 l/min ± 5 %
Connector	mini DIN style

Respiration Simulation

Rates	0, 5, 10, 15, 30, 40, 60, 80, 120, 180 brpm
Resistance Variations	0.2, 0.5, 1.0, 3.0 Ω
Accuracy	±10%
Base resistances	500, 1000, 1500 and 2000 Ω
Accuracy	±5%
Lead selection	1 (LA), 2(LL) user selectable
Apnoea Simulation	Manual on/off

Temperature Simulation

Simulation	YSI 400 / 700A / 700B Static
Temperature unit	˚C or ˚F, user selectable
Range	pre-set 4 values at 0.0, 24.0, 37.0, and 40.0˚C
pre-set 4 values at 32.0, 75.2, 98.6, 104.0˚F	
Accuracy	± 0.1 ˚C / ˚F
Connector	mini DIN style

Invasive Blood Pressure Simulation

Channels	4 channels
Static Pressure Channel 1	-10, 0, 80, 160, 240, 320, 400 mmHg
Static Pressure Channel 2	-10, 0, 50, 100, 150, 200, 240 mmHg
Static Pressure Channel 3&4	-5, 0, 20, 40, 60, 80, 100 mmHg
Dynamic Simulation	Arterial [ART] 120/80 Radial Artery [RA] 120/80 Left Ventricle [LV] 120/00 Right Ventricle [RV] 25/00 Right Atrium (central venous) [CVP] 15/10 Pulmonary Artery [PA] 25/10 Pulmonary Artery Wedge [PAW] 10/2 Left Atrium [LA] 14/4
Auto sequence (C1 only)	Cycle through simulations with 15 second step duration: Arterial [ART] 120/80 Radial Artery [RA] 120/80 Left Ventricle [LV] 120/00 Right Ventricle [RV] 25/00 Pulmonary Artery Wedge [PAW] 10/2 Pulmonary Artery [PA] 25/10 Right Atrium (central venous) [CVP] 15/10

Accuracy	± 1mmHg
Excitation voltage	2V to 16V
Impedance	350Ω Nominal
Simulated sensitivity	5µV/V/mmHg or 40µV/V/mmHg (user selectable)
Connector	mini DIN style

Cardiac Output Simulation

Catheter type	Baxter Edwards, 93a-131-7f
Calibration Coefficient	0.542 (0˚C injectate), 0.595 (24 ˚C injectate)
Blood temperature	37 ˚C (98.6 ˚F) ± 2 %
Injectate volume	10 cc
Injectate temperature	0 ˚C or 24 ˚C ± 2 % value
Cardiac output	2.5 l/min, 5 l/min, 10 l/min ± 5 %
Connector	mini DIN style

5.2. General Specifications

General Specifications

Mains power/Battery info	3.7V 3900mAh 14.4WH Li-Ion battery 5V 1A USB micro-B power supply 100-240V ~ 50/60Hz 0.18A max.
Charge time (new battery)	Up to 6 hours
Battery life	Up to 8 hours (depending on simulation and screen brightness)
Weight	0.70 Kg / 1.5 lbs
Dimensions	180 x 150 x 55 mm, 7.1 x 5.9 x 2.2 inch

Serviceability

Warranty	5 years [terms and conditions apply]
Calibration	1 year

Environmental

Operating conditions	10 - 40˚C (50 - 104˚F) 0-90% RH - NC
Storage environment	-15 - 60˚C (5 - 140˚F) 0-90% RH – NC
Environmental protection	IP40
Impact Rating	IK08

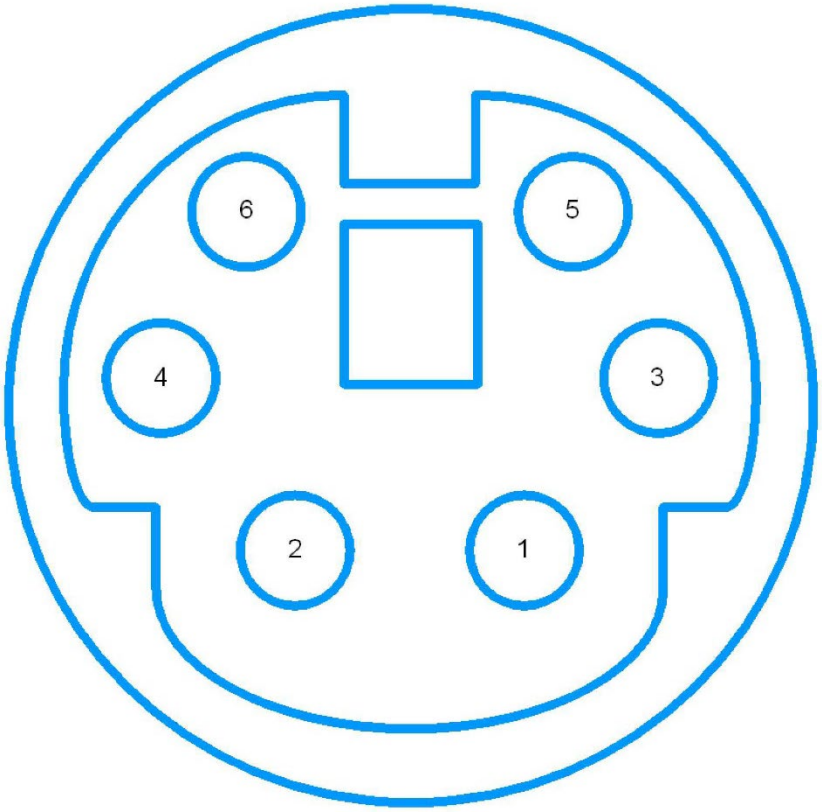
Electrical Interfaces

ECG (& respiration)	10 x 4 mm sockets
IBP 1 – 4	6 pin mini DIN
Temperature output	8 pin mini DIN
Cardiac output	8 pin mini DIN
USB Port	micro

6. Appendix

6.1. Invasive Blood Pressure Socket Wiring Diagram

The wiring diagram for any of the IBP sockets is as follows:



Notes;

1. Pinout:

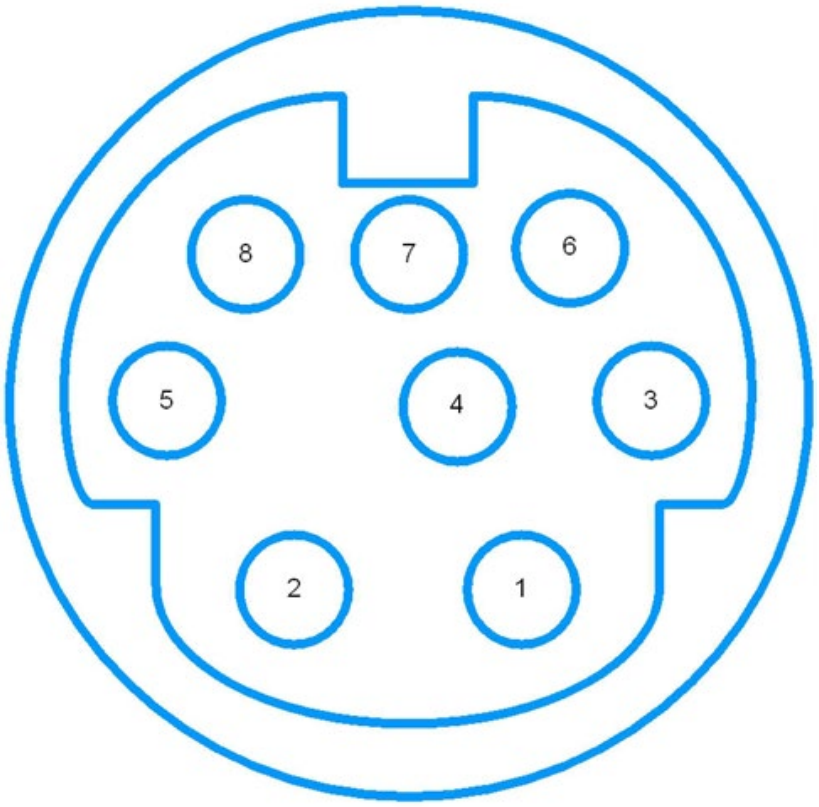
1	+VE Excitation
2	No Connection
3	+VE Output
4	–VE Excitation
5	No Connection
6	–VE Output

2. IBP 1 and 2 pinouts are identical

3. Pinout with respect to looking at the PatSim 400

6.2. Temperature Socket Wiring Diagram

The wiring diagram for the Temperature Output socket is as follows:



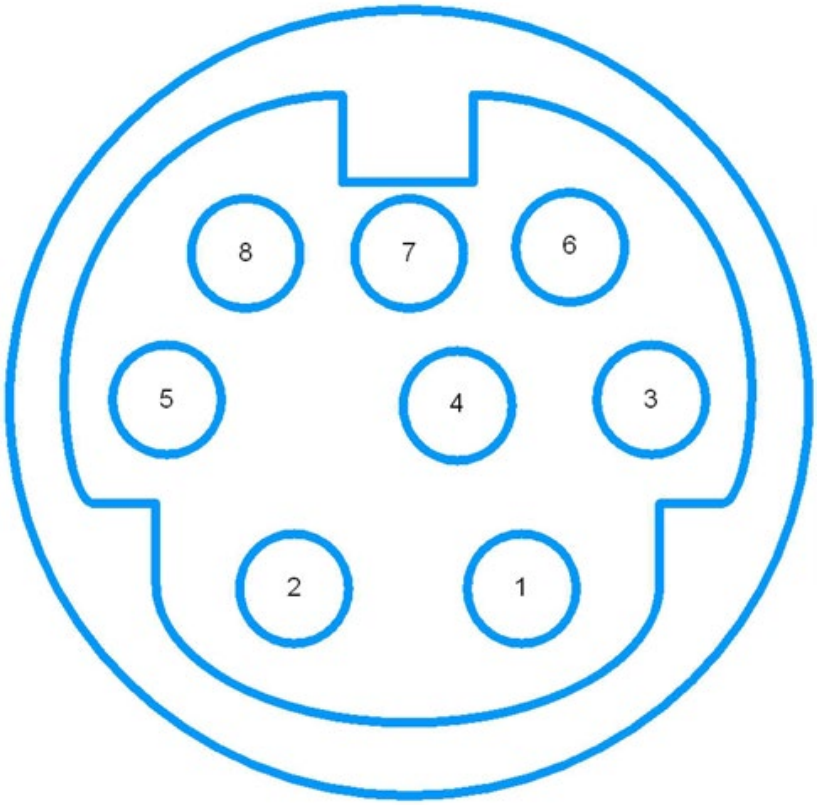
Notes;
1. Pinout:

1	No Connection
2	YSI 400
3	No Connection
4	No Connection
5	YSI 700B
6	No Connection
7	Temp Common
8	YSI 700A

2. Pinout with respect to looking at the PatSim 400

6.3. Cardiac Output Socket Wiring Diagram

The wiring diagram for the Cardiac Output socket is as follows:



Notes;

1. Pinout:

1	No Connection
2	No Connection
3	No Connection
4	CO Delta Ohms
5	No Connection
6	CO Ground
7	No Connection
8	No Connection

2. Pinout with respect to looking at the PatSim 400

7. Support

7.1. Contact Us

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