RIGEL MEDICAL

Innovating Together

# RIGEL UNI-PULSE

defibrillator analyser

Copyright © 2016 SEAWARD GROUP
Last Update: 20th April 2016

Instruction Manual
386A550 Revision 1.3

## Rigel Medical 24 Month Warranty Statement

Rigel Medical provides a standard 12-month manufacturer's warranty against breakdown during normal use. This warranty can be upgraded to a 24-month warranty (terms and conditions apply*). Problems caused through misuse, damage, fair wear & tear, consumables and accessories are excluded from standard warranty. Such components found to be being used in excess of their manufacturer's operating recommendations are also excluded. Shipping to an authorised service centre is the responsibility of the sender.

*Terms and Conditions of 24 Month Warranty

The Rigel product must be registered with Rigel Medical within 30 days of purchase to be eligible for the extended 24-month warranty. Instruments must be returned to an authorised service centre complete with proof of purchase within 13 months of purchase for calibration at the current rate. Any items returned for calibration outside of the 13 month period stated above may not be eligible for the second 12 month section of warranty. The second 12 month section of the warranty begins at the expiry of the initial 12 month period, not when the unit is calibrated.

Details correct at time of going to print. The manufacturer retains the right to make amendments to the above terms and conditions without prior notice.

## Calibration Statement

The Rigel Uni-Pulse Defibrillator Analyser 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 in not effected 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.

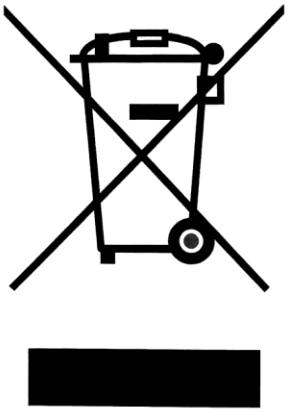
Date received into service; / / .

© Copyright 2016

All rights reserved. Nothing from this edition may be multiplied, or made public in any form or manner, either electronically, mechanically, by photocopying, recording, or in any manner, without prior written consent from the SEAWARD GROUP. This also applies to accompanying drawings and diagrams.

Due to a policy of continuous development the SEAWARD GROUP reserves the right to alter the equipment specification and description outlined in this publication without prior notice and no part of this publication shall be deemed to be part of any contract for the equipment unless specifically referred to as an inclusion within such contract.

Disposal of old product



The Rigel Uni-Pulse 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.

## Statement of Conformity

This product is manufactured by:

Seaward Electronic Ltd, Bracken Hill, South West Industrial Estate, Peterlee, County Durham, SR8 2SW, UK

As the manufacturer of the apparatus listed, we declare under our sole responsibility that the product:

## Rigel Uni-Pulse – AED and defibrillator analyser

Conforms with the relevant Directives and conformity is indicated by the symbol CE , i.e. “Conformité Européenne”

Seaward Electronic Ltd. is registered under **BS EN ISO9001** Certificate No.: Q05356.

A copy of the Declaration of Conformity and a copy of our ISO certificate are available in the Support & Resources area of the Seaward website www.seaward.co.uk".

# Index

*Index* ..... *2*
*1. Introduction* ..... *4*
1.1. Design Philosophy ..... 4
1.2. Unpacking the Uni-Pulse ..... 4
*2. Warnings and Cautions* ..... *5*
2.1. User Notes ..... 5
2.2. Safety Notes ..... 5
*3. At a Glance* ..... *6*
3.1. Uni-Pulse Overview ..... 6
3.2. Icons ..... 7
*4. Getting started* ..... *7*
4.1. Turning the Uni-Pulse On and Off ..... 7
4.2. Accessing the Uni-Pulse Tests ..... 8
4.3. Setting the Time/Date ..... 9
4.4. Setting the Language ..... 10
4.5. Displaying Uni-Pulse Information ..... 10
4.6. Clearing the Results Memory ..... 12
4.7. Restoring Factory Settings ..... 12
*5. Analysing Defibrillators* ..... *13*
5.1. Connecting a Defibrillator to the Uni-Pulse ..... 13
5.2. Testing Energy Discharge ..... 13
5.3. Testing Cardiac Synchronisation ..... 14
5.4. Testing Charge Time ..... 15
*6. Analysing Automated External Defibrillators (AED)* ..... *16*
*7. Viewing Data* ..... *18*
7.1. Saving a Test Result ..... 18
7.2. Viewing a Saved Test Result ..... 18
7.3. Printing a Saved Test Result ..... 19
7.4. Deleting a Saved Test Result ..... 20
*8. Simulating ECG Waveforms* ..... *22*

**8.1. Connecting ECG leads to the Uni-Pulse ..... 22**
**8.2. Simulating a Waveform ..... 22**
**8.3. Simulating an Arrhythmia Waveform ..... 24**
**8.4. Simulating a Performance Waveform ..... 25**
**8.5. Simulating a Pacer Waveform ..... 26**
***9. Connecting to another Device ..... 28***
**9.1. Searching for a Bluetooth Device ..... 28**
**9.2. Connecting to the Test 'n' Tag Elite Printer ..... 28**
**9.3. Connecting to the Bluetooth Barcode Scanner ..... 29**
***10. Environmental Conditions ..... 30***
***11. Maintaining the Rigel Uni-Pulse ..... 31***
**11.1. Cleaning ..... 31**
**11.2. User Maintenance ..... 31**
**11.3. Return Instructions ..... 31**
***12. Accessories ..... 32***
**12.1. Standard Contents ..... 32**
**12.2. Optional Accessories ..... 32**
**12.3. Replacement Spare Parts ..... 32**
***13. Specifications ..... 33***
**13.1. Technical Specifications ..... 33**
**13.2. General Specifications ..... 35**
***14. Support ..... 36***
**14.1. Contact Us ..... 36**

# 1. Introduction

## 1.1. Design Philosophy

The Rigel Uni-Pulse is a portable and battery operated defibrillator analyser, designed to safely test the performance of all mono and bi-phasic, standard and pulsating waveforms and AED applications. Control of the Rigel Uni-Pulse is through a menu driven colour graphic user interface (GUI).

## 1.2. Unpacking the Uni-Pulse

Carefully unpack all items from the box and ensure the following items are included:

Rigel Uni-Pulse Defibrillator Analyser
AC Power Supply
ECG Snap Adapters (pack of 10)
Uni-Pulse Quick Start Guide
Utilities Disc
Carry Case
USB cable

# 2. Warnings and Cautions

## 2.1. User Notes

The following symbols are used throughout this Instruction Manual.

Warning of electrical danger!
Indicates instructions must be followed to avoid danger to persons.

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

## 2.2. Safety Notes

**Users** - The Rigel Uni-Pulse Defibrillator Analyser is designed for use by adequately trained technical personnel only.

**Operation** - The Rigel Uni-Pulse Defibrillator Analyser is designed for use within the published specifications. Any application outside of these specifications or any unauthorised user modifications may result in hazardous conditions or improper operation.

**Operation** - The Rigel Uni-Pulse Defibrillator Analyser is designed for use with Defibrillators and Automated External Defibrillators (AED's) only.

**Operation** - Refer to the Device Under Test (DUT) manufacturer operating instructions to
ensure safe operation whilst analysing the DUT.

**Safety** - Ensure that only accessories supplied by the manufacturer or accessories that meet the manufacturer's specification are used.

**Safety** - Use extreme caution when working with voltages greater than 30 Volts.

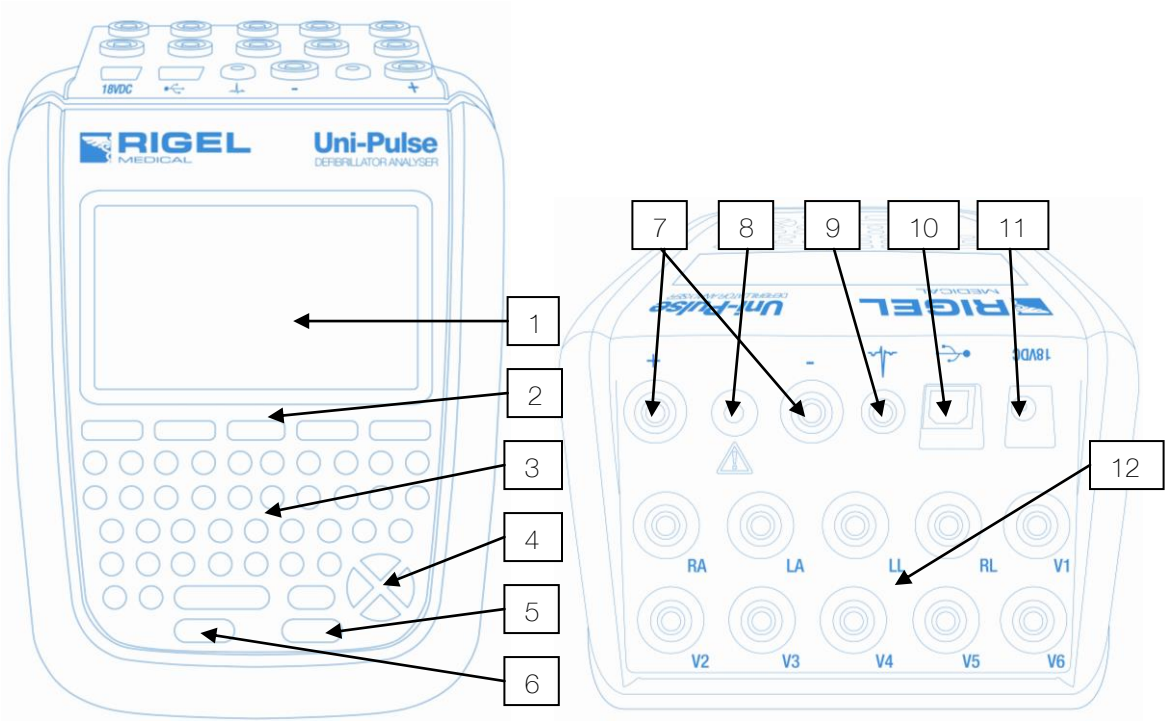
**Safety** - Where safe operation of the Uni-Pulse is no longer possible it should be immediately shut down and secured to prevent accidental operation.

It must be assumed that safe operation is no longer possible:

- if the instrument or leads show any sign of damage or
- the instrument does not function or
- after long periods of storage under adverse environmental conditions.

# 3. At a Glance

## 3.1. Uni-Pulse Overview




1 Large colour graphic display
2 Function keys F1 - F5
3 QWERTY keyboard
4 Directional navigation keys
5 Power ON/Start button
6 Power OFF/Stop button
7 Defib/paddle adaptor box connection
8 Variable load box connection
9 ECG-Hi output
10 USB connection
11 Power supply socket
12 10 x ECG connections

## 3.2. Icons

To make navigating through the options of the Uni-Pulse an easier and more intuitive experience, the traditional menu format has been replaced by a unique set of easily recognisable icons:

# 4. Getting started

## 4.1. Turning the Uni-Pulse On and Off

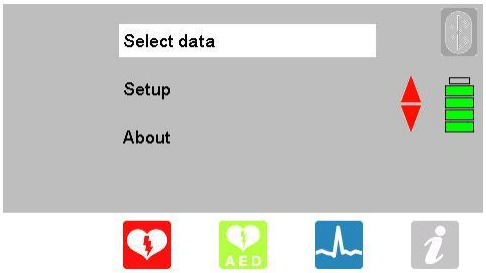
To turn the Uni-Pulse ON, press and hold the green ON key until the Rigel Medical splash screen appears.

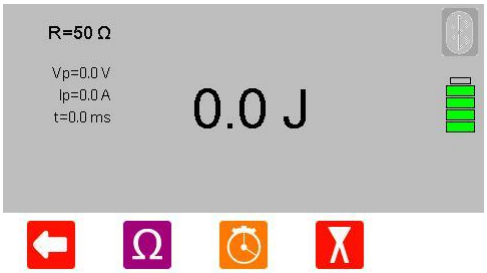
To turn the Uni-Pulse OFF, press and hold the red OFF key until power is removed from the unit.

## 4.2. Accessing the Uni-Pulse Tests

From the main menu you can access the following test menus using the function keys F1-F5:

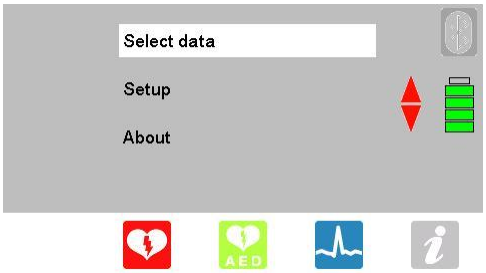
**Defibrillator Mode**

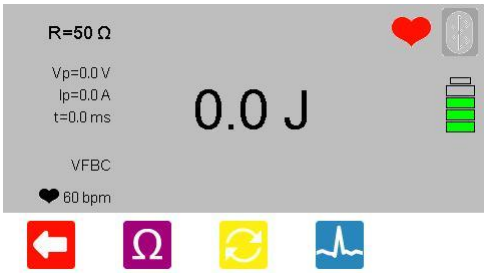



Press for Defibrillator mode.

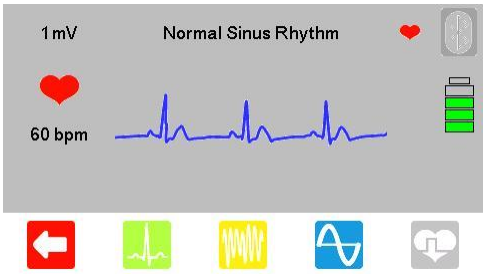
**Automated External Defibrillator (AED) Mode**



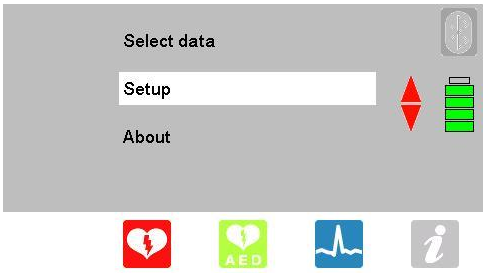

Press for AED mode.

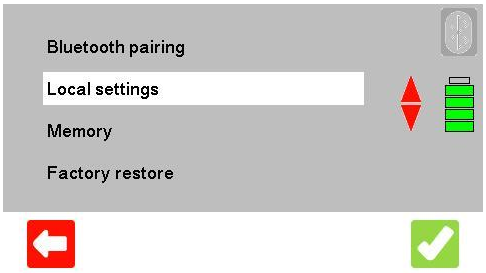
**Electrocardiogram (ECG) Simulation Mode**



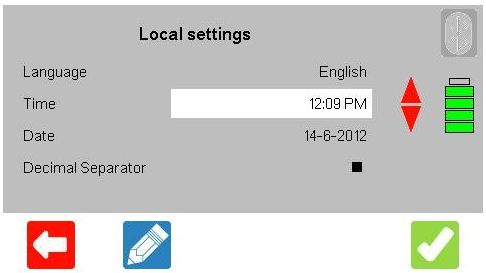

Press for ECG simulation.

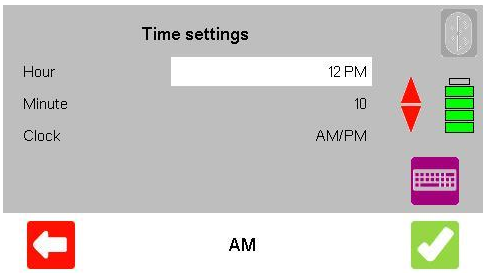
## 4.3. Setting the Time/Date



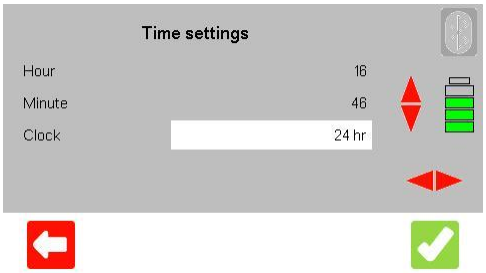




From the main menu, use the ▲▼ arrow keys to highlight Setup and press the ↵ key. Highlight Local settings and press the ↵ key.



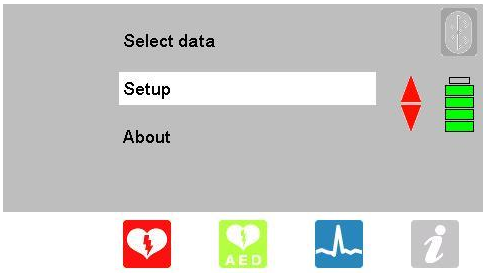

Highlight Time and press to edit the time settings. Use the keyboard to edit the hour and minute and use **F3** to switch between AM and PM.

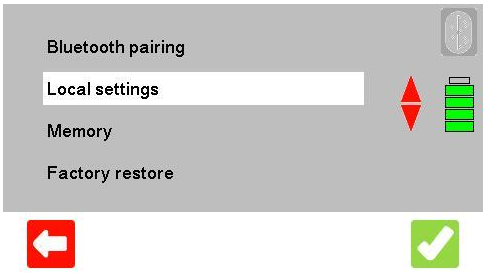



To change between 12/24 Hr clock, scroll down to Clock and use the ◄► arrow keys to change the clock format.

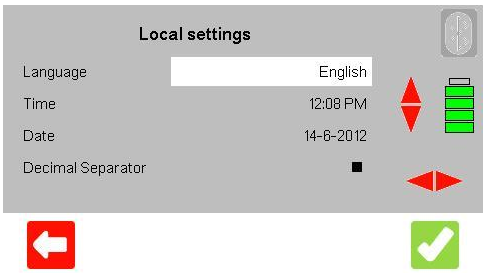
Press ✓ to confirm and save the changes, or ← to exit without saving.

## 4.4. Setting the Language



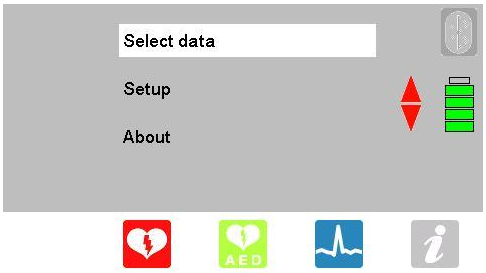

From the main menu, use the ▲▼ arrow keys to highlight Setup and press the ↵ key. Highlight Local settings and press the ↵ key.



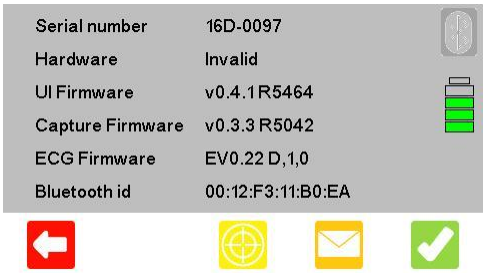

To change the Language, scroll through the available languages using the ◄► arrow keys.

Press ✓ to confirm and save the changes, or ← to exit without saving.

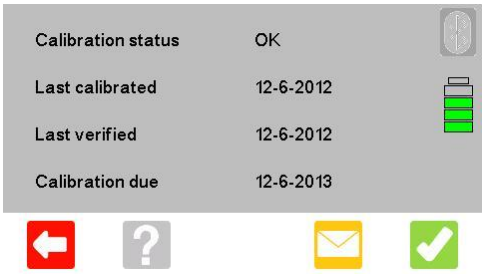
## 4.5. Displaying Uni-Pulse Information



From the main menu press ℹ to view the unit information, serial no., calibration status and calibration and service contact details.




Press ? to view the serial no. and hardware/firmware version of the unit.

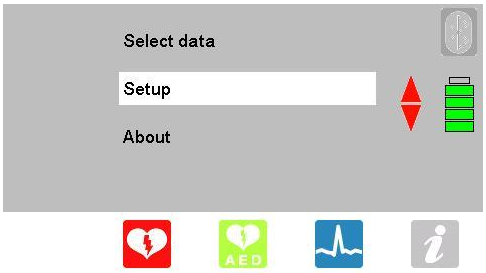


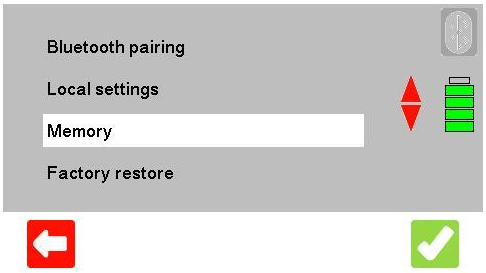

Press to view the calibration status of the unit.

Press to view service and calibration contact information.

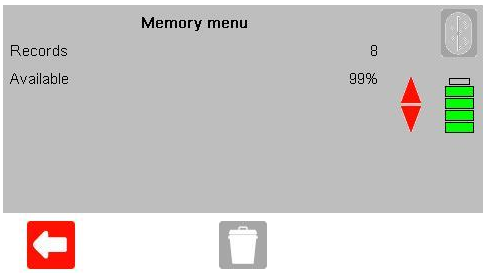
Press or to exit and return to the previous menu.

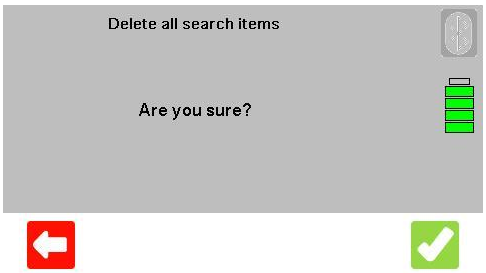
## 4.6. Clearing the Results Memory



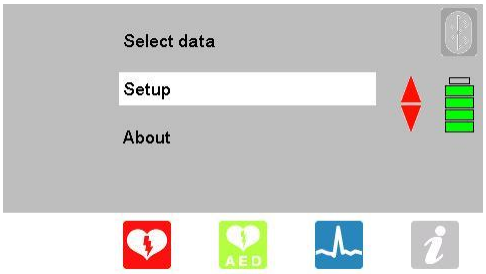

From the main menu, use the ▲▼ arrow keys to highlight Setup and press the ↵ key. Highlight Memory and press the ↵ key.

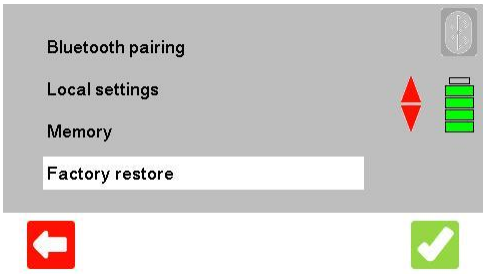


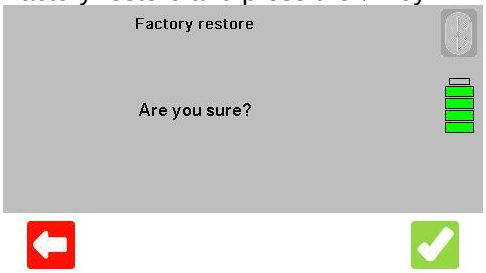

Press 🗑 to delete the results memory and press ✓ to confirm.

## 4.7. Restoring Factory Settings



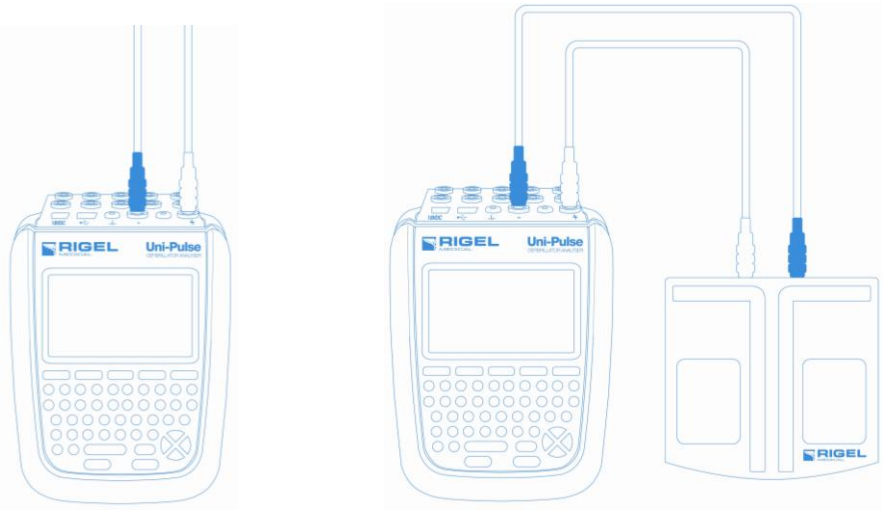

From the main menu, use the ▲▼ arrow keys to highlight Setup and press the ↵ key. Highlight Factory restore and press the ↵ key.



Press ✅ to restore factory settings.

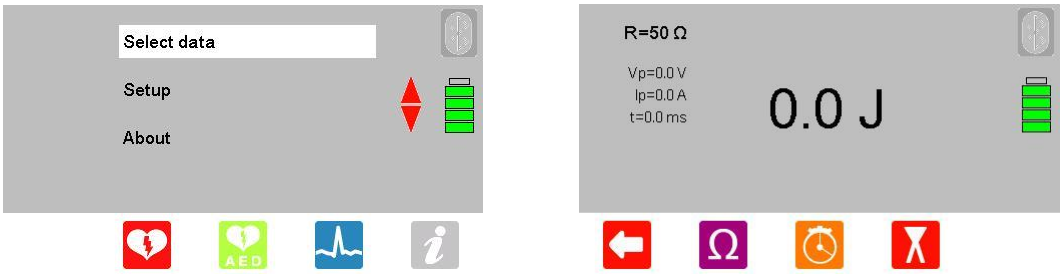
# 5. Analysing Defibrillators

## 5.1. Connecting a Defibrillator to the Uni-Pulse




The defibrillator or AED under test can be connected direct to the Uni-Pulse using 4mm connectors, or the paddle adaptor box can be used as shown above.

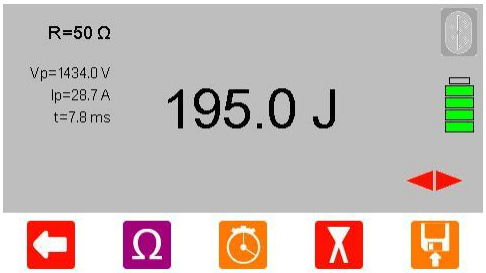
## 5.2. Testing Energy Discharge

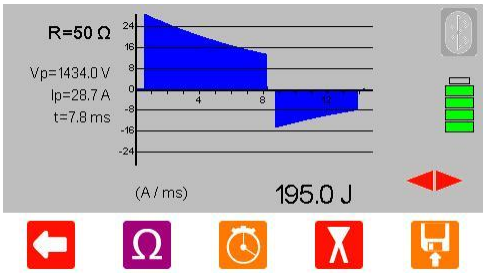



From the main menu press ❤ for Defibrillator mode. The Uni-Pulse is now ready to measure the defibrillator discharge.

Charge the defibrillator. Once the defibrillator is charged, use the **shock/discharge** button to safely deliver the electrical energy into the Uni-Pulse.

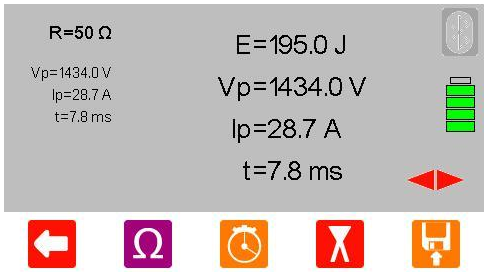
Ensure all safety precautions and safe operating procedures are observed as highlighted in the manufacturer operating instructions for your device.



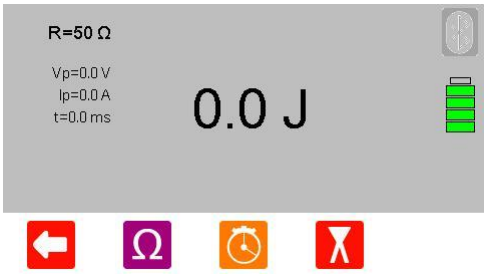

The measured energy will be displayed on the Uni-Pulse screen along with peak voltage, peak current and pulse duration.

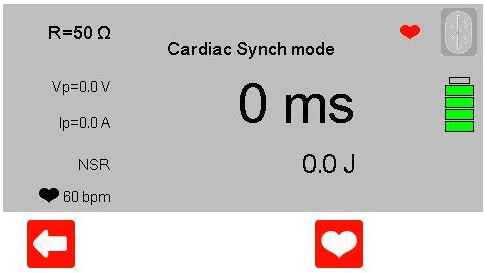
Press the ◄► key to view the waveform graph and a measurement summary.




Press to save the test result or to exit.

## 5.3. Testing Cardiac Synchronisation



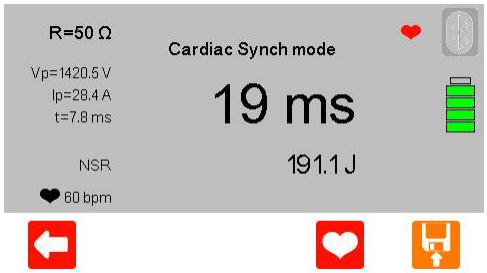




From the Defibrillator mode menu press for Cardiac Synch mode. The Uni-Pulse is now ready to measure the cardiac synchronisation time.

Activate Synchronisation mode on the defibrillator.

Charge the defibrillator. Once the defibrillator is charged, use the **shock/discharge** button to safely deliver the electrical energy into the Uni-Pulse.

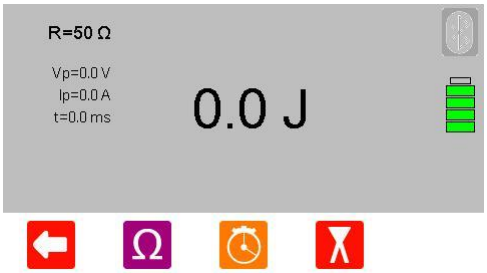
Ensure all safety precautions and safe operating procedures are observed as highlighted in the manufacturer operating instructions for your device.

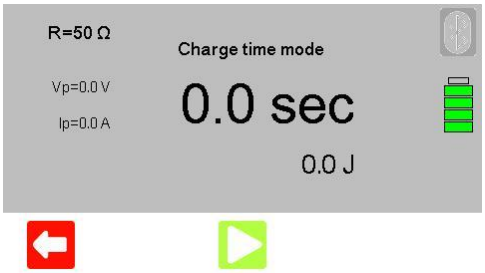



The cardiac synchronisation time will be displayed on the Uni-Pulse screen along with the measured energy, peak voltage, peak current and pulse duration.

Press to save the test result or to exit.

## 5.4. Testing Charge Time



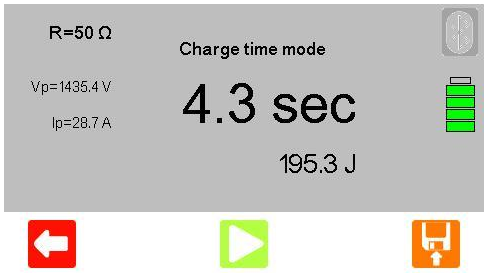

From the Defibrillator mode menu press for Charge time mode.

To accurately measure charge time the defibrillator charge must be called for at exactly the same time is pressed to begin the timer.

As soon as the defibrillator is charged, use the **shock/discharge** button to safely deliver the electrical energy into the Uni-Pulse.

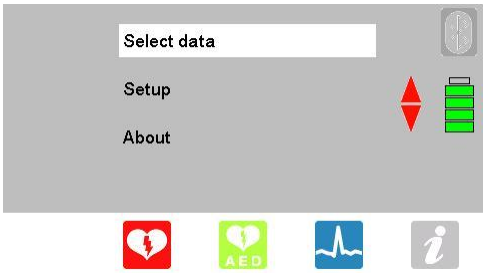
Once the energy discharge is registered by the Uni-Pulse the timer will stop.

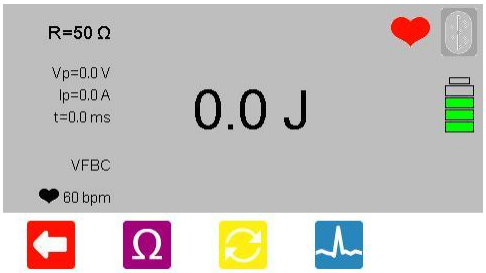
Ensure all safety precautions and safe operating procedures are observed as highlighted in the manufacturer operating instructions for your device.




The charge time will be displayed on the Uni-Pulse screen along with the measured energy, peak voltage, peak current and pulse duration. Press to save the test result or to exit.

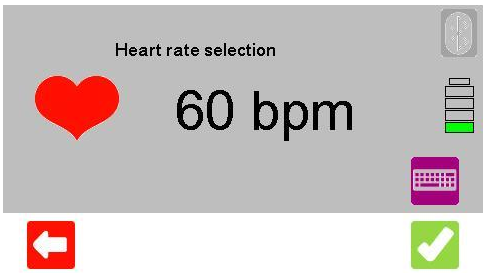
# 6. Analysing Automated External Defibrillators (AED)




From the main menu press AED for AED mode. The Uni-Pulse is now ready to test the function of the AED.

Press to change the output waveform of the Uni-Pulse.



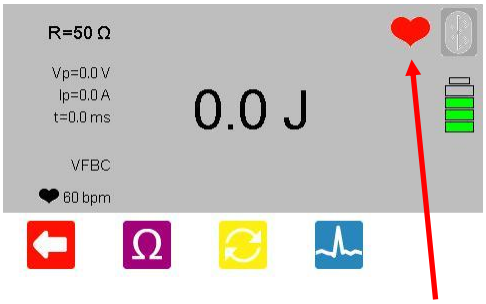

Use the ◄► arrow keys to scroll through the selection of shockable and non-shockable rhythms:

Ventricular Fibrillation Fine (VFBF), shockable
Ventricular Fibrillation Coarse (VFBC), shockable
Polymorphic Ventricular Tachycardia (PVT), shockable.

Normal Sinus Rhythm (NSR), non-shockable
Monomorphic Ventricular Tachycardia (MVT), non-shockable
Atrial Fibrillation (AFB), non-shockable
Asystole (ASYS), non-shockable

Press to change the heart rate. This is only available for NSR, MVT and AFB. ASYS. VFBF and VFBC are set to a default. Use the keyboard to enter a value between 20 and 300 BPM and press to confirm.

Press again to return to the AED menu.

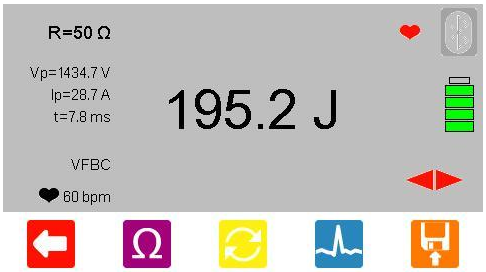


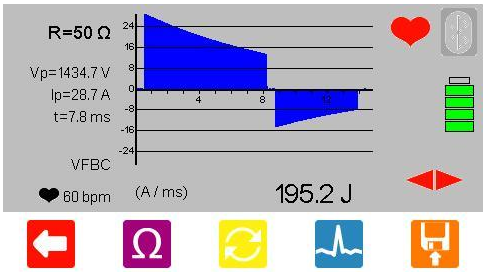

The simulation is active when the red heart symbol is pulsing.

Power on the AED and follow the instructions. The AED will monitor the output rhythm and confirm whether a shock is necessary.

If a shock is advised, use the **shock/discharge** button to safely deliver the electrical energy into the Uni-Pulse.

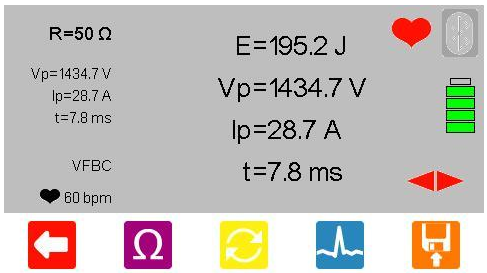
Ensure all safety precautions and safe operating procedures are observed as highlighted in the manufacturer operating instructions for your device.




The measured energy will be displayed on the Uni-Pulse screen along with peak voltage, peak current and pulse duration.

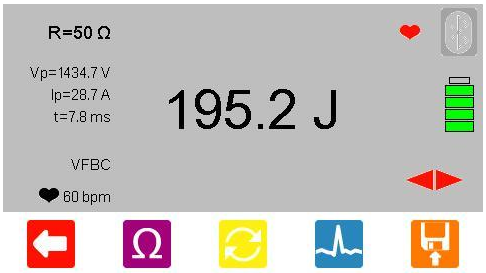
Press the ◄► key to view the waveform graph and a measurement summary.

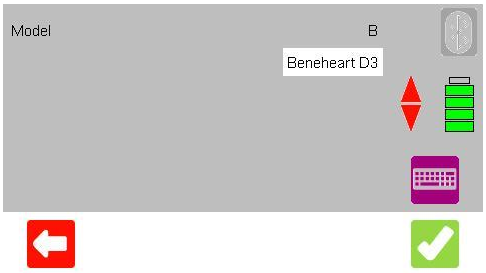



Press to save the test result or to exit.

# 7. Viewing Data

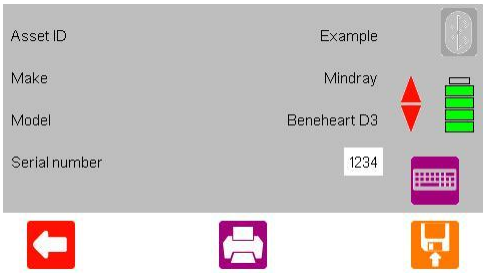
## 7.1. Saving a Test Result

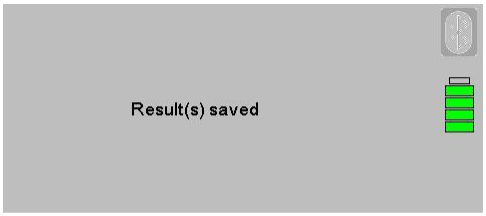



At the end of a test press to save. Enter the save details using the keyboard or scan the Asset ID using the Bluetooth barcode scanner.

If an item of information has previously been saved, the Uni-Pulse will predict the data entry from the first key presses.



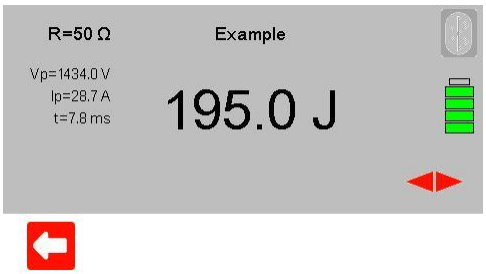




Once all of the information has been entered press to save. A message will be displayed to confirm the save.

## 7.2. Viewing a Saved Test Result

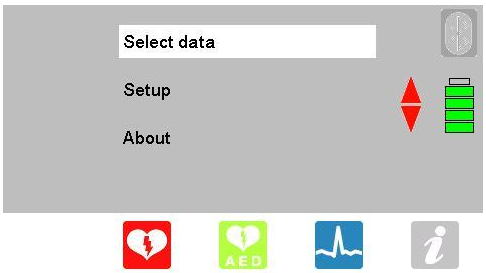
From the main menu, use the arrow keys to highlight Select data and press the ↵ key.

Enter search criteria using the keyboard or an Asset ID using the Bluetooth barcode scanner on the search screen. Press to display the results.



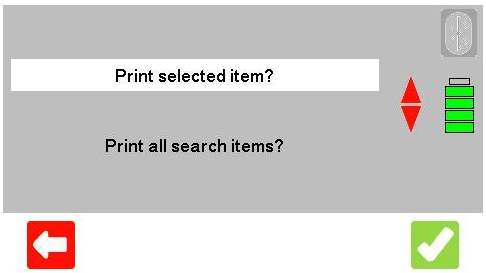

Use the ▲▼ arrow keys to highlight the asset you wish to view and press ✓ to view the test result.

## 7.3. Printing a Saved Test Result



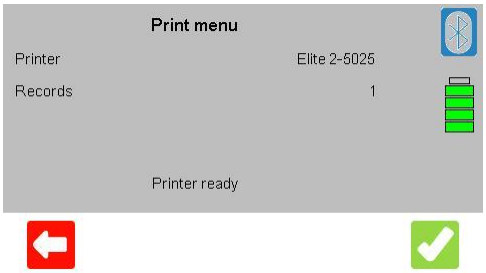
From the main menu, use the ▲▼ arrow keys to highlight Select data and press the ↵ key.

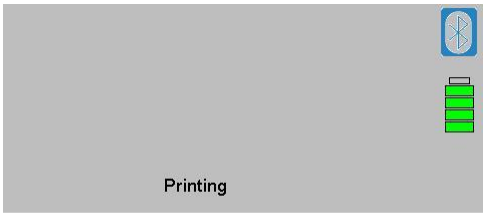
Enter search criteria using the keyboard or an Asset ID using the Bluetooth barcode scanner on the search screen. Press 🔍 to display the results.




Use the ▲▼ arrow keys to highlight the asset you wish to view and press 🖨 to either print this test result or to print results for all items in the list.

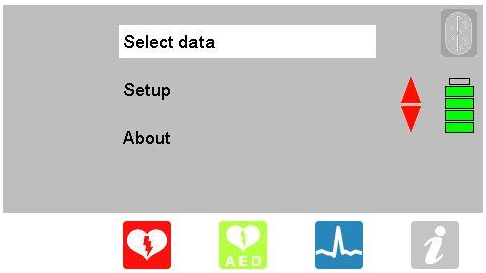
Press ✓ to connect to the printer.



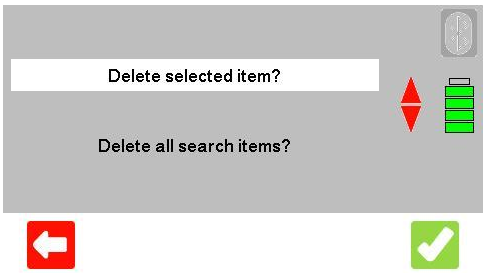

Once the connection is made press to print.

## 7.4. Deleting a Saved Test Result



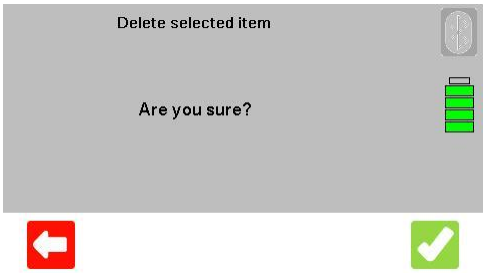
From the main menu, use the arrow keys to highlight Select data and press the ↵ key.

Enter search criteria using the keyboard or an Asset ID using the Bluetooth barcode scanner on the search screen. Press to display the results.




Use the arrow keys to highlight the asset you wish to delete and press to either delete this test result or to delete all results in the list.

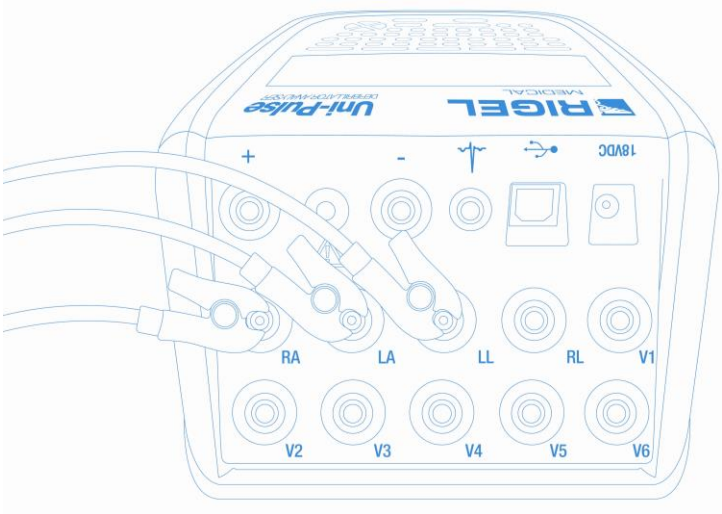
Press to confirm.



Press again to confirm or press to exit.

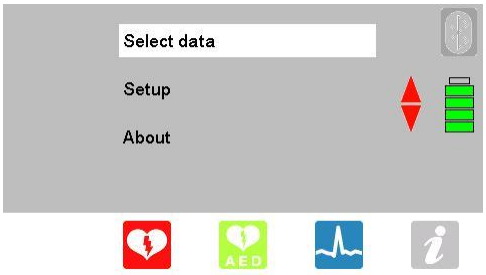
# 8. Simulating ECG Waveforms

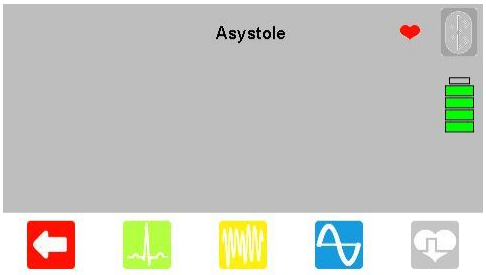
## 8.1. Connecting ECG leads to the Uni-Pulse



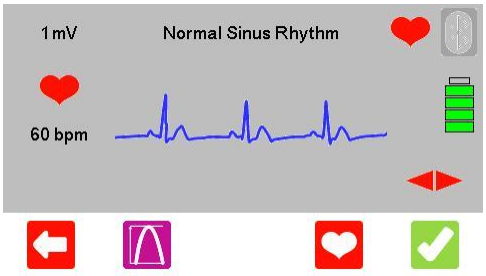

Use the supplied ECG snap connectors to connect ECG leads to the 4mm ECG terminals on the rear of the Uni-Pulse. The ECG connectors are colour coded as per international standards.

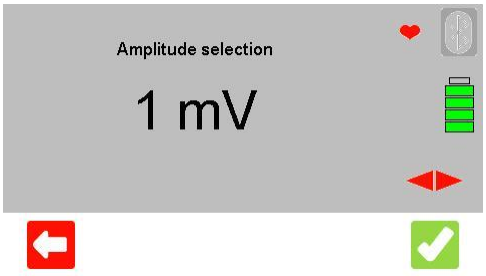
## 8.2. Simulating a Waveform



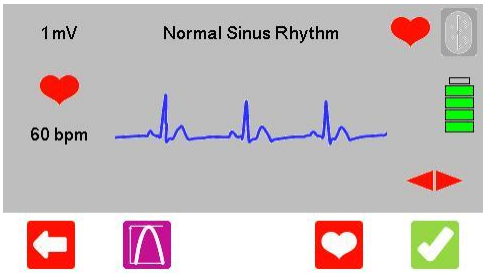

From the main menu press for ECG simulation then press for simulation waveforms.

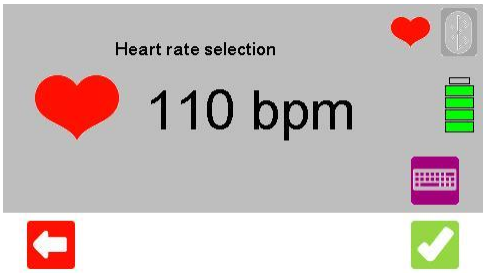


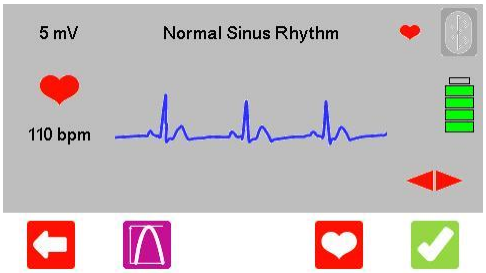

Use the ◄► arrow keys to move between the available simulation waveforms.

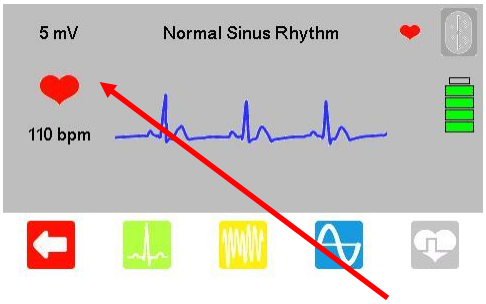
Press to change the Pulse Amplitude to a fixed value of 0.5mV, 1mV, 2mV or 5mV. Press to confirm or to exit without saving.




Press to change the Heart Rate to any value between 20 and 300 BPM. Press to confirm or to exit without saving.



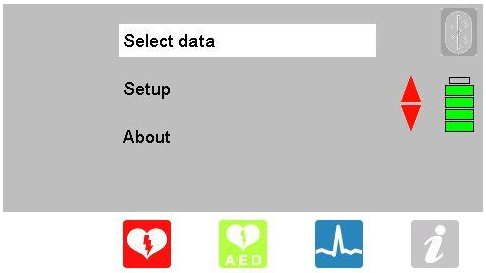



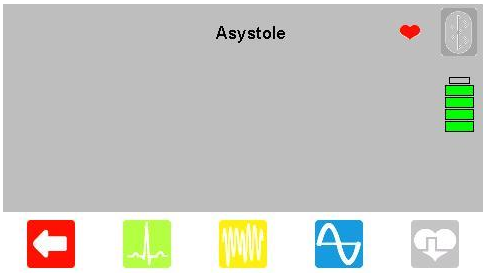

Press to confirm the simulation settings and begin the new simulation. The new amplitude and heart rate settings can be viewed on the left hand side of the display.

The following simulation waveforms are available:

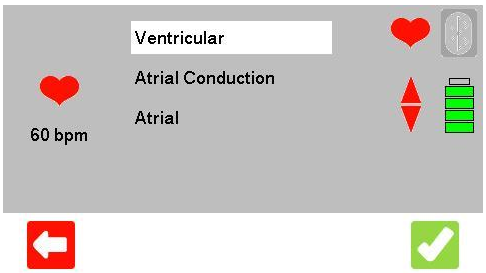
Normal Sinus Rhythm (NSR)
ST Elevation
ST Depression
Myocardial Infarction
Tall T

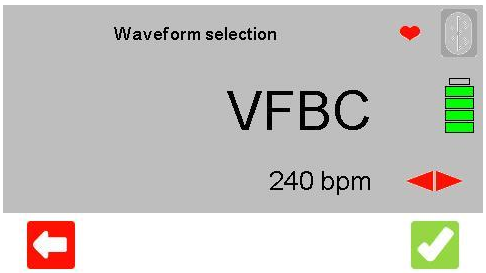
## 8.3. Simulating an Arrhythmia Waveform




From the main menu press for ECG simulation then press for arrhythmia waveforms.



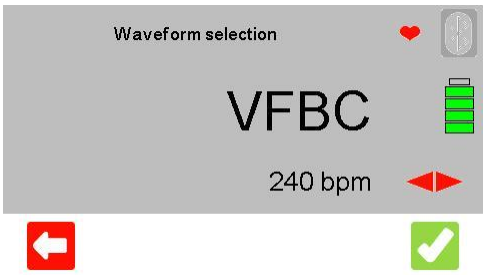




Use the arrow keys to highlight the required arrhythmia type and press to enter the sub-menu.

Use the arrow keys to scroll through the available arrhythmias and press to confirm or to exit.

The following arrhythmia waveforms are available:

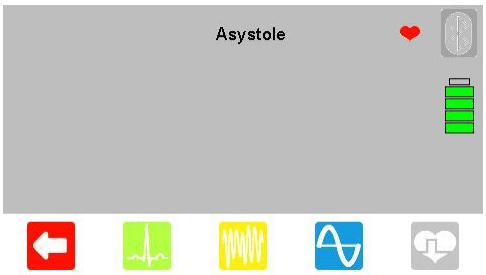
| **Ventricular** | **Atrial Conduction** | **Atrial** |
|---|---|---|
| Ventricular Fibrillation Coarse (VFBC)<br>Ventricular Fibrillation Fine (VFBF)<br>Monomorphic Ventricular Tachycardia (MVT)<br>Polymorphic Ventricular Tachycardia (PVT)<br>Right Focal Premature Ventricular Contraction (RFPVC)<br>Premature Ventricular Contraction Intermittent (PVCI)<br>Premature Ventricular Contraction Continuous (PVCC)<br>Bigeminy (BIG)<br>Trigeminy (TRIG)<br>Ventricular Flutter (VFLT) | First Degree AV Block (FAVB)<br>Second Degree AV Block Mobitz I (SAVB_MI)<br>Second Degree AV Block Mobitz II (SAVB_MII)<br>Third Degree AV Block (TAVB)<br>Right Bundle Branch Block (RBB)<br>Left Bundle Branch Block (LBB)<br>Left Anterior Hemiblock (LAH) | Sinus Arrhythmia (SAR)<br>Missing Beat (MB)<br>Atrial Flutter (AFLT)<br>Atrial Fibrillation (AFB)<br>Paroxysmal Atrial Tachycardia (PAT)<br>Junctional Premature Contraction (JPC) |



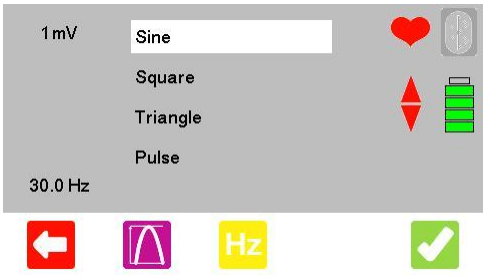

Press to change the Pulse Amplitude and press to change the Heart Rate. If either of these options are unavailable, then the selected waveform has a default setting which can not be changed.

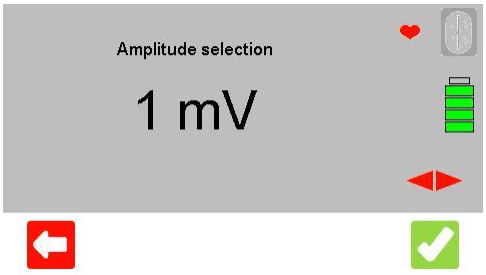
Press to confirm the waveform and again to begin the simulation.

## 8.4. Simulating a Performance Waveform

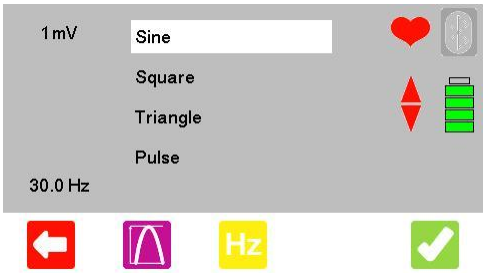


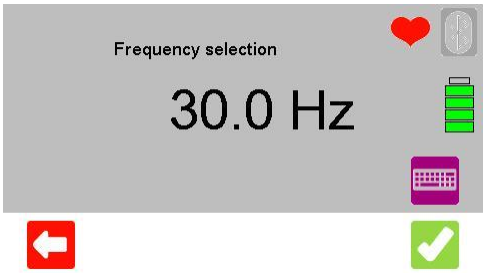

From the main menu press for ECG simulation then press for performance waveforms.




Use the arrow keys to highlight the required performance waveform. Press to change the Pulse Amplitude.

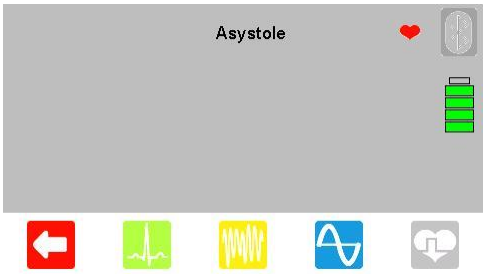


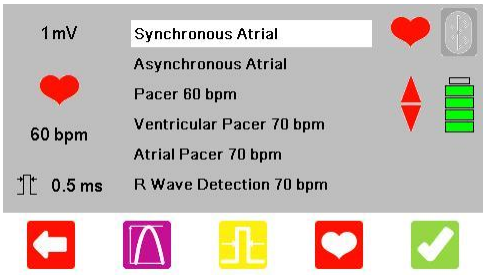

Press Hz to change the Pulse Frequency. Pulse frequency can be set to any value between 0.1Hz and 100Hz.

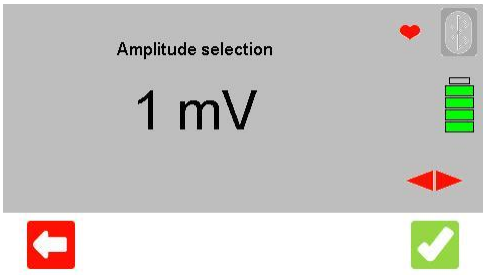
Press to confirm the settings or to exit.

## 8.5. Simulating a Pacer Waveform




From the main menu press for ECG simulation then press for pacer waveforms.



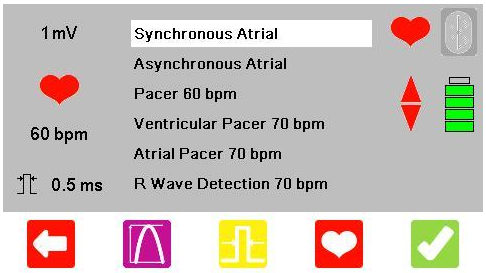



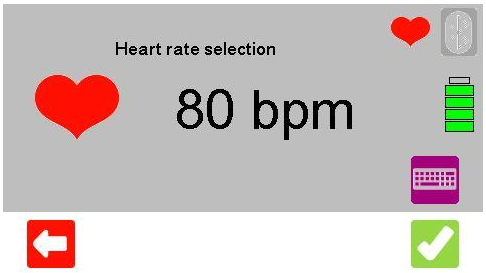

Press to change the Pulse Amplitude.

Press to confirm or to exit.

Press to change the Pulse Width. Pulse width can be set to any value between 0.1ms and 2ms.

Press to confirm or to exit.



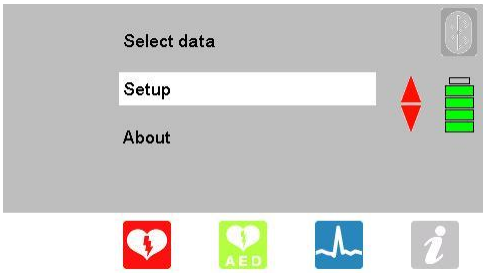

Press to change the Heart Rate.

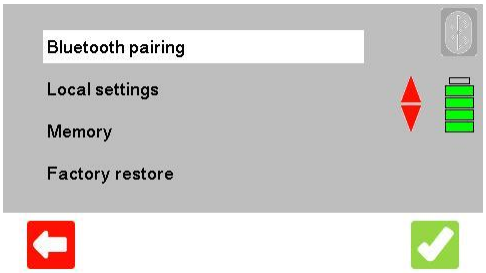
This option is only available for Synchronous Atrial and Asynchronous Atrial. The remaining pacer simulations have a set default heart rate.

Press to confirm or to exit.

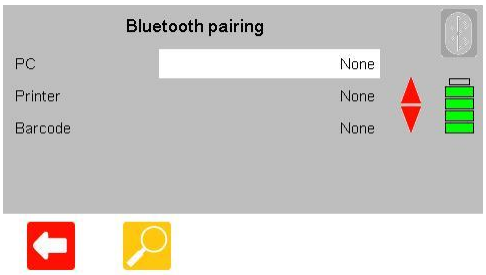
# 9. Connecting to another Device

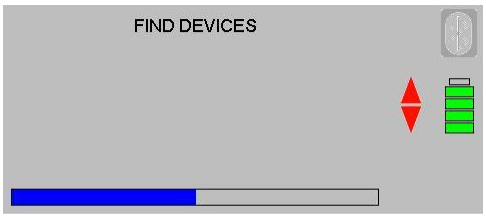
## 9.1. Searching for a Bluetooth Device




From the main menu use the ▲▼ arrow keys to highlight **Setup** and press ↵. Highlight **Bluetooth Pairing** and press ↵**.** The Uni-Pulse is now ready to search for Bluetooth devices.

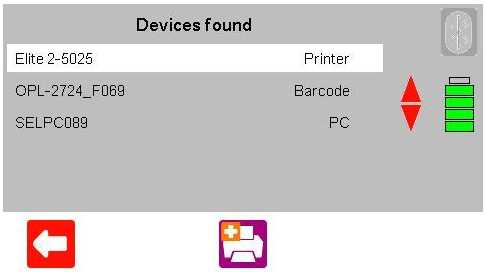


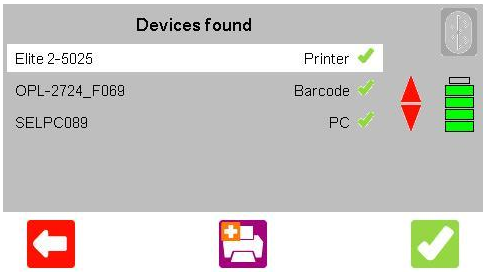




Press 🔍 to begin searching for Bluetooth devices. A blue progress bar will appear displaying the progress of the search.

## 9.2. Connecting to the Test ‘n’ Tag Elite Printer

Ensure the Test ‘n’ Tag Elite Printer is switched on. Consult the user manual for this device for instructions.




A list of available Bluetooth devices will be displayed one searching is complete. Use the ▲▼ arrow keys to scroll through the list and identify the device you wish to pair with.

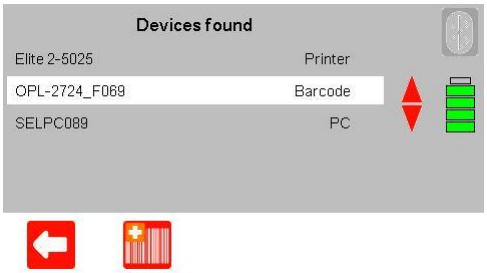
Press to tick the devices to be paired with then press to confirm.

A confirmation message will appear and your paired device will appear in the Bluetooth pairing menu.

Press to confirm and exit.

## 9.3. Connecting to the Bluetooth Barcode Scanner

Ensure the Bluetooth Barcode Scanner is switched on and is discoverable. Consult the user manual for this device for instructions.



A list of available Bluetooth devices will be displayed one searching is complete. Use the **Up/Down** arrow keys to scroll through the list and identify the device you wish to pair with.

Press to tick the devices to be paired with then press to confirm.

A confirmation message will appear and your paired device will appear in the Bluetooth pairing menu.

Press to confirm and exit.

# 10. Environmental Conditions

The Rigel Uni-Pulse has been designed to perform tests and measurements in a dry environment.

Maximum barometric elevation for making measurements is 2000m.

Protective system IP40 according to IEC 60529.

Electromagnetic compatibility (EMC). Interference immunity and emitted interference conforming to IEC 61326-1.

Operating temperature range of 0°C to +40°C, without moisture condensation.

The Uni-Pulse can be stored at any temperature in the range -15°C to +60°C (relative humidity up to 90%).

Operating altitude 0 to 2000m.

# 11. Maintaining the Rigel Uni-Pulse

## 11.1. Cleaning

Clean the external case of the Rigel Uni-Pulse with a clean dry cloth. Avoid using solvents and abrasive scouring agents to clean the external case of the Rigel Uni-Pulse.

Do not allow liquid inside the Rigel Uni-Pulse or near the sockets. Do not use abrasives, solvents or alcohol.

If the Uni-Pulse is subject to liquid ingress, the unit should be returned for repair, stating clearly the cause for repair.

## 11.2. User Maintenance

The Rigel Uni-Pulse 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.

Always check the Uni-Pulse and all accessories for damage and signs of wear before use.
Do not attempt to open the Uni-Pulse. Maintenance should only be performed by authorised personnel.
The Uni-Pulse contains no user serviceable parts.
Keep the Uni-Pulse and accessories clean and dry.
The recommended calibration period for this unit is 12 months.

## 11.3. Return Instructions

For repair or calibration of the Uni-Pulse, please contact Calibration House.

Calibration House
11 Bracken Hill
Southwest Industrial Estate
Peterlee
County Durham
SR8 2LS

Tel: +44 (0)191 587 8739
Fax: +44 (0)191 518 4666

Email: info@calibrationhouse.com

Prior to returning your unit, please contact Calibration House to obtain a RMA.

By obtaining a RMA, your service request can be booked in advance allowing for a quicker turnaround time of your equipment.

Please have your instrument **make**, **model** and **serial number** available.

# 12. Accessories

## 12.1. Standard Contents

Uni-Pulse defibrillator analyser unit
Sling style carry case
AC power supply
ECG snap adaptors
Uni-Pulse quick start guide
USB cable
Calibration certificate

## 12.2. Optional Accessories

386A950 - Paddle adaptor box
339A970 - Test 'n' Tag Elite mobile bluetooth printer
339A923 - Bluetooth barcode scanner

## 12.3. Replacement Spare Parts

298A678 - ECG snap adaptors (pack of 10)
386A011 - AC power supply
386A008 - Battery pack 9.6V/2400mAh
386W507 - Paddle adaptor box lead (Red)
386W508 - Paddle adaptor box lead (Black)
43B759 - 4mm socket link for use with variable load adaptor box

# 13. Specifications

## 13.1. Technical Specifications

**Energy Measurement**

| | |
|---|---|
| Load Resistance | 50Ω ± 1% non-inductive |
| Range (Low) | 0 - 199.9 Joules |
| Resolution | 0.1 Joules |
| Accuracy | ± 1% of reading ± 0.1 Joule |
| Range (High) | 200 - 600 Joules |
| Accuracy | ± 1% of reading ± 1 Joule |
| Voltage | 0 - 6000 Volts |
| Current | 0 - 120 Amps |
| Sampling Rate | 100 kHz sampling frequency |
| Maximum discharge time | 20 ms |

**Cardioversion (Synchronisation) Time**

| | |
|---|---|
| Measurement | From peak of the simulated ECG R-wave to the peak of the defibrillator output pulse. |
| Range | -250 to +250ms |
| Accuracy | 1% of full scale ± 1ms |

**Charge Time**

Measurement is initiated by pressing the function key and simultaneously charging the defibrillator. Charge time is recorded after the defibrillator has discharged across the 50Ω load.

**Discharge Waveform Output**

| | |
|---|---|
| Stored | Waveform is captured onscreen and stored in memory for download/print. |

**ECG Arrhythmia Simulator**

ECG full 12-lead simulation including hi-level output.

**Waveforms**

| | |
|---|---|
| Normal Sinus Rhythm (NSR) | 20 - 300 BPM; Pulse amplitude 0.5, 1, 2, 5mV |
| ST Elevation | 20 - 300 BPM; Pulse amplitude 0.5, 1, 2, 5mV |
| ST Depression | 20 - 300 BPM; Pulse amplitude 0.5, 1, 2, 5mV |
| Myocardial Infarction | 20 - 300 BPM; Pulse amplitude 0.5, 1, 2, 5mV |

**Arrhythmia Waveforms - Ventricular**

| | |
|---|---|
| Premature Ventricular Contraction - Intermittent (PVCI) | 80 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Premature Ventricular Contraction - Continuous (PVCC) | 80 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Bigeminy (BIG) | 80 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Trigeminy (TRIG) | 80 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Ventricular Flutter (VFLT) | 240 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Ventricular Fibrillation - Coarse (VFBC) | 240 BPM Fixed; Pulse amplitude fixed |
| Ventricular Fibrillation - Fine (VFBF) | 240 BPM Fixed; Pulse amplitude fixed |
| Monomorphic Ventricular Tachycardia (MVT) | 210 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Polymorphic Ventricular Tachycardia (PVT) | 240 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Right-focal Premature Ventricular Contraction (RFPVC) | 80 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |

**Arrhythmia Waveforms - Atrial Conduction**

| | |
|---|---|
| First Degree AV Bock (FAVB) | 80 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Second Degree AV Block - Mobitz I (SAVB_MI) | 80 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Second Degree AV Block - Mobitz II (SAVB_MII) | 80 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Third Degree AV Block | 80 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Right Bundle Branch Block (RBB) | 80 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Left Bundle Branch Block (LBB) | 80 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Left Anterior Hemiblock (LAH) | 80 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |

**Arrhythmia Waveforms - Atrial**

| | |
|---|---|
| Sinus Arrhythmia (SAR) | 20 - 300 BPM; Pulse amplitude 0.5, 1, 2, 5mV |
| Missing Beat (MB) | 80 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Atrial Flutter (AFLT) | 20 - 300 BPM; Pulse amplitude 0.5, 1, 2, 5mV |
| Atrial Fibrillation (AFB) | 20 - 300 BPM; Pulse amplitude 0.5, 1, 2, 5mV |
| Paroxysmal Atrial Tachycardia (PAT) | 180 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |
| Junctional Premature Contraction (JPC) | 80 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV |

**Performance Waveforms**

| | |
|---|---|
| Sine | 0.1 - 100Hz; Pulse amplitude 0.5, 1, 2, 5mV |
| Square | 0.1 - 100Hz; Pulse amplitude 0.5, 1, 2, 5mV |
| Triangle | 0.1 - 100Hz; Pulse amplitude 0.5, 1, 2, 5mV |
| Pulse | 0.1 - 100Hz; Pulse amplitude 0.5, 1, 2, 5mV |

**Pacer Waveforms**

| | |
|---|---|
| Synchronous Atrial | 20 - 300 BPM; Pulse amplitude 0.5, 1, 2, 5mV; Pulse width 0.1 - 2ms |
| Asynchronous Atrial | 20 - 300 BPM; Pulse amplitude 0.5, 1, 2, 5mV; Pulse width 0.1 - 2ms |
| Pacer 60 BPM | 60 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV; Pulse width 0.1 - 2ms |
| Ventricular Pacer 70 BPM | 70 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV; Pulse width 0.1 - 2ms |
| Atrial Pacer 70 BPM | 70 BPM Fixed BPM; Pulse amplitude 0.5, 1, 2, 5mV; Pulse width 0.1 - 2ms |
| R-wave Detection 70 BPM | 70 BPM Fixed; Pulse amplitude 0.5, 1, 2, 5mV; Pulse width 0.1 - 2ms |

**Waveform Output**

| | |
|---|---|
| Low Level | 12-lead ECG and on Paddles |
| Hi Level | Output Jack |

**Accuracy**

| | |
|---|---|
| Rate | ± 1% |
| Amplitude | ± 2% (LA-LL), ± 10% (Paddles) |

## 13.2. General Specifications

| | |
|---|---|
| Dimensions | 220mm x 150mm x 90mm (L x W x H) |
| Weight | 1.5kg |
| Operation | 12V/2400mAh Nickel Metal Hydride battery pack |
| Mains Supply | 110/230V AC; 48 to 66Hz, 35VA power supply |
| Storage Environment | -15°C to +60°C |
| Operating Conditions | 0°C to +40°C |
| Environmental Protection | IP 40 |
| Communication | Bluetooth and USB |
| Display | LCD colour graphic display ¼" VGA |
| Memory | 100 test results including graphs |

# 14. Support

## 14.1. Contact Us

**Sales and Delivery enquiries**
Tel: +44 (0) 191 587 8730
Fax: +44 (0) 191 586 0227
Email: sales@rigelmedical.com

**Technical enquiries**
Tel: +44 (0) 191 587 8701
Email: support@rigelmedical.com

**Service, Calibration and Repair**
Tel: +44 (0) 191 587 8739
Fax: +44 (0) 191 518 4666
Email: info@calibrationhouse.com

Rigel Medical
15 - 18 Bracken Hill
South West Industrial Estate
Peterlee
County Durham
SR8 2SW
United Kingdom

Part of
SEAWARD GROUP