BC Biomedical
A UNIT OF BC GROUP INTERNATIONAL, INC.

PROGRAMMABLE PATIENT SIMULATOR REMOTE CONTROL

WITH TRENDING

PSR-2200

USER MANUAL

BC BIOMEDICAL
PSR-2200
TABLE OF CONTENTS

This User Manual covers the following units:

- PSR-2200

WARNING - USERS

The PSR-2200 is for use by skilled technical personnel only.

WARNING - USE

The PSR-2200 is intended for testing only and should never be used in diagnostics, treatment or any other capacity where it would come in contact with a patient.

WARNING - CONNECTIONS

All connections to patients must be removed before connecting the DUT to the Patient Simulator and PSR-2200. A serious hazard may occur if the patient is connected when testing with the Patient Simulator & PSR-2200.

CAUTION - MODIFICATIONS

The PSR-2200 is intended for use within the published specifications. Any application beyond these specifications or any unauthorized user modifications may result in hazards or improper operation.

CAUTION - SERVICE

The PSR-2200 is intended to be serviced only by authorized service personnel. Troubleshooting and service procedures should only be performed by qualified technical personnel.

CAUTION - INSPECTION

The PSR-2200 should be inspected before each use for obvious signs of abuse or wear. The PSR-2200 should not be used and should be serviced if any parts are in question.

CAUTION - CLEANING

Do not immerse. The PSR-2200 should be cleaned by wiping gently with a damp, lint-free cloth. A mild detergent can be used if desired.

CAUTION - LIQUIDS

Do not submerge or spill liquids on the PSR-2200. Do not operate the PSR-2200 if it may have been exposed to fluid.

CAUTION - ENVIRONMENT

Exposure to environmental conditions outside the specifications can adversely affect the performance of the PSR-2200. Allow the PSR-2200 to acclimate to specified conditions for at least 30 minutes before attempting to operate it.

NOTICE – ABBREVIATIONS

ANSI	**American National Standards Institute**
BPM	**Beats Per Minute**
C	**Celsius**
°	**degree(s)**
DUT	**Device Under Test**
ECG	**Electrocardiogram**
F	**Fahrenheit**
Hz	**hertz**
IEC	**International Electrotechnical Commission**
Lbs	**pounds**
LED	**Light Emitting Diode**
mm	**millimeter(s)**
mV	**millivolt(s)**
NEDA	**National Electronic Distributors Association**
USA	**United States of America**
V	**Volt(s)**

NOTICE – DISCLAIMER

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NOTICE – CONTACT INFORMATION

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BC BIOMEDICAL
PSR-2200
PATIENT SIMULATOR REMOTE CONTROL

The Model PSR-2200 is a Microprocessor based remote control for use with the BC Biomedical PS-2200 Series of Patient Simulators. The remote allows the user to configure the patient simulator and provides pre-programmed configurations as well as programmable key functions and key sequences.

The following are highlights of some of the main features:

- 10 FIXED FUNCTION KEYS
- 18 PROGRAMMABLE FUNCTION KEYS
- PROGRAMMABLE KEY NAMES UP TO 20 CHARACTERS
- 10 STEP KEY SEQUENCE PROGRAMMABILITY
- UP TO 30 HOURS WORTH OF TRENDING CAPABILITY
- PC INTERFACE FOR SIMPLE CONFIGURATION
- LARGE GRAPHICS DISPLAY WITH CURSOR SELECTION OF OPTIONS AND SETUP OF PARAMETERS
- DISPLAY BACKLIGHT WITH ADJUSTABLE TIMER
- BATTERY LIFE DISPLAY (0 TO 100%)
- SOFTWARE ADJUSTABLE CONTRAST
- PROGRAMMABLE AUTO SHUTDOWN TO CONSERVE BATTERY LIFE
- FLASH UPGRADEABLE FOR EASY FIRMWARE UPDATES IN THE FIELD
- CUSTOM PROGRAMMABLE FOR LARGE-VOLUME REQUIREMENTS

ACCESSORIES:

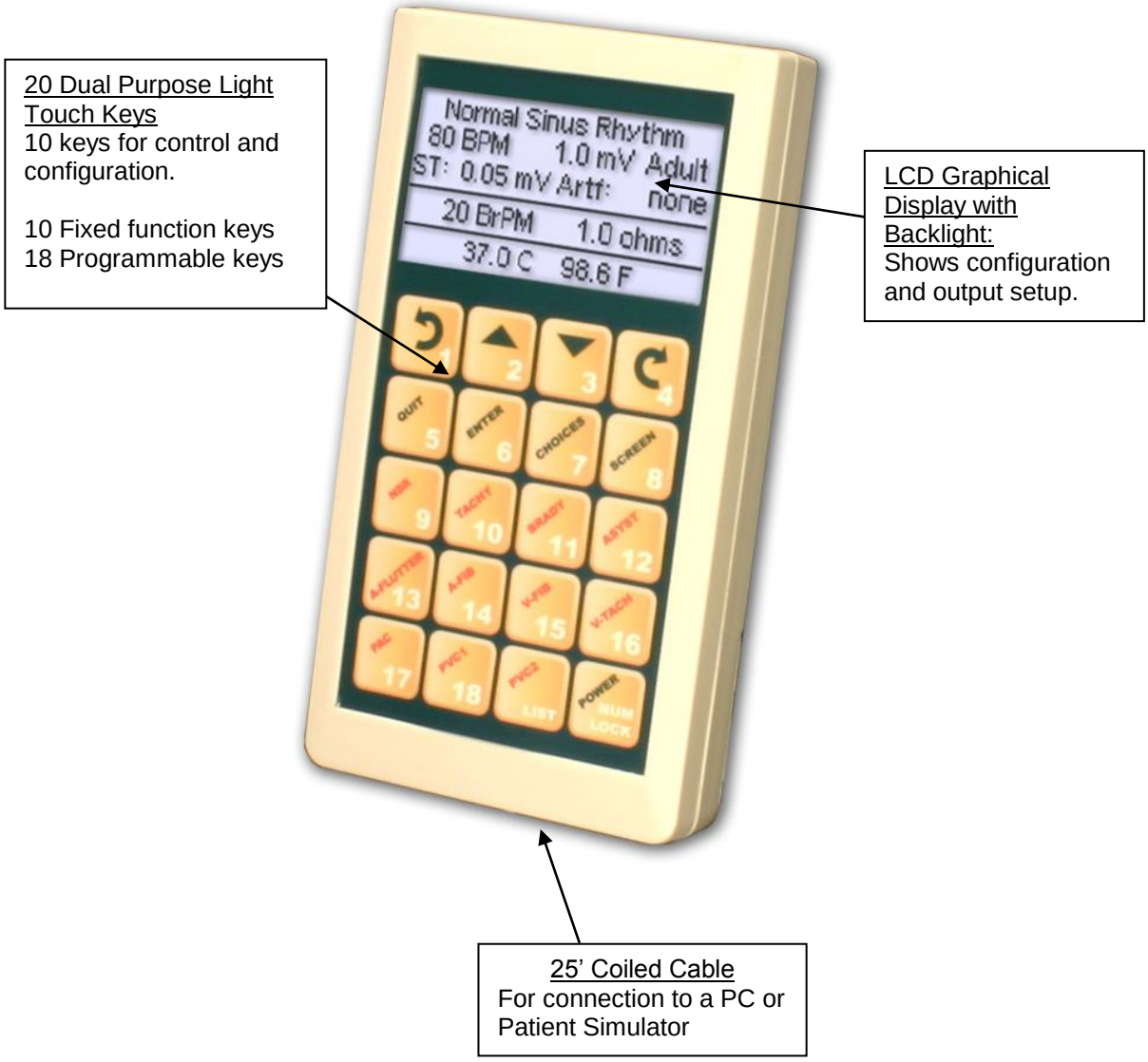
BC20 - 41342	COMMUNICATION CABLE (Mini Din F to DB9 F) (For PC to Remote Programming)

OPTIONAL ACCESSORIES:

BC20 - 41338	COMMUNICATION CABLE (Mini DIN F to DB9 M) (For remote to MPS-450 or Marq III)
BC20 - 41339	COMMUNICATION CABLE ADAPTER (USB to DB9 M) (For use with BC20-41337)

LAYOUT

This section looks at the layout of the PSR-2200 gives descriptions of the elements that are present.



KEYS

20 soft touch keys are provided for system operation:

– Pressing and holding this key for 3 seconds will turn the unit off. Pressing and releasing this key will toggle NUM LOCK MODE. Num Lock mode is identified by a 'NUM' icon in the upper right corner of the screen.

– These keys will change the selected item on the screen. The selected item will be highlighted.

– In the SELECT MODE, if a parameter has been highlighted, these keys with scroll through the available settings.

– This key allows the user to exit the Choices Menu or cancel a selection that has not been entered.

– This key selects a changed option.

– This key is used to show a list of available choices for the selected setting.

– This key toggles the display mode. The available display modes are ECG Output, Blood Pressure Output and Operating Mode.

– These are 10 fixed function keys that configure the Patient Simulator for a pre-defined output configuration.

NOTE: The default outputs can be adjusted using the PSR-2200 keys described above (See the CONTROLLING A PATIENT SIMULATOR Section on page 20 for more details).

(See APPENDIX A – STANDARD CONFIGURATION OUTPUTS for a description of the default outputs of these keys.)

– These are user-defined keys that are accessed via the NUM LOCK MODE. Num Lock is toggled by pressing the 

key.

NOTE: The PSR-2200 has been pre-configured with a default set of NUM LOCK programmed outputs. Each of these is a programmed sequence (See the TRENDING CAPABILITIES Section on page 16 for more details).

(See APPENDIX B – PRE-PROGRAMMED OUTPUTS for a listing of these pre-programmed keys.)

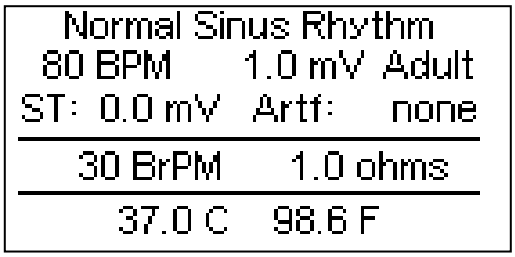
– This key displays the user-defined keys by Keyname. Keynames are programmable via the computer interface.

SCREENS

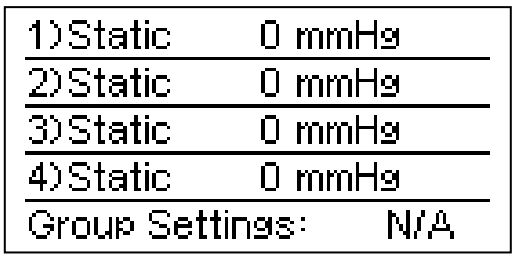
MAIN SCREENS – There are three main screens: ECG, Blood Pressure and Operating Mode. The available screens can be toggled using 

.

ECG SCREEN – The ECG screen shows the current operating mode of the Patient Simulator as well as the parameters that are available for that mode. Operating modes available to the remote control are ECG, Arrhythmias, Pacemaker, Performance, Fetal/Maternal and Cardiac Output.



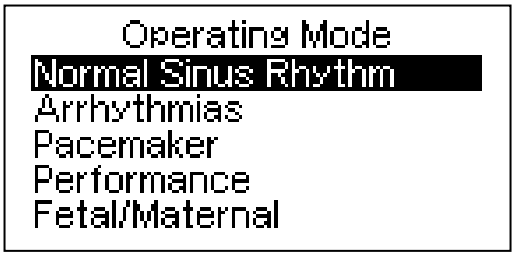
BLOOD PRESSURE SCREEN – The Blood Pressure screen shows the output settings for the Patient Simulator Invasive Blood Pressure Output.



NOTE: Not all patient simulators have four blood pressure channels. Changes made to blood pressure channels that are not present on the patient simulator will not affect the performance or operation of the patient simulator.

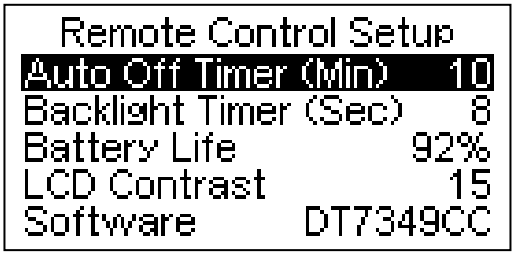
NOTE: Blood Pressure is not active for all operating modes.

OPERATING MODE SCREEN – This screen shows a list of the available Operating Modes. This allows for quickly changing between output modes. The last list item allows for access to the Remote Control Setup screen.



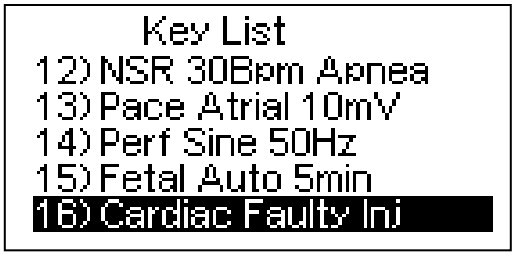
ADDITIONAL SCREENS – There are two additional screens: Remote Control Setup and Key List.

REMOTE CONTROL SETUP SCREEN – This screen shows the setup for the remote control. It can be accessed as the last item on the Operating Mode Screen. The user can select an Auto-Off period, change the LCD Contrast, as well as view the Battery Life and Firmware Version. (See Setup for more information.)



KEY LIST SCREEN – This screen shows the key names for the 18 programmable keys. This gives the user the ability to identify a programmed key by name instead of memorizing key numbers. It can be accessed using the 

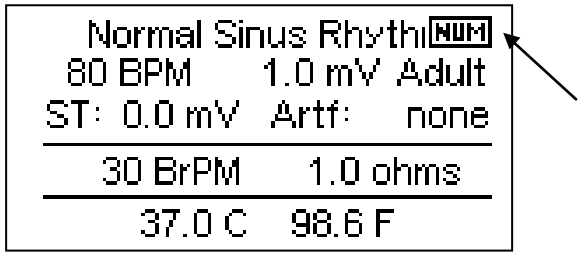
key.



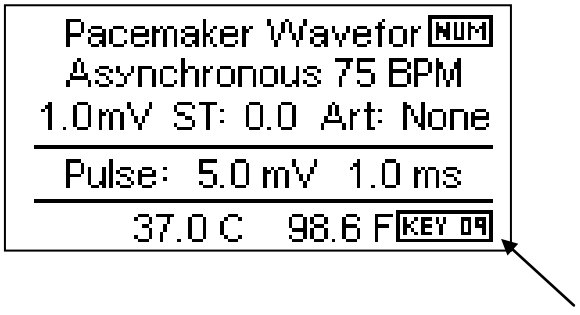
MESSAGES

Several status messages are available to indicate the present state of the system. The following is a brief description of the available messages:

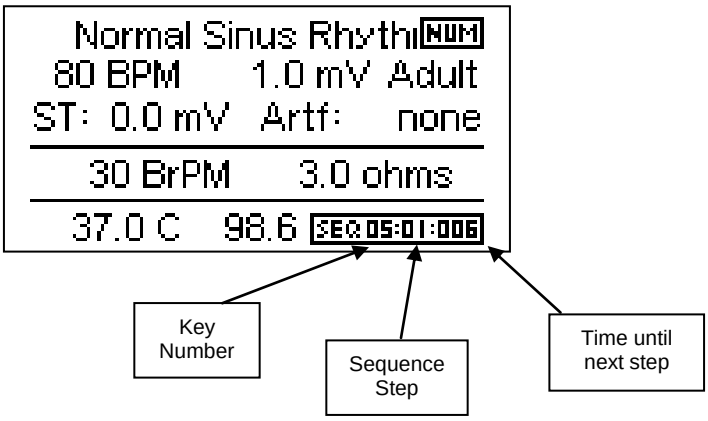
NUM LOCK – This is a small graphic overlay located in the upper right corner of the screen that indicates that the remote is in NUM LOCK MODE and any further key entry will activate the user programmed key configuration.



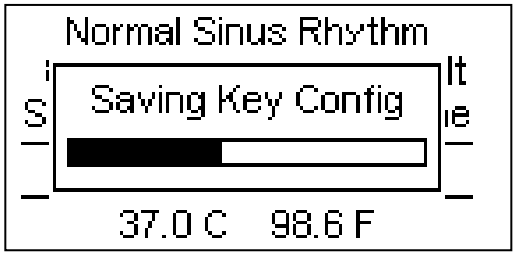
KEY NUMBER– This is a small graphic overlay located in the lower right corner of the screen that indicates which user programmed key function has been loaded.



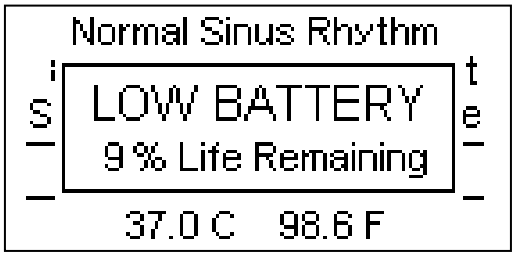
SEQUENCE NUMBER– This is a small graphic overlay located in the lower right corner of the screen that indicates which user programmed key sequence is running.



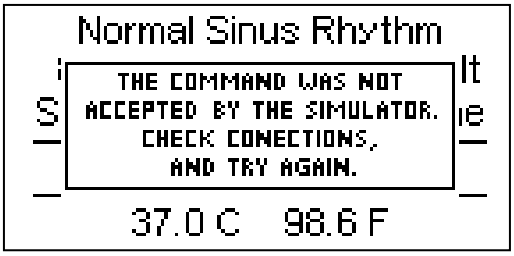
SAVE PROGRESS– This indicator is shown when a key configuration has been successfully sent from the PC. During this process, the key configuration data is being stored to non-volatile memory in the remote control.



LOW BATTERY – This message indicates that the batteries are low and should be replaced.

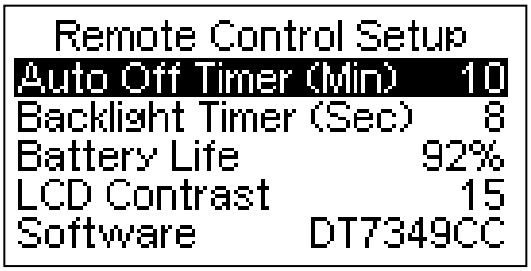


COMMUNICATION ERROR – This message indicates that the simulator did not acknowledge a command that was sent to it. If the cables are connected properly, cycle power on the PSR-2200 and the Patient Simulator and try the command again.



SETUP

The SETUP MODE allows the user to adjust the configuration of the remote. The Setup screen can be entered using the SCREEN 8 key and then selecting the Remote Control Setup item from the Operating Mode list. The parameters can be changed by using 1 4 keys to highlight the desired line and 2 3 to toggle the available options. The Setup screen can be exited using either the QUIT 5 or SCREEN 8 keys.



The following is a breakdown of the parameters available in the configuration of the unit and their available options:

System Setup Configuration		
Parameter	**Description**	**Range**
Auto Off Timer (Min)	Determines the period of inactivity before the unit is turned OFF. A timer is started when the unit is turned ON and is reset each time a key is pressed. When the timer reaches the value set in this parameter, the power is automatically turned OFF. (NOTE: Setting this parameter to 0 disables the Auto Off timer. When running from line power, the unit does not automatically shut off. Auto Off timer is inactive during a test.)	0-30 Minutes
Backlight Timer	Off – Always off 1-20 sec – The elapsed time after which the backlight will automatically turn off. Always ON – The backlight will be on	Off, 1-20 sec, Always On
Battery Life	Displays current life of the battery. At 10%, a warning screen will appear. At 0%, the unit will power down automatically.	0-100% (Read Only)
LCD Contrast	Sets the contrast of the display screen.	0-20
Software	Displays current software program.	(Read Only)

OPERATIONS

CONFIGURATION USING A PC

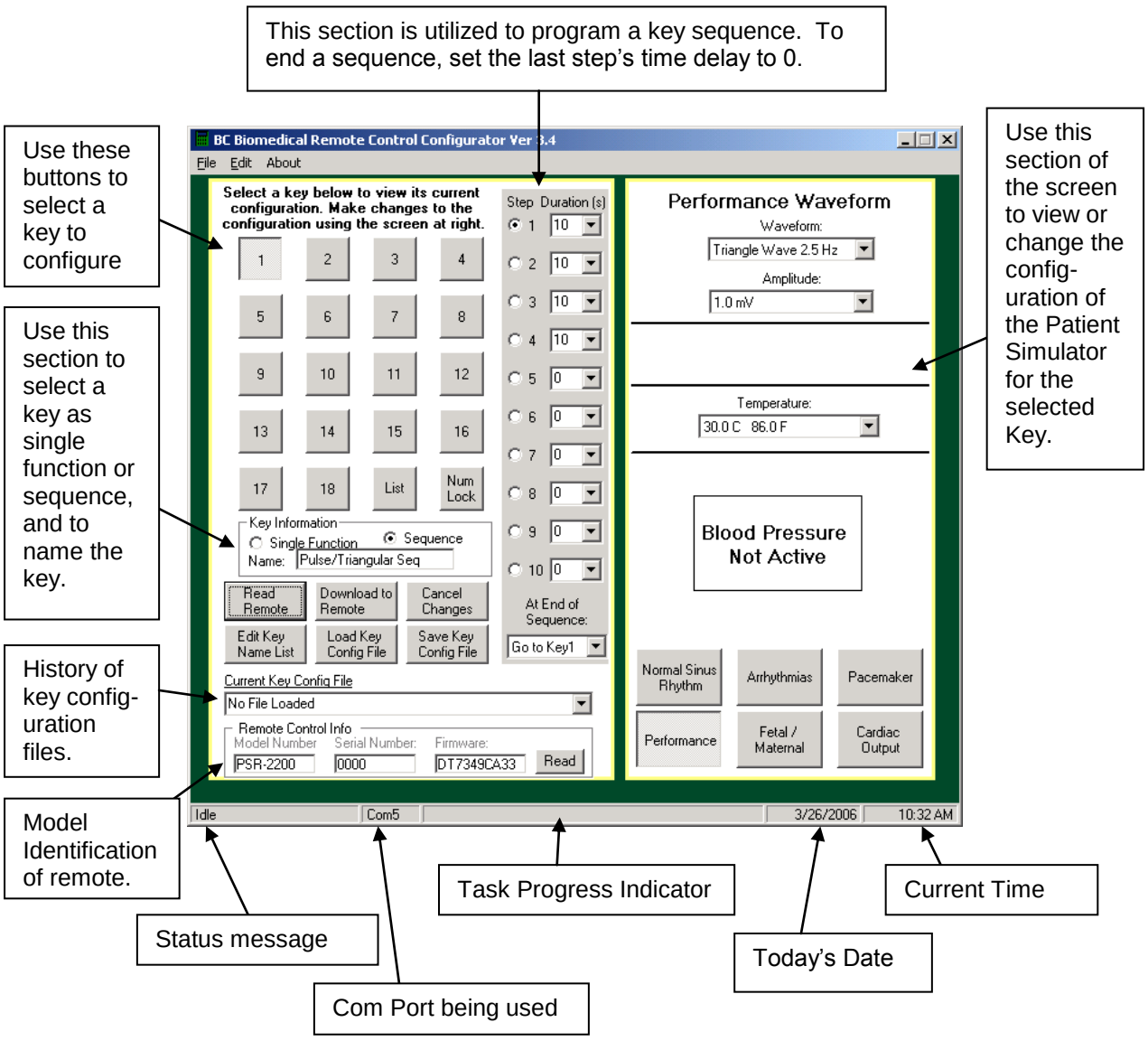
The remote control can be easily programmed through a serial port on any Windows-based computer. For laptops and computers that do not have a serial port, a USB to serial port adapter can be used. This utility program can also be used to “clone” a specific remote control setup to multiple remotes, once the initial remote control is configured and the key configuration file has been stored to the PC.

INSTALLING THE CONFIGURATION UTILITY: To install the windows based configuration utility, simply put the CD into your computer’s drive and follow the on-screen instructions. If the CD does not auto-run, browse to the files contained on the CD and run the SETUP.EXE program.

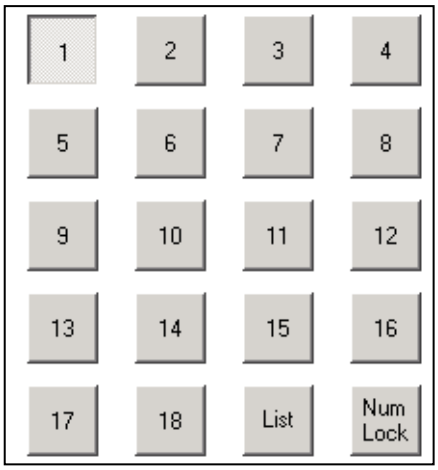
RUNNING THE CONFIGURATION UTILITY: At the end of the installation process, you will be prompted to run the configuration utility. You can start the program at this time, or close the installation program and run the Configuration Utility from an icon that was added to your desktop.

NOTE: If the USB to Serial port converter is used, the drivers must be installed before running the utility.

MAIN CONFIGURATION SCREEN (AT A GLANCE):



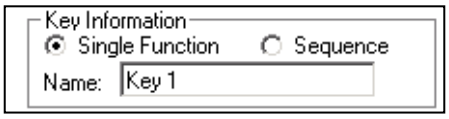
Key Selection:



Use the buttons 1-18 to select a programmable remote key. The selected key will be depressed, as key 1 is shown. When a key is selected, the right half of the screen changes to show the configuration of that key.

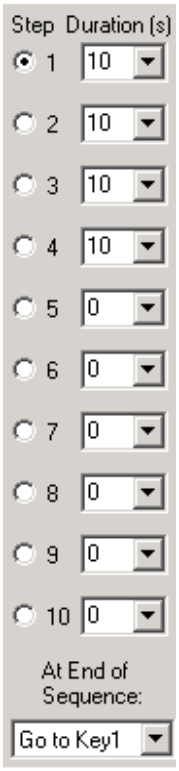
LIST: This key is used to view/edit the Keynames.

Key Information:



This box allows the user to select whether a key will perform a single function or run a sequence of functions and to view/edit the Keyname.

Key Sequence:



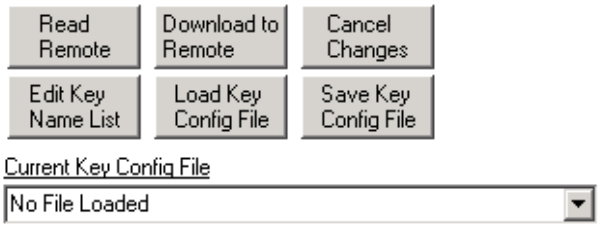
When a key is set to run a sequence, this window is used to program each step of the sequence, the delay between each step and the action to be taken at the end of the sequence. Each step can be programmed to a specific Operating Mode. The delay between steps is programmable from 1 to 600 seconds. If any step delay is set to 0 seconds, the sequence will end at that step. At the end of the sequence, the remote can be set to halt at the current setting or to jump to a specific programmable key. Nested sequences can be performed by programming multiple key sequences and having the end of one sequence jump to another.

Trending Capabilities:

Through the use of Key Sequences, the PSR-2200 is capable of running an endless loop of trended patient physiological data. The 18 separate programmable keys, each of which can be programmed with unique waveform outputs for up to 600 seconds each, can be "daisy-chained" to create a trending pattern with up to 180 unique steps and with a total trend duration of up to 108,000 seconds (30 hours) worth of waveform data.

The PSR-2200 comes with a pre-programmed set of sequence data already assigned to specific keys as listed in Appendix B PRE-PROGRAMMED OUTPUTS.

Control Buttons:



Read Remote: This button is used to read the current settings in the remote.

Download To Remote: This button is used to update the remote with the key configurations shown on the screen.

Cancel Changes: This button cancels any changes that have been made to the selected key configuration. Once a new key is selected, the changes cannot be canceled.

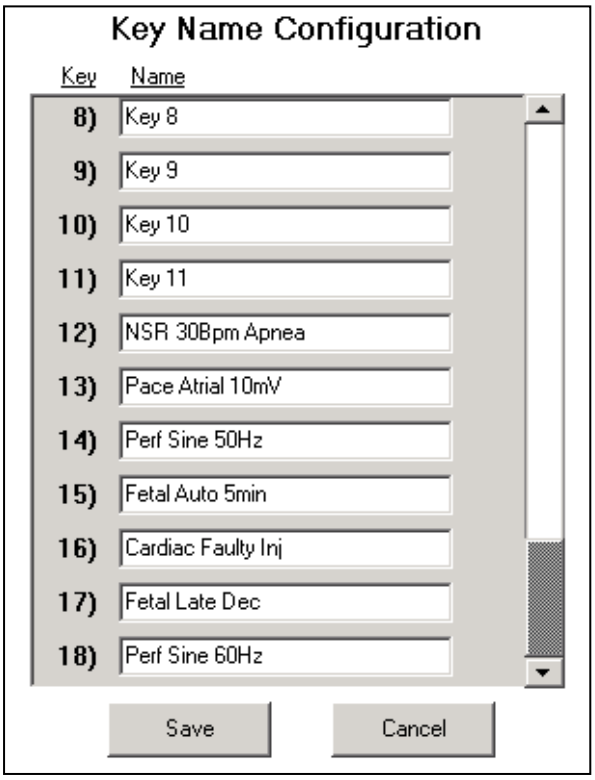
Edit Key Name List: This button is used to show the Keyname list window, which shows a list of all of the Keynames.

Load Key Config File: This button is used to open a key configuration file that has been saved on the computer. As files are opened, they are added to the Current Key Config File history for quick future reference. If changes have been made to an open file, you will be prompted to save them before loading a new file.

Save Key Config File: This button is used to save the current key settings to a file on the computer.

Current Key Config File: This is a listing of the previous config files that have been opened. Selecting a file from the list will cause it to open. If changes have been made to an open file, you will be prompted to save them before loading a new file.

Keyname List:



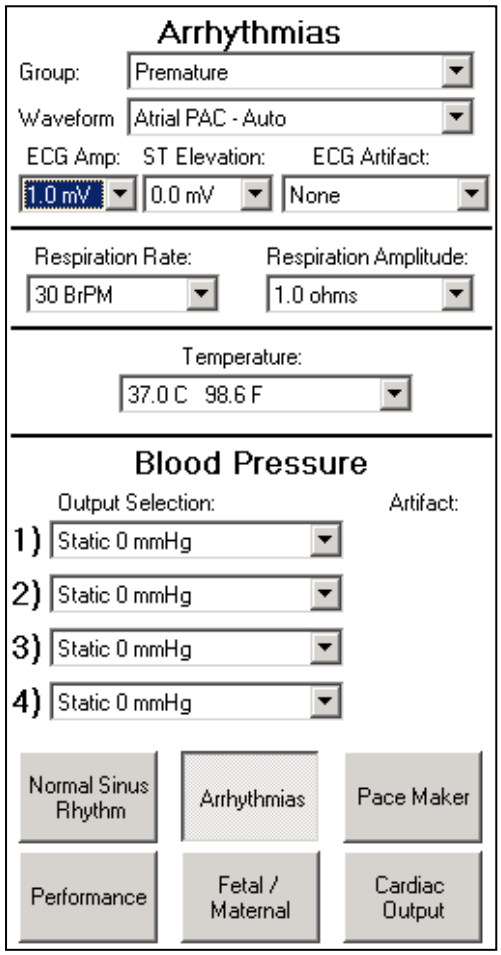
The Keyname List is a quick way to view and change all of the Keynames. By selecting a Keyname, the right hand section of the screen will be updated with that key's configuration.

Save: This button is used to accept any changes made to the Keynames and the close the Keyname screen.

Cancel: This button is used to close the Keyname screen without saving any Keyname changes that were made.

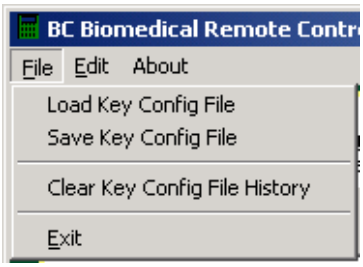
NOTE: Keynames are restricted to 20 characters.

Output Configuration:



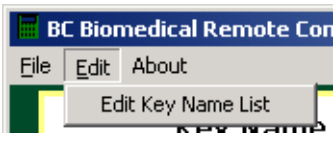
This section shows the Patient Simulator configuration for the selected key. The buttons at the bottom select the Output Mode. The dropdown lists select the setting for each parameter available in the selected output mode.

File Menu:



This menu allows you to load a key configuration file, save a key configuration file, clear the loaded file list history or exit the program.

Edit Menu:



The edit menu provides another way to access the Keyname list.

CONTROLLING A PATIENT SIMULATOR

To control a patient simulator, the remote control is first plugged into the AUX connector of the simulator.

PRE-DEFINED FUNCTIONS: A fixed function can be loaded by pressing the desired key. To make adjustments to the output selections,  and  can be used to select and modify output settings. When the desired output is selected, the  key is used to send the configuration to the Patient Simulator. Any changes made on the remote will be immediately made on the Patient Simulator.

USER PROGRAMMABLE FUNCTIONS: User programmable functions are accessed through the NUM LOCK MODE. This mode is set by pressing the  key.

NOTE: The NUM LOCK MODE is identified by the 'NUM' icon in the upper right corner of the screen.

To select a pre-programmed output, simply press the number of the output while in NUM LOCK MODE.

The 

key can be used to show the list of Keynames that correspond to the user-programmable keys. With the List Mode, the user no longer has to remember which key number corresponds to which Output Mode. The key number can be named and the name is viewed through the Key List Mode. The 

keys are used to select the desired Output Mode and the 

key is used to activate that output.

When a user-defined key is loaded, a small icon will appear in the lower right corner to identify which key number is loaded.

Further modifications can be made to the simulator output by exiting the NUM LOCK MODE and using the 

and 

keys to select and modify output parameters. When the desired output is selected, the 

key is used to send the configuration to the Patient Simulator. Any changes made on the remote will be immediately made on the Patient Simulator.

PATIENT SIMULATOR MODE: The PATIENT SIMULATOR OUTPUT MODE (ECG, Arrhythmia, Pacemaker, Performance, Fetal/Maternal, or Cardiac) can be selected easily by pressing the 

key to select the Operating Mode Menu with the current operating mode selected. The 

and 

keys are used to select the desired Operating Mode and the 

or 

keys are used to activate the new Output Mode.

POWER:

To turn the remote control off, hold the 

key for 3 seconds.

SPECIAL CONFIGURATIONS AVAILABLE:

The PSR-2200 is a unique and extremely versatile instrument, capable of many different configurations. This capability allows for custom configurations for our large-volume customers who desire a dedicated and functionally unique remote control for their patient simulator fleet. If you have special requirements on a large-scale (typically 50 units or more), please feel free to contact us regarding your needs.

POWER

The PSR-2200 is designed for use with a standard 9V Alkaline battery. Additionally, the PSR-2200 can also get power from the PS-2200. With the use of a battery eliminator on the PS-2200, the PSR-2200 can operate indefinitely.

MANUAL REVISIONS

Revision #	Program #	Revisions Made
Rev 01	DT7349CA	Preliminary Manual
Rev 02	DT7349CA	Pre-Programmed Outputs Added
Rev 03	DT7349CA	Appendices Added
Rev 04	DT7349CA	Power Information Added
Rev 05	DT7349CC	Added Backlight
Rev 06	DT7349CC	Accessories Updated
Rev 07	DT7349CD	Manual Format Updated

LIMITED WARRANTY

WARRANTY: BC GROUP INTERNATIONAL, INC. WARRANTS ITS NEW PRODUCTS TO BE FREE FROM DEFECTS IN MATERIALS AND WORKMANSHIP UNDER THE SERVICE FOR WHICH THEY ARE INTENDED. THIS WARRANTY IS EFFECTIVE FOR TWELVE MONTHS FROM THE DATE OF SHIPMENT.

EXCLUSIONS: THIS WARRANTY IS **IN LIEU OF** ANY OTHER WARRANTY EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF **MERCHANTABILITY** OR FITNESS FOR A PARTICULAR PURPOSE.

BC GROUP INTERNATIONAL, INC. IS NOT LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

NO PERSON OTHER THAN AN OFFICER IS AUTHORIZED TO GIVE ANY OTHER WARRANTY OR ASSUME ANY LIABILITY.

REMEDIES: THE PURCHASER'S SOLE AND EXCLUSIVE REMEDY SHALL BE: (1) THE REPAIR OR REPLACEMENT OF DEFECTIVE PARTS OR PRODUCTS, WITHOUT CHARGE. (2) AT THE OPTION OF **BC GROUP INTERNATIONAL, INC.**, THE REFUND OF THE PURCHASE PRICE.

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SPECIFICATIONS

PHYSICAL & ENVIRONMENTAL		
DISPLAY	LCD Graphical 128 X 64 Pixels, White LED Backlight	
CONSTRUCTION	ENCLOSURE	ABS Plastic
	FACE PLATE	Lexan, Back printed
SIZE	5.98 x 3.27 x 1.28 Inches (151.9 x 83.1 x 32.5 mm)	
WEIGHT	< 1 Lbs (0.45 kg)	
OPERATING RANGE	15 to 40 °C (59 to 104 °F)	
STORAGE RANGE	-20 to 65 °C (-4° to 149 °F)	

ELECTRICAL	
BATTERY	9V Alkaline Battery (1 Required) (NEDA 1604 Alkaline or equivalent)

APPENDIX A – STANDARD CONFIGURATION OUTPUTS

There are eleven keys on the remote labeled to provide standard outputs. The following tables detail the outputs for each of the keys:

Standard Outputs	
Key	**Waveform**
NSR	Normal Sinus Rhythm @ 80 BPM
Tachy	Normal Sinus Rhythm @ 160 BPM
Brady	Normal Sinus Rhythm @ 30 BPM
Asyst	Ventricular Arrhthmias Asystole
A-Flutter	Supraventricular Arrhythmias Atrial Flutter
A-Fib	Supraventricular Arrhythmias Atrial Finrillation – Coarse
V-Fib	Supraventricular Arrhythmias Ventricular Fibrillation - Coarse
V-Tach	Ventricular Arrhythmias Ventricular Tachycardia
PAC	Premature Arrythmias Atrial PAC-Auto
PVC1	Premature Arrythmias PVC 1 – Auto
PVC2	Premature Arrythmias PVC 2 – Auto

Common Configuration for Standard Outputs	
Parameter	**Setting**
ECG Amplitude	1.0 mV
Patient Mode	Adult
ST Segment	0 mV
ECG Artifact	None
Respiration	30 BrPM
Respiration Resistance	1 Ω
Temperature	37° C 98.6° F
BP Channel Settings	0 mmHg

APPENDIX B – PRE-PROGRAMMED OUTPUTS

The PSR-2200 comes with a pre-programmed set of sequence data already assigned to specific keys as listed below:

Performance Waveforms

Common Configuration for Performance Outputs	
Parameter	**Setting**
ECG Amplitude	1.0 mV
Temperature	30.0° C / 86.0° F
BP Channel Settings	Not Active

KEY 1 – Square/Triangular Waves Sequence		
Step	**Waveform**	**Duration**
1	Square Wave @ 0.125 Hz	10 seconds
2	Square Wave @ 2.000 Hz	10 seconds
3	Triangle Wave @ 2.000 Hz	10 seconds
4	Triangle Wave @ 2.500 Hz	10 seconds
5	Not Used	-
6	Not Used	-
7	Not Used	-
8	Not Used	-
9	Not Used	-
10	Not Used	-
End of Sequence Action	Repeat Sequence from Step 1	

KEY 2 – Sine Waves Sequence		
Step	**Waveform**	**Duration**
1	Sine Wave @ 0.1 Hz	10 seconds
2	Sine Wave @ 0.5 Hz	10 seconds
3	Sine Wave @ 5.0 Hz	10 seconds
4	Sine Wave @ 10 Hz	10 seconds
5	Sine Wave @ 40 Hz	10 seconds
6	Sine Wave @ 50 Hz	10 seconds
7	Sine Wave @ 60 Hz	10 seconds
8	Sine Wave @ 100 Hz	10 seconds
9	Not Used	-
10	Not Used	-
End of Sequence Action	Repeat Sequence from Step 1	

KEY 3 – Pulse Wave Sequence		
Step	**Waveform**	**Duration**
1	Pulse Wave @ 30 BPM	10 seconds
2	Pulse Wave @ 60 BPM	10 seconds
3	Pulse Wave @ 120 BPM	10 seconds
4	Not Used	-
5	Not Used	-
6	Not Used	-
7	Not Used	-
8	Not Used	-
9	Not Used	-
10	Not Used	-
End of Sequence Action	Repeat Sequence from Step 1	

KEY 4 – R-Wave Sequence		
Step	**Waveform**	**Duration**
1	R-Wave @ 30 BPM	10 seconds
2	R-Wave @ 60 BPM	10 seconds
3	R-Wave @ 80 BPM	10 seconds
4	R-Wave @ 120 BPM	10 seconds
5	R-Wave @ 200 BPM	10 seconds
6	R-Wave @ 250 BPM	10 seconds
7	Not Used	-
8	Not Used	-
9	Not Used	-
10	Not Used	-
End of Sequence Action	Repeat Sequence from Step 1	

Blood Pressure

Common Configuration for Blood Pressure Outputs	
Parameter	**Setting**
ECG Waveform	Normal Sinus Rhythm @ 80 BPM
ECG Amplitude	1.0 mV
Patient Mode	Adult
ST Segment	0 mV
ECG Artifact	None
Respiration	30 BrPM
Respiration Resistance	1 Ω
Temperature	37.0° C / 98.6° F

KEY 5 – Blood Pressure Sequence			
Step	**BP Channels**	**Waveform**	**Duration**
1	All	Static 0 mmHg	10 seconds
2	All	Static 20 mmHg	10 seconds
3	All	Static 40 mmHg	10 seconds
4	All	Static 60 mmHg	10 seconds
5	All	Static 100 mmHg	10 seconds
6	All	Static 150 mmHg	10 seconds
7	All	Static 200 mmHg	10 seconds
8	All	Static 250 mmHg	10 seconds
9	All	Static 300 mmHg	10 seconds
10	All	Static 400 mmHg	10 seconds
End of Sequence Action		Repeat Sequence from Step 1	

Respiration

Common Configuration for Respiration Outputs	
Parameter	**Setting**
ECG Waveform	Normal Sinus Rhythm @ 80 BPM
ECG Amplitude	1.0 mV
Patient Mode	Adult
ST Segment	0 mV
ECG Artifact	None
Respiration Resistance	1 Ω
Temperature	37.0° C / 98.6° F
BP Channel Settings	0 mmHg

KEY 6 – Respiration Sequence		
Step	**Respiration Rate**	**Duration**
1	0 BrPM Apnea	10 seconds
2	15 BrPM	10 seconds
3	20 BrPM	10 seconds
4	30 BrPM	10 seconds
5	40 BrPM	10 seconds
6	60 BrPM	10 seconds
7	80 BrPM	10 seconds
8	100 BrPM	10 seconds
9	120 BrPM	10 seconds
10	Not Used	-
End of Sequence Action	Repeat Sequence from Step 1	

KEY 7 – Apnea Sequence		
Step	**Respiration Rate**	**Duration**
1	30 BrPM	30 seconds
2	12 Second Apnea	30 sec step time
3	30 BrPM	30 seconds
4	22 Second Apnea	30 sec step time
5	30 BrPM	30 seconds
6	32 Second Apnea	60 sec step time
7	30 BrPM	10 seconds
8	Apnea	15 seconds
9	Not Used	–
10	Not Used	–
End of Sequence Action	Repeat Sequence from Step 1	

ECG Artifact

Common Configuration for Artifact Outputs	
Parameter	**Setting**
ECG Waveform	Normal Sinus Rhythm @ 80 BPM
ECG Amplitude	1.0 mV
Patient Mode	Adult
ST Segment	0 mV
Respiration	30 BrPM
Respiration Resistance	1 Ω
Temperature	37.0° C / 98.6° F
BP Channel Settings	0 mmHg

KEY 8 – ECG Artifact Sequence		
Step	**Artifact**	**Duration**
1	None	15 seconds
2	50 Hz Noise	15 seconds
3	60 Hz Noise	15 seconds
4	Muscle	15 seconds
5	Baseline Wander	15 seconds
6	Respiration	15 seconds
7	Not Used	–
8	Not Used	–
9	Not Used	–
10	Not Used	–
End of Sequence Action	Repeat Sequence from Step 1	

Temperature

Common Configuration for Temperature Outputs	
Parameter	**Setting**
ECG Waveform	Normal Sinus Rhythm @ 80 BPM
ECG Amplitude	1.0 mV
Patient Mode	Adult
ST Segment	0 mV
ECG Artifact	None
Respiration	30 BrPM
Respiration Resistance	1 Ω
BP Channel Settings	0 mmHg

KEY 9 – Temperature Sequence		
Step	**Temperature**	**Duration**
1	0 Deg C / 32.0 Deg F	15 seconds
2	24 Deg C / 75.2 Deg F	15 seconds
3	30 Deg C / 86.0 Deg F	15 seconds
4	35 Deg C / 95.0 Deg F	15 seconds
5	37 Deg C / 98.6 Deg F	15 seconds
6	40 Deg C / 104.0 Deg F	15 seconds
7	42 Deg C / 107.6 Deg F	15 Seconds
8	Not Used	-
9	Not Used	-
10	Not Used	-
End of Sequence Action	Repeat Sequence from Step 1	

Arrhythmias

Common Configuration for Arrhythmia Outputs	
Parameter	**Setting**
ECG Amplitude	1.0 mV
Patient Mode	Adult
ST Segment	0 mV
ECG Artifact	None
Respiration	30 BrPM
Respiration Resistance	1 Ω
Temperature	37.0 Deg C / 98.6 Deg F
BP Channel Settings	0 mmHg

KEY 10 – Premature Sequence		
Step	**Premature Arrhythmia Waveform**	**Duration**
1	Atrial PAC – Auto	60 seconds
2	Nodal PNC – Auto	60 seconds
3	PVC 1 – Auto	60 seconds
4	PVC 1 Early – Auto	60 seconds
5	PVC 1 R on R – Auto	60 seconds
6	PVC 2 – Auto	60 seconds
7	PVC 2 Early – Auto	60 seconds
8	PVC R on T – Auto	60 seconds
9	Multifocal PVC – Auto	60 seconds
10	Not Used	-
End of Sequence Action	Repeat Sequence from Step 1	

KEY 11 – Supraventricular Sequence		
Step	**Supervent Arrhythmia Waveform**	**Duration**
1	Atrial Fibrillation – Course	60 seconds
2	Atrial Fibrillation – Fine	60 seconds
3	Atrial Flutter	60 seconds
4	Atrial Tachycardia	60 seconds
5	Paroxysmal Atrial Tachycardia	60 seconds
6	Supraventricular Tachycardia	60 seconds
7	Sinus Arrhythmia	60 seconds
8	Missed Beat – Auto	60 seconds
9	Missed Beat – Manual	60 seconds
10	Nodal Rhythm	60 seconds
End of Sequence Action	Repeat Sequence from Step 1	

KEY 12 – Ventricular Sequence		
Step	**Ventricular Arrhythmia Waveform**	**Duration**
1	Pair of PVCs – Auto	60 seconds
2	Run of 5 PVCs – Auto	60 seconds
3	Run of 11 PVCs – Auto	60 seconds
4	6 PVCs per Minute	60 seconds
5	12 PVCs per Minute	60 seconds
6	24 PVCs per Minute	60 seconds
7	Frequent Multifocal PVCs	60 seconds
8	Bigeminy	60 seconds
9	Trigeminy	60 seconds
10	Ventricular Tachycardia	60 seconds
End of Sequence Action	Repeat Sequence from Step 1	

KEY 13 – Conduction Sequence		
Step	**Conduction Arrhythmia Waveform**	**Duration**
1	1st Degree Heart Block	60 seconds
2	2nd Degree Heart Block	60 seconds
3	3rd Degree Heart Block	60 seconds
4	Right Bundle Branch Block	60 seconds
5	Left Bundle Branch Block	60 seconds
6	Not Used	-
7	Not Used	-
8	Not Used	-
9	Not Used	-
10	Not Used	-
End of Sequence Action	Repeat Sequence from Step 1	

KEY 14 – Pacemaker Sequence		
Step	**Pacemaker Waveform**	**Duration**
1	Atrial @ 80 BPM	60 seconds
2	Asynchronous @ 75 BPM	60 seconds
3	Non-Capture	60 seconds
4	Non- Function	60 seconds
5	Demand – Occasional	60 seconds
6	Demand – Frequent	60 seconds
7	AV Sequential	60 seconds
8	Not Used	-
9	Not Used	-
10	Not Used	-
End of Sequence Action	Repeat Sequence from Step 1	

Fetal / Maternal

Common Configuration for Fetal / Maternal Outputs	
Parameter	**Setting**
Maternal ECG	80 BPM
Fetal ECG	120 BPM
Trigger Mode	2 Minutes

KEY 15 – Fetal / Maternal Sequence		
Step	**IUP Simulation**	**Duration**
1	Uniform Deceleration	360 seconds
2	Early Deceleration	360 seconds
3	Late Deceleration	360 seconds
4	Uniform Acceleration	360 seconds
5	Not Used	-
6	Not Used	-
7	Not Used	-
8	Not Used	-
9	Not Used	-
10	Not Used	-
End of Sequence Action	Repeat Sequence from Step 1	

Sick Patient

Common Configuration for Sick Patient Outputs	
Parameter	**Setting**
ECG Amplitude	1.0 mV
Patient Mode	Adult
Respiration Resistance	1 Ω

KEY 16 – Sick Patient 1 Sequence			
Step	**IUP Simulation**		**Duration**
1	Heart Rate ST Elevation Artifact Respiration Temperature BP Channel 1	90 BPM 0.1 mV None 40 BrPM 35 Deg C/95 Deg F 120/80	60 seconds
2	Heart Rate ST Elevation Artifact Respiration Temperature BP Channel 1	100 BPM 0.0 mV Respiration 40 BrPM 40 Deg C/104 Deg F 120/80 w/5 mm artifact	15 seconds
3	Heart Rate ST Elevation Artifact Respiration Temperature BP Channel 1	120 BPM 0.5 mV Baseline Wander 60 BrPM 40 Deg C/104 Deg F 120/80 w/10 mm artifact	30 seconds
4	Heart Rate ST Elevation Artifact Respiration Temperature BP Channel 1	140 BPM 0.4 mV Muscle 60 BrPM 42 Deg C/104 Deg F 120/80 w/10 mm artifact	10 seconds
5	Heart Rate ST Elevation Artifact Respiration Temperature BP Channel 1	180 BPM 0.8 mV Baseline Wander 80 BrPM 40 Deg C/104 Deg F 120/80 w/16 mm artifact	15 seconds
6	Heart Rate ST Elevation Artifact Respiration Temperature BP Channel 1	140 BPM 0.4 mV None 60 BrPM 40 Deg C/104 Deg F 120/80 w/10 mm artifact	15 seconds
7	Heart Rate ST Elevation Artifact Respiration Temperature BP Channel 1	100 BPM 0.1 mV Baseline Wander 40 BrPM 35 Deg C/95 Deg F 120/80	15 seconds
8	Heart Rate ST Elevation Artifact Respiration Temperature BP Channel 1	90 BPM 0.1 mV None 40 BrPM 35 Deg C/95 Deg F 120/80	15 seconds
9	Not Used		-
10	Not Used		-
End of Sequence Action		Repeat Sequence from Step 1	

NSR Rate

Common Configuration for NSR Rate Outputs	
Parameter	**Setting**
ECG Amplitude	1.0 mV
Patient Mode	Adult
ST Segment	0 mV
ECG Artifact	None
Respiration	30 BrPM
Respiration Resistance	1 Ω
Temperature	37.0 Deg C / 98.6 Deg F
BP Channel Settings	120/80

KEY 17 – NSR Rate Ramp Sequence			
Step	**ECG**	**Respiration**	**Duration**
1	20 BPM	15 BrPM	15 seconds
2	40 BPM	20 BrPM	15 seconds
3	45 BPM	40 BrPM	15 seconds
4	60 BPM	60 BrPM	15 seconds
5	80 BPM	80 BrPM	15 seconds
6	90 BPM	80 BrPM	15 seconds
7	100 BPM	100 BrPM	15 Seconds
8	120 BPM	120 BrPM	15 Seconds
9	140 BPM	120 BrPM	15 Seconds
10	180 BPM	120 BrPM	15 Seconds
End of Sequence Action		Repeat Sequence from Step 1	

Ventricular Fibrillation

Common Configuration for V-Fib Outputs	
Parameter	**Setting**
ECG Amplitude	1.0 mV
Patient Mode	Adult
ST Segment	0 mV
ECG Artifact	None
Respiration	30 BrPM
Respiration Resistance	1 Ω
Temperature	37.0 Deg C / 98.6 Deg F
BP Channel Settings	0 mmHg

KEY 18 – V-Fib Sequence		
Step	**Waveform**	**Duration**
1	NSR @ 80 BPM	30 seconds
2	Run of 5 PVCs	30 seconds
3	NSR @ 80 BPM	30 seconds
4	Run of 11 PVCs	30 seconds
5	Ventricular Tachycardia	15 seconds
6	Ventricular Fibrillation – Course	10 seconds
7	Ventricular Fibrillation – Fine	10 seconds
8	Asystole	10 seconds
9	Not Used	-
10	Not Used	-
End of Sequence Action	Repeat Sequence from Step 1	

NOTES

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