

FLUKE®

Biomedical

medSim 300B

Patient Simulator

Operators Manual

PN 2243039

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Notices

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If the instrument is delivered in good physical condition but does not operate within specifications, or if there are any other problems not caused by shipping damage, please contact Fluke Biomedical or your local sales representative.

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1. Every product returned to Fluke must have a Return Material Authorization (RMA) number. To obtain an RMA, contact Fluke through one of the following methods:

Phone: 888-99FLUKE (888-993-5853) or 425-446-5560

Email: service@fluke.com

2. Pack the instrument carefully, using the original packing materials if available. Failure to pack the instrument properly could void your warranty and result in you paying for the instrument's repair.
3. Insure the unit for full retail value and ship to the address specified by Fluke.

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Chapter 1

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Introduction

The medSim 300B is a high performance patient simulator that generates the following physiological simulations:

- ECG waveforms
- Respiration
- Four dynamic blood pressure channels
- Dynamic and static temperature

All functions are set from a 2-line by 24-character LCD display and a keyboard with seven keys.

The medSim 300B has three electrically isolated sections for the simulation circuitry:

- ECG and respiration
- Blood pressure
- Temperature

Functions can be controlled remotely using the RS-232 serial port interface.

Two optional features are available:

- Option 1 (Cardiac Catheterization, Fetal/Maternal ECG with Intrauterine Pressure and Intra-aortic Balloon Pump)
- Cardiac Output Option

Safety Considerations

General

This instrument and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

Safety Symbols

Warning

The warning sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a warning sign until the indicated conditions are fully understood and met.

Caution

The caution sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

medSim 300B Instrument Specifications

ECG Section

The ECG configuration is 12-lead with independent outputs for each signal lead referenced to RL, and provides:

- A "High Level ECG" output.
- Selectable parameters including rate, amplitude, ST segment deviation, axis deviation, neonatal waveforms, performance waveforms, R-wave detection, PVC focus, PVC timing, PVCs per minute, arrhythmias (32), pacemaker amplitude, and pacemaker width.
- Input for interactive defibrillator training and simulation.

Normal Sinus Rhythm ECG Waveform Selections

Rate:	30, 60, 80, 120, 160, 200, 240, and 300 BPM
	Accuracy: 1 %
Amplitude:	Lead II
	0.05 mV to 0.5 mV in 0.05 mV steps
	0.50 mV to 5.5 mV in 0.25 mV steps
	The high level output is approximately 0.2 V per mV of the low level output. Selection is either manual or automatic at stepped intervals of 6 seconds
	Accuracy: 5 % on Lead II into a 100 Hz low pass filter
Impedance to the RL Lead:	Limb leads are selectable at 500 Ω , 1000 Ω , 1500 Ω and 2000 Ω . The V-leads are 1000 Ω
	Accuracy: 5%
ST Segment Deviation (Elevation and Depression):	Lead II at 1 mV
	+0.8 mV to -0.8 mV in 0.1 mV steps, also +0.05 mV and -0.05 mV
	Both manual and auto-stepping modes. Auto-step time interval is 12 seconds
	Operates at ECG rates from 30 to 160 BPM
Axis Deviation:	Horizontal, vertical and intermediate heart positions

ECG Performance Waveform Selections

Amplitudes are set by "Baseline ECG Amplitude". Amplitude applies to Lead II and V-leads. Lead I is 0.7 times Lead II; Lead III is 0.3 times Lead II. The V-leads are the same as Lead II.

Performance Waveforms	Rates
Zero	Zero output
Pulse	4 seconds
Square	2 Hz
Triangle	2 Hz
Sine	0.05, 0.5, 1, 10, 25, 30, 40, 50, 60, and 100 Hz
R-Wave Detection	Width: 20 ms increments from 20 to 200 ms and two smaller widths of 8 and 12 ms. Auto-step time interval is 6 seconds.
	Amplitude: 0.05 mV to 0.5 mV in 0.05 mV steps; 0.5 mV to 5.5 mV in 0.25 mV steps. Auto-step time interval is 6 seconds.
	R-Wave Rate: 60 BPM

Arrhythmia Selections

Supraventricular	Atrial fibrillation (1 and 2)
	Atrial flutter
	Sinus arrhythmia
	Missed beat at 80 BPM
	Missed beat at 120 BPM
	Paroxysmal atrial tachycardia (PAT)
	Nodal rhythm
	Supraventricular tachycardia (SVT)
Premature	Premature atrial contraction (PAC)
	Premature nodal contraction (PNC)
	Premature ventricular contraction (PVC)
	Multifocal 1
	Multifocal 2
	Multifocal 3
Ventricular Rhythm	Bigeminy
	Trigeminy
	Couplet (pair of PVCs)
	Run of 5 PVCs
	Run of 11 PVCs

Ventricular Rhythm 2	Ventricular
	Ventricular tachycardia
	Ventricular fibrillation
	Electromotive disassociation
	Asystole
Conduction	First degree A-V block
	Second degree A-V block, type 1
	Second degree A-V block, type 2
	Third degree A-V block
	Right bundle branch block
	Left bundle branch block

Premature Ventricular Contraction (PVC) Parameter Selections

PVC Type	1, 2, 3 and 4
----------	---------------

Note

See the "Operation" chapter for descriptions.

PVC Timing	R on T, early and standard
------------	----------------------------

Note

See the "Operation" chapter for descriptions.

PVC per Minute	0 to 25. Manual and auto-stepping modes. Auto-step time interval is 60 seconds.
PVC Total	Counts number of PVCs generated. Maximum count is 65535.

Insertion Selections

PVCs, PACs, and PNCs can be inserted one at a time by pushing a button. Operates on normal sinus waveforms only and at ECG rates from 30 to 160 BPM.

Pacemaker Selections

Pacemaker Waveforms	Asynchronous at 75 BPM, continuously paced
	Demand 1
	Demand 2
	Atrial-ventricular sequential
	Non-capture
	Non-function
	Atrial and ventricular pacemaker pulses are set up independently

Pacemaker Amplitude	2 mV steps from -20 mV to +20 mV and settings of ± 50 , ± 100 , ± 200 , ± 500 , and ± 700 mV
	Accuracy is 10 % of setting ± 0.2 mV
Pacemaker Width	0.1, 0.2, 0.5, 1.0, and 2.0 ms
	Accuracy is 5 %
	Both "amplitude" and "width" have manual and auto-stepping modes. Auto-step time interval is 6 seconds.
Pacemaker Input	The minimum pulse amplitude is ± 0.1 mA or ± 1.5 V
	The input impedance is $15\text{ k}\Omega$

Defibrillator Section

The simulator has three training scenarios each with a preprogrammed series of ECG waveforms that require clinical intervention with a cardiac defibrillator. The operator interacts with these scenarios by either manually selecting functions on the simulator keyboard, or inputting an attenuated defibrillator discharge signal through the "SYNC" input. This stimulus can be generated by discharging a defibrillator into a Fluke Biomedical defibrillator analyzer. Just connect the analyzer's 1000:1 oscilloscope output to the simulator's "SYNC" input to automatically sequence the ECG waveforms.

- Emergency 1: ECG starts normally, then after 2 PVCs (R on T) it changes to ventricular fibrillation. Defibrillation converts back to normal.
- Emergency 2: ECG starts normally, then changes to ventricular tachycardia, and then to ventricular fibrillation. Defibrillation converts back to normal.
- Elective Cardioversion: ECG shows atrial fibrillation. A properly timed defibrillation pulse converts back to normal. A late defibrillation pulse causes ventricular fibrillation. The cardioversion time window is ± 100 ms from the R-wave peak.
- "SYNC/A PACE" Input Level: A positive voltage transition through ± 0.4 V triggers this input. Maximum voltage is ± 35 V and input impedance is approximately $15\text{ k}\Omega$.

Respiration Section

Output Configuration:	The output configuration is Lead I or II/RL-LL
Baseline Impedance:	500, 1000, 1500, and $2000\ \Omega$
	Accuracy is 5 %
Delta Impedance:	0, 0.1, 0.2, 0.5, 1.0, and $3.0\ \Omega$.
	Accuracy is 10 %
Normal Physiological Rate:	15, 20, 30, 40, 60, and 120 BrPM
	Accuracy is 5 %
Apnea:	Off, momentary, continuous, 12 s and 32 s
Ratio:	5/1, 4/1, 3/1, 2/1 and 1/1 (inspiration/expiration)
Baseline Shift:	The delta impedance is reduced to 1/6 and shifted to

	either "positive" or "negative". The rate is shifted to 120 BrPM for 12 seconds each minute.
Ventilator Simulation:	40 BrPM at fixed ratio, other parameters variable as in "normal"

Blood Pressure Section

Input/Output Impedance:	300 Ω
Exciter Input Voltage Range:	2 to 16 V
Exciter Input Frequency Range:	DC to 4 kHz
Output Sensitivity:	5 or 40 $\mu\text{V}/\text{V}/\text{mmHg}$
Output Range:	-10 to +300 mmHg on BP1, BP2 and BP4
	-10 to +30 mmHg on BP3
Accuracy:	$\pm(1\%$ of full range + 1 mmHg) at 80 BPM, normal sinus rhythm ECG only
Rate:	All dynamic pressures track all normal sinus rhythm rates and track all arrhythmias
Isolation:	Blood pressure circuitry is electrically isolated from all other medSim 300B outputs
Channel 1 (mmHg):	Atmosphere (0)
	Arterial = 120/80
	Left ventricle = 120/0
	Central venous pressure = 15/10
	Right ventricle = 25/0
	Pulmonary artery = 25/10
	Pulmonary artery wedge = 10/2
	Static: -10, -5, 0, 20, 40, 80, 100, 200, 250, and 300 Manual or auto-stepping at 12 second intervals
Channel 2 (mmHg):	Atmosphere (0)
	Arterial = 120/80
	Left ventricle = 120/0
	Central venous pressure = 15/10
	Right ventricle = 25/0
	Pulmonary artery = 25/10
	Pulmonary artery wedge = 10/2
	Static: -10, -5, 0, 20, 40, 80, 100, 200, 250 and 300 Manual or auto-stepping at 12 second intervals

Channel 3 (mmHg):	Atmosphere (0)
	Central venous pressure = 15/10
	Right ventricle = 25/0
	Pulmonary artery = 25/10
	Pulmonary artery wedge = 10/2
	Static: -10, -5, 0, 5, 10, 20 and 30
	Manual or auto-stepping at 12 second intervals
	Swan-Ganz: start, insert, inflate, deflate and remove
Channel 4 (mmHg):	Atmosphere (0)
	Arterial = 120/80
	Left ventricle = 120/0
	Right ventricle = 25/0
	Pulmonary artery = 25/10
	Pulmonary artery wedge = 10/2
	Triangle = 30, 2 Hz
	Triangle = 300, 2 Hz
	Static: -10, -5, 0, 20, 40, 80, 100, 200, 250 and 300
	Manual or auto-stepping at 12 second intervals

Temperature Section

Variable Temperature:	34 °C, 37 °C, 40 °C, hyperthermia, hypothermia, and spike
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Note

See the "Operation" chapter for descriptions of waveforms.

Note

"VAR TEMP" is inoperative during the Cardiac Output simulation.

Fixed Temperature:	Fixed at 37 °C
	Channel 2's accuracy is 0.1 °C
Probe Compatibility:	400 and 700 series YSI types
Isolation:	Variable temperature is electrically isolated from the rest of the instrument except Cardiac Output. Fixed temperature is isolated from all other outputs.

Cardiac Output Section

See the "Cardiac Output" option chapter in this manual.

Artifact Section

ECG Artifact

Wave Type:	50 Hz, 60 Hz, muscle, or baseline-wander
Leads:	Any wave type can be added to any limb lead, or to the V-leads, or to all leads
Size:	0.25, 0.5, and 1.0 times the Lead II ECG amplitude setting

Blood Pressure/Respiration Artifact

Respiration artifact can be injected into any blood pressure waveform. Arterial and left ventricle waveforms are modulated by the selected respiration rate at 5 % or 10 %. All others have respiration added to them at 5 mmHg or 10 mmHg.

Sequences Section

Sequences step through a series of preprogrammed selections.

There are two types of sequences—autosequences and step-sequences. Autosequences run automatically with no display interaction; step-sequences can be started and stopped by the operator. There are three preprogrammed step-sequences and four user-programmable step sequences.

Note

See the "Operation" chapter for more information and a list of the sequences.

Utility Functions Section

View Angle:	Down, up and save; saved permanently
Auto Power Off Time:	0.5, 1.0, 2.0, 4.0 and 8.0 hours; and off.
	This is reset each time a key is pressed; saved permanently
Key Beep:	On and off; not saved
RS-232 Baud Rate:	300, 600, 1200, and 2400 baud; saved permanently
Save:	Saves all current settings as power-on conditions

RS-232 Serial Port Interface

The medSim 300B can be interfaced to a personal computer or to the Fluke Biomedical medTester 5000B. Most functions can be controlled remotely except for slide switch controlled functions.

Note

A special cable is required and is available from Fluke Biomedical. Refer to the current Fluke Biomedical Price List for availability, part number information and price.

Baud rates are 300, 600, 1200, and 2400.

General Specifications for medSim 300B

Parameter	Specification
Power Requirements	Two 9-volt batteries for 20-hour life or the 9-volt battery eliminator
Temperature Range	Operating: 59 °F to 95 °F; 15 °C to 35 °C
	Storage: 32 °F to 131 °F; 0 °C to 55 °C
Display	2 line x 24 character LCD display
	Weight 3.5 lb; 1.6 kg
Dimensions	7" L x 10" W x 3" H;
	17.78 cm Lx 25.40 cm W x 7.62 cm H

medSim 300B, Options, and Accessories

	Part No.
300B Base Model	
ECG waveforms, blood pressure, respiration and temperature simulations.	2247184
Optional Features	
Option 1*	2399546
Cardiac Catheterization; Fetal/Maternal ECG with Intrauterine Pressure; Intra-aortic Balloon Pump	
Cardiac Output Option*	2399638
Provides cardiac output simulations	
medSim Controller Option (HHC3 Handheld Controller)	2645641
Provides direct push-button access to the medSim 300B	
Combined Cardiac Output and Option 1*	2399728
medSim 300B Accessories	
Standard	
9-volt Battery Eliminator 115-230 VAC	2183983
Soft Vinyl Carrying Case	2392826
Operating and Service Manual	2243039
Two 9-volt alkaline batteries	

Optional**	
Blood Pressure Cables	
Temperature Cables	
RS-232 Interface Cables	
Option 1 Cables	

Note

See the "Option 1" chapter also.

Cardiac Output Option Cables	
------------------------------	--

Note

See the "Cardiac Output" chapter also.

Note

See the HHC3 Handheld Controller (PN2645641) Users Manual for all information regarding the controller's operation.

Note

** These part numbers to be used at original time of order only. Contact Fluke Biomedical for field upgrade kits covering these options.*

*** Refer to the current Fluke Biomedical Price List for availability, part number information and price.*

Chapter 2 ***Installation***

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Unpacking and Inspection

Standard receiving practices should be followed upon receipt of the medSim 300B Patient Simulator. The shipping carton should be checked for damage. If damage is found, stop unpacking the instrument. Notify the carrier and ask for an agent to be present while the instrument is unpacked. There are no special unpacking instructions, but care should be taken not to damage the unit. Inspect the instrument for physical damage, such as bent or broken parts, dents, or scratches.

Claims

Our routine method of shipment is via common carrier, FOB origin. Upon delivery, if physical damage is found, retain all packing materials in their original condition and contact the carrier immediately to file a claim.

If delivered in good physical condition but instrument does not operate within specifications, or if there are any other problems not caused by shipping damage, please contact Fluke Biomedical or your local sales representative.

Warranty Repair

The warranty statement for this Fluke Biomedical product is printed at the front of this manual.

Use the original carton and packaging material for shipment. If they are not available, we recommend the following guide for repackaging:

- Use a double-walled carton of sufficient strength for the weight being shipped.
- Use heavy paper or cardboard to protect all instrument surfaces. Use a nonabrasive material around all projecting parts.
- Use at least four inches of tightly packed, industrial-approved, shock-absorbent material around the instrument.

Chapter 3

Operation

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Power

This is a battery-powered instrument with the option of using a battery eliminator.

The power control is a momentary "ON/OFF" key located on the top panel.

For optimum battery life, turn the instrument off when not in use, or use the battery eliminator.

In addition, from the UTILITY MENU, you can preset a time interval to automatically turn off the instrument after the last key has been pressed. The display flashes to indicate a low battery condition when both batteries are low.

For battery replacement, the battery compartment is located on the bottom side of the instrument. To access, twist the slotted latch one-quarter turn and lift. Fit a coin into the slot for increased leverage. Replace both batteries at the same time with two 9-volt alkaline batteries: Duracell MN1604 or equivalent.

Note

Do not use mercury, air, or carbon-zinc batteries.

Power-On Conditions

Upon power-on, the medSim 300B display shows the model number and the firmware version.

The "power off time" (unless turned off) is displayed next. Following that, the Function Select menu is displayed.

The following conditions are present when the power is first turned on:

Parameter	Specification
ECG	Waveform: Normal sinus rhythm Baseline BPM: 60 Axis: Normal Amplitude: 1 mV ST segment deviation: None PVCs: None Pacemaker: Off
Respiration Waveform	Normal Rate: 20 BrPM Ohms: 1.0 Ω Ratio: 3/1
Blood pressure	All channels: Atmosphere
Temperature	37 °C

Parameter	Specification
Artifact All	Off
Power-off time	Off
Key beep	On
Baud rate	2400
Cardiac output baseline	37 °C

Note

These power-on conditions can be changed by utilizing the "save" function in the UTILITY MENU.

Panel Descriptions, Controls and Connectors

Top Panel

LCD Display and Keyboard

The LCD display—2 lines by 24 characters—displays messages, and provides information necessary for setting output levels and selecting waveform types.

The keyboard has the following eight pressure-sensitive keys: four function keys (F1, F2, F3, and F4), three arrow keys (left, up and right), and the "ON/OFF" key.

ECG Leads

Located above the LCD display are ten ECG lead-binding posts that are compatible with disposable snaps, 3.2 mm or 4 mm electrodes, and banana plugs. All leads have independently generated signals.

RS232

For remote control of the patient simulator, the RS232 serial port interface is used to connect the medSim Controller Option to a computer or terminal. For information regarding the operation of the RS-232 interface, see the RS-232 SERIAL PORT OPERATION section later in this chapter.

High Level ECG

The "HIGH LEVEL ECG" port is a 1/4" standard phone jack with a Lead II waveform at 0.2 V/mV of the ECG Lead II signal. The "HIGH LEVEL ECG" output is designed for use with central station monitors or recorders requiring an analog high-level input.

Battery Test

Tests 8.4-volt and 9-volt batteries. The LED illuminates when the battery has more than a 6.2-volt charge.

Lead Test

Tests continuity of the ECG leads. The LED illuminates when the resistance is less than 1 k Ω .

Cardiac Output

"CARDIAC OUTPUT" is optional. When installed, refer to the "Cardiac Output" chapter for operating instructions.

Temperature—Variable and Fixed

For variable temperature selection, set the "CARDIAC OUTPUT/ VAR TEMP" switch to "VAR TEMP", and adjust the temperature from the keyboard. Set the "PROBE" switch to match the monitor probe type-400 or 700**.

Note

*"CARDIAC OUTPUT" is disabled in "VAR TEMP" mode.

**Temperature connector cables are available from Fluke Biomedical. The type of probe simulated—either the 400 or 700 series YSI—determines the type of cable to use.

Fixed temperature ("FIXED TEMP") is 37 °C/98.6 °F.

Blood Pressure

There are four blood pressure channels, labeled as "BP1", "BP2", "BP3" and "BP4/AUX". Each channel is independently adjustable from the keyboard.

Set the "SENSITIVITY" switch to match the patient monitor's input sensitivity (either 40 or 5 μ V/V/mmHg).

Note

To connect to the four blood pressure connectors, cables prewired for many monitors, as well as an unterminated cable (see illustration "Unterminated Blood Pressure Output Cable Assembly" at the end of this chapter), are available from Fluke Biomedical. Refer to the medSim 300B Accessories section in Chapter 1 and to the Fluke Biomedical Price List.

Respiration

- The respiration signal is output across the ECG leads.
- Corresponding with the type of patient monitor in use, set the "LEAD SELECT" switch to the lead in use (I or II/RL-LL).
- Use the "BASELINE IMPEDANCE" switch to set the impedance (500, 1000, 1500, or 2000) between any two limb leads.
- Use the keyboard to set the respiration parameters.

Rear Panel

Battery Eliminator

The jack ("BATT ELIM 9 V DC") for the battery eliminator on the medSim 300B rear panel. Use only a battery eliminator supplied by Fluke Biomedical.

Note

Refer to the medSim 300B Accessories section in Chapter 1 and to the Fluke Biomedical Price List.

V PACE

This jack is not active.

SYNC/A PACE

The jack for input of a pulse from a defibrillator for the interactive defibrillator training mode, and for use as the Intra-Aortic Balloon Pump (IABP) signal input for arterial waveform augmentation.

Bottom Panel

Battery Compartment

Houses two 9-volt alkaline batteries. For replacement information, refer to instructions contained in the POWER section at the beginning of this chapter.

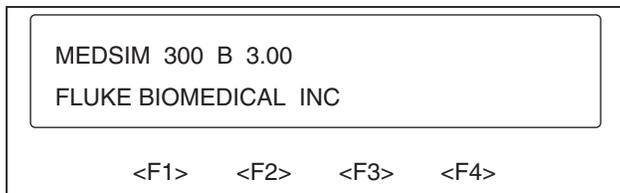
ROMS and CAL Switch Access

The calibration-enable switch and the software ROMs are housed behind this panel.

Operating the medSim 300B

Initialization

Turn on the instrument by pressing the "ON/OFF" key, and a momentary display of the firmware version appears, as shown below:

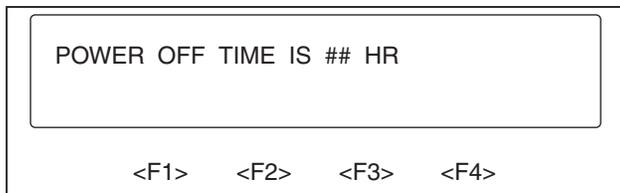


eic002.eps

Note

If options are installed, they are indicated on the top line of the display. The Cardiac Output Option is indicated by "CO" and Option 1 is indicated by "OPI".

If "power off time" has been manually set from the UTILITY MENU, a momentary display appears indicating time in hours as shown below:



eic003.eps

Note

To set "power off time" refer to the Function Select - Utility Menu section later in this chapter.

Note

The simulator can also be operated via the optional handheld controller. Refer to the HHC3 Handheld Controller (PN2645641) manual for operating instructions.

Menu Overview

Main Menu

The MAIN MENU—"FUNCTION SELECT"—offers eight main function groups, from which all other selections are made.

The eight main function group menus are discussed in detail in the MENU SELECTIONS section later in this chapter.

Located at the end of this chapter is a condensed listing of these menus.

Movement through Menus

When a menu choice is made by pressing the function key directly below the displayed selection (<F1>, <F2>, <F3>, or <F4>), the display changes to show the menu for that choice.

Using the function keys creates downward movement through the menus, one level at a time. Pressing the <up arrow> moves back up through the menus, one level at a time.

Executable Parameter Values

At the lowest menu level are the executable parameter values. These executable parameter values are indicated in lower case letters, such as, "baseline bpm - 30, 60, 80, 120, 160, 200, 240, 300"; while the other menus are presented in upper case letters: for instance, "ECG - BASE, PERF, ARRH, PVC, PACE, INS".

A flashing display indicates that a selection is active. If an illegal key is pressed, three quick beeps sound.

Some functions save the values in nonvolatile memory (EEPROM). Such a save is indicated by a single long beep after a short delay.

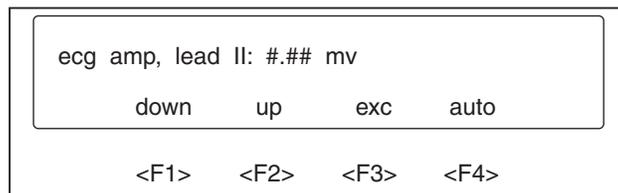
Step Menus

Several functions have step menus. Step menus allow for stepping, either manually or automatically, through the available parameter values.

Setting the parameter for the ECG baseline amplitude exemplifies how a step menu functions. To illustrate—from the FUNCTION SELECT MENU:

1. Press <F1>-ECG, then press <F1>-BASE, and then press <F2>-AMP.

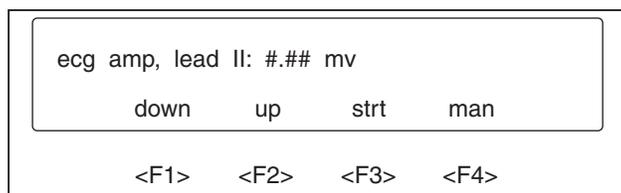
Your display now appears like this:



eic004.eps

In the step menu, the top display line indicates the name of the parameter being modified and a value for it. If the value shown (illustrated above as "#.##") is active, it flashes.

2. Press <F1>-DOWN or <F2>-UP to decrement or increment the displayed value.
3. Press <F3>-EXC to execute the displayed value.
4. Press <F4>-AUTO and the bottom display line changes as follows:



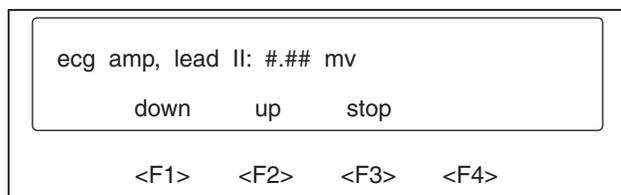
eic005.eps

In this mode, use of the <F1>-DOWN key and the <F2>-UP key decrements and increments the displayed value, and immediately executes the selected value without requiring a separate "execute" key.

Note

Use of the <F4>-MAN key returns to the previous mode.

5. To activate the automatic stepping mode, press the <F3>-STRT key and the display changes to:



eic006.eps

At this point, the parameter is automatically stepping at a predetermined rate (refer to the "Specifications" chapter). Upon reaching either limit, the stepping switches directions and continues.

6. Choose <F1>-DOWN or <F2>-UP to reverse the incrementing and decrementing of the values.
7. Press <F3>-STOP to stop the stepping and return to the manual mode.
8. Pressing the <up arrow> also stops automatic stepping and moves you back up through the menu.

Only one automatic stepping mode can be active at a time.

Menu Selections

Main Menu—Function Select

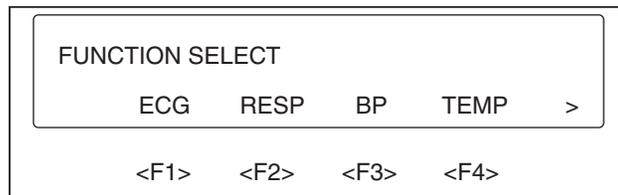
Immediately following the "Initialization" display(s), the MAIN MENU —"FUNCTION SELECT" is presented.

"FUNCTION SELECT" offers the following eight main function groups:

- ECG
- Respiration
- Blood Pressure
- Temperature
- Artifacts
- Sequences
- Defibrillator Tests
- Utility

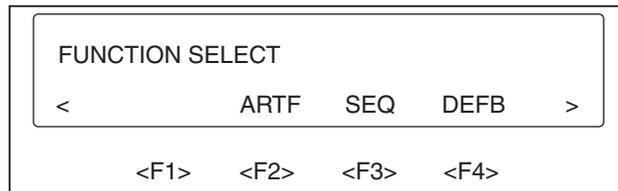
All other selections are made from these function groups.

To access the three pages of "FUNCTION SELECT" choices, use the <left arrow> or the <right arrow> key, as indicated in the displays by "<" or ">". The first page appears as follows:



eic007.eps

To access page 2 of the FUNCTION SELECT MENU, press the <right arrow> key:

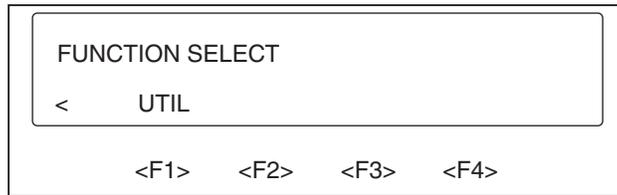


eic008.eps

Note

Illustrations may not match the medSim 300B display when future additions, options, and expansion modules are installed.

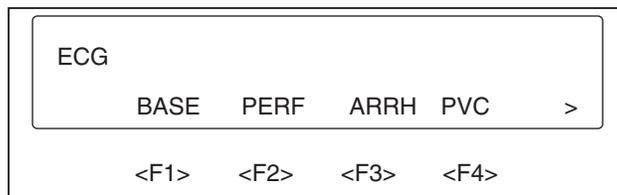
To access page 3, as shown below, press the <right arrow> key again (pressing the <left arrow> returns you to page 1 of the FUNCTION SELECT MENU):



eic009.eps

Function Select - ECG Menu

1. To choose the ECG MENU, return to the first page of the FUNCTION SELECT MENU and press <F1>-ECG.
2. The ECG MENU choices are presented on two pages as illustrated below. Again, use the <left arrow> and <right arrow> keys to access the six ECG function selections.



eic010.eps



eic011.eps

Note

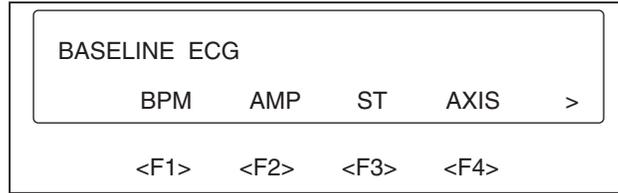
Illustrations may not match your medSim 300B display if additions, options, or expansion modules have been installed.

Function Select - ECG - Baseline ECG Menu

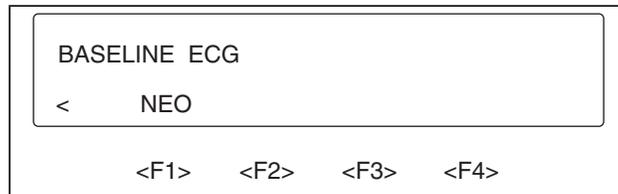
To access the BASELINE ECG MENU:

1. Press <F1>-BASE from page 1 of the ECG MENU.

The five parameter groups for setting the normal sinus rhythm ECG are displayed in two pages as shown in the following two illustrations:

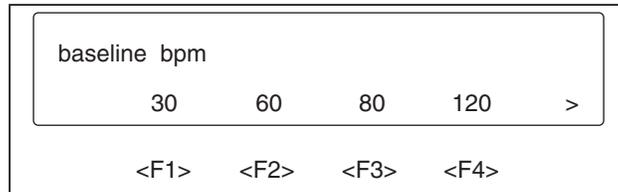


eic012.eps

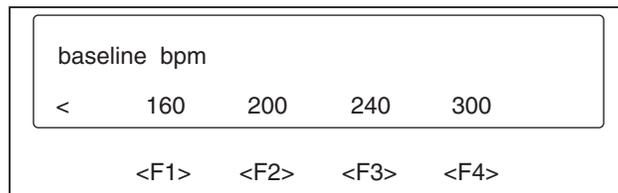


eic013.eps

2. From page 1 of the BASELINE ECG MENU, press <F1>-BPM. The eight "baseline bpm" parameter values are shown on two pages as follows:



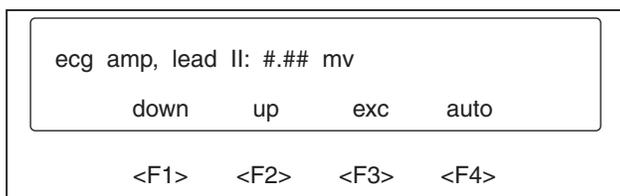
eic014.eps



eic015.eps

Selections made from this BASELINE BPM MENU set the normal sinus rhythm rate (canceling arrhythmias and restoring all previously set baseline values).

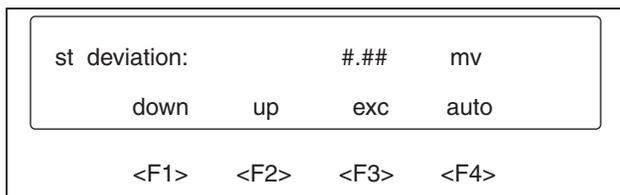
3. To set the amplitude for all ECG baseline waveforms, press <F2>-AMP from page 1 of the BASELINE ECG MENU:



eic016.eps

This is a "step" menu. Refer to Step Menus in the MENU OVERVIEW section earlier in this chapter for detailed information on automatic and manual step functions.

4. To adjust the ST segment deviation (elevation and depression), press <F3>-ST from page 1 of the BASELINE ECG MENU:

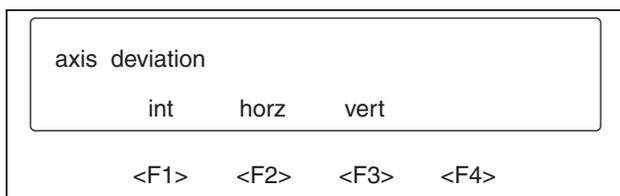


eic017.eps

This function simulates an adult heart (not neonatal) at rates less than or equal to 160 BPM and with most arrhythmias having an 80 BPM rate.

This is a "step" menu. Refer to Step Menus in the MENU OVERVIEW section earlier in this chapter for detailed information on automatic and manual step functions.

5. Press <F4>-AXIS (from page 1 of the BASELINE ECG MENU) to set the axis of the normal ECG to one of these three heart positions: intermediate, horizontal, or vertical. The display appears as shown here:



eic018.eps

6. To select "neonatal ECG", press <F1>-NEO from page 2 of the BASELINE ECG MENU. The display appears as illustrated:



eic019.eps

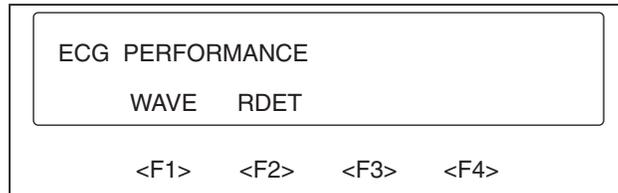
Neonatal is a narrower ECG with a 40 ms QRS. All dynamic blood pressures are decreased by 25 % in the neonatal mode.

Function Select - ECG - ECG Performance Menu

ECG performance waveforms are divided into two groups: waveforms and R-wave detection functions.

To access the ECG PERFORMANCE MENU:

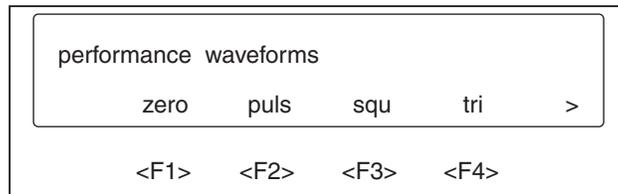
1. Press the <up arrow> key to return to the ECG MENU, and then press <F2>-PERF:



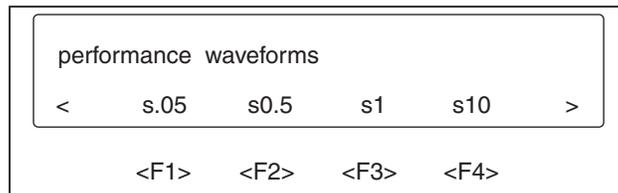
eic020.eps

The amplitude of all performance waveforms except R-wave detection is set by the baseline amplitude.

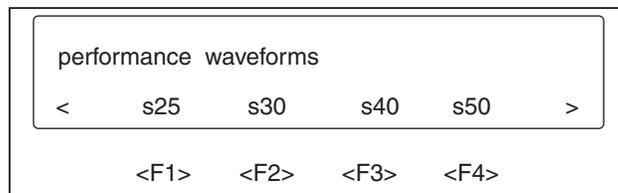
2. Press <F1>-WAVE to access the following four pages of performance waveform selections:



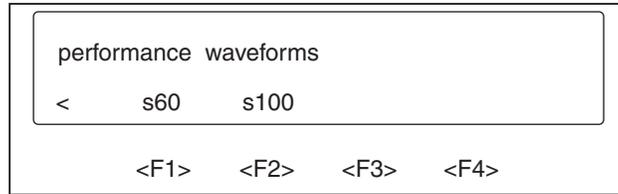
eic021.eps



eic022.eps



eic023.eps



eic024.eps

3. Press the corresponding function key for the desired performance waveform.

Selections Descriptions

zero	Zero output
puls	Pulse at 4 s, square
squ	Square waveform at 2 Hz
tri	Triangle waveform at 2 Hz
s##	Sine waveforms at the indicated frequencies

4. To select R-wave detection waveforms, press <F2>-RDET from the ECG PERFORMANCE MENU:

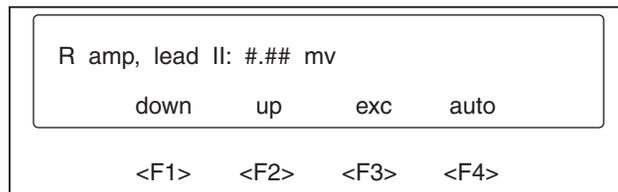


eic025.eps

Note

The R-wave detection waveforms contain only the R-wave.

5. The amplitude and width are variable. Press the appropriate function key, <F1>-AMP or <F2>-WIDTH, to access either step menu:



eic026.eps



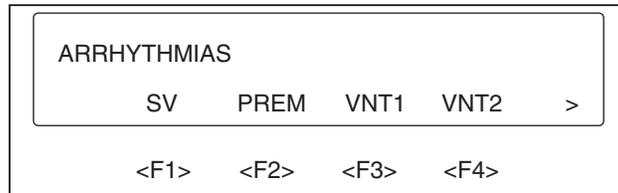
eic027.eps

To set R-wave amplitude or width parameters, follow step menu instructions as presented earlier in this chapter.

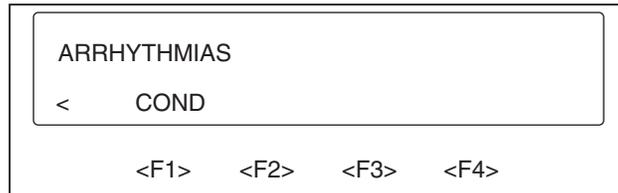
Upon leaving R-wave detection, the ECG amplitude is equal to the adjusted R-wave amplitude.

Function Select - ECG - Arrhythmias Menu

To select the ARRHYTHMIA MENU, press the <F3>-ARRH key from the ECG MENU:



eic028.eps



eic029.eps

Arrhythmias are divided into these five groups: supraventricular, premature, ventricular rhythm 1, ventricular rhythm 2 and conduction.

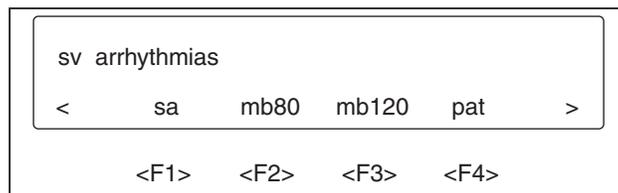
Those that contain normal beats have an 80 BPM rate and unless otherwise stated, the PR interval is 0.16 seconds.

When an arrhythmia contains one or more abnormal beats within a series of normal beats, the abnormal beat is the second beat of the total series starting after one normal beat.

Supraventricular is a group of upper heart defect arrhythmias. To select the supraventricular group, from the ARRHYTHMIAS MENU, press <F1>-SV for the following three display pages of ten supraventricular waveform selections:



eic030.eps



eic031.eps



eic032.eps

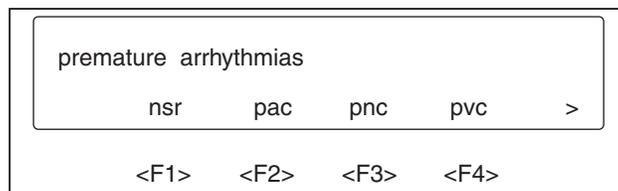
The desired waveform selections can be made by pressing the corresponding function key.

Descriptions of the supraventricular selections follow:

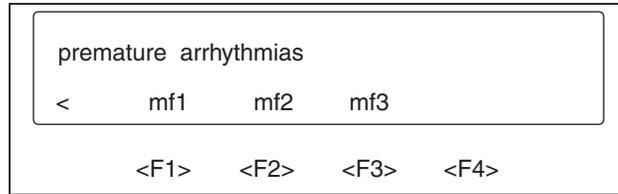
Selections	Descriptions
nsr	Normal sinus rhythm. Provides a convenient way to return to normal sinus rhythm.
af1	Atrial fibrillation, coarse. Rapid irregular atrial signal with no real P-waves. Irregular ventricular rate.
af2	Atrial fibrillation, fine. Rapid irregular atrial signal with no real P-waves. Irregular ventricular rate.
aflt	Atrial flutter. Large regular P-waves at 300 BPM. Ventricular response at 5:1 for 12 seconds, 13:1 for 6 seconds and 2:1 for 6 seconds; all repeat.
sa	Sinus arrhythmia. Normal beats, but triggered at an irregular interval, from 60 to 100 BPM.
mb80	Missed beat at 80 BPM. Normal sinus rhythm, but every 10 th beat is missing.
mb120	Missed beat at 120 BPM. Normal sinus rhythm, but every 10 th beat is missing.
pat	Paroxysmal atrial tachycardia. 160 BPM for 5 seconds alternating with normal sinus rhythm at 80 BPM for 12 seconds.
nodal	Nodal rhythm. Normal sinus rhythm except P-wave originates in the A-V node. Shortened PR interval of 0.09 seconds.
svt	Supraventricular tachycardia. Normal sinus rhythm at 160 BPM.

The second selection of arrhythmia waveforms is the premature group—a group of arrhythmias that have premature beats mixed in with normal beats.

To select this group, press <F2>-PREM from the ARRHYTHMIAS MENU for the following two display pages of seven premature arrhythmias:



eic033.eps



eic034.eps

The premature arrhythmia waveform selections can be made by pressing the corresponding function key.

Descriptions of the premature arrhythmia selections follow:

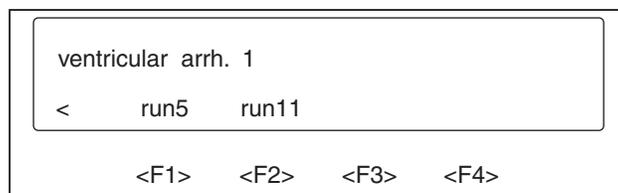
Selections	Descriptions
nsr	Normal sinus rhythm. Provides a convenient way to return to normal sinus rhythm.
pac	Premature atrial contraction. Normal sinus rhythm except every 10 th beat is premature by 25 %.
pnc	Premature nodal contraction. Nodal rhythm except every 10 th beat is premature by 25 %.
pvc	Premature ventricular contraction. Normal sinus rhythm except every 10 th beat is a PVC.
mf1	Multifocal PVCs. Normal sinus rhythm except 2 of every 15 beats are PVCs. PVC type alternates between type 1 and type 2.
mf2	Multifocal PVCs. Like "mf1" except PVC types are 2 and 3.
mf3	Multifocal PVCs. Like "mf1" except PVC types are 3 and 4.

The third group of arrhythmia waveforms is the ventricular rhythm 1 group—a group with normal sinus rhythm at 80 BPM mixed with PVCs.

To select this group, press <F3>-VNT1 from the ARRHYTHMIAS MENU for the following two display pages of six ventricular arrhythmia 1 waveforms:



eic035.eps



eic036.eps

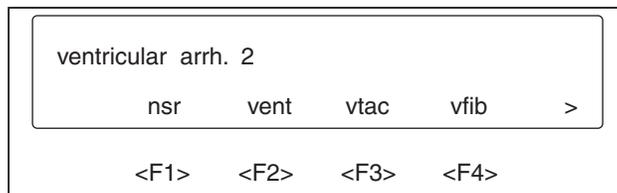
Make selections by pressing the corresponding function key.

Descriptions of the ventricular arrhythmia 1 selections follow:

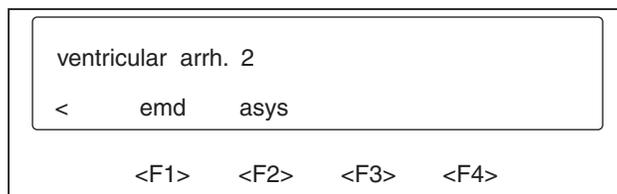
Selections	Descriptions
nsr	Normal sinus rhythm. Provides a convenient way to return to normal sinus rhythm.
big	Bigeminy. Normal beat followed by a PVC, repeated.
trig	Trigeminy. Two normal beats followed by a PVC, repeated.
pair	Two PVCs together in a series with 14 normal beats, repeated. Also called a couplet.
run5	Five PVCs together in a series with eight normal beats, repeated.
run11	Ten PVCs and one with a different focus together in a series with eight normal beats, repeated.

The fourth group of arrhythmia waveforms is the ventricular rhythm 2 group—a group in which all activity originates in the ventricles.

To select this group, press <F4>-VNT2 from the ARRHYTHMIAS MENU for the following two display pages of six ventricular arrhythmia 2 waveforms:



eic037.eps



eic038.eps

Make selections by pressing the corresponding function key.

Descriptions of the ventricular arrhythmia 2 selections follow:

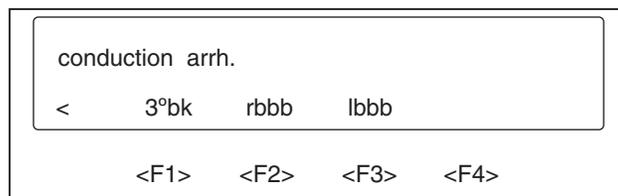
Selections	Descriptions
nsr	Normal sinus rhythm. Provides a convenient way to return to normal sinus rhythm.
vent	Ventricular rhythm. Similar to left focus PVCs at 120 BPM.
vtac	Ventricular tachycardia. Similar to left focus PVCs at 180 BPM.
vfib	Ventricular fibrillation. Irregular ventricular waveform.
emd	Electromotive disassociation. Irregular weak signal.
asys	Asystole. No beats, but very small irregular signal remains.

The fifth group of arrhythmia waveforms is the conduction arrhythmia group—a group that consists of various conduction defects.

To select this group, press <F1>-COND from page 2 of the ARRHYTHMIAS MENU for the following two display pages of seven conduction arrhythmia waveforms:



eic039.eps



eic040.eps

Make selections by pressing the corresponding function key.

Descriptions of the conduction arrhythmia selections follow:

Selections	Descriptions
nsr	Normal sinus rhythm. Provides a convenient way to return to normal sinus rhythm.
1 °bk	First degree A-V block. Normal sinus rhythm except with long PR interval of 0.25 seconds.
2 °b1	Second degree A-V block, type 1, Wenckebach. Increasing PR interval from 0.22 to 0.47 seconds, followed by a P-wave only with no QRS response, repeated. P-waves at 80 BPM.
2 °b2	Second degree A-V block, type 2. Waveform similar to right bundle branch block except PR interval is 0.25 seconds. Eighteen beats at 80 BPM followed by two missed beats; repeated.
3 °bk	Third degree A-V block. Normal sinus rhythm waveform except with a P-wave rate of 80 BPM and a QRS rate of 30 BPM running independently of each other.
rbbb	Right bundle branch block. Wide QRS complexes. An 80 BPM rate with a PR interval of 0.16 seconds.
lbbb	Left bundle branch block. Wide QRS complexes. An 80 BPM rate with a PR interval of 0.16 seconds.

Function Select - ECG - PVC Parameters Menu

PVCs can be added to normal sinus rhythm waveforms.

Four PVC focuses (types) are available, each with three different timing selections. The number of PVCs per minute can be set from 0 to 25, and the PVCs can be counted.

"PVCs per minute" and "PVC timing" only affect normal sinus rhythm waveforms 30 to 160 BPM. "PVC type" also selects the PVC for arrhythmias.

To access the PVC PARAMETERS MENU, from page 1 of the ECG MENU:

1. Press <F4>-PVC:



eic041.eps

2. Press <F1>-TYPE to access the four available PVC focuses as shown:



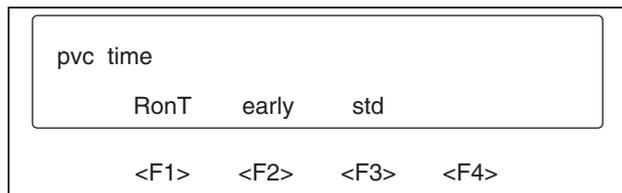
eic042.eps

Descriptions of the four PVC focus selections follow:

Selections	Descriptions
1	Left focus with marked left axis deviation and concordant positiveness in the V-leads.
2	Right focus with right axis deviation and LBBB configuration.
3	Left focus with left axis deviation and RBBB with left anterior fascicular block.
4	Right focus with left axis deviation and concordant negativity in the V-leads.

Each focus has three different timing selections. To access:

1. Press <F2>-TIME from the PVC PARAMETERS MENU:



eic043.eps

Descriptions of the PVC time selections follow:

Selections	Descriptions
RonT	65 % premature (260 ms after R-wave).
early	33 % premature.
std	25 % premature (standard).

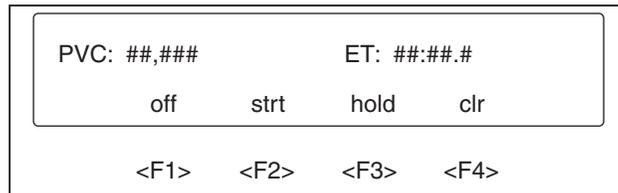
- To set the number of PVCs per minute, press <F3>-/MIN from the PVC PARAMETERS MENU:



eic044.eps

The number of PVCs per minute can be set from 0 to 25. Zero turns off the function. To set, follow the instructions for the step menu functions.

- To count PVCs, press <F4>-TOTL from the PVC PARAMETERS MENU:



eic045.eps

The TOTL MENU displays the number of PVCs generated and shows the elapsed time (ET).

Descriptions of the "TOTL" executable selections follow:

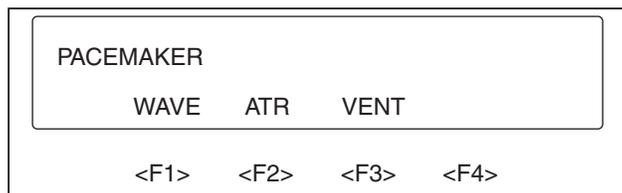
Selections	Descriptions
off	Turns off the counter, and clears the values.
strt	Initiates or restarts the counter.
hold	Stops the counter, but does not clear the values.
clr	Clears the values, but does not shut the counter off.

Function Select - ECG - Pacemaker Menu

To access the PACEMAKER MENU:

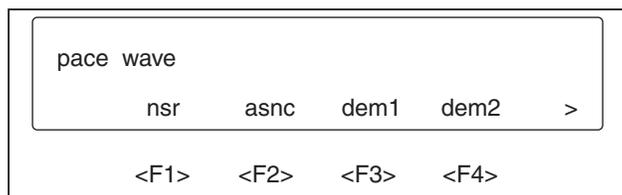
1. Press <F1>-PACE from page 2 of the ECG MENU.

The three main pacemaker parameter selections are pace wave, atrial pacer, and ventricle pacer, and are displayed as shown:

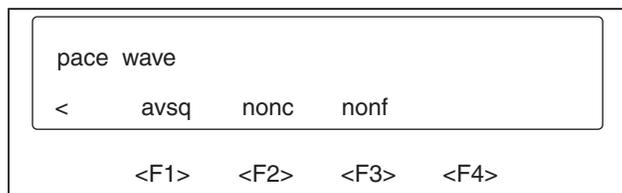


eic046.eps

2. Press <F1>-WAVE from the PACEMAKER MENU to access the PACE WAVE MENU:



eic047.eps



eic048.eps

In the PACE WAVE MENU, the atrial-ventricular sequential waveform uses both atrial and ventricular pacemakers. All others use the ventricular pacemaker. The pacemaker rate is 75 BPM.

Note

The ventricular pacemaker triggers a wide QRST wave similar to LBBB since the ventricular pacemaker is in the right ventricle.

Descriptions of the pacemaker waveform selections follow:

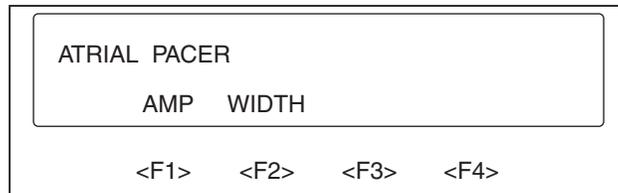
Selections	Descriptions
nsr	Normal sinus rhythm. Provides a convenient way to return to normal sinus rhythm.
asnc	Asynchronous. At 75 BPM, continuously paced.
dem1	Demand 1. Mostly paced. A series of 40 paced beats and 20 normal beats. Pacemaker kicks in when normal beat is 20 % late and kicks out when normal beat comes in time for an 80 BPM rate.

dem2	Demand 2. Mostly paced. Same as Demand 1 except 20 paced beats and 40 normal beats.
avsq	Atrial-ventricular sequential. Dual pacemaker spikes—first triggers P-wave, second triggers QRST—0.15 seconds apart.
nonc	Non-capture. Asynchronous paced except every 10th beat there is no QRST response.
nonf	Non-function. Pacemaker spikes only. No QRST response.

The ATRIAL PACER and the VENTRICLE PACER can be varied independently—the amplitude (height) from -700 mV to +700 mV and the width from 0.1 ms to 2 ms.

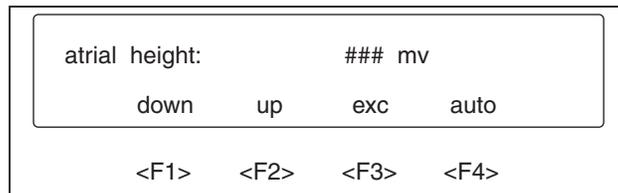
To set atrial pacemaker parameters:

1. Press <F2>-ATR from the PACEMAKER MENU, to reach the ATRIAL PACER MENU, and the following display:

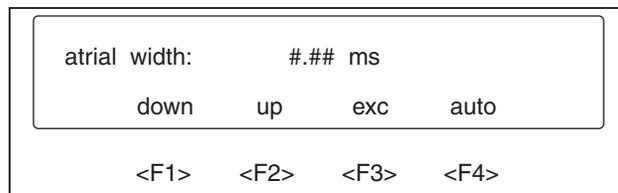


eic049.eps

2. To set atrial pacemaker amplitude (height) and atrial pacemaker width parameters, press the corresponding function keys, and then follow instructions for step menu functions. The displays follow:



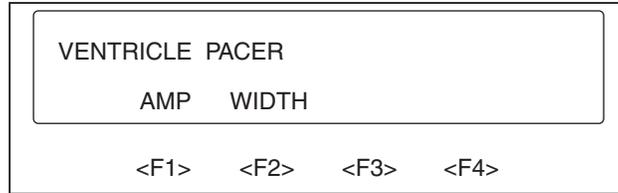
eic050.eps



eic051.eps

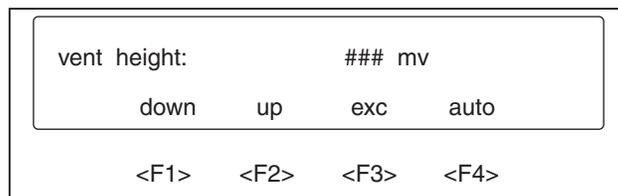
To set ventricle pacemaker parameters:

1. Press <F3>-VENT from the PACEMAKER MENU to reach the VENTRICLE PACER MENU, and the following display appears:

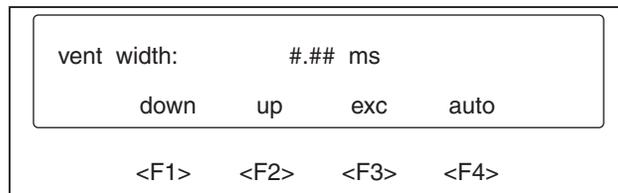


eic052.eps

2. To set ventricle pacemaker amplitude (height) and ventricle pacemaker width parameters, once again press the corresponding function keys. The displays follow:



eic053.eps



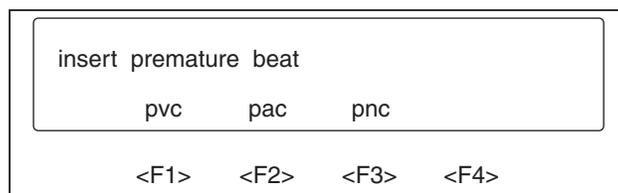
eic054.eps

Follow the instructions for the step menu functions as previously described in this chapter.

Function Select - ECG - Insert Premature Beat Menu

To access the INSERT PREMATURE BEAT MENU:

1. Press <F2>-INS from page 2 of the ECG MENU.



eic055.eps

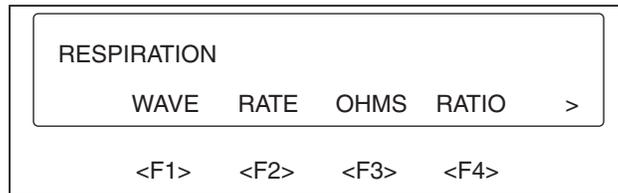
- Press the related function key to select a premature beat to be inserted each time the key is pressed. A description of the premature beats selections is below:

Selections	Descriptions
pvc	Premature ventricular contraction.
pac	Premature atrial contraction.
pnc	Premature nodal contraction.

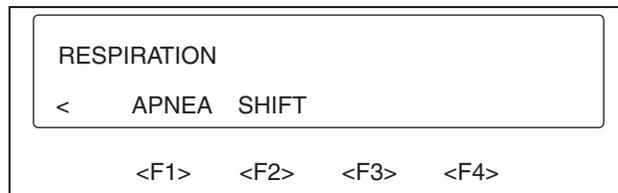
Function Select - Respiration Menu

To choose the RESPIRATION MENU, press <F2>-RESP from page 1 of the FUNCTION SELECT MENU.

The RESPIRATION MENU executable parameter selections—respiration wave, respiration rate, respiration ohms, respiration ratio (inspiration/expiration), apnea, and respiration base shift—are presented on two pages of display as illustrated below:



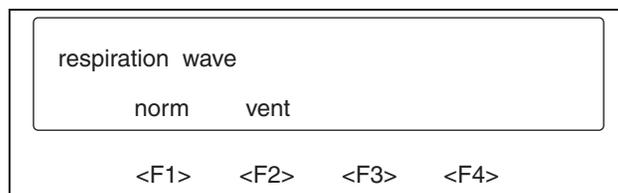
eic056.eps



eic057.eps

To choose the RESPIRATION WAVE MENU:

- Press <F1>-WAVE from page 1 of the RESPIRATION MENU for the following display:



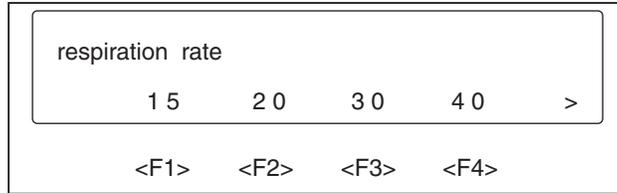
eic058.eps

- Press the corresponding function key for the desired respiration waveform selection. Descriptions of the respiration waveform selections follow:

Selections	Descriptions
norm	Normal respiration.
vent	Ventilator assisted, 12 seconds.

To set the respiration rate for normal waveform:

1. Press <F2>-RATE from page 1 of the RESPIRATION MENU for the following two pages of menu display:



eic059.eps

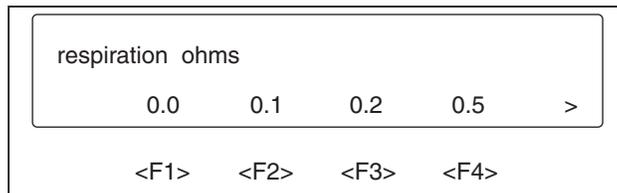


eic060.eps

2. Select the respiration rate in breaths per minute for a normal waveform by pressing the corresponding function key.

To set respiration amplitude:

1. Press <F3>-OHMS from page 1 of the RESPIRATION MENU. The following two pages of the RESPIRATION OHMS MENU are displayed:



eic061.eps



eic062.eps

2. Select respiration amplitude (impedance variation in ohms) by pressing the corresponding function key.

To set the inspiration/expiration ratio on normal respiration only:

1. Press the <F4>-RATIO key from page 1 of the RESPIRATION MENU. Five ratio settings are available from the following two menu pages:



eic063.eps

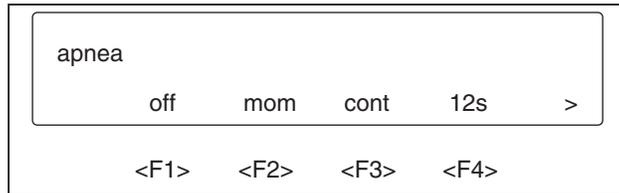


eic064.eps

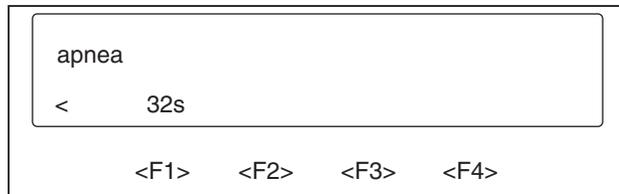
2. Select the inspiration/expiration ratio (on normal respiration only) by pressing the corresponding function key.

To select one of five apnea modes:

1. Press <F1>-APNEA from page 2 of the RESPIRATION MENU. The five modes are shown in two pages of display as follows:



eic065.eps



eic066.eps

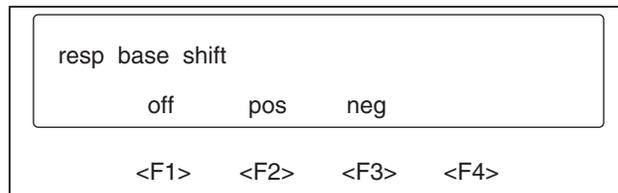
2. Select the desired apnea mode by pressing the corresponding function key.

Apnea mode selections and their descriptions follow:

Selections	Descriptions
off	Turns off apnea. Resumes breathing.
mom	Momentary. Causes apnea while the function key is pressed.
cont	Continuous apnea. Disabled by the "off" selection.
12 s	Generates 12 seconds of apnea each time the key is pressed.
32 s	Generates 32 seconds of apnea each time the key is pressed.

For respiration baseline shift:

1. Press <F2>-SHIFT from page 2 of the RESPIRATION MENU. Three selections are available as shown:



eic067.eps

2. A selection of "positive" or "negative" shifts the respiration baseline either positive or negative and changes the respiration rate to 120 BrPM for 12 of every 60 seconds.

Baseline shift selections and their descriptions follow:

Selections	Descriptions
off	Turns off baseline shift.
pos	Shifts baseline up and decreases delta impedance to 1/6 for 12 seconds.
neg	Shifts baseline down and decreases delta impedance to 1/6 for 12 seconds.

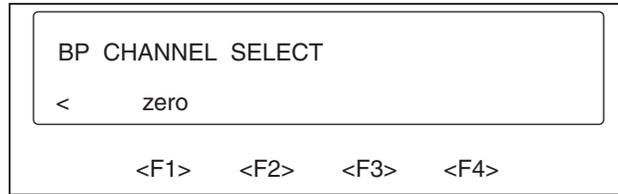
Function Select - Blood Pressure Menu

To choose the BLOOD PRESSURE MENU, press <F3>-BP from page 1 of the FUNCTION SELECT MENU.

The BP CHANNEL SELECT MENU offers the following five selections—1, 2, 3, 4 and zero—on two pages of display:



eic068.eps



eic069.eps

Note

Illustrations may not match your medSim 300B display if additions, options, or expansion modules have been installed.

There are four blood pressure channels, each programmed separately.

The dynamic blood pressures are specified for their systolic and diastolic values for rates of 80 BPM and less. For higher rates, the systolic pressure stays the same but the diastolic pressure increases as the rate increases.

All dynamic pressures are synchronized with all normal sinus rhythm rates, and physiologically track all arrhythmias.

Note

Select <F1>-ZERO from the BP SELECT CHANNEL to set all the channels to "atmosphere".

Press <F1>-1 to access the BP 1 MENU:

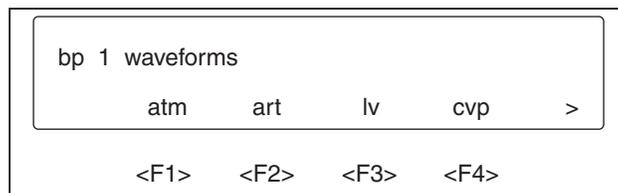


eic070.eps

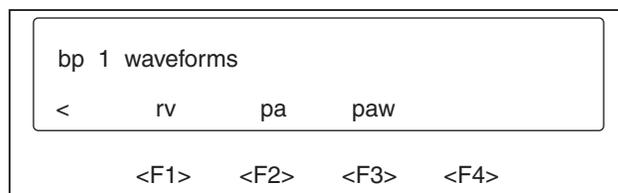
BP 1 has both dynamic waveforms and static pressures.

To select a dynamic waveform:

1. Press <F1>-WAVE to access the two menu pages as shown:



eic071.eps



eic072.eps

2. Press the corresponding function key for the desired BP 1 dynamic waveform. Waveform selections and their descriptions follow.

Selections	Descriptions
atm	Atmosphere - 0 mmHg.
art	Arterial at 120/80 mmHg.
lv	Left ventricle at 120/0 mmHg.
cvp	Central venous pressure at 15/10 mmHg.
rv	Right ventricle at 25/0 mmHg.
pa	Pulmonary artery at 25/10 mmHg.
paw	Pulmonary artery wedge at 10/2 mmHg.

To select BP 1 static pressures, press <F2>-STAT from the BP 1 MENU for the following display:



eic073.eps005A

Follow the instructions for the step menu functions presented earlier in this chapter.

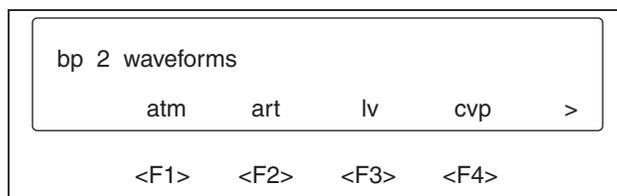
BP 2 dynamic waveforms and static pressures are identical to BP 1. To select BP 2, press <F2>-2 from the BP CHANNEL SELECT MENU to access the following menu:



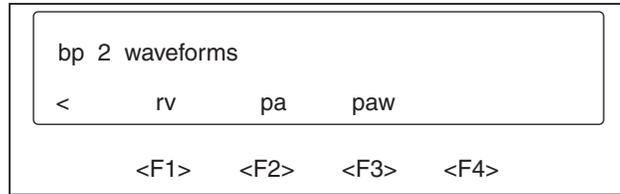
eic074.eps

To select a BP 2 dynamic waveform:

1. Press <F1>-WAVE to access the two menu pages as shown:



eic075.eps

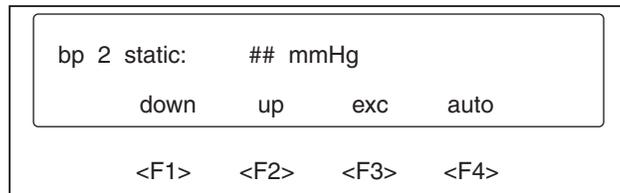


eic076.eps

2. Press the corresponding function key for the desired BP 2 dynamic waveform selection. Waveform selections and their descriptions follow:

Selections	Descriptions
atm	Atmosphere - 0 mmHg.
art	Arterial at 120/80 mmHg.
lv	Left ventricle at 120/0 mmHg.
cvp	Central venous pressure at 15/10 mmHg.
rv	Right ventricle at 25/0 mmHg.
pa	Pulmonary artery at 25/10 mmHg.
paw	Pulmonary artery wedge at 10/2 mmHg.

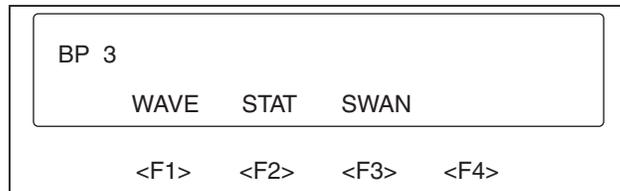
To select BP 2 static pressures, press <F2>-STAT from the BP 2 MENU for the following display:



eic077.eps

Follow the instructions for the step menu functions presented earlier in this chapter.

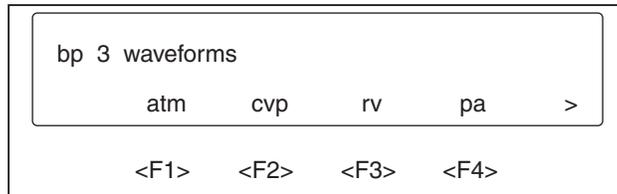
To select BP 3, press <F3>-3 from the BP CHANNEL SELECT MENU to access the following menu:



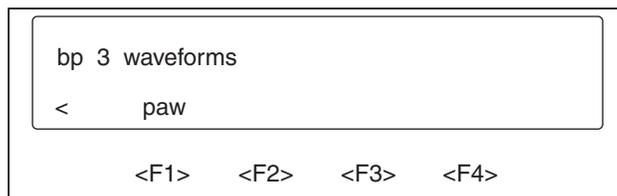
eic078.eps

To select a BP 3 dynamic waveform:

1. Press <F1>-WAVE to access the two menu pages as shown:



eic079.eps



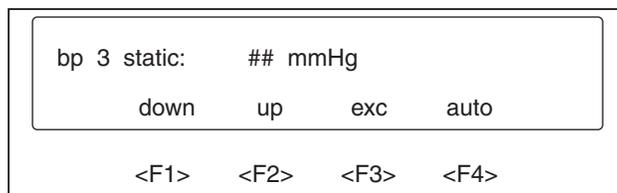
eic080.eps

2. Press the corresponding function key for the desired BP 3 dynamic waveform selection.

BP 3 dynamic waveform selections and their descriptions follow:

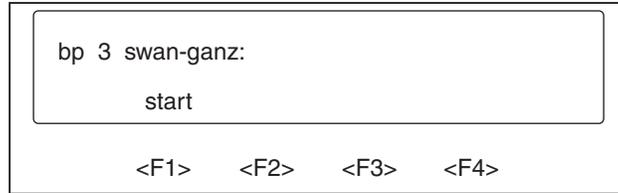
Selections	Descriptions
atm	Atmosphere - 0 mmHg.
cvp	Central venous pressure at 15/10 mmHg.
rv	Right ventricle at 25/0 mmHg.
pa	Pulmonary artery at 25/10 mmHg.
paw	Pulmonary artery wedge at 10/2 mmHg.

To select BP 3 static pressures, press <F2>-STAT from the BP 3 MENU for the following display:



eic081.eps

Follow the instructions for the step menu functions as presented earlier in this chapter. To access the BP 3 SWAN-GANZ MENU, press <F3>-SWAN from the BP 3 MENU for the following:

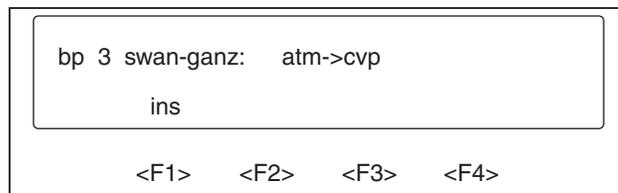


eic082.eps

The descriptions of the function selections and waveform simulations for the SWAN-GANZ MENU are:

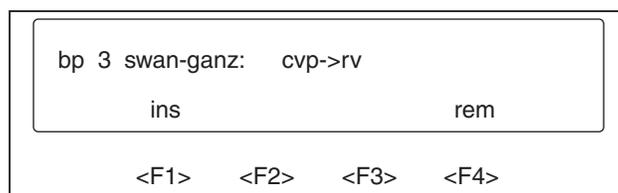
Selections	Descriptions
start	Starts the simulated Swan-Ganz procedure.
ins	Insert: advances to the next step.
rem	Remove: returns to the beginning.
inf	Inflate: inflates the balloon in the pulmonary artery and creates the pulmonary artery wedge
def	Deflate: deflates the pulmonary artery wedge and returns to the pulmonary artery
atm	Atmosphere.
cvp	Central venous pressure
rv	Right ventricle
pa	Pulmonary artery
paw	Pulmonary artery wedge

1. Press <F1>-START to begin the simulated Swan-Ganz procedure. The following menu is displayed:



eic083.eps

2. To proceed from atmosphere to central venous pressure, press <F1>-INS:



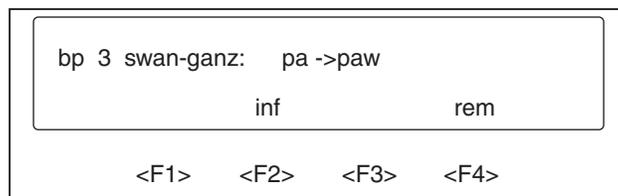
eic084.eps

3. To proceed from central venous pressure to right ventricle, press <F1>-INS (or press <F4>-REM to return to atmosphere):



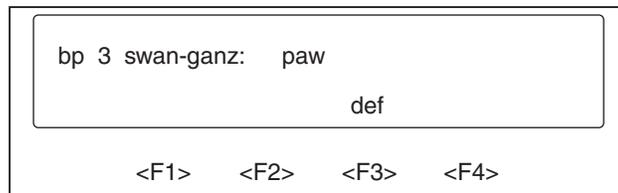
eic085.eps

4. To proceed from right ventricle to pulmonary artery, press <F1>-INS (or press <F4>-REM to return to atmosphere):



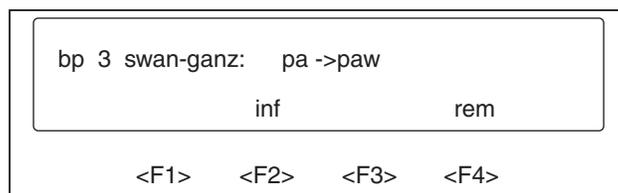
eic086.eps

5. Press <F2>-INF to proceed from pulmonary artery to pulmonary artery wedge (or press <F4>-REM to return to atmosphere):



eic087.eps

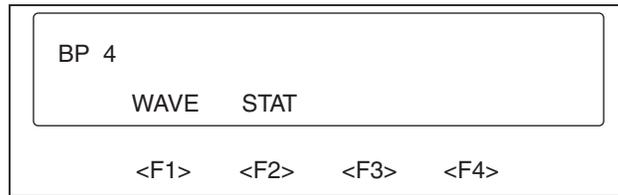
6. From pulmonary artery wedge, press <F3>-DEF to return to pulmonary artery:



eic088.eps

7. As described previously, press <F2>-INF to move to pulmonary artery wedge or press <F4>-REM to return to atmosphere.

8. To select BP 4, press <F4>-4 from the BP CHANNEL SELECT MENU to access the following menu:



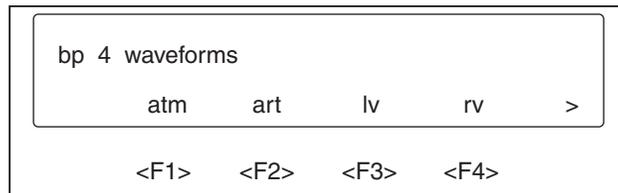
eic089.eps

Note

Illustrations may not match your medSim 300B display if additions, options, or expansion modules have been installed.

To select a dynamic waveform from BP 4:

1. Press <F1>-WAVE to access the two menu pages as shown:



eic090.eps



eic091.eps

2. Press the corresponding function key to select a BP 4 dynamic waveform.

Waveform selections and their descriptions follow:

Selections	Descriptions
atm	Atmosphere - 0 mmHg.
art	Arterial at 120/80 mmHg.
lv	Left ventricle at 120/0 mmHg.
rv	Right ventricle at 25/0 mmHg.
pa	Pulmonary artery at 25/10 mmHg.
paw	Pulmonary artery wedge at 10/2 mmHg.
t30	Triangle, 30 mmHg, 2 Hz.
t300	Triangle, 300 mmHg, 2 Hz.

To select BP 4 static pressures, press <F2>-STAT from the BP CHANNEL SELECT MENU for the following display:



eic092.eps

Follow the instructions for the step menu functions as previously described in this chapter.

Function Select - Temperature Menu

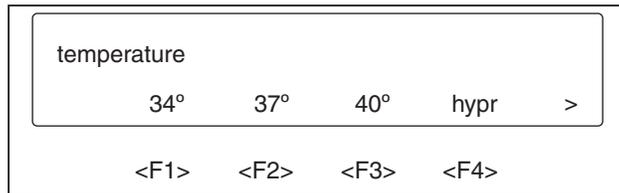
To access the TEMPERATURE MENU, from the FUNCTION SELECT MENU:

1. Press <F4>-TEMP.

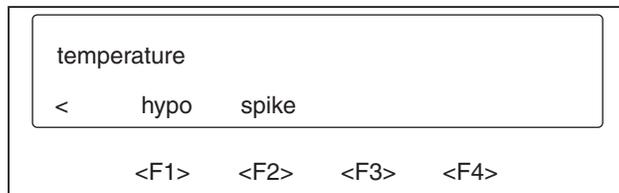
Note

Temperature selections are available only when the "CARDIAC OUTPUT/VAR TEMP" switch is set to "VAR TEMP". For more information, refer to the Temperature—Variable and Fixed section in the PANEL DESCRIPTIONS, CONTROLS, AND CONNECTORS section near the beginning of this chapter.

TEMPERATURE MENU selections are shown in two pages of display as follows:



eic093.eps



eic094.eps

2. Press the corresponding function key for the desired temperature selection.

Temperature selections and their descriptions follow:

Selections	Descriptions
34 °	34 °C fixed temperature.
37 °	37 °C fixed temperature.

40 °	40 °C fixed temperature.
hypr	Hyperthermia: starts at 37 °C, then in 20 minutes increases to 40 °C, and holds for 60 minutes; then in 20 minutes decreases to 37 °C, and holds for 60 minutes; and then starts over.
hypo	Hypothermia: starts at 37 °C, then in 20 minutes decreases to 34 °C, and holds for 60 minutes; then in 20 minutes increases to 37 °C, and holds for 60 minutes; and then starts over.
spike	Spike: starts at 37 °C, then in 20 minutes increases to 40 °C; then in 20 minutes decreases to 37 °C, and holds for 60 minutes; and then starts over.

Function Select - Artifact Menu

To access the ARTIFACT MENU, press <F2>-ARTF from page 2 of the FUNCTION SELECT MENU.

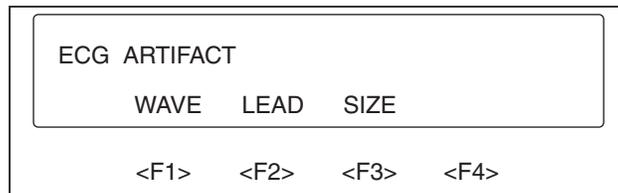
An artifact can be inserted into ECG or blood pressure. The ARTIFACT MENU appears as illustrated below:



eic095.eps

Function Select - Artifact - ECG Artifact Menu

To access the ECG ARTIFACT MENU, press <F1>-ECG from the ARTIFACT MENU for the following display:



eic096.eps

There are four waveform types of ECG artifact.

An ECG artifact waveform type can be added to any limb lead, to the V-leads, or to all leads, and has three amplitude settings.

To select ECG artifact waveform type:

1. Press <F1>-WAVE from the ECG ARTIFACT MENU to access the following two pages of menu selections:



eic097.eps



eic098.eps

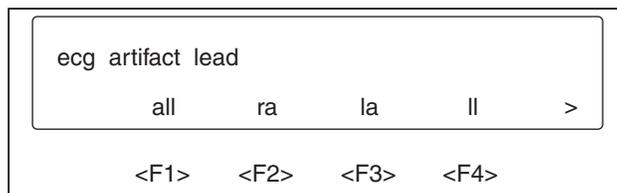
2. Press the corresponding function key for the desired ECG artifact waveform type selection.

ECG artifact waveform type selections and their descriptions follow:

Selections	Descriptions
off	Shuts off ECG artifact.
50 Hz	50 Hz artifact.
60 Hz	60 Hz artifact.
mscl	Muscular artifact.
wndr	Baseline wander artifact.

To select the lead to which the waveform type is to be added:

1. Press <F2>-LEAD from the ECG ARTIFACT MENU to access the following two menu pages:



eic099.eps



eic100.eps

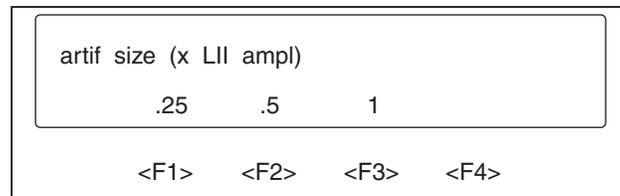
2. Press the corresponding function key for the desired lead selection.

Lead selections and their descriptions follow:

Selections	Descriptions
all	All
ra	Right arm
la	Left arm
l1	Left leg
vl	Chest

To select ECG artifact size:

1. Press <F3>-SIZE from the ECG ARTIFACT MENU to access the three size factors as shown in the following menu:



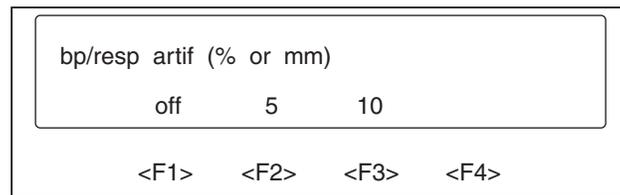
eic101.eps

The ECG artifact size factor multiplied by the ECG Lead II amplitude determines the size of the ECG artifact. For example, 0.5 (artifact size factor) times 5 mV (ECG Lead II amplitude) equals 2.5 mV (ECG artifact size).

2. To select the ECG artifact size, press the function key that corresponds to the desired artifact size factor—0.25, 0.5, or 1.0.

Function Select – Artifact Blood Pressure/Respiration Artifact Menu

To access the BLOOD PRESSURE/RESPIRATION ARTIFACT MENU, press <F2>-BP/R from the ARTIFACT MENU for this display:



eic102.eps

Respiration artifact can be injected into any blood pressure waveform.

Arterial and left ventricle waveforms are modulated by the selected respiration rate at 5 % or 10 %, while all others have a respiration artifact added to them at 5 mmHg or 10 mmHg.

Select 5 % or 5 mmHg by pressing <F2>-5, and select 10 % or 10 mmHg by pressing <F3>-10.

Function Select - Sequences Menu

To access the SEQUENCES MENU, press <F3>-SEQ from page 2 of the FUNCTION SELECT MENU for the following display:



eic103.eps

Sequences are preprogrammed lists of waveform selections that can be stepped through either automatically or manually.

There are two types of sequences—autosequences and step-sequences.

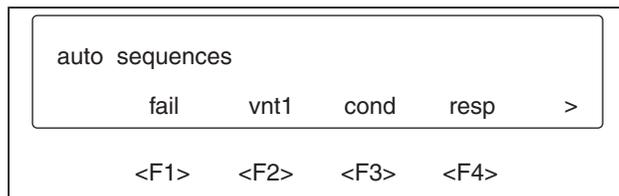
Autosequences run automatically with no display interaction. There are eight different selections in the AUTOSEQUENCE MENU.

Step-sequences can be started and stopped manually and involve screen display. In the STEP-SEQUENCE MENU there are three preprogrammed step-sequences and four user-programmable step-sequences.

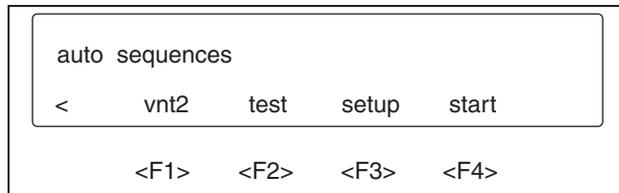
Function Select - Sequences - Autosequences Menu

To select the AUTOSEQUENCES MENU:

1. Press <F1>-AUTO from the SEQUENCES MENU:



eic104.eps



eic105.eps

2. From these eight selections, choose an autosequence by pressing the corresponding function key.

Autosequence selections are listed below along with their segments and run times. The last entry in each list indicates whether the sequence stops, or returns to the first segment and repeats. An autosequence can be terminated by pressing the <up arrow> key.

Selections	Segments	Run Times
fail (Cardiac failure)	ECG BPM 80	1.0 min
	PVCs 12/min	0.2 min
	PVCs 0/min	

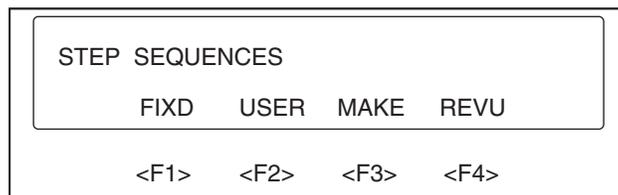
Selections	Segments	Run Times
vntl (Ventricular series 1)	Ventricular tachycardia	0.2 min
	Ventricular fibrillation II	0.2 min
	Asystole	Continuous
	Stop	
	ECG BPM 80	1.0 min
	PVCs 12/min	0.5 min
	PVCs 0/min	
	Bigeminy	0.2 min
	Run 5 PVCs	0.5 min
	Repeat	
cond (Conduction defect)	ECG BPM 80	0.2 min
	1 °block	0.5 min
	2 °block type 1	1.0 min
	3 °block	Continuous
	Stop	
resp (Respiration apnea/Cardiovascular artifact)	Respiration ohms 1.0	
	ECG BPM 80	
	Respiration rate 60	1.0 min
	ECG BPM 120	
	Respiration rate 120	1.0 min
	ECG BPM 80	
	Respiration rate 60	1.0 min
	Respiration ohms 0.5	
	Respiration rate 120	0.3 min
	Respiration ohms 1.0	
	Respiration rate 60	1.7 min
	Apnea 12 s	1.0 min
	Repeat	

Selections	Segments	Run Times
vnt2 (Ventricular series 2)	ECG BPM 80	1.0 min
	PVC type 1	
	PVCs 12/min	1.0 min
	PVCs 0/min	
	PVC type 2	
	Run 11 PVCs	1.0 min
	Multifocal 1	1.0 min
	Run 11 PVCs	1.0 min
	Repeat	
	test (Monitor test)	ECG BPM 80
Respiration rate 20		
BPI atmosphere		
BP2 atmosphere		
BP3 atmosphere		
BP4 atmosphere		0.2 min
Respiration rate 120		
ECG BPM 240		
BP1 300		
BP2 300		
BP3 30		
BP4 300		0.5 min
ECG BPM 80		
Respiration rate 20		
BP1 atmosphere		
BP2 atmosphere		
BP3 atmosphere		
BP4 atmosphere		Continuous
Stop		

Selections	Segments	Run Times
setup (Monitor setup)	Blood pressure/artifact off ECG BPM 80 Respiration rate 20 BP1 atmosphere BP2 atmosphere BP3 atmosphere BP4 atmosphere Stop	Continuous
start (Monitor start)	ECG BPM 80 Respiration rate 20 BP1 artifact BP2 pulmonary artery BP3 central venous pressure BP3 left ventricle Stop	Continuous

Function Select – Sequences - Step-sequences Menu

Step-sequences, as opposed to autosequences, can be started and stopped manually. To select the STEP-SEQUENCES MENU, press <F2>-STEP from the SEQUENCES MENU:



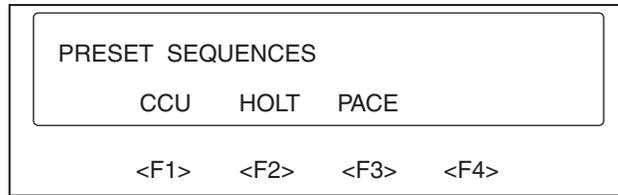
eic106.eps

This menu provides:

- Three preprogrammed (also referred to as "fixed" or "preset") step-sequences that are accessed by pressing <F1>-FIXD.
- Four user-programmable step-sequences that are accessed—only after being programmed into the medSim 300B—by pressing <F2>-USER.
- User step-sequences programming that is accessed by pressing <F3>-MAKE.
- User step-sequences review that is accessed by pressing <F4>-REVU.

Function Select - Sequences - Step-sequences - Preset Sequences Menu.

To select the PRESET SEQUENCES MENU, press <F1>-FIXD from the STEP-SEQUENCES MENU:



eic107.eps

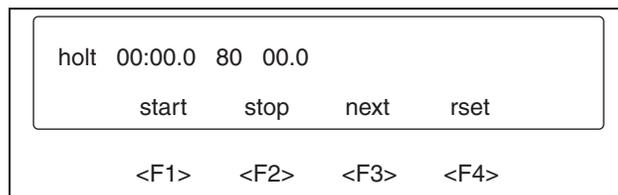
To choose a preprogrammed ("preset" or "fixed") step-sequence series—CCU series, Holter series, or Pacemaker series—press one of the three corresponding function keys as illustrated next:

1. Press <F1>-CCU to access the CCU series menu.



eic108.eps

2. Press <F2>-HOLT to access the Holter series menu.



eic109.eps

3. Press <F3>-PACE to access the Pacemaker series menu.



eic110.eps

In the preceding three illustrations, the top line displays the name of the sequence, the length of time the sequence has run, the description (abbreviated) of the segment currently being output, and the length of time the segment has run. Segments that run for zero time are displayed for one second.

Menu selections and their descriptions follow:

Selections	Descriptions
strt	Starts the sequence running.
stop	Stops the sequence.
next	Steps to the next segment if running.
rset	Reset stops the sequence, returns to the first segment, and clears the time. Reset does not restart the sequence.

Note

A sequence can also be terminated by pressing the <up arrow> key.

The following are listings of the segments in each preprogrammed step-sequence along with the run time. The last entry in each list indicates whether the sequence stops, or returns to the first segment and repeats.

Selections	Segments	Run Times
CCU (CCU series)	BP1 artifact	
	BP2 pulmonary artery	
	BP3 central venous pressure	
	BP4 left ventricle BP/R artifact 10	1 min
	Respiration wave normal	
	Respiration rate 20	
	ECG BPM 80	
	PVCs 6/min	9 min
	PVCs 12/min	10 min
	PVCs 24/min	1 min
	PVCs 0/min	
	ECG BPM 80	9 min
	Pair PVCs	1 min
	ECG BPM 60	19 min
	Paroxysmal atrial tachycardia	10 min
	Repeat	
HOLT (Holter series)	ECG BPM 80	30 min
	PVCs 6/min	
	ECG muscular artifact on	1 min
	PVCs 12/min	
	ECG muscular artifact off	29 min
	PVCs 0/min	

Selections	Segments	Run Times
	ECG BPM 80	90 min
	PVCs 12/min	1 min
	PVCs 0/min	
	ECG BPM 80	89 min
	ECG BPM 60	60 min
	ECG BPM 60	60 min
	ECG BPM 60	60 min
	PVCs 6/min	60 min
	PVCs 0/min	
	Pair PVCs	1 min
	Run 5 PVCs	1 min
	ECG BPM 80	58 min
	Repeat	
PACE (Pacemaker Series)	Demand 1	10 min
	Non-capture	9 min
	Non-function	1 min
	Demand 2	10 min
	Repeat	

Function Select - Sequences - Step-sequences - Make Sequences Menu

To program a user step-sequence:

1. Press <F3>-MAKE from the STEP SEQUENCES MENU and the following display appears:

sequence to make

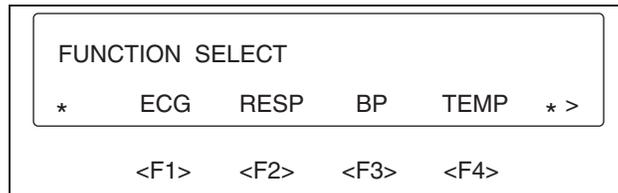
SEQ1 SEQ2 SEQ3 SEQ4

<F1> <F2> <F3> <F4>

eic111.eps

2. From this menu, press the function key that corresponds to the user sequence that is to be programmed.

When a sequence choice is made, the display returns to the FUNCTION SELECT MENU and an asterisk (*) at each end of the second line indicates that the "make" sequence mode is running. The menu display looks like this:

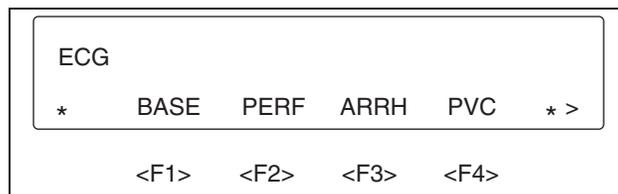


eic112.eps

The following example shows how a waveform segment of a user step-sequence is saved and placed into a sequence. As an illustration, an ECG baseline BPM setting with its run time is placed into a user step-sequence.

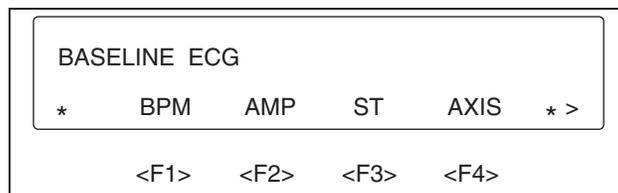
After a sequence (<F1>-SEQ1, <F2>-SEQ2, <F3>-SEQ3, or <F4>-SEQ4) has been chosen from the SEQUENCE TO MAKE MENU:

1. Press <F1>-ECG from the FUNCTION SELECT MENU:



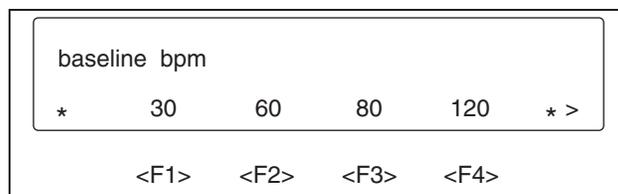
eic113.eps

2. Press <F1>-BASE:



eic114.eps

3. Press <F1>-BPM:



eic115.eps

- At this menu level, the executable parameters for baseline BPM are selected. If, for instance, a baseline BPM of 60 is desired, press <F2>-60, and the display changes to:



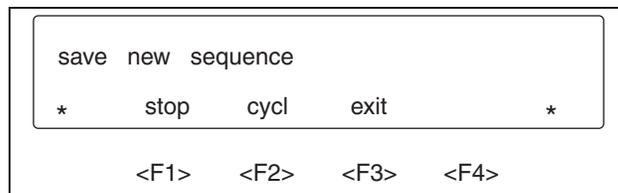
eic116.eps

- From the STEP TIME (MINUTES) MENU, set the desired run time for that segment. Press the related function key repeatedly to increment the value directly above that key.
- Time is adjustable from 10 to 99 minutes using the <F1> and <F2> keys, and from 0.0 to 9.9 minutes using the <F2> and <F3> keys.

Note

To cancel a setting, or to remove a selection, press the <up arrow> key, an action that returns you to the previous menu. Then reselect the executable parameter.

- To save a desired setting, press <F4>-SAVE. When a time setting is saved, the segment is placed into the sequence, and you are returned to the previous menu.
- Continue in the same manner to program any additional segments into the selected sequence. There can be up to 20 segments in a sequence.
- After the last segment of a sequence is saved, use the <up arrow> key to return to the FUNCTION SELECT MENU, page 2, then press <F3>-SEQ, and the following menu appears:



eic117.eps

From this menu select the sequence ending:

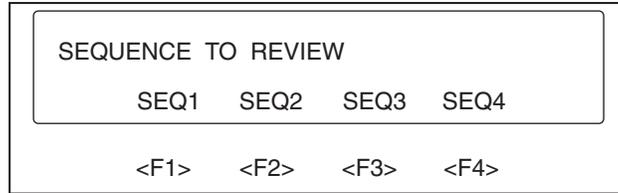
Selections	Descriptions
stop	Sequence holds at the last segment
cycl	Sequence cycles back to the beginning and continues
exit	Cancels the entire sequence just programmed and restores the previous one

Note

An error beep results if an item that cannot be in a sequence (such as viewing angle) is selected.

Function Select - Sequences -Step-sequences - Sequence to Review Menu

To select the SEQUENCE TO REVIEW MENU, press <F4>-REVU from the STEP SEQUENCES MENU and the following display appears:



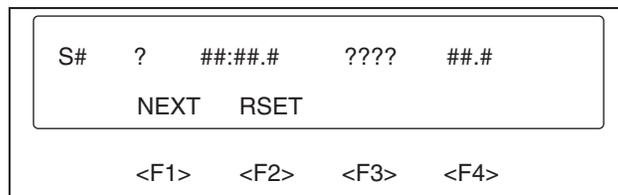
eic118.eps

This menu provides for a review of user step-sequences.

Note

If a selected sequence has not yet been programmed, an error beep sounds.

Upon selecting a sequence to review (<F1>, <F2>, <F3>, or <F4>) the display, as represented below, provides the following information:



eic119.eps

From the top line of the display:

- S# Is the sequence name: "S 1", "S2", "S3", or "S4"
- ? Is the end mode: "s" or "c" (stop or cycle)
- ##:##.# Is the sequence run time
- ???? Is the segment name (abbreviated)
- ##.# Is the segment run time

The second line of the display shows the selections as follows:

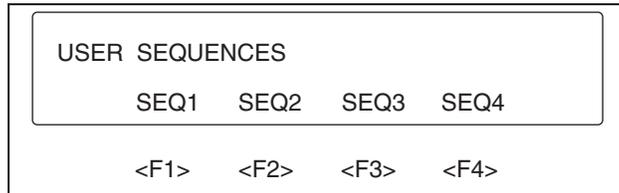
- | Selections | Descriptions |
|-------------------|--------------------------------------|
| NEXT | Steps through the segments |
| RSET | Reset goes back to the first segment |

Function Select - Sequences -Step-sequences - User Sequences Menu

After programming user step-sequences, from the USER SEQUENCES MENU choose the user step-sequence to run.

To select the USER SEQUENCES MENU:

1. Press <F2>-USER from the STEP SEQUENCES MENU for the following menu display:



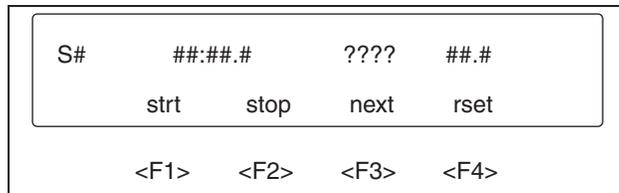
eic120.eps

2. Press the corresponding function key to select the desired sequence.

Note

If a selected sequence has not yet been programmed, an error beep sounds. To program user step-sequences, follow the instructions that appear in the Make Sequences Menu section located earlier in this chapter.

Upon pressing a function key related to a previously programmed user step-sequence, the display, as represented below, provides the following information:



eic121.eps

From the top line of the display:

- S# Is the sequence name: "S1", "S2", "S3", or "S4"
- ##:##.# Is the sequence run time
- ???? Is the segment name (abbreviated)
- ##.# Is the segment run time

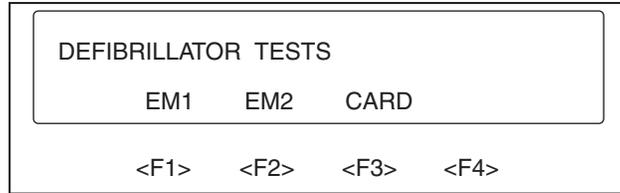
Menu operations for user step-sequences are the same as for preset (or fixed) step-sequences.

The user step-sequence selections and descriptions follow:

Selections	Descriptions
strt	Starts the sequence running
stop	Stops the sequence
next	Steps to the next segment if running
rset	Reset stops the sequence, returns to the first segment, and clears the time. Reset does not restart the sequence

Function Select - Defibrillator Tests Menu

To access the DEFIBRILLATOR MENU, press <F4>-DEFB from page 2 of the FUNCTION SELECT MENU:



eic122.eps

The DEFIBRILLATOR TESTS MENU contains a series of interactive waveforms in which the patient simulator outputs a fibrillation waveform that can be "defibrillated" either by a menu selection ("defib") or by inputting a pulse signal through the "SYNC/A-PACE" jack.

Obtain this pulse signal by discharging a defibrillator into a Fluke Biomedicals Defibrillator Analyzer that is connected through the Real Time Output to the medSim 300B through the "SYNC/A PACE" jack.

In the emergency simulations ("EMI" and "EM2"), the pulse signal can be inserted at any time during ventricular fibrillation for successful defibrillation.

In the cardioversion ("CARD") mode, the pulse must be synchronized with the R-wave and must come within 100 ms (before or after) the peak of the R-wave. If the pulse signal is inserted within this time window, the simulator is defibrillated successfully. If the pulse signal is inserted outside this time window, the ECG waveform changes to ventricular fibrillation, and the simulator can then be defibrillated back to a normal waveform.

The successful defibrillation waveform for all series is a negative pulse that takes 3 seconds to recover to a flat line, then 3 nodal beats at 30 BPM, then 6 nodal beats at 60 BPM, and ends with continuous normal beats at 80 BPM.

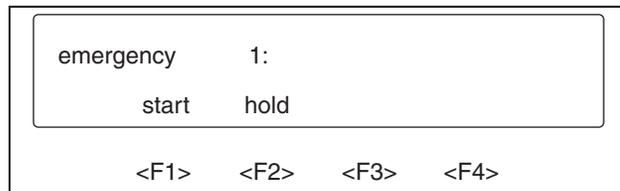
The waveform for an unsuccessful defibrillation, when in cardioversion, is the same negative pulse and 3 seconds of recovery followed by ventricular fibrillation.

Function Select - Defibrillator Tests -Emergency 1 Menu

"Emergency 1" generates a series of 10 normal beats, a PVC (R on T), 6 normal beats, another PVC (R on T), and then a continuous fine ventricular fibrillation.

To access the EMERGENCY 1 MENU:

1. Press <F1>-EM1 from the DEFIBRILLATOR TESTS MENU:

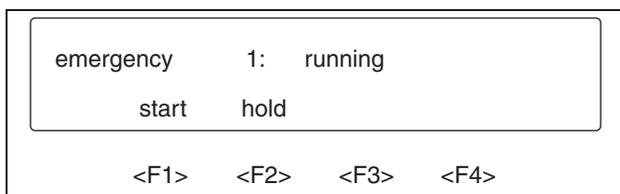


eic123.eps

Menu selections and their descriptions follow:

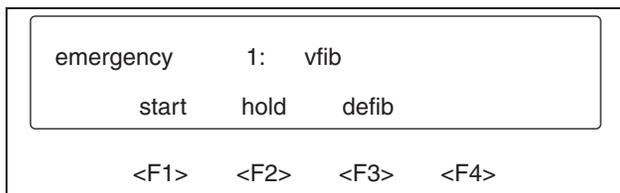
Selections	Descriptions
start	Starts the series
hold	Disables the signal from the "SYNC/A PACE" input. When "hold" is flashing, the signal is disabled

2. Press <F1>-START to start "Emergency I", and the display changes to:



eic124.eps

When the waveform changes to ventricular fibrillation, the display changes to:



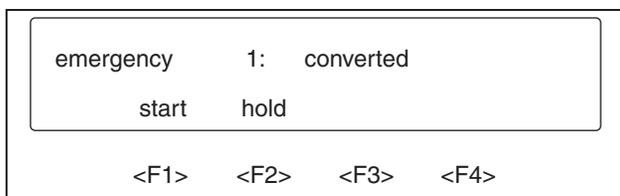
eic125.eps

3. Press <F3>-DEBB or input a pulse signal through the rear panel "SYNC/A PACE" jack to defibrillate the simulator and convert the ECG to normal sinus rhythm.

Note

For the medSim 300B patient simulator to be able to receive the input signal, make certain that "hold" is not flashing.

A successful defibrillation is indicated as the display changes to:



eic126.eps

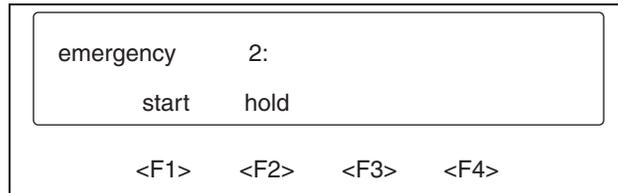
The sequence can be repeated by pressing <F1>-START.

Function Select - Defibrillator Tests -Emergency 2 Menu

"Emergency 2" selects a series with 10 normal beats, 25 beats of ventricular tachycardia (180 BPM), and then a continuous fine ventricular fibrillation.

To access the EMERGENCY 2 MENU:

1. Press <F2>-EM2 from the DEFIBRILLATOR TESTS MENU:



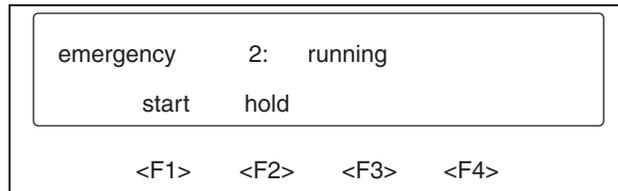
eic127.eps

Menu selections (same as "EM1") and their descriptions follow:

Selections Descriptions

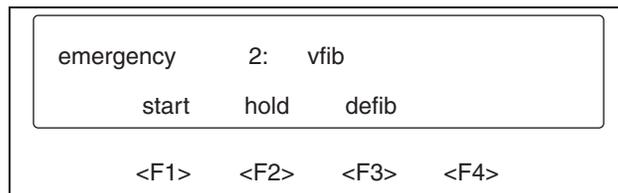
- | | |
|-------|---|
| start | Starts the series |
| hold | Disables the signal from the "SYNC/A PACE" input. When "hold" is flashing, the signal is disabled |

2. Press <F1>-START to start "Emergency 2", and the display changes to:



eic128.eps

When the waveform changes to ventricular fibrillation, the display changes to:



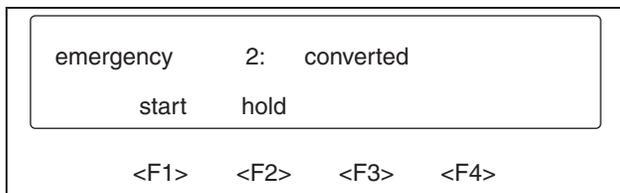
eic129.eps

3. Press <F3>-DEFIB or input a pulse signal through the rear panel "SYNC/A PACE" jack to defibrillate the simulator and convert the ECG to normal sinus rhythm.

Note

For the medSim 300B patient simulator to be able to receive the input signal, make certain that "hold" is not flashing.

A successful defibrillation is indicated as the display changes to:



eic130.eps

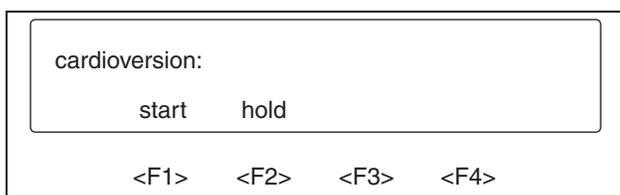
The sequence can be repeated by pressing <F1>-START.

Function Select - Defibrillator Tests -Cardioversion Menu

"Cardioversion" produces a coarse atrial fibrillation waveform that, to be defibrillated, must be synchronized with the R-wave.

To choose the CARDIOVERSION MENU:

1. Press <F3>-CARD from the DEFIBRILLATOR TESTS MENU:

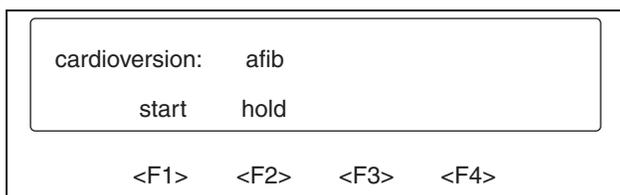


eic131.eps

Menu selections and their descriptions follow:

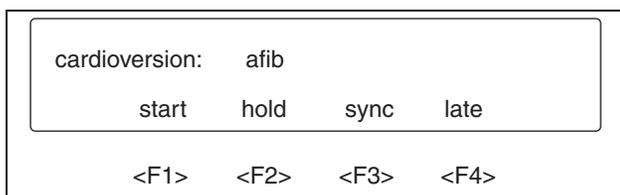
Selections	Descriptions
start	Starts the series
hold	Disables the signal from the "SYNC/A PACE" input. When "hold" is flashing, the signal is disabled

2. Press <F1>-START to start atrial fibrillation, and the display changes to:



eic132.eps

and then quickly to:

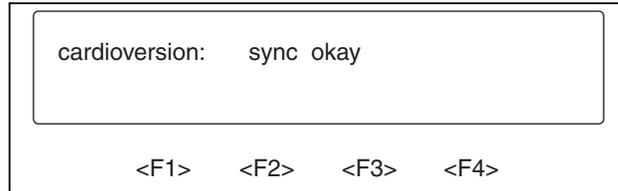


eic133.eps

At this point, defibrillation can be accomplished either by a defibrillator signal input or by using the CARDIOVERSION MENU.

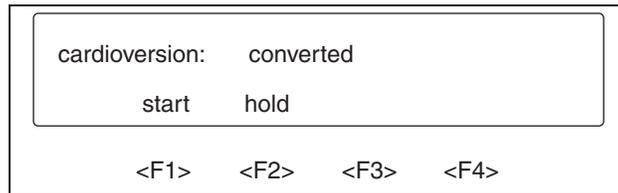
3. When defibrillating by a defibrillator pulse signal input through the "SYNC/A PACE" jack, the timing relationship to the ECG R-wave peak is checked.

If the pulse comes within ± 100 ms, defibrillation is successful and the ECG converts to normal sinus rhythm. The display then shows the following:



eic134.eps

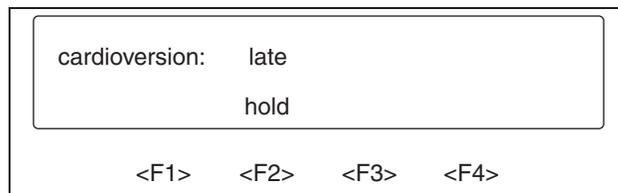
and, after 3 seconds, changes to:



eic135.eps

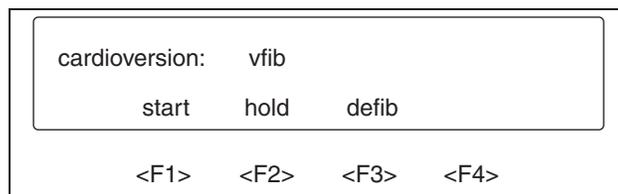
This is the end of the sequence. It can be restarted by pressing <F1>-START.

4. If the pulse signal is outside ± 100 ms, defibrillation is late and the ECG changes to ventricular fibrillation. The display shows:



eic136.eps

then changes to:



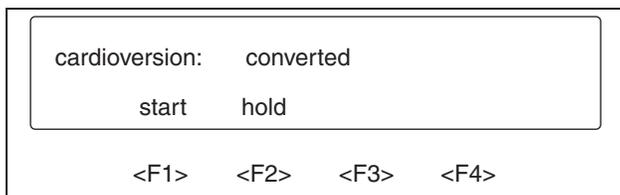
eic137.eps

5. Press <F3>-DEFIB or input a pulse signal through the rear panel "SYNC/A PACE" jack to defibrillate the simulator and convert the ECG to normal sinus rhythm.

Note

For the medSim 300B patient simulator to be able to receive the input signal, make certain that "hold" is not flashing.

A successful defibrillation is indicated when the display changes to:



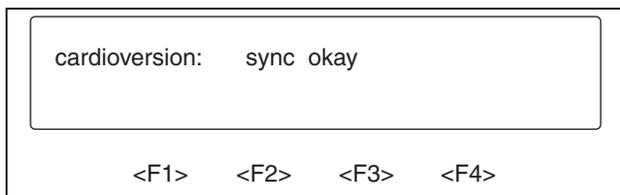
eic138.eps

This is the end of the sequence. It can be restarted by pressing <F1>-START.

To defibrillate from the CARDIOVERSION MENU, follow the previous illustrations to start atrial fibrillation.

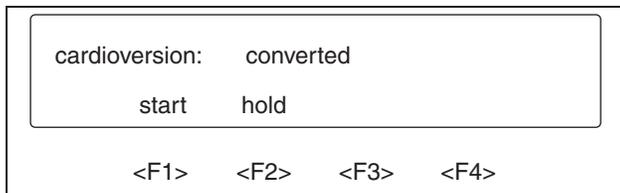
1. Then press <F3>-SYNC, which defibrillates the waveform at 20 ms after the next R-wave peak.

As the waveform converts to normal sinus rhythm, the display shows:



eic139.eps

then, after 3 seconds, changes to:

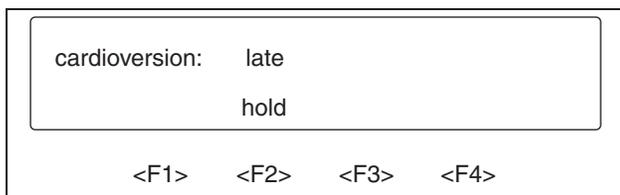


eic140.eps

This is the end of the sequence. It can be restarted by pressing <F1>-START.

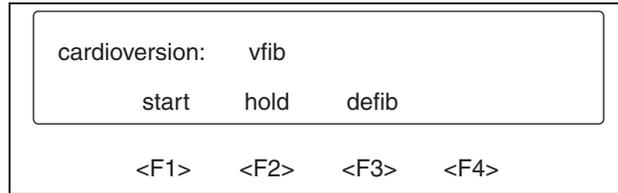
2. Press <F4>-LATE to defibrillate the waveform at 200 ms after the R-wave peak and convert the waveform to ventricular fibrillation.

The display shows:



eic141.eps

then changes to:



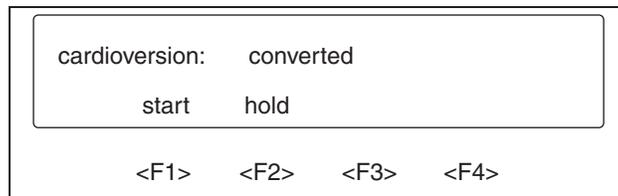
eic142.eps

3. Press <F3>-DEFIB or input a pulse signal through the rear panel "SYNC/A PACE" jack to defibrillate the simulator and convert the ECG to normal sinus rhythm.

Note

For the medSim 300B patient simulator to be able to receive the input signal, make certain that "hold" is not flashing.

A successful defibrillation is indicated as the display changes to:



eic143.eps

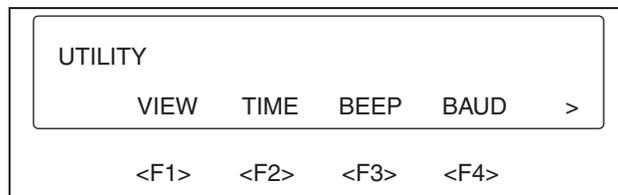
This is the end of the sequence. It can be restarted by pressing <F1>-START.

Function Select - Utility Menu

To choose the UTILITY MENU:

1. Press <F1>-UTIL from the FUNCTION SELECT MENU, page 3.

The five UTILITY MENU selections are displayed in two pages as shown:

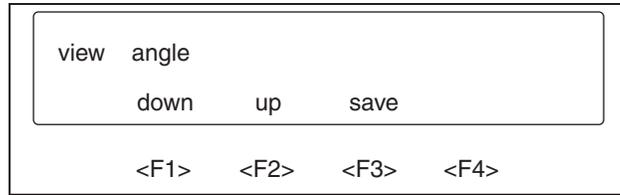


eic144.eps



eic145.eps

- Use the VIEW MENU to adjust the viewing angle of the display for the best contrast. From the UTILITY MENU, select <F1>-VIEW for the following display:



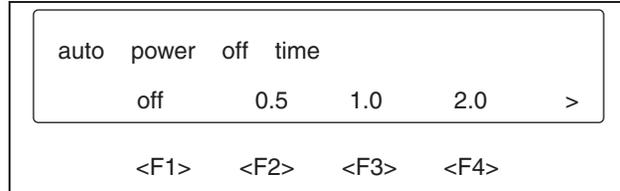
eic146.eps

- Press either <F1>-DOWN or <F2>-up repeatedly to change the viewing angle and the contrast of the display.
- Press <F3>-SAVE to save the desired viewing angle permanently in the EEPROM.

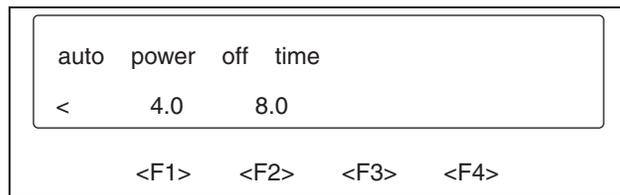
Note

If not saved, the viewing angle returns to the previous setting the next time the power is turned on.

- Use the TIME MENU to select a time interval to automatically shut off the medSim 300B following the last key pressed.
- From the UTILITY MENU, choose <F2>-TIME:



eic147.eps



eic148.eps

- Press a related function key to select a desired time interval (in hours) after which the medSim 300B is to automatically shut off. Press <F1>-OFF to disable this mode.

The selected value is saved in the EEPROM.

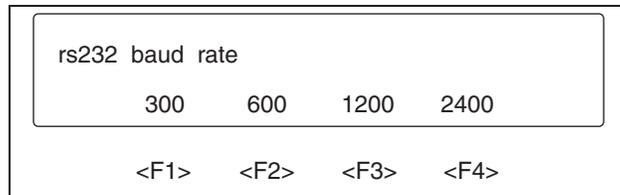
8. The BEEP MENU is for turning the key "beep" off and on. From the UTILITY MENU, choose <F3>-BEEP:



eic149.eps

The key beep setting is not saved.

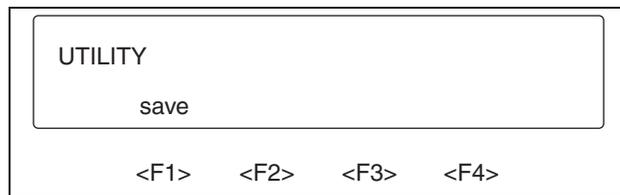
9. The BAUD MENU selects the RS-232 baud rate. From the UTILITY MENU, choose <F4>-BAUD:



eic150.eps

10. Select the function key that relates to the desired baud rate. This setting is saved.

The SAVE MENU:



eic151.eps

Press <F1>-SAVE to save all present settings as power-on settings.

Note

Additional information on "Power-On Conditions" can be found in the POWER-ON CONDITIONS section at the beginning of this chapter.

RS-232 Serial Port Operation

Overview

All functions, except utilities and switch settings, can be controlled remotely via RS-232 serial port operation.

Note

A specialized cable, available from Fluke Biomedical, is required for RS-232 remote control. Refer to the current Fluke Biomedical Price List for availability, part number information, and price.

Baud rate is adjustable to 300, 600, 1200, or 2400 from the UTILITY MENU as shown in the previous section. Parity is off and there are 2 stop bits.

Remote commands can be sent in lower case or in upper case letters and all command strings must be terminated with a carriage return [CR] and/or a line feed [LF]; that is, [command][CR][LF]. Illegal entries cause the error message "? CR LF" to be returned, and legal entries return "* CR LF". This process can take up to one second during which time all other inputs are ignored.

The function entered is displayed on the front panel display of the medSim 300B.

To prevent functional inconsistencies, some commands can cause changes in certain parameters: for example, entering an arrhythmia turns off PVCs per minute, and starting Swan-Ganz sets ECG to normal sinus rhythm.

Remote Commands

By category, the following is a list of RS-232 remote commands and their descriptions.

Note

The command is preceded by a bullet (•), which is not part of the command string.

Normal Sinus Rhythm:

- NSBn BPM n
n = 30, 60, 80, 120, 160, 200, 240, and 300

ECG Amplitude:

- NSAn Amplitude = n
n = 0.05, 0.10, 0.15, 0.20, 0.25, 0.30,
0.35, 0.40, 0.45, 0.50, 0.75, 1.00,
1.25, 1.50, 1.75, 2.00, 2.25, 2.50,
2.75, 3.00, 3.25, 3.50, 3.75, 4.00,
4.25, 4.50, 4.75, 5.00, 5.25 and 5.50

ST Deviation:

- STDn ST deviation = n
n = 0, ± (0.05, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7 and 0.8.)

Axis Deviation:

- AXNRM Normal axis

- AXHRZ Horizontal axis
- AXVER Vertical axis

Neonatal:

- NEOOFF Neonatal, off
- NEOON Neonatal, on

ECG Performance Waveforms:

- ZERO Zero output
- PUL Pulse at 4 s, 1 mV
- SQU Square waveform, 2 Hz at 1 mV.
- TRI Triangle waveform, 2 Hz at 1 mV
- SINn Sine waveform
n = 0.05, 0.5, 1, 10, 25, 30, 40, 50, 60 and 100

R-wave Width:

- RWn Width = n
n = 8, 12, 20, 40, 60, 80, 100, 120, 140, 160, 180 and 200

Supraventricular Arrhythmias:

- AF1 Atrial fibrillation 1
- AF2 Atrial fibrillation 2
- AFL Atrial flutter
- SINA Sinus arrhythmia
- MB80 Missing beat at 80 BPM
- MB120 Missing beat at 120 BPM
- PAT Paroxysmal atrial tachycardia.
- NOD Nodal rhythm
- SVT Supraventricular tachycardia

Premature Arrhythmias:

- PAC Premature atrial contraction
- PNC Premature nodal contraction
- PVC Premature ventricular contraction
- MF1 Multifocal PVCs 1
- MF2 Multifocal PVCs 2
- MF3 Multifocal PVCs 3

Ventricular Arrhythmias:

- BIG Bigeminy
- TRG Trigeminy
- PAIR Pair of PVCs

- RUN5 Run of 5 PVCs
- RUN11 Run of 11 PVCs
- VNT Ventricular rhythm
- VTC Ventricular tachycardia
- VFB Ventricular fibrillation
- EMD Electromotive disassociation
- ASY Asystole

Conduction Arrhythmias:

- 1DB First degree A-V block
- 2DB1 Second degree A-V block, type 1
- 2DB2 Second degree A-V block, type 2
- 3DB Third degree A-V bloc
- RBB Right bundle branch block
- LBB Left bundle branch block

PVC Type (Focus):

- PVCTn Type = n
n = 1, 2, 3 and 4

Note

For descriptions of PVC types 1, 2, 3 and 4, see the Funtion Select ECG – PVC Parameters Menu section earlier in this chapter.

PVC Timing:

- PVCR R on T
- PVCE Early
- PVCS Standard

PVCs per Minute:

- PVCn PVCs per minute = n
n = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, and 25

Pacemaker Waveforms:

- ASN Asynchronous at 75 BPM
- DM1 Demand 1
- DM2 Demand 2
- AVS Atrial-ventricular sequential
- NCA Non-capture
- NFU Non-function

Atrial Pacemaker Amplitude:

- AHn amplitude = n
 n = 0, ±(2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 50, 100, 200, 500, and 700.)

Atrial Pacemaker Width:

- AWn width = n
 n = 0.1, 0.2, 0.5, 1.0, and 2.0

Ventricular Pacemaker Amplitude:

- VHn amplitude = n
 n = 0 ± (2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 50, 100, 200, 500, and 700)

Ventricular Pacemaker Width:

- VWn width = n
 n = 0.1, 0.2, 0.5, 1.0, and 2.0

Insert Premature Beat:

- IPVC Insert PVC
- IPAC Insert PAC
- IPNC Insert PNC

Respiration Waveform:

- RNRM Normal respiration
- RVNT Ventilator assisted respiration

Respiration Rate:

- RRn rate = n
 n = 15, 20, 30, 40, 60, and 120

Respiration Ohms:

- ROn ohms = n
 n = 0.0, 0.1, 0.2, 0.5, 1.0, and 3.0

Respiration Ratio:

- RATn ratio = n
 n = 1/1, 2/1, 3/1, 4/1, and 5/1.

Respiration Apnea:

- AOFF Apnea, off
- AON Apnea, on
- A12 Apnea, 12 seconds
- A32 Apnea, 32 seconds

Respiration Shift:

- SFTOFF Baseline shift, off
- R+SFT Baseline shift, positive
- R-SFT Baseline shift, negative

Blood Pressure—All Channels:

- ZALL Zero all blood pressure channels

Blood Pressure Channel 1:

- P1ART Arterial
- P1LV Left ventricle
- P1CVP Central venous pressure
- P1RV Right ventricle
- P1PA Pulmonary artery
- P1W Pulmonary artery wedge
- P1Sn Static = n
n = -10, -5, 0, 20, 40, 80, 100, 200, 250, and 300

Blood Pressure Channel 2:

- P2ART Arterial
- P2LV Left ventricle
- P2CVP Central venous pressure
- P2RV Right ventricle
- P2PA Pulmonary artery
- P2W Pulmonary artery wedge
- P2Sn Static = n
n = -10, -5, 0, 20, 40, 80, 100, 200, 250, and 300

Blood Pressure Channel 3:

- P3CVP Central venous pressure
- P3RV Right ventricle
- P3PA Pulmonary artery
- P3W Pulmonary artery wedge
- P3Sn static = n
n = -10, -5, 0, 5, 10, 20, and 30
- STSG Swan-Ganz, start
- INS Swan-Ganz, insert
- INF Swan-Ganz, inflate
- DEF Swan-Ganz, deflate
- REM Swan-Ganz, remove

Blood Pressure Channel 4:

- P4ART Arterial
 - P4LV Left ventricle
 - P4RV Right ventricle
 - P4PA Pulmonary artery
 - P4W Pulmonary artery wedge
 - P4T30 Triangle, 30 mm
 - P4T300 Triangle, 300 mm
 - P4Sn Static = n
- n = -10, -5, 0, 20, 40, 80, 100, 200, 250, and 300

Temperature:

- T34 Temperature, 34 °C
- T37 Temperature, 37 °C
- T40 Temperature, 40 °C
- THYPO Hypothermia
- THYPR Hyperthermia
- TSPK Spike

ECG Artifact:

- EAOFF ECG artifact, off
- EA50 ECG artifact, 50 Hz
- EA60 ECG artifact, 60 Hz
- EAMSC ECG artifact, muscular
- EAWNDR ECG artifact, baseline-wander

ECG Artifact Lead:

- EALALL ECG artifact, all leads
- EALRA ECG artifact, Lead RA
- EALLA ECG artifact, Lead LA
- EALLL ECG artifact, Lead LL
- EALV1 ECG artifact, Lead V1

ECG Artifact Size:

- EAAX.25 ECG Lead II amplitude times 0.25
- EAAX.5 5 ECG Lead II amplitude times 0.5
- EAAX1.0 ECG Lead II amplitude times 1.0

Blood Pressure/Respiration Artifact:

- PAOFF BP/R artifact, off
- PA5 BP/R artifact, amplitude 5% or 5 mmHg

- PA10 BP/R artifact, amplitude 10% or 10 mmHg

Autosequences:

- FAIL
- VNT1
- COND
- RESP
- VNT2
- TEST
- SETUP
- STRTUP

Note

For descriptions of the above autosequence remote commands see the Function Select – Sequences – Autosequences Menu section earlier in this chapter.

Step-sequences:

- CCU
- HOLT
- PACE
- USEQ1
- USEQ2
- USEQ3
- USEQ4

Note

For descriptions of the above step-sequences remote commands see the Function Select - Sequences - Step-sequences Menu section earlier in this chapter.

Defibrillator:

- STDEF1 Start emergency 1 series
- STDEF2 Start emergency 2 series
- STCARD Start elective cardioversion
- DEFIB Simulate a defibrillation
- LATE Simulate a late defibrillation
- SYNC Simulate a synchronized defibrillation
- DFON Enable defibrillator input
- DFOFF Disable defibrillator input

Miscellaneous:

- IDENT Instrument returns identification

- KOFF Disable keyboard
- KON Enable keyboard

Menu Structure

All medSim 300B menu choices are made from the MAINMENU "Function Select".

A condensed listing of the menus follows. This listing does not include the executable parameter value menu levels, as described earlier in this chapter.

Note

An asterisk () preceding an item denotes a menu feature option.*

ECG

- | | |
|--------------------------|--|
| BASELINE ECG: | Baseline BPM
ECG amplitude, Lead II
ST deviation
Axis deviation
Neonatal |
| ECG
PERFORMANCE: | Performance waveforms
R-wave detection |
| ARRHYTHMIAS: | Supraventricular
Premature
Ventricular 1
Ventricular 2
Conduction |
| PVC PARAMETERS: | Type (focus)
Time
PVCs per minute
Total |
| PACEMAKER: | Pacemaker waveforms
Atrial pacer
Ventricle pacer |
| INSERT
PREMATURE BEAT | |
| *FETAL ECG: | *BPM
*Intrauterine Pressure |

Respiration

WAVE
RATE
OHMS
RATIO
APNEA
BASELINE SHIFT

Blood Pressure Channel Select

BLOOD PRESSURE 1: BP 1 waveforms
BP 1 static

BLOOD PRESSURE 2: BP 2 waveforms
BP 2 static

BLOOD PRESSURE 3: BP 3 waveforms
BP 3 static
Bp 3 Swan-Ganz

BLOOD PRESSURE 4: BP 4 waveforms
BP 4 static
*Intra-aortic Balloon Pump
*Normal sinus rhythm BPM
*Intra-aortic balloon pump arrhythmias
*Intra-aortic balloon pump paced

ZERO

*CATHETERIZATION: * Aortic valve
* Mitral valve
* Pulmonary valve

Temperature

***Cardiac Output**

*CARDIAC OUTPUT
BASELINE
TEMPERATURE

*CARDIAC OUTPUT
WAVEFORM

*CARDIAC OUTPUT
TRENDS: *Normal
* Interrupted
* Slow

* ADJUST BASELINE
TEMPERATURE

Artifact

ECG ARTIFACT: ECG Artifact Wave
 ECG Artifact Lead
 ECG Artifact Size

BLOOD
PRESSURE/RESPIRA
TION ARTIFACT
SIZE:

Sequences

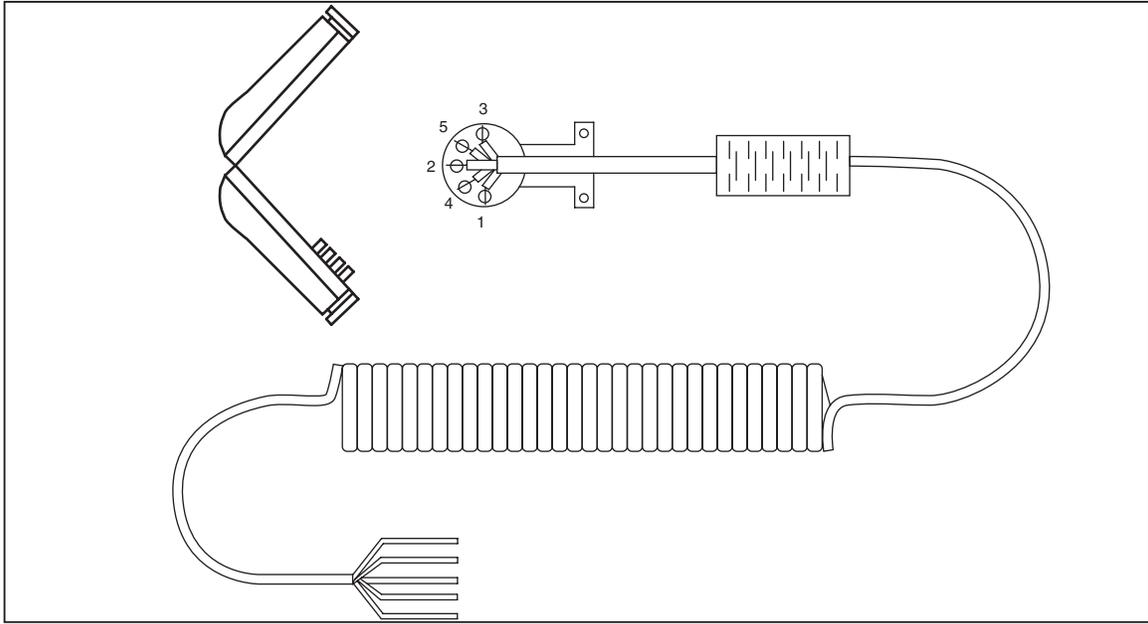
AUTOSEQUENCES
STEP-SEQUENCES Fixed (Preset) Sequences
 User Sequences
 Sequence to Make
 Sequence to Review

Defibrillator Tests

EMERGENCY 1
EMERGENCY 2
CARDIOVERSION

Utility

VIEW ANGLE
AUTOMATIC OFF TIME
KEY BEEP
RS-232 BAUD RATE
SAVE



eic152.eps

Figure 3-1. Unterminated Blood Pressure Output Cable Assembly

Table 3-1. Wiring Table

Function	Color	PIN
-OUTPUT	RED	1
+OUTPUT	BLACK	4
SHIELD	BLUE	2
-EXCITER	GREEN	5
+EXCITER	WHITE	3

Chapter 4

Option 1

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Overview

Option 1 enables the medSim 300B to generate waveforms that simulate:

- Cardiac catheterization (by single and dual lumen catheters).
- Fetal/maternal ECG with intrauterine pressure.
- Intra-aortic balloon pump augmentation.

Note

These waveforms are useful when you are evaluating cardiac catheterization systems, fetal monitors, and intra-aortic balloon pumps.

Cardiac Catheterization

The medSim 300B can simulate systolic pressure gradients (measured with single and dual lumen cardiac catheters) across the aortic, pulmonary and mitral valves.

Note

To evaluate cardiac catheterization systems, blood pressure cables are needed. Refer to the current Fluke Biomedical Price List for availability, part number information and price.

The medSim 300B uses the following default (normal) values for medSim 300B outputs BP1, BP2, BP3 and BP4 when beginning cardiac valve simulation:

Channel	Description	Pressure
BP1	Left ventricular (LV)	120/0
BP2	Arterial (ART)	120/80
BP3	Pulmonary arterial (PA)	25/10
BP4	Right ventricular (RV)	25/0

Pressure Gradients across Aortic and Pulmonary Valves

In a normal heart, systolic pressures on both sides of both the aortic valve and the pulmonary valve (ventricular and arterial systolic pressures) are about the same. A gradient, or difference, in these pressures indicates an abnormal valve.

The medSim 300B simulates aortic valve and pulmonary valve defects by increasing ventricular systolic pressure 5 % to 50 % above a constant arterial systolic pressure.

The drawings that follow simulate blood pressure relationships indicating:

- A normal aortic valve
- A defective aortic valve
- A normal pulmonary valve
- A defective pulmonary valve

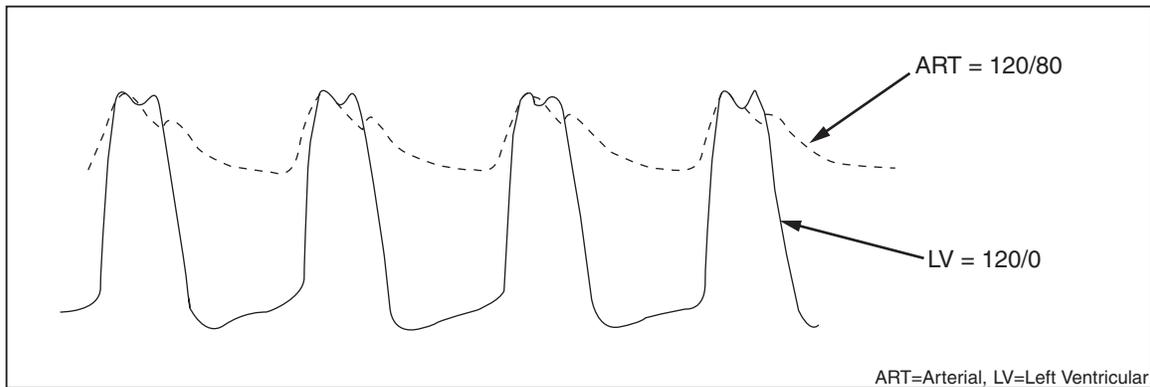


Figure 4-1. medSim 300B Simulated Waveforms for Normal Blood Pressure Relationships across the Aortic Valve

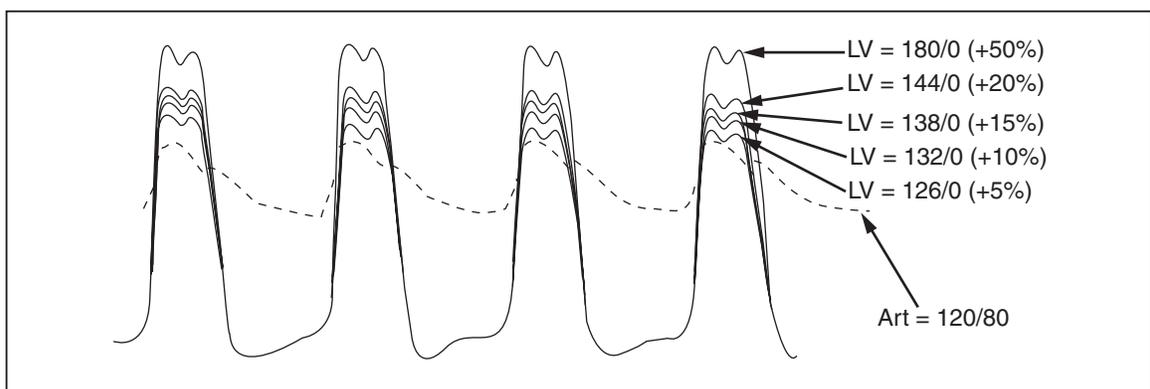


Figure 4-2. medSim 300B Simulated Systolic Pressure Gradients Indicating a Defective Aortic Valve

Note

Increases in left ventricular (LV) pressure over arterial (ART) pressure simulate a defective aortic valve.

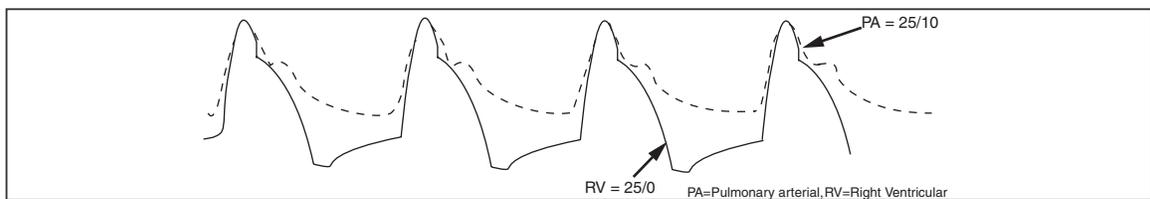


Figure 4-3. medSim 300B Simulated Waveforms for Normal Blood Pressure Relationships across the Pulmonary Valve

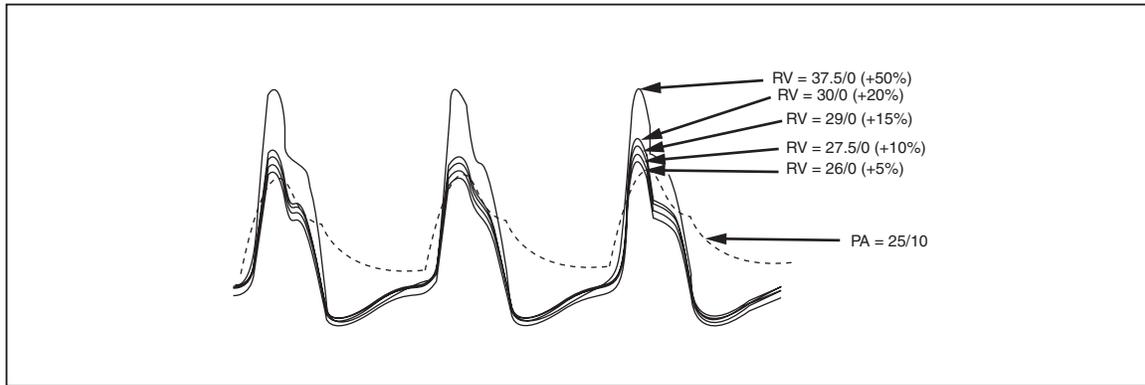


Figure 4-4. medSim 300B Simulated Systolic Pressure Gradients Indicating a Defective Pulmonary Valve

Note

Increases in right ventricular (RV) pressure over pulmonary arterial (PA) pressure simulate a defective pulmonary valve.

Aortic Valve Simulation

For aortic valve simulation, using medSim 300B channels BP1 and BP2, connect the medSim 300B to the cardiac catheterization system under test.

Follow the illustration below:

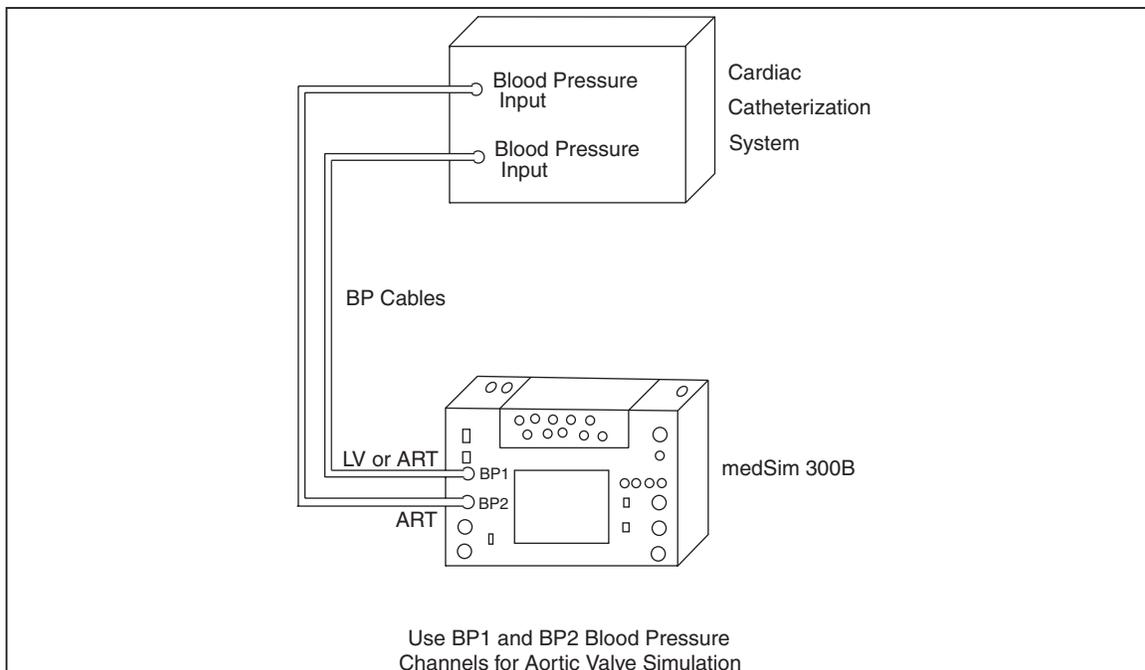
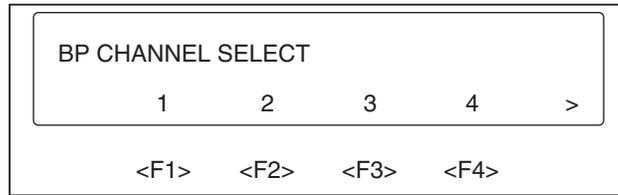


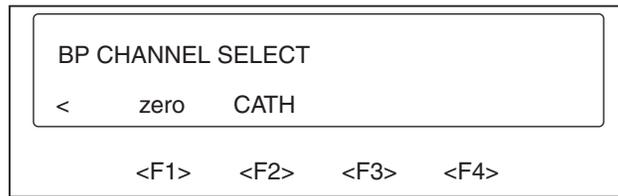
Figure 4-5. Cardiac Catheterization Connections for Aortic Valve Simulation

1. Turn both units on.
2. After a connection has been made, the medSim 300B and the monitor need to be zeroed.

- To zero all four of the medSim 300B blood pressure channels, press <F3>-BP from page 1 of the FUNCTION SELECT MENU, for the following two pages of display:



eic158.eps



eic159.eps

- Press <F1>-ZERO from the second page of the menu.
This sets all the medSim 300B blood pressure channels to zero.

Note

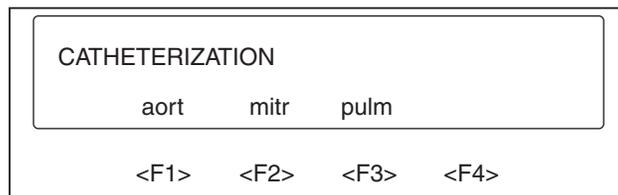
Necessary to complete only once after connecting the medSim 300B to the equipment under test (EUT).

- Now zero the blood pressure channels to be used on the EUT.

To begin aortic valve simulation:

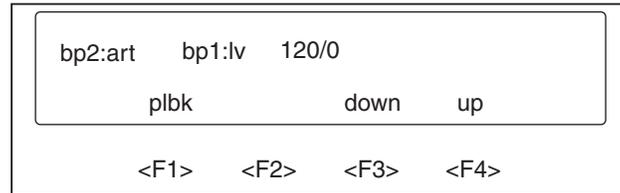
- Choose <F2>-CATH from page 2 of the BP CHANNEL SELECT MENU.

The medSim 300B display shows:



eic160.eps

2. Press <F1>-AORT for the following menu display:



eic161.eps

The top line of the display gives the following information:

bp2:art BP channel 2 arterial pressure-120/80
 bp1:lv BP channel 1 left ventricular pressure
 120/0 Left ventricular pressure setting (variable)

The variable systolic blood pressure selections for left ventricular pressure are:

120/0 Normal (medSim 300B default value)
 126/0 5 % above arterial blood pressure
 132/0 10 % above arterial blood pressure
 138/0 15 % above arterial blood pressure
 144/0 20 % above arterial blood pressure
 180/0 50 % above arterial blood pressure

3. Press <F4>-UP or <F3>-DOWN on the medSim 300B to increase or decrease the systolic blood pressure value for the left ventricle on blood pressure channel 1 (bp 1:lv).

Single and Dual Lumen Catheter Simulation

The medSim 300B simulates blood pressure waveforms obtained with single and dual lumen catheters.

When the medSim 300B begins aortic simulation, it simultaneously represents two types of measurements:

- A single lumen catheter with the lumen placed in the left ventricle.
- A dual lumen catheter with the distal lumen placed in the left ventricle and the proximal lumen in the aorta (one lumen on either side of the aortic valve).

The next two illustrations show single and dual lumen catheter insertion, and single lumen catheter pullback:

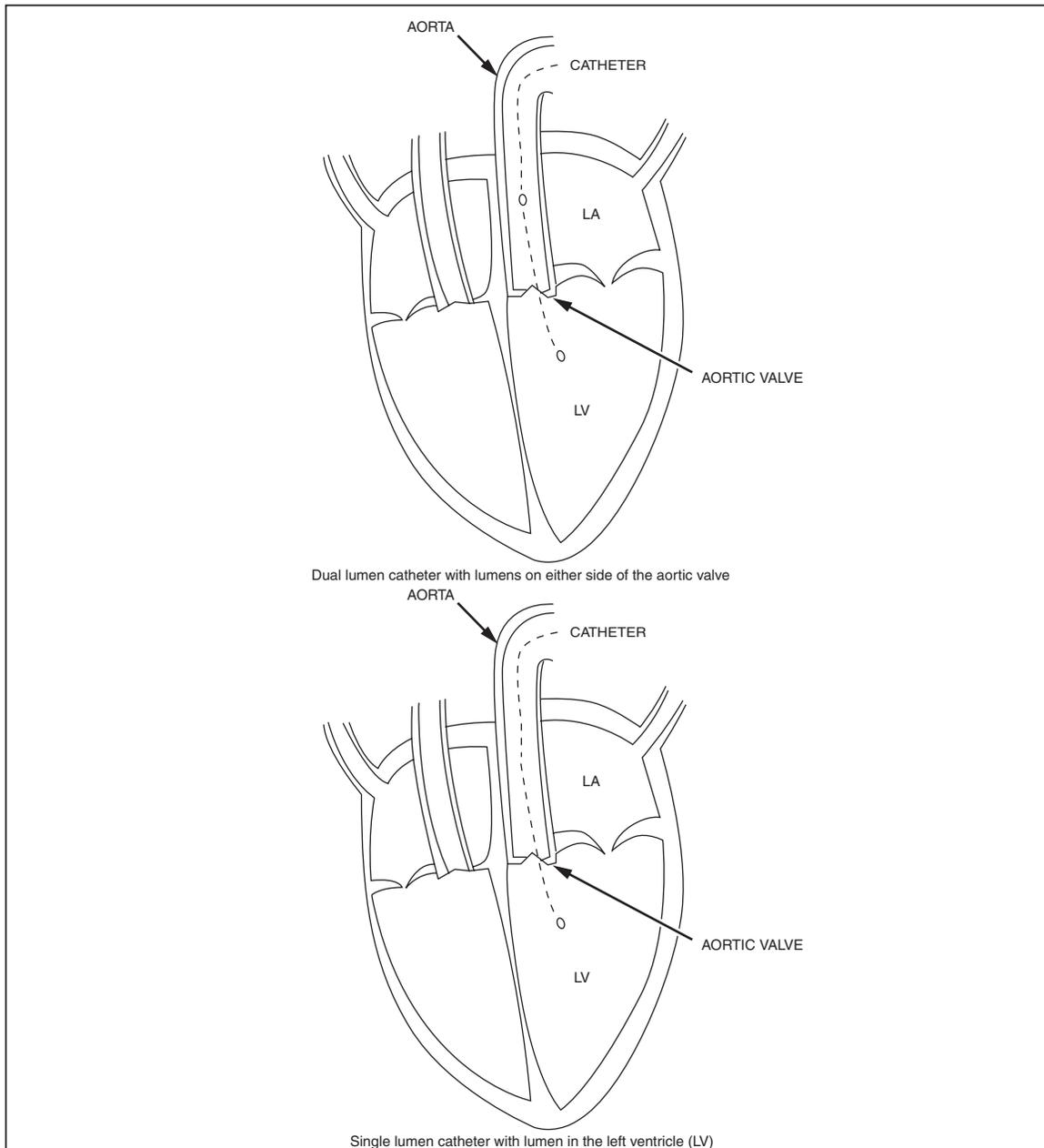


Figure 4-6. Aortic Dual and Single Lumen Catheter Insertion

Note

The medSim 300B simulates blood pressure waveforms obtained with dual and single lumen catheters.

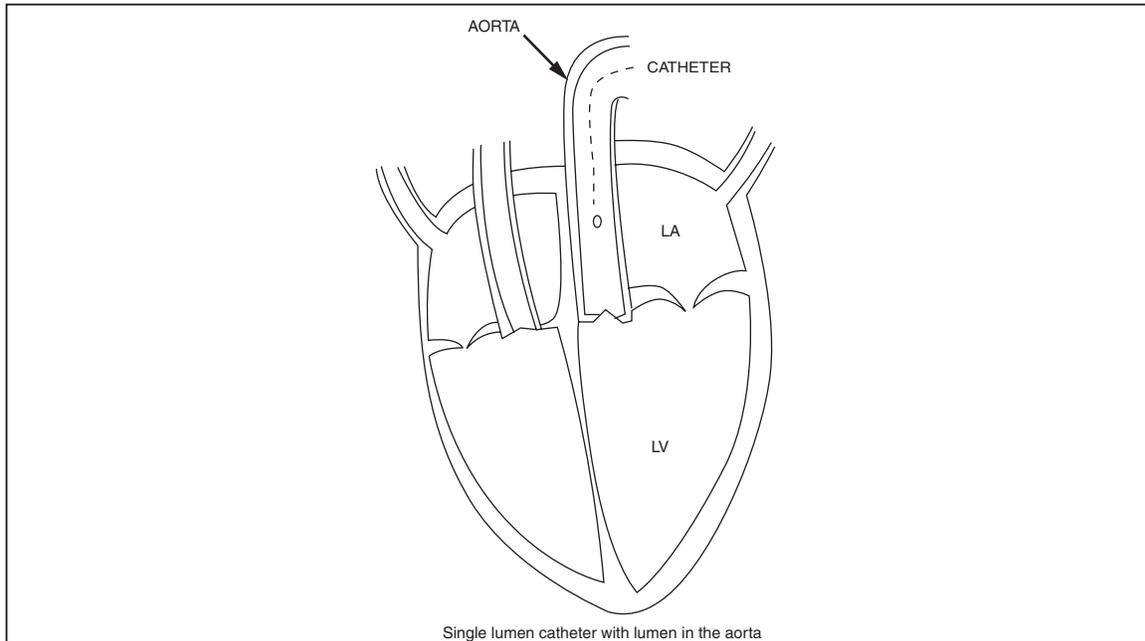


Figure 4-7. Aortic Single Lumen Catheter Pullback

eic163.eps

Note

The medSim 300B waveform for arterial pressure simulates a measurement obtained with the single lumen catheter pullback.

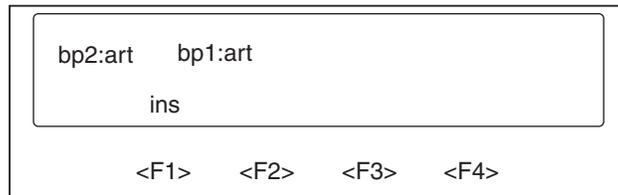
The following represents the simulated blood pressure waveforms for single and dual lumen catheterization in the aorta:

Catheterization	Blood Pressure Waveforms
Single Lumen Catheter	
Inserted	BP1 = LV Variable
Pulled back	BP1 = ART 120/80
Dual Lumen Catheter	
Distal lumen (tip)	BP1 = LV Variable
Proximal lumen	BP2 = ART 120/80

To simulate a single lumen catheter with the lumen in the aorta:

1. Press <F1>-AORT from the CATHETERIZATION MENU, and then press <F1>-PLBK.

The single lumen catheter pullback (aortic valve) simulation begins as follows on the medSim 300B:



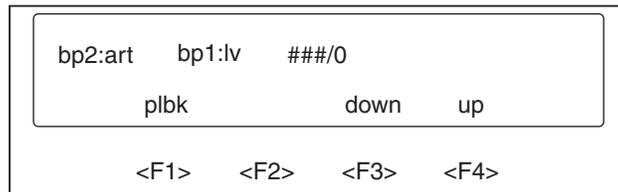
eic164.eps

The top line of the display gives the following information:

bp2:art BP channel 2 arterial blood pressure—120/80

bp1:art BP channel 1 arterial blood pressure—120/80

2. To simulate insertion of the catheter back into the left ventricle select <F1>-INS. The medSim 300B returns to the previous display as shown below:



eic165.eps

Note

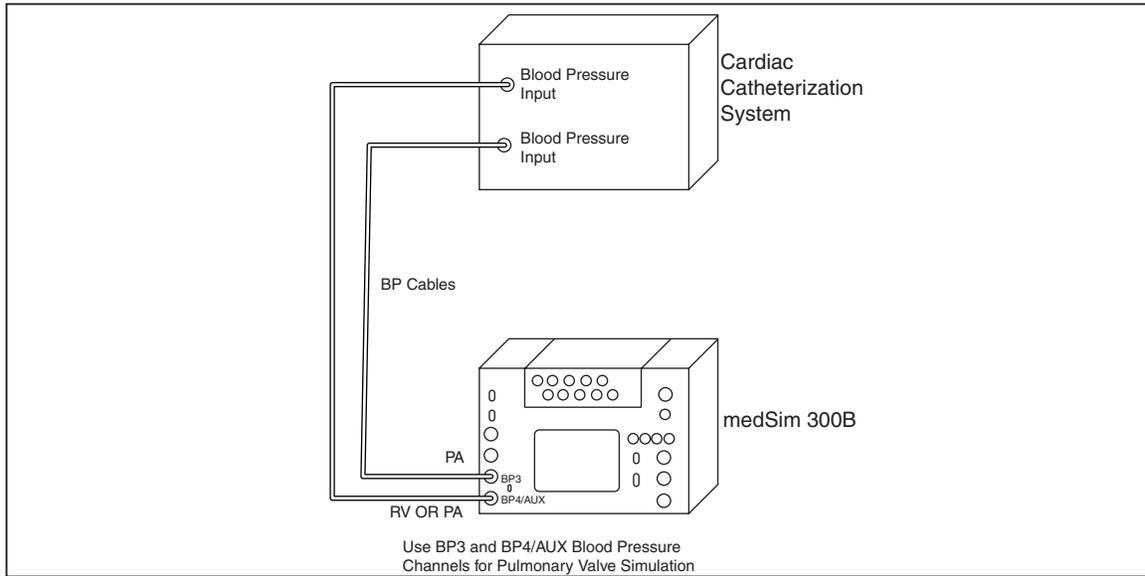
In the above display "###/0" represents the previously selected left ventricular pressure value.

3. To exit the medSim 300B aortic valve simulation, press the <up arrow> key until you view the desired menu.

Pulmonary Valve Simulation

For pulmonary valve simulation, using medSim 300B channels BP3 and BP4/AUX, connect the medSim 300B to the cardiac catheterization system under test.

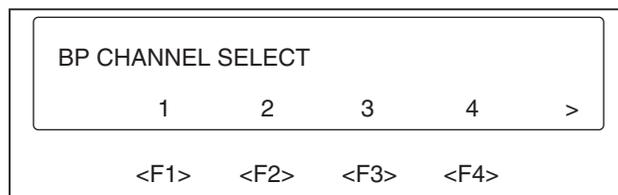
Follow the illustration below:



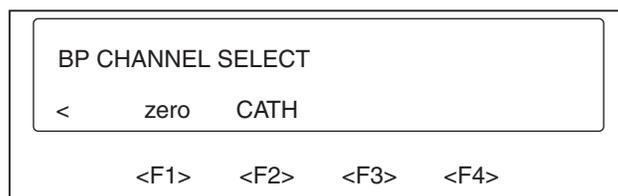
eic166.eps

Figure 4-8. Cardiac Catheterization Connections for Pulmonary Valve Simulation

1. Turn both units on.
2. After a connection has been made, the medSim 300B and the monitor need to be zeroed.
3. To zero all four of the medSim 300B blood pressure channels, press <F3>-BP from page 1 of the FUNCTION SELECT MENU, for the following two pages of display:



eic167.eps



eic168.eps

4. Press <F1>-ZERO from the second page of the menu.
This sets all the medSim 300B blood pressure channels to zero.

Note

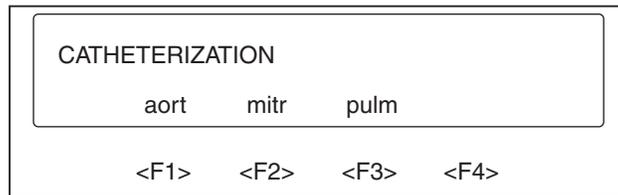
Necessary to complete only once after connecting the medSim 300B to the equipment under test (EUT).

Now zero the blood pressure channels to be used on the EUT.

To begin pulmonary valve simulation:

1. Choose <F2>-CATH from page 2 of the BP CHANNEL SELECT MENU.

The medSim 300B display shows:



eic169.eps

2. Press <F3>-PULM for the following menu display:



eic170.eps

The top line of the display gives the following information:

bp3:pa BP channel 3 pulmonary arterial pressure—25/10
bp4:rv BP channel 4 right ventricular pressure
25/0 Right ventricular pressure setting (variable)

The variable systolic blood pressure selections for right ventricular pressure are:

25/0 Normal (medSim 300B default value)
26/0 5 % above arterial blood pressure
27.5/0 10 % above arterial blood pressure
29/0 15 % above arterial blood pressure
30/0 20 % above arterial blood pressure
37.5/0 50 % above arterial blood pressure

3. Press <F4>-UP or <F3>-DOWN on the medSim 300B to increase or decrease the systolic blood pressure value for the right ventricle on blood pressure channel 4 (bp4:rv).

Single and Dual Lumen Catheter Simulation

The medSim 300B simulates blood pressure waveforms obtained with single and dual lumen catheters.

When the medSim 300B begins pulmonary simulation, it simultaneously represents two types of measurements:

- A single lumen catheter with the lumen placed in the right ventricle.

- A dual lumen catheter with the distal lumen placed in the pulmonary artery and the proximal lumen in the right ventricle (one lumen on either side of the pulmonary valve).

The next two illustrations show single and dual lumen catheter insertion, and single lumen catheter pullback:

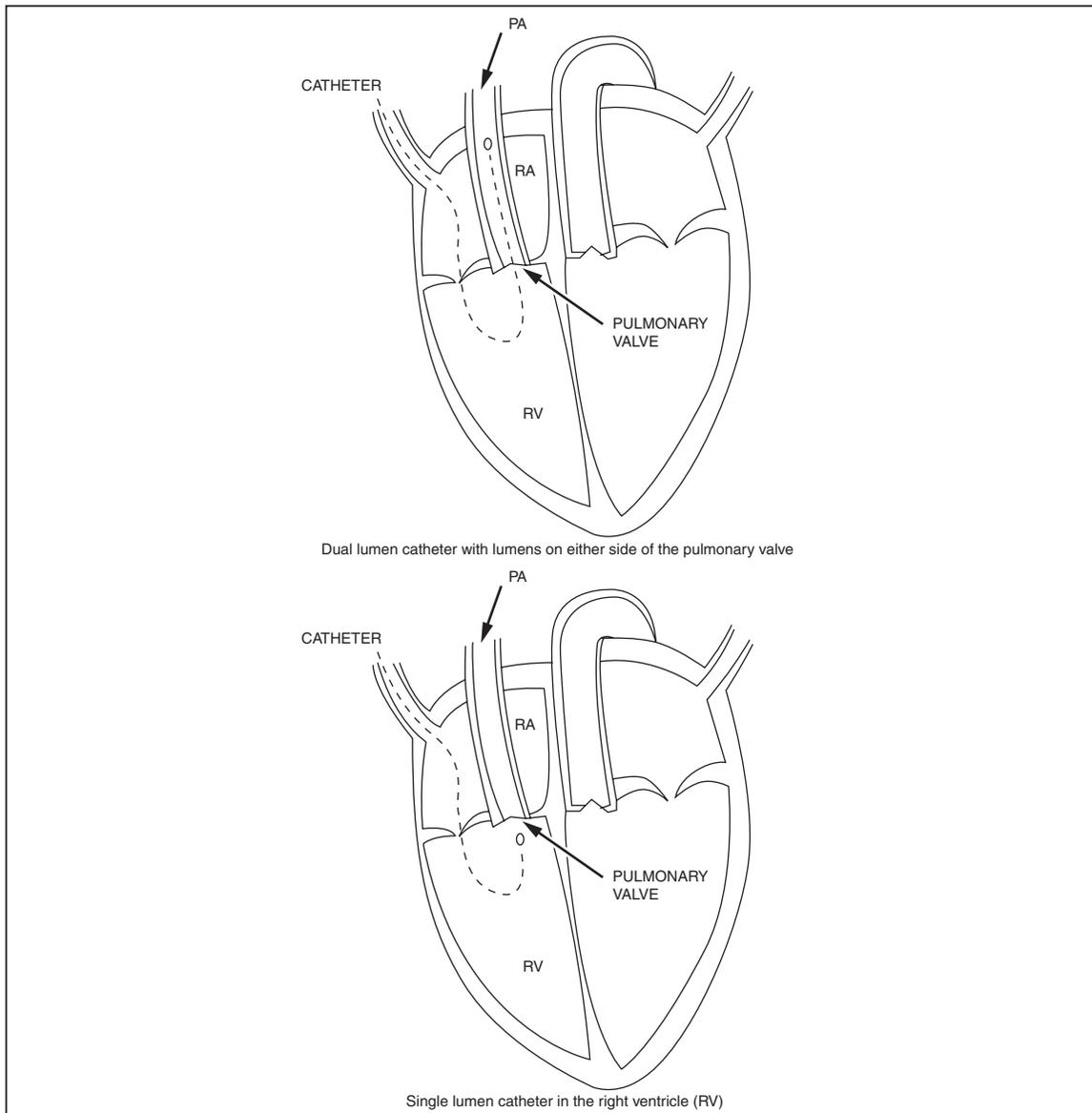


Figure 4-9. Pulmonary Dual and Single Lumen Catheter Insertion

eic171.eps

Note

The medSim 300B simulates waveforms obtained with dual and single lumen catheters.

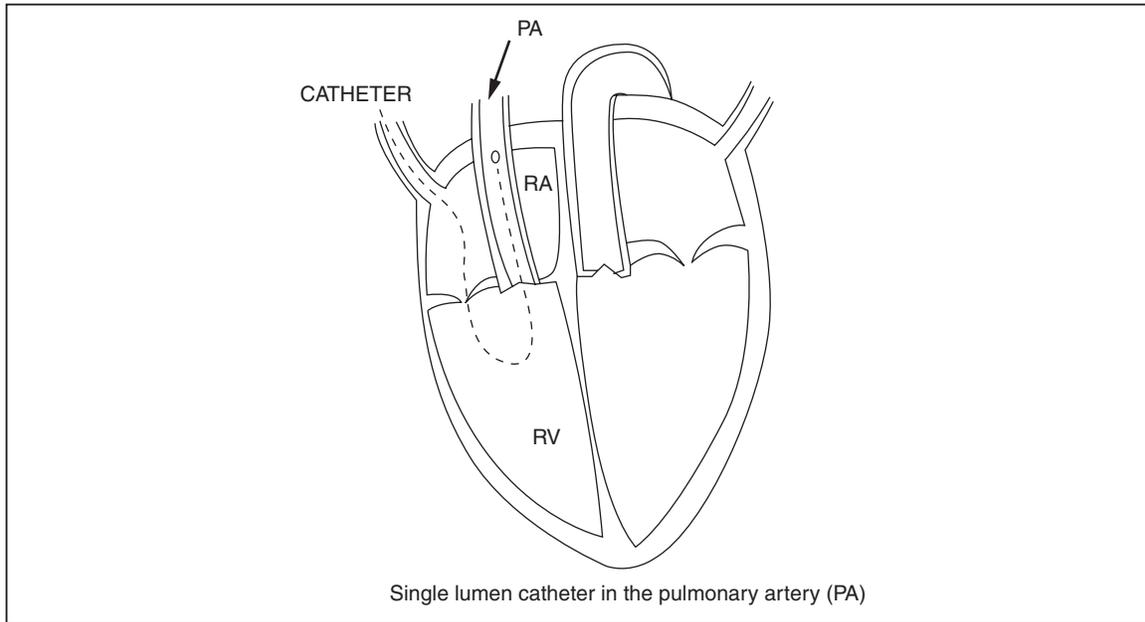


Figure 4-10. Pulmonary Artery Single Lumen Catheter Pullback

Note

The medSim 300B single lumen catheter pullback waveform for pulmonary artery pressure simulates a measurement obtained with this procedure.

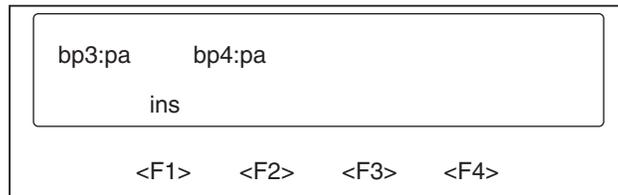
The following represents the simulated blood pressure waveforms for single and dual lumen catheterization in the pulmonary artery:

Catheterization	Blood Pressure Waveforms
Single Lumen Catheter	
Inserted	BP4 = RV Variable
Pulled back	BP4 = PA 25/10
Dual Lumen Catheter	
Distal lumen (tip)	BP3 = PA 25/10
Proximal lumen	BP4 = RV Variable

To simulate a single lumen catheter with the lumen in the pulmonary artery:

1. Press <F3>-PULM from the CATHETERIZATION MENU, and then press <F1>-PLBK.

The single lumen catheter pullback (pulmonary valve) simulation begins as follows on the medSim 300B:



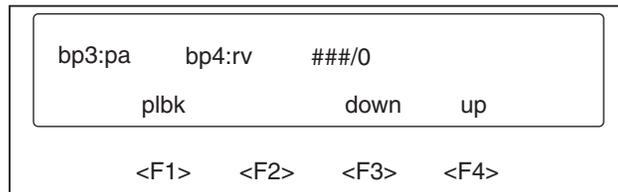
eic173.eps

The top line of the display gives the following information:

bp3:pa BP channel 2 pulmonary arterial pressure—25/10

bp4:pa BP channel 4 pulmonary arterial pressure—25/10

2. To simulate insertion of the catheter back into the right ventricle, select <F1>-INS. The medSim 300B returns to the previous display as shown below:



eic174.eps

Note

In the above display "###/0" represents the previously selected right ventricular pressure value.

3. To exit the medSim 300B pulmonary valve simulation, press the <up arrow> key until you view the desired menu.

Pressure Gradients across the Mitral Valve

For an indication of mitral valve function, it is necessary to compare left atrial pressure (LAP) and left ventricular end diastolic pressure (LVEDP). Since a direct measurement of LAP is difficult to obtain, LAP is indirectly measured by using pulmonary artery wedge (PAW) pressure.

Normal peak PAW pressure is below LVEDP. By comparing PAW pressure to LVEDP, any variations from normal can indicate an abnormal mitral valve.

The medSim 300b illustrations that follow simulate blood pressure relationships indicating:

- A normal mitral valve
- A defective mitral valve

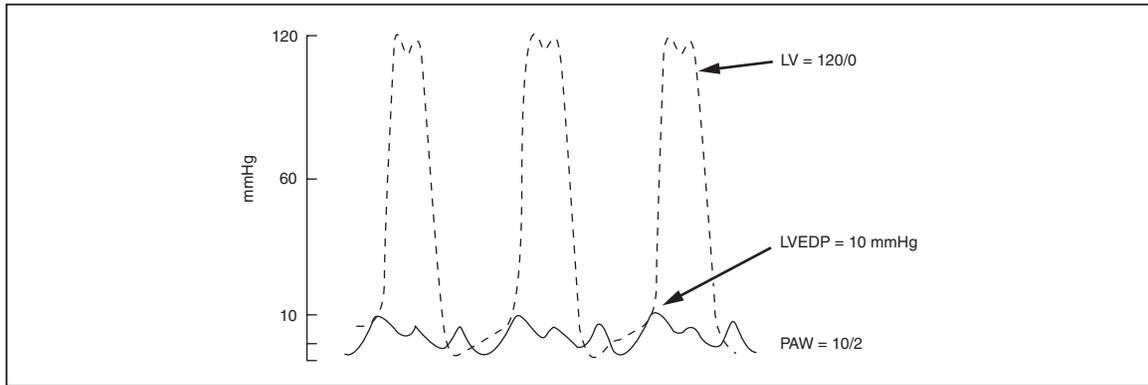


Figure 4-11. Simulated Waveforms for Normal Blood Pressure Relationships between the Left Atrial Pressure and the Left Ventricular End Diastolic Pressure eic175.eps

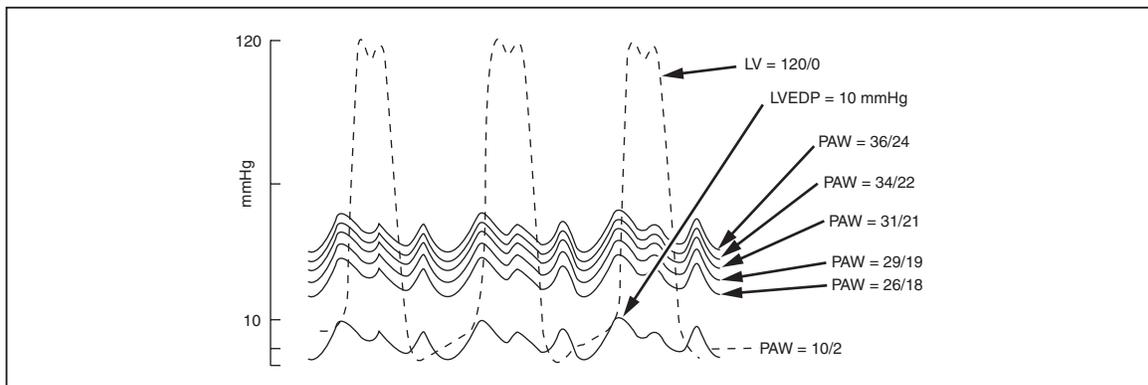


Figure 4-12. Simulated Systolic Pressure Gradients Indicating a Defective Mitral Valve eic176.eps

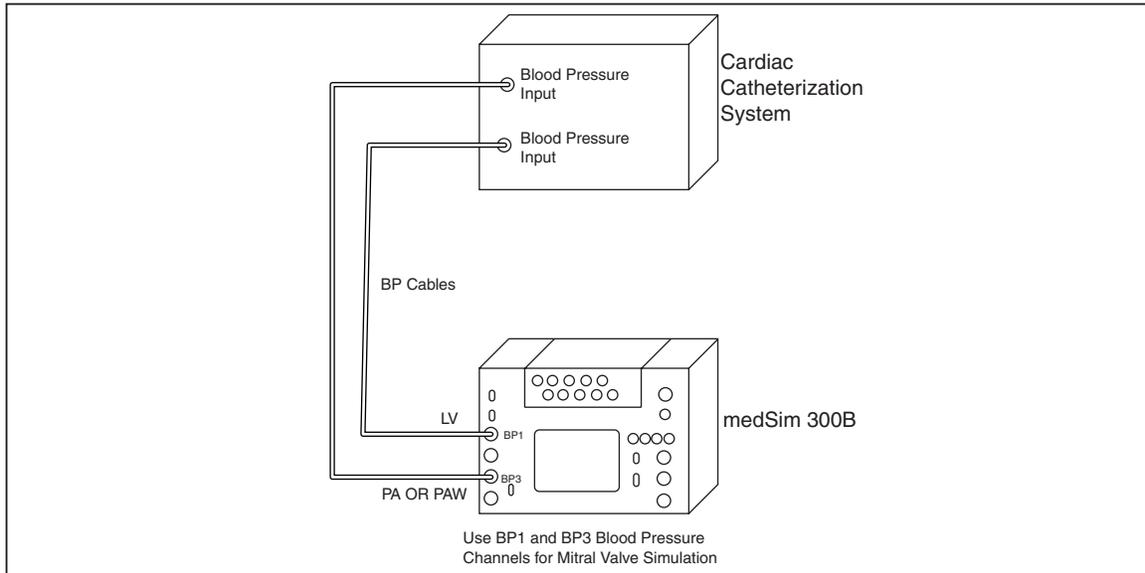
Note

Increases in left atrial pressure (represented by PAW pressure) over left ventricular end diastolic pressure (LVEDP) simulate a defective mitral valve.

Mitral Valve Simulation

For mitral valve simulation, using medSim 300B channels BP1 and BP3, connect the medSim 300B to the cardiac catheterization system under test.

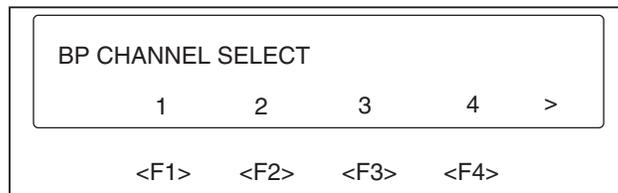
Follow the illustration below.



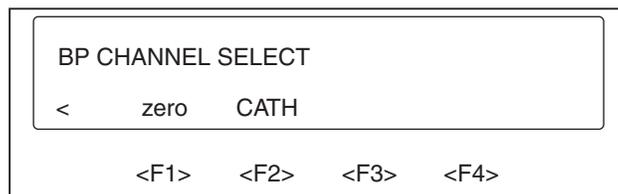
eic177.eps

Figure 4-13. Cardiac Catheterization Connections for Mitral Valve Simulation

1. Turn both units on.
2. After a connection has been made, the medSim 300B and the monitor need to be zeroed.
3. To zero all four of the medSim 300B blood pressure channels, press <F3>-BP from page 1 of the FUNCTION SELECT MENU, for the following two pages of display:



eic178.eps



eic179.eps

4. Press <F1>-ZERO from the second page of the menu.
This sets all the medSim 300B blood pressure channels to zero.

Note

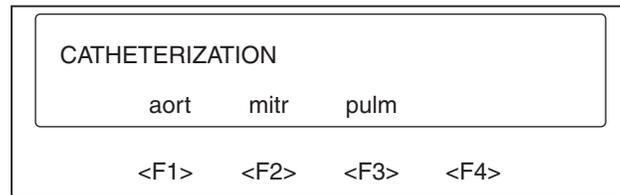
Necessary to complete only once after connecting the medSim 300B to the equipment under test (EUT).

Now zero the blood pressure channels to be used on the EUT.

To begin mitral valve simulation:

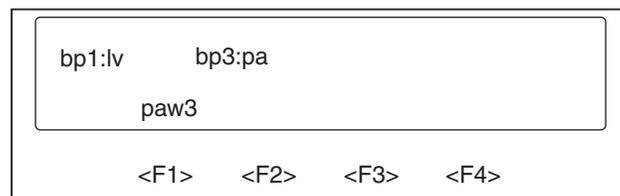
1. Choose <F2>-CATH from page 2 of the BP CHANNEL SELECT MENU.

The medSim 300B display shows:



eic180.eps

2. Press <F2>-MITR for the following menu display:



eic181.eps

The top line of the display gives the following information:

bp1:lv BP channel 1 left ventricular pressure—120/0

bp3:pa BP channel 3 pulmonary artery pressure—25/10

Catheter Simulation

These medSim 300B waveforms represent a measurement obtained with a catheter placed in the pulmonary artery.

The catheterization procedure for measuring mitral valve pressures is shown in the next two illustrations:

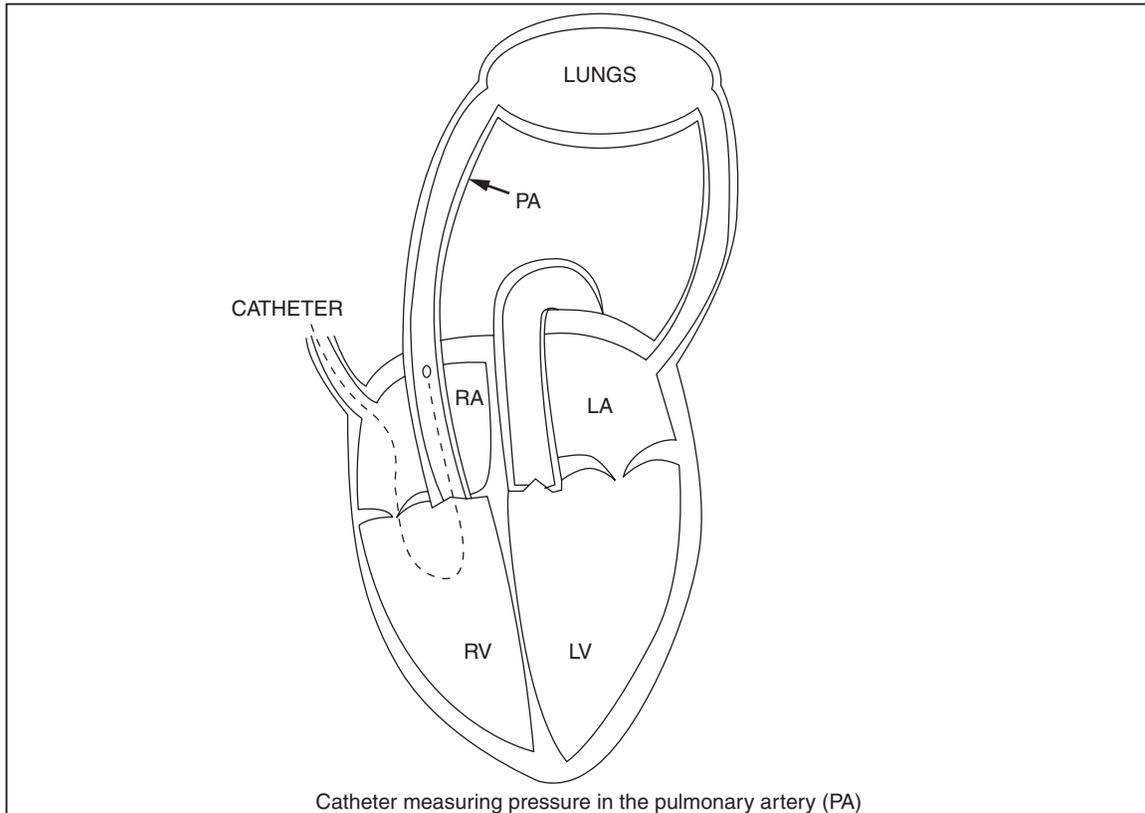
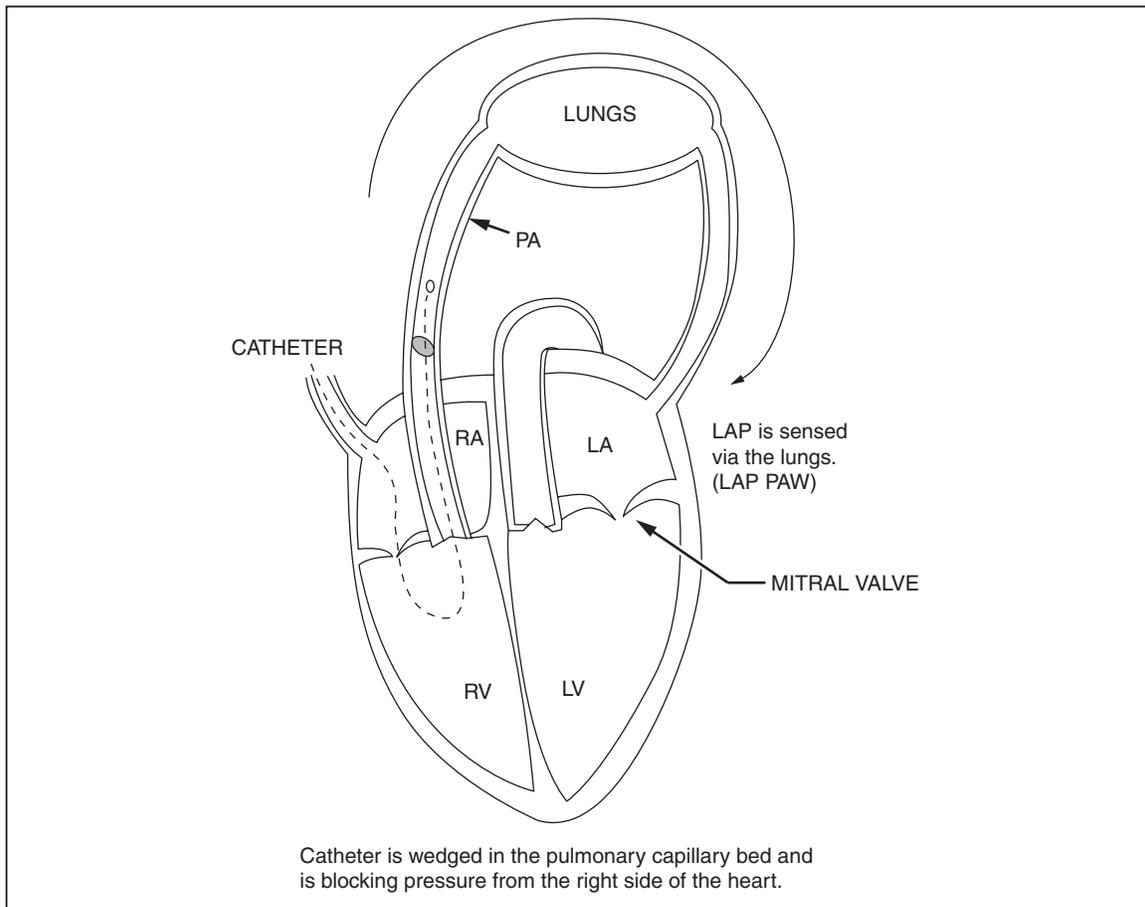


Figure 4-14. Catheter in the Pulmonary Artery (PA)

Note

The medSim 300B waveform for pulmonary artery (PA) pressure simulates a measurement obtained with this procedure.



eic183.eps

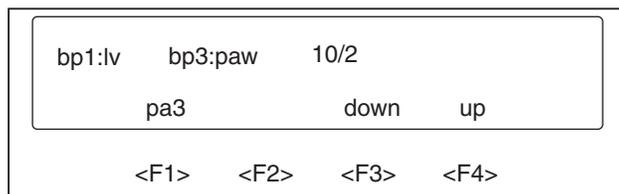
Figure 4-15. Catheter wedged in the Pulmonary Artery (PA)

Note

The medSim 300B waveform for pulmonary artery wedge (PAW) simulates a measurement obtained with this procedure.

To simulate a PAW pressure on the medSim 300B:

1. Press <F2>-MITR from the CATHETERIZATION MENU, and then press <F1>-PAW3. The display will change to the one illustrated below:



eic184.eps

The top line of the display gives the following information:

bp1:lv BP channel 1 left ventricular pressure—120/0
bp3:paw BP channel 3 pulmonary artery wedge pressure
10/2 Pulmonary artery wedge (PAW) pressure setting (variable)

The medSim 300B is now simulating measurements from a catheter wedged in the pulmonary capillary bed and sensing pressure from the left side of the heart via the lungs.

The variable systolic blood pressure selections for PAW pressure are:

- 10/2 (normal—medSim 300B default value)
 - 26/18
 - 29/19
 - 31/21
 - 34/22
 - 36/24
2. Press <F4>-UP or <F3>-DOWN on the medSim 300B to increase or decrease the systolic blood pressure value for the pulmonary artery wedge (PAW) on blood pressure channel 3 (bp3:paw).
 3. To exit the medSim 300B mitral valve simulation, press the <up arrow> key until you view the desired menu.

Fetal/Maternal ECG with Intrauterine Pressure

The medSim 300B can simulate a fetal and maternal electrocardiogram (ECG) that occurs during labor, along with a pressure waveform that is produced by uterine contractions. This ECG is comprised of the fetal heart rate (FHR) and the maternal heart rate.

The fetal heart rate can be either fixed or interactive with uterine contractions (periodic). The maternal ECG is always a normal sinus rhythm with a heart rate of 80 BPM.

The medSim 300B produces waveforms that represent direct measurements of the fetal heart rate and the intrauterine pressure.

The medSim 300B simulated fetal heart rate represents a measurement from a fetal scalp electrode while the simulated maternal heart rate represents a measurement from an electrode on the mother's thigh. The simulated intrauterine pressure waveform represents a measurement taken by an intra-amniotic catheter connected to a pressure transducer.

The medSim 300B does not simulate any indirect measurements of fetal heart rate and intrauterine pressure, such as obtained by phonocardiography, tocodynamometer, ultrasound, etc.

Note

To produce fetal and maternal ECG simulations for fetal monitor evaluation, you will need:

- *Intrauterine pressure cables (refer to the current Fluke Biomedical Price List for availability, part number information, and price).*
- *Fetal scalp electrode.*
- *Maternal thigh reference plate and ECG cable.*
- *Three jumper wires.*

Intrapartum Fetal and Maternal Heart Rate

You can add a fetal heart rate (FHR), fixed or periodic, to the maternal ECG. The fixed FHR is not affected by uterine contractions while the periodic FHR reflects uterine contractility.

When you add FHR to the maternal ECG, the maternal R-wave amplitude is reduced by 50%. This amplitude returns to normal when you remove the FHR.

The next two drawings illustrate:

- A maternal ECG
- A maternal ECG with fetal ECG added



Figure 4-16. medSim 300B Simulated Maternal ECG

eic185.eps

Note

Blood pressure = 120/80; heart rate = 80 BPM.

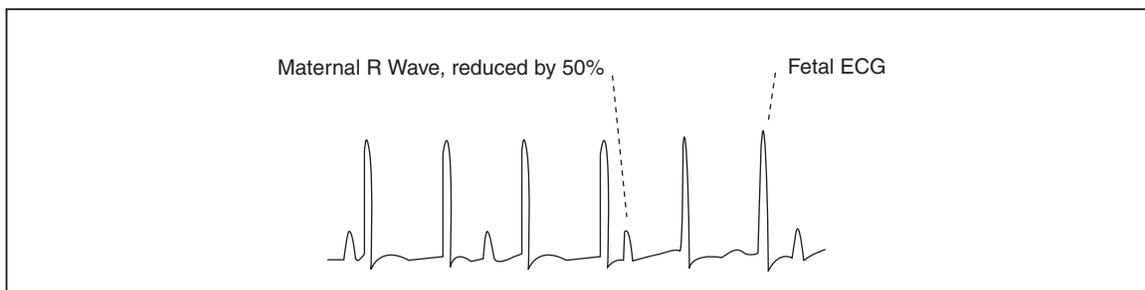


Figure 4-17. medSim 300B Simulated Maternal ECG with Fetal ECG Added

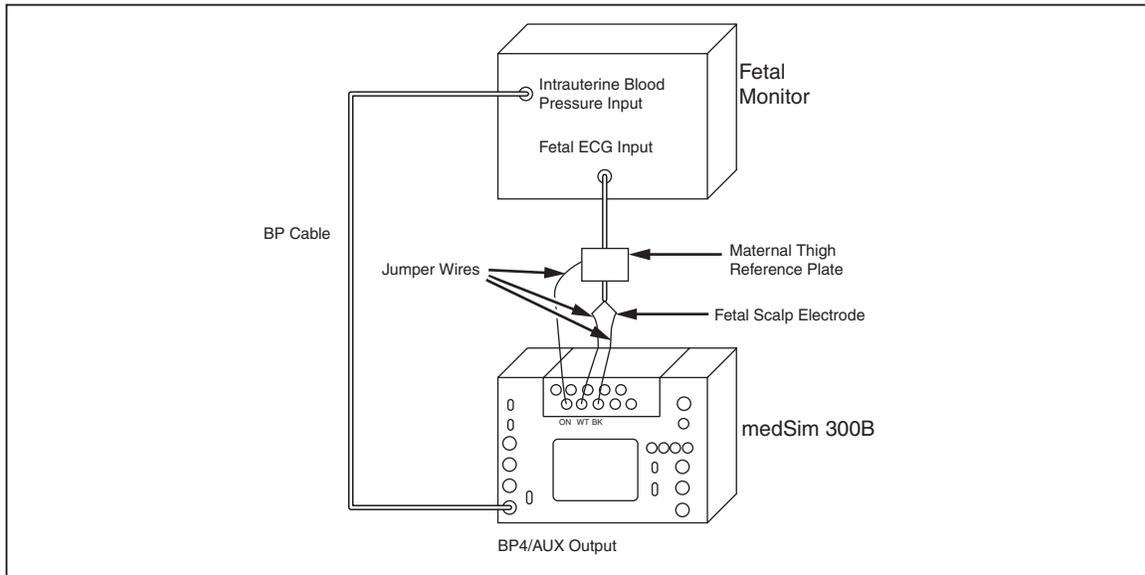
eic186.eps

Note

*Maternal R-wave is reduced 50 % when fetal heart rate (ECG) is added.
 Fetal heart rate = 140 BPM; maternal heart rate = 80 BPM.*

For intrapartum fetal and maternal heart rate simulation, connect the medSim 300B to the fetal monitor under test.

Follow the diagram below:



eic187.eps

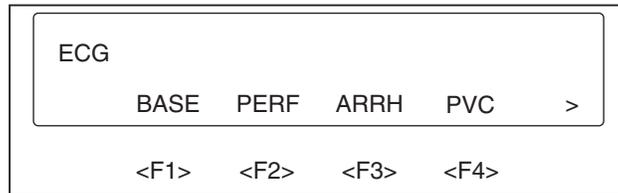
Figure 4-18. medSim 3008 Connections for Fetal Heart Rate Simulation

Turn both units on.

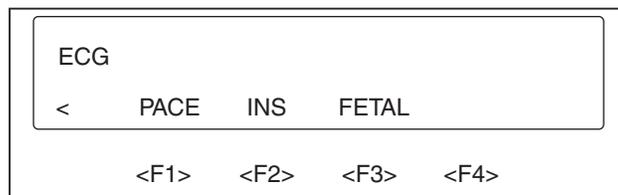
Fetal Heart Rate (FHR) Simulation

To view the choices on the medSim 300B for fetal heart rate:

1. Select <F1>-ECG from the FUNCTION SELECT MENU for the following two pages of display:



eic188.eps



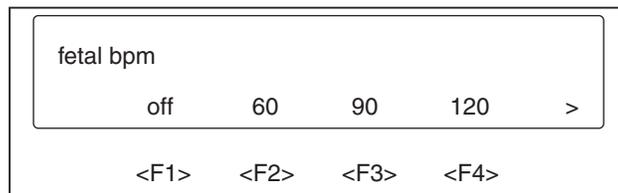
eic189.eps

2. Press <F3>-FETAL from the second page of the menu for the following display:



eic190.eps

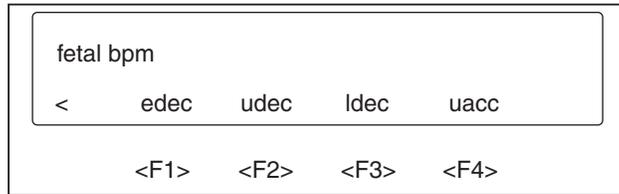
3. Press <F1>-BPM for the 12 fetal heart rate choices, fixed and periodic, as illustrated below:



eic191.eps



eic192.eps



eic193.eps

Note

*Descriptions of fetal heart rate selections appear in the subsequent sections
Fixed Fetal Heart Rates and Periodic Fetal Heart Rates.*

4. Use the <left arrow> key and the <right arrow> key to view all the choices and press the corresponding function key for the desired selection.

Fixed Fetal Heart Rates

The seven choices for fixed fetal heart rates are:

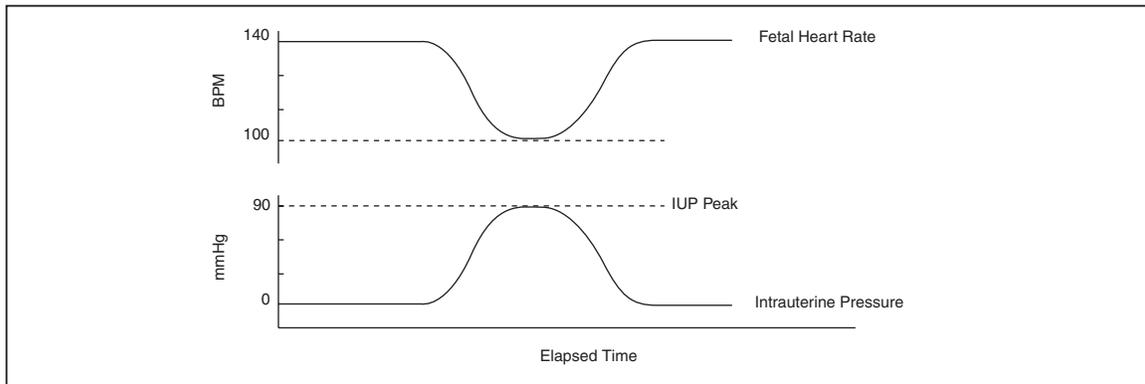
- 60 BPM
- 90 BPM
- 120 BPM
- 140 BPM
- 150 BPM
- 210 BPM
- 240 BPM

Periodic Fetal Heart Rates

The periodic fetal heart rate waveforms are:

- edec: Early deceleration
- udec: Uniform deceleration
- ldec: Late deceleration
- uacc: Uniform acceleration

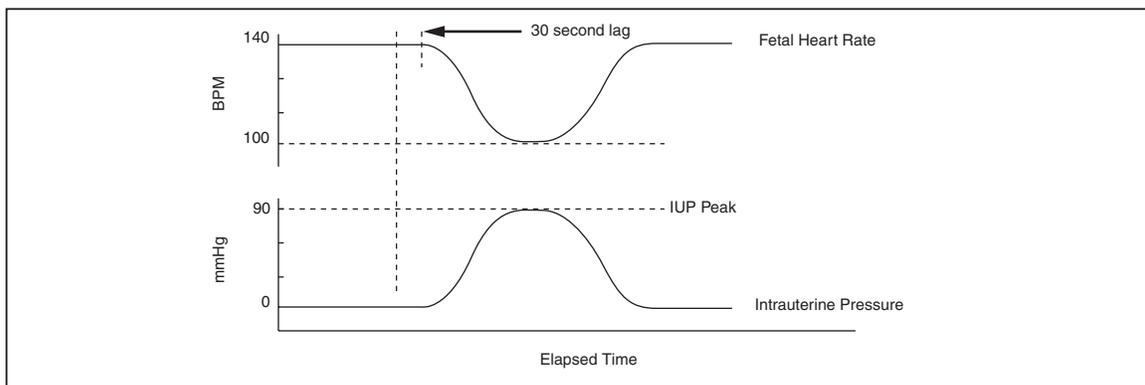
Illustrations of the periodic fetal heart rate selections, with their selection names and descriptions follow:



eic194.eps

Figure 4-19. medSim 300B Simulated Early Deceleration

edec: Early deceleration. Fetal heart rate starts at 140 BPM, slows to 100 BPM at intrauterine pressure peak, and returns to 140 BPM as the intrauterine pressure falls back to zero.



eic195.eps

Figure 4-20. medSim 300B Simulated Uniform Deceleration

udec: Uniform deceleration. Fetal heart rate change lags intrauterine pressure change by 30 seconds. Fetal heart rate starts at 140 BPM, slows to 100 BPM, and returns to 140 BPM.

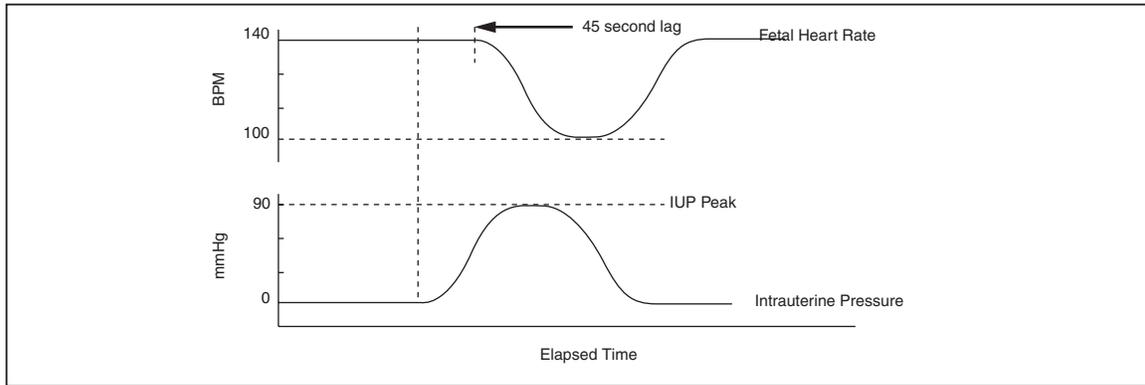


Figure 4-21. medSim 300B Simulated Late Deceleration

eic196.eps

ldec: Late deceleration. Fetal heart rate change begins when intrauterine pressure is at its peak (lags intrauterine pressure change by 45 seconds). Fetal heart rate starts at 140 BPM, slows to 100 BPM, and returns to 140 BPM.

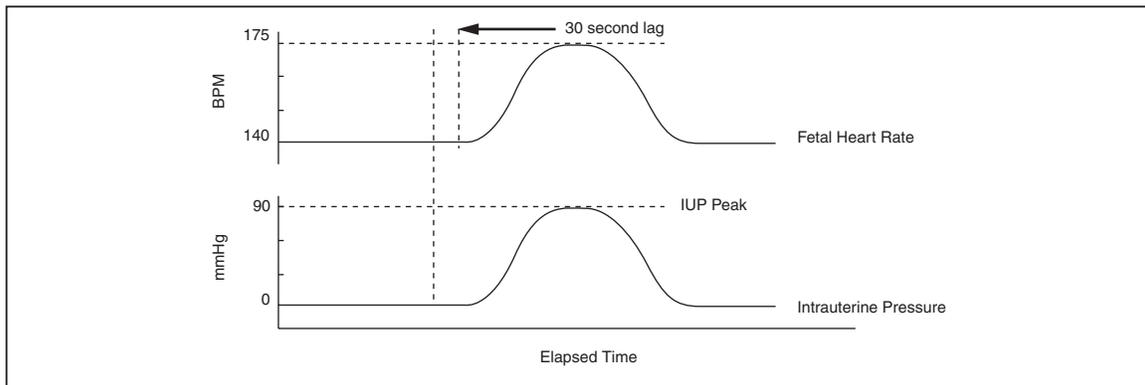


Figure 4-22. medSim 300B Simulated Uniform Acceleration

eic197.eps

uacc: Uniform acceleration. Fetal heart rate change lags intrauterine pressure change by 30 seconds. Fetal heart rate starts at 140 BPM, increases to 175 BPM, and returns to 140 BPM.

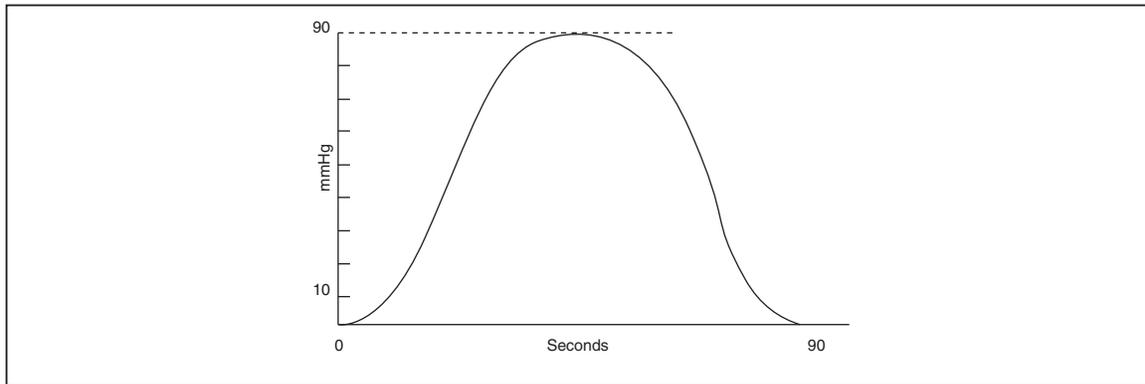
off: Removes fetal heart rate from the maternal ECG.

5. To exit the medSim 300B fetal heart rate simulation, press the <up arrow> key until you view the desired menu.

Intrauterine Pressure (IUP) Simulation

The intrauterine pressure (IUP) waveform is output at "BP4/AUX".

The following drawing illustrates the medSim 300B simulated intrauterine pressure waveform.



eic198.eps

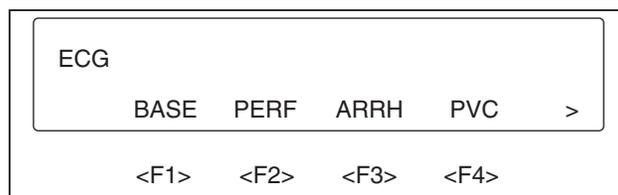
Figure 4-23. medSim 300B Simulated Intrauterine Pressure Waveform

At the blood pressure "SENSITIVITY" switch located on the front panel, adjust the medSim 300B to match the input sensitivity of the fetal monitor—either $5 \mu\text{V}/\text{V}/\text{mmHg}$ or $40 \mu\text{V}/\text{V}/\text{mmHg}$.

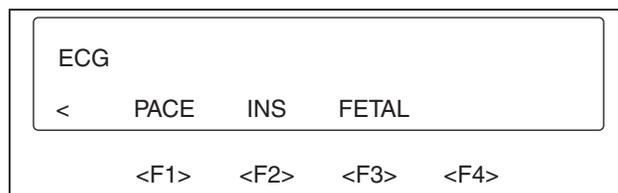
The frequency of the uterine contractions generated by the medSim 300B can be varied.

To vary the rate at which contractions occur:

1. Select <F1>-ECG from the FUNCTION SELECT MENU for the following two pages of display:



eic199.eps



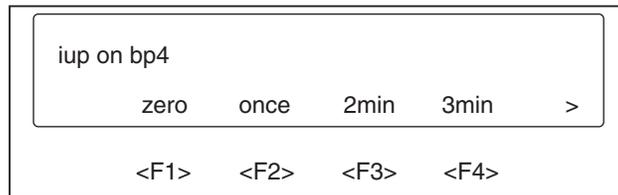
eic200.eps

2. Press <F3>-FETAL from the second page of the menu for the following display:



eic201.eps

3. Press <F2>-IUP for the following two pages of displays:



eic202.eps



eic203.eps

4. Use the <left arrow> key and the <right arrow> key to view all the choices and press the corresponding function key for the desired selection.

The selections and descriptions for intrauterine pressure follow:

Selections Descriptions

- | | |
|------|--|
| zero | IUP is at zero. This allows the technician time to set up the equipment. |
| once | The medSim 300B generates one IUP waveform each time the <F2>-ONCE key is pressed. |
| 2min | The medSim 300B generates one IUP waveform every 2 minutes. |
| 3min | The medSim 300B generates one IUP waveform every 3 minutes. |
| 5min | The medSim 300B generates one IUP waveform every 5 minutes. |

5. To exit the medSim 300B fetal ECG intrauterine pressure simulation, press the <up arrow> key until you view the desired menu.

Intra-Aortic Balloon Pump (IABP) Augmentation

During Intra-Aortic Balloon Pump (IABP) simulation, the medSim 300B generates an arterial blood pressure waveform modified by the IABP "assist sync pulse".

You can send simulated normal sinus rhythms (NSRs), arrhythmias, or paced waveforms to the intra-aortic balloon pump under test.

The medSim 300B also simulates various effects of balloon inflation and deflation timing on arterial pressure, depending on how you have set the IABP controls.

The medSim 300B and the intra-aortic balloon pump under test are interactive during IABP simulation.

Note

To produce medSim 300B simulations for IABP evaluation, you will need:

- A blood pressure (BP) cable (refer to the current Fluke Biomedical Price List for availability, part number information, and price).
- A synchronization ("sync") cable (refer to the current Fluke Biomedical Price List for availability, part number information, and price).
- ECG leads.

For IAPB simulation, connect the medSim 300B to the intra-aortic balloon pump under test.

Follow the diagram below:

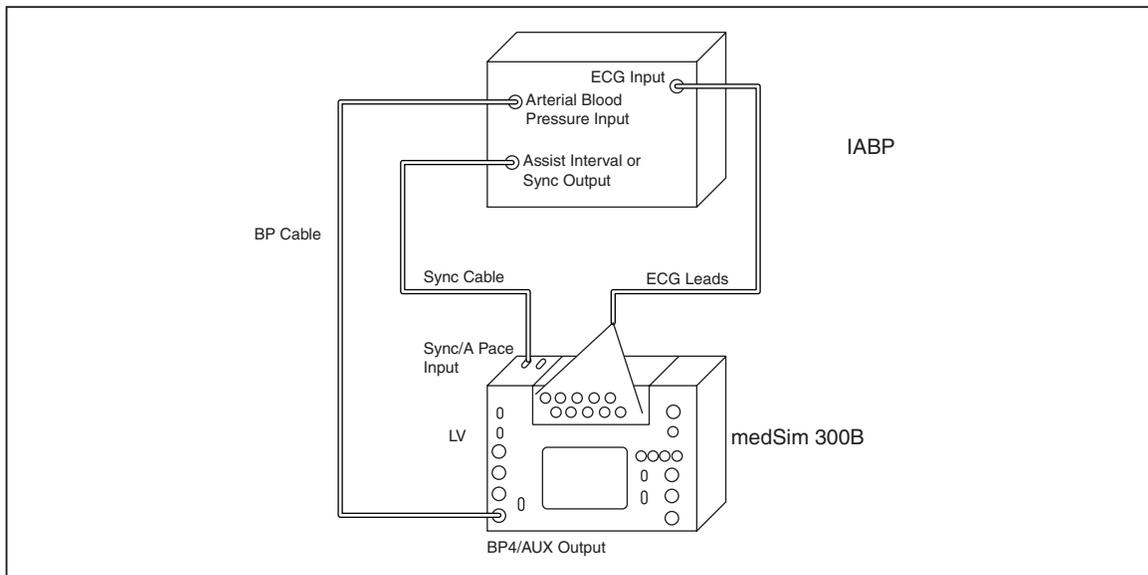


Figure 4-24. Connections for Intra-Aortic Balloon Pump (IABP) Simulation

eic204.eps

Turn both units on.

Intra-Aortic Balloon Timing

Characteristics—normal inflation, early inflation, late inflation, early deflation and late deflation—of the medSim 300B balloon timing simulations are illustrated below.

These examples show the medSim 300B responses to an IABP assist ratio of 1:2 in which every second pressure waveform is augmented.

Normal Inflation

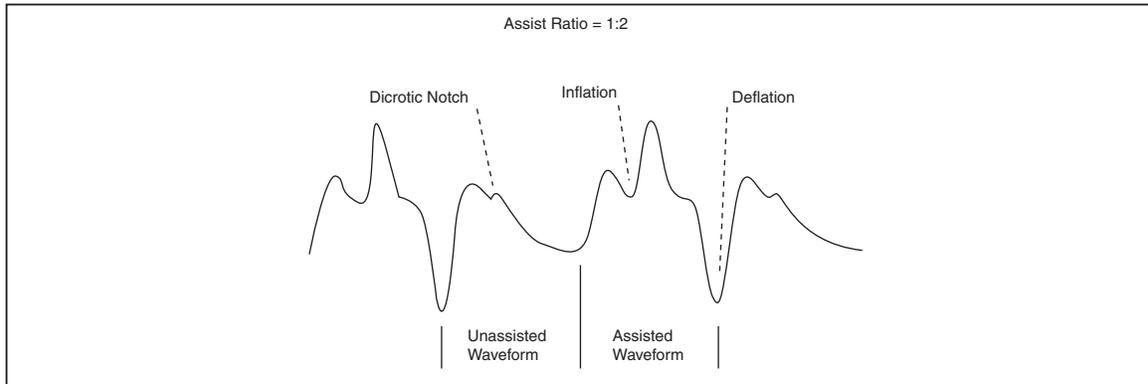


Figure 4-25. medSim 300B Simulated Normal Waveform with the IABP Properly Set

- Inflation begins at the dicrotic notch (the small increase on the downslope of the arterial waveform that is caused by the closure of the aortic valve).
- Deflation ends just before the next arterial pressure waveform.

Early Inflation

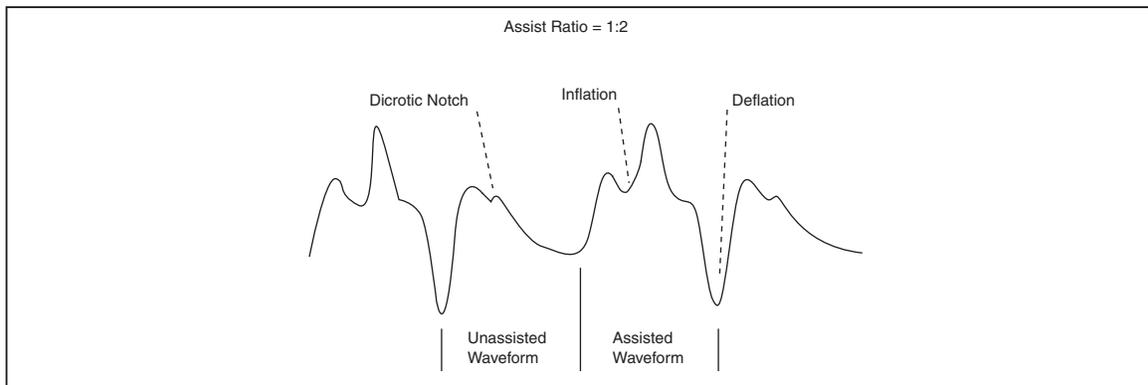


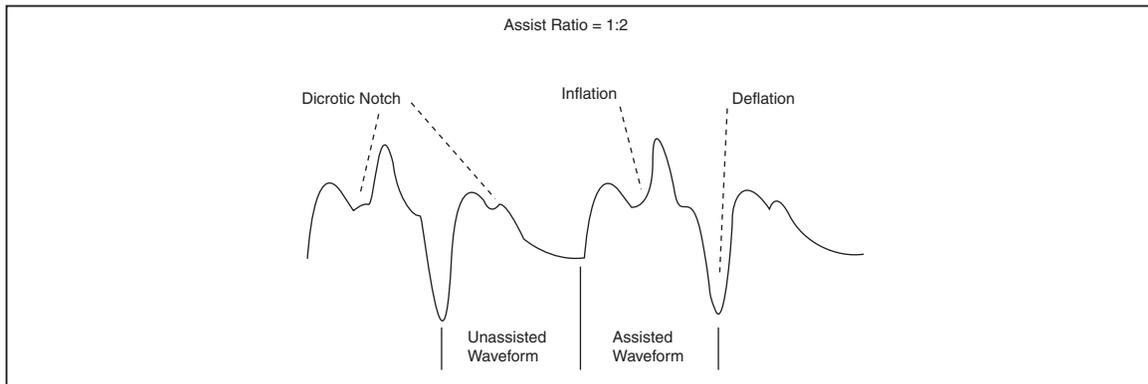
Figure 4-26. medSim 3008 Simulated Early Balloon Inflation

- Inflation begins prior to the dicrotic notch (aortic valve closure).
- Deflation ends just before the next arterial pressure waveform.

Note

The dicrotic notch is not visible because balloon inflation occurs prior to the aortic valve closure.

Late Inflation



eic207.eps

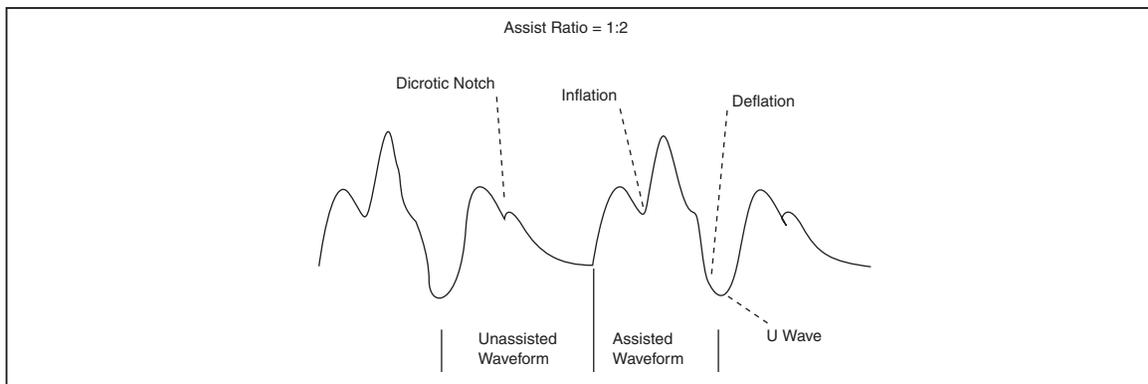
Figure 4-27. medSim 300B Simulated Late Balloon Inflation

- Inflation begins after the dicrotic notch (aortic valve closure).
- Deflation ends just before the next arterial pressure waveform.

Note

The dicrotic notch is visible prior to the balloon inflation point.

Early Deflation



eic208.eps

Figure 4-28. medSim 30013 Simulated Early Balloon Deflation

- Inflation begins at the dicrotic notch (aortic valve closure).
- Deflation ends too soon, causing a large U-wave before the next arterial waveform.

Late Deflation

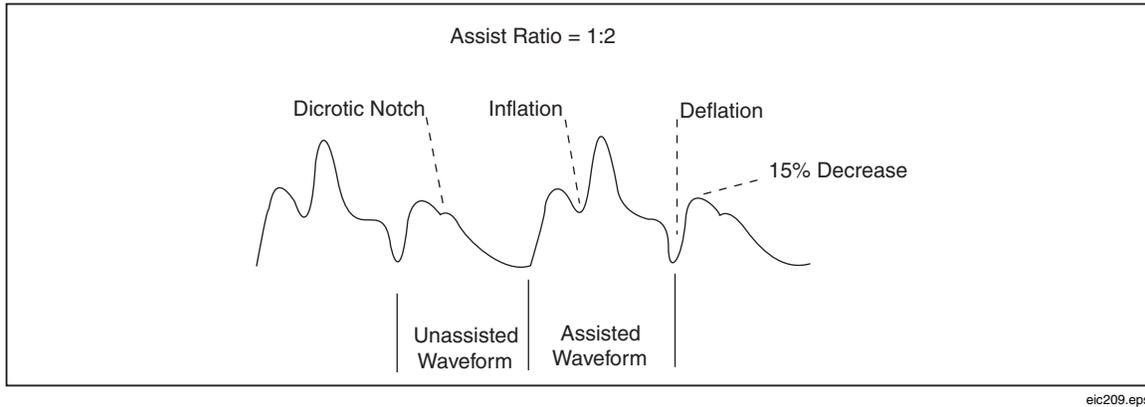


Figure 4-29. medSim 300B Simulated Late Balloon Deflation

- Inflation begins at the dicrotic notch (aortic valve closure).
- Late deflation causes a 15 % decrease in the following systolic peak pressure.

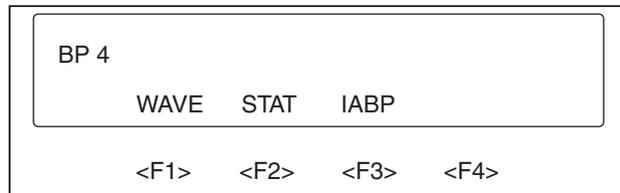
Normal Sinus Rhythm Simulation

For simulated normal sinus rhythm (NSR) waveforms:

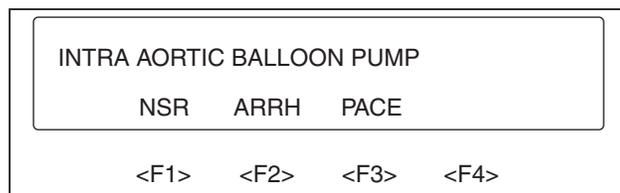
1. Select <F3>-BP from the FUNCTION SELECT MENU for the following:



2. Press <F4>-4:



3. Press <F3>-IABP:



4. Press <F1>-NSR:

iabp normal sinus bpm			
30	60	80	120
<F1>	<F2>	<F3>	<F4>

eic213.eps

5. Press the corresponding function key for the desired selection.

The four choices for normal sinus rhythm waveforms are:

- 30 BPM
- 60 BPM
- 80 BPM
- 120 BPM

Note

Unassisted arterial blood pressure is set at 120/80 mmHg.

Arrhythmia Simulation

For simulated arrhythmia waveforms:

1. Press <F2>-ARRH from the INTRA-AORTIC BALLOON PUMP MENU:

iabp arrhythmias			
afib	6/mn	run5	run11
<F1>	<F2>	<F3>	<F4>

eic214.eps

2. Press the corresponding function key for the desired selection.

The four arrhythmia choices are:

- afib Atrial fibrillation
- 6/mn 6 PVCs per minute
- run5 Run of 5 PVCs
- run11 Run of 11 PVCs

Note

Unassisted arterial blood pressure is set at 120/80 mmHg.

Pacemaker Waveform Simulation

For simulated pacemaker waveforms:

1. Press <F3>-PACE from the INTRA-AORTIC BALLOON PUMP MENU:



eic215.eps

2. Press the corresponding function key for the desired selection.

The two pacemaker waveform choices are:

async Asynchronous, at 75 BPM, continuously paced

dem1 Paced on demand, primarily paced.

Note

Unassisted arterial blood pressure is set at 120/80 mmHg.

Option I RS-232 Serial Port Operation

By category, the following is a list of medSim 300B Option 1 RS-232 remote commands and their descriptions.

Note

For complete information on remote commands, refer to the RS-232 SERIAL PORT OPERATION section in Chapter 3.

Note

Each command is preceded by a bullet (•), which is not part of the command string.

Cardiac Catheterization - Aortic Valve Simulation

- CAORT Aortic catheter selection
- CPLBK Aortic catheter pullback
- CINS Aortic catheter insertion
- CA120 Aortic catheter LV pressure = 120/0 mmHg
- CA126 Aortic catheter LV pressure = 126/0 mmHg
- CA132 Aortic catheter LV pressure = 132/0 mmHg
- CA138 Aortic catheter LV pressure = 138/0 mmHg
- CA144 Aortic catheter LV pressure = 144/0 mmHg
- CA180 Aortic catheter LV pressure = 180/0 mmHg

Cardiac Catheterization - Pulmonary Valve Simulation:

- CPULM Pulmonary catheter selection
- CPLBK Pulmonary catheter pullback
- CINS Pulmonary catheter insertion
- CP25 Pulmonary catheter RV pressure = 25/0 mmHg
- CP26 Pulmonary catheter RV pressure = 26/0 mmHg
- CP27.5 Pulmonary catheter RV pressure = 27.5/0 mmHg
- CP29 Pulmonary catheter RV pressure = 29/0 mmHg
- CP30 Pulmonary catheter RV pressure = 30/0 mmHg
- CP37.5 Pulmonary catheter RV pressure = 37.5/0 mmHg

Cardiac Catheterization - Mitral Valve Simulation

- CMITR Mitral catheter selection
- CMPAW Mitral catheter PAW pressure = 10/2 mmHg
- CMPA Mitral catheter PA pressure =
- CM10 Mitral catheter PAW pressure = 10/2 mmHg
- CM26 Mitral catheter PAW pressure = 26/18 mmHg
- CM29 Mitral catheter PAW pressure = 29/19 mmHg
- CM31 Mitral catheter PAW pressure = 31/21 mmHg
- CM34 Mitral catheter PAW pressure = 34/22 mmHg
- CM36 Mitral catheter PAW pressure = 36/24 mmHg

Fetal/Maternal ECG with Intrauterine Pressure:

- FOFF Fetal heart rate—off
- F60 Fetal heart rate—60 BPM
- F90 Fetal heart rate—90 BPM
- F120 Fetal heart rate—120 BPM

- F140 Fetal heart rate—140 BPM
- F150 Fetal heart rate—150 BPM
- F210 Fetal heart rate—210 BPM
- F240 Fetal heart rate—240 BPM
- FEDEC Fetal heart rate—Early deceleration
- FUDEC Fetal heart rate—Uniform deceleration
- FLDEC Fetal heart rate—Late deceleration
- FUACC Fetal heart rate—Uniform acceleration
- P4S0 Intrauterine pressure (IUP)—off
- IUP1 One IUP waveform at key press
- IUP2M Two IUP waveforms per minute
- IUP3M Three IUP waveforms per minute
- IUP5M Five IUP waveforms per minute

Intra-aortic Balloon Pump (IABP) Augmentation:

- IABP30 Normal sinus rhythm (NSR) at 30 BPM
- IABP60 NSR at 60 BPM
- IABP80 NSR at 80 BPM
- IABP120 NSR at 120 BPM
- IABPAFB Atrial fibrillation
- IABP6/M 6 PVCs per minute
- IABPR5 Run of 5 PVCs
- IABPR11 Run of 11 PVCs
- IABPASN Asynchronous pacer at 75 BPM
- IABPD1 Paced on demand

Chapter 5

Cardiac Output

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Overview

The Cardiac Output Option electronically simulates the dynamic temperature changes in the patient's blood during thermal dilution cardiac output measurement.

Thermal dilution cardiac output measurements are based upon the heat exchange between the patient's blood and a known volume of chilled saline injected into the heart. Cardiac output is expressed in liters per minute (L/min) and ranges between 3 L/min and 7 L/min for normal adults.

Current cardiac output measurement devices have additional technical capabilities to ensure that the most accurate readings are attained. These capabilities include the ability to average a series of readings to eliminate variations because of artifacts, as well as reject readings because of clinician technique or the patient's underlying cardiovascular disease.

Note

Cardiac output measurement devices using different techniques (such as Fick dye injection, Doppler ultrasonography and bioimpedance) are neither addressed nor intended for use with the Fluke Biomedical medSim 300B Patient Simulator.

Specifications

The Fluke Biomedical medSim 300B Cardiac Output Option is designed to test the features and specifications of the cardiac output patient monitors identified above.

The cardiac output simulation is based upon the electrical characteristics of the American Edwards Catheter 93A-131-7 F which has a 7 F-catheter diameter and uses an injectate volume of ten cubic centimeters (10 cc). Accordingly, cardiac output values are programmed at fixed readings of 3 L/min, 5 L/min and 7 L/min; 3 defective readings; and 3 series of readings with variations.

Note

While the Cardiac Output Option is based upon the American Edwards Catheter, it is compatible with comparable adult cardiac output measurement catheters, such as Gould/SpectraMed and Abbott (Sorenson).

Specifications for the Cardiac Output Option follow:

Simulated Catheter Type:	American Edwards Catheter 93A-131-7 F
Computational Constant:	0.542
Catheter Size:	7 F
Injectate Volume:	10 cc
Baseline Temperature:	36 °C, 37 °C, and 38 °C
Injectate Temperature:	2 °C
Waveforms:	3 L/min, 5 L/min, and 7 L/min Interrupted injectate Left ventricular shunt Slow injectate

Trends:	Normal sequence Sequence with interrupted injectate Sequence with slow injectate
Accuracy:	10 % of setting for 3 L/min, 5 L/min, and 7 L/min at 37 °C ±0.4 °C for baseline temperature
Isolation:	Cardiac output is electrically isolated from the rest of the unit except temperature channel 1

Note

Cardiac output is inoperative during the temperature channel 1 simulation ("VAR TEMP" mode).

Accessories

Standard

Accessories	Part No.
CI-3 module/cable	2392199
General purpose connector	2392158

Note

Additional general purpose connectors are available from Fluke Biomedical.

Optional

Currently offered cardiac output adapter cables are listed below:

- Hewlett Packard Cardiac Output Adapter
- Hewlett Packard Adapter
- Gould/SpectraMed Model 1445 Adapter
- Gould/SpectraMed Model 1465 Adapter

Note

Refer to the current Fluke Biomedical Price List for availability, part number information, and price.

Cardiac Output Simulation

Introduction

The Cardiac Output Option for the medSim 300B consists of both internal firmware and external hardware.

The external hardware is designated as the CI-3 module/cable, and plugs directly into the medSim 300B top panel at the "CARDIAC OUTPUT" jack.

Note

See illustration "CI-3 module/cable" located at the end of this chapter.

The purpose of the CI-3 module/cable is:

- To facilitate the medSim 300B connection to the cardiac output measurement device under test.
- To simulate the injectate temperature (IT) thermistor at 2 °C.

Of the two connectors on the CI-3 module/cable, the smaller 3-pin connector is for catheter blood temperature (BT) and is standard on most monitors.

Note

This 3-pin catheter BT connector is compatible with the standard Baxter (Edwards) BT catheter and similar catheters available from other manufacturers such as Viggo-SpectraMed and Abbott (Sorenson).

The larger 4-pin connector supplies the simulated injectate temperature.

The 10-turn 100 k Ω potentiometer enables adjustment of the injectate temperature to 2 °C.

Although this 100 k Ω range of resistance has proven adequate to simulate the 2 °C temperature for most brands of cardiac output measurement devices, the 4-pin IT thermistor connector is not standard on all monitors. Therefore, a general purpose connector that can be wired to the equipment under test (EUT) injectate cable is also supplied.

Note

An illustration of the assembly and wiring of the general purpose connector is located at the end of this chapter. Please note that the injectate temperature thermistor will have to be cut off the EUT cable to install the general purpose connector. In addition, an EUT cardiac output cable modified for testing purposes should not be used for any clinical application. If the EUT cardiac output cable incorporates an interconnection (or plug-in) for the injectate temperature bath probe assembly, modify that plug-in cable only.

Note

To facilitate the interface of the medSim 300B patient simulator to selected brands of cardiac output measurement devices, optional adapter cables are offered by Fluke Biomedical.

- *To evaluate Hewlett Packard Merlin systems, a cardiac output adapter and a temperature adapter are required.*
- *Gould/SpectraMed Models SP1445 and SP1465 cardiac output devices each require a specific adapter.*

See the current Fluke Biomedical Price List for availability, part number information and price.

For cardiac output simulation, connect the medSim 300B to the EUT using the supplied CI-3 module/cable and, if necessary, the general purpose connector.

Set up the EUT for the following simulated parameters:

Catheter Size:	7 F
Injectate Volume:	10 cc
Computational Constant:	0.542

Function Select - Cardiac Output Menu

Set the "CARDIAC OUTPUT/VAR TEMP" switch on the top panel of the medSim 300B to "CARDIAC OUTPUT".

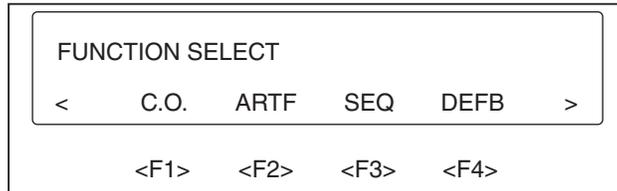
Cardiac output simulation is set up:

- By selecting an injectate temperature of 2 °C using the potentiometer on the CI-3 module/cable.
- By selecting a baseline temperature from the medSim 300B CARDIAC OUTPUT MENU.
- By executing a waveform.

To begin the cardiac output simulation, adjust the 10-turn potentiometer on the CI-3 module/cable to simulate the 2 °C injectate temperature.

To set the baseline blood temperature from the medSim 300B:

1. Begin at the FUNCTION SELECT MENU and press the <right arrow> key to access page 2 as shown below:

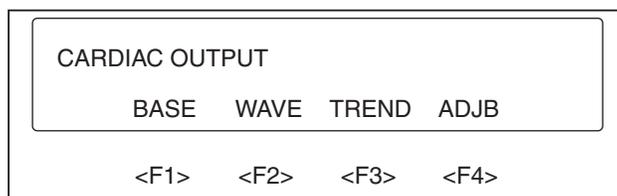


eic216.eps

Note

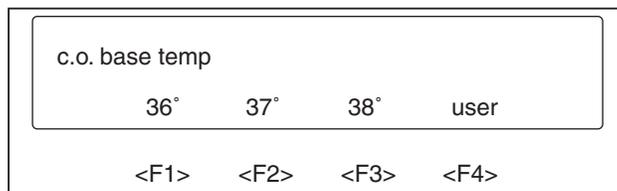
Illustrations may not match your medSim 300B display if additions, options, or expansion modules have been installed.

2. Press <F1>-C.O.:



eic217.eps

3. Press <F1>-BASE:



eic218.eps

4. Press the corresponding function key for the desired baseline blood temperature.

Note

The default or normal baseline blood temperature selection is 37 °C.

Note

Changing the baseline blood temperature resets a running waveform.

Blood temperature selections and their descriptions follow:

Selections	Descriptions
36 °	36 °C temperature
37 °	37 °C temperature
38 °	38 °C temperature
user	The temperature set from the ADJ BASE TEMP MENU

Note

ADJ BASE TEMP MENU instructions follow.

To set "user" baseline temperature:

1. Press <F4>-ADJB from the CARDIAC OUTPUT MENU for the following display:



eic219.eps

2. Press either <F1>-DOWN or <F2>-UP to adjust the baseline temperature. The adjustment is reflected in the EUT display.

Note

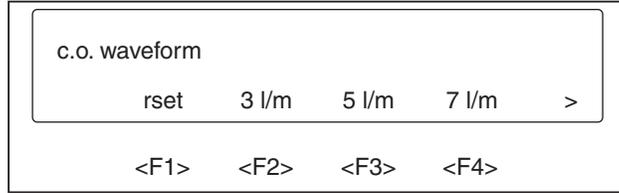
This adjustment can be made after selecting any baseline temperature, but the setting is lost on power-off except when saved from the UTILITY MENU.

Note

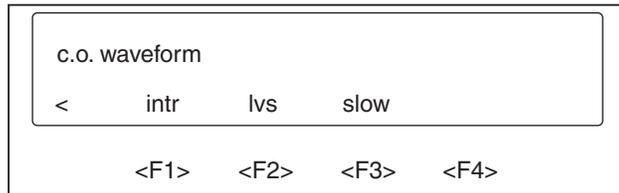
To save a "user" baseline temperature setting, refer to the Function Select - Utility Menu section in Chapter 3.

To select a cardiac output (C.O.) waveform:

1. Press <F2>-WAVE from the CARDIAC OUTPUT MENU for the following two display pages:



eic220.eps



eic221.eps

2. Press the corresponding function key for the desired C.O. waveform.

Note

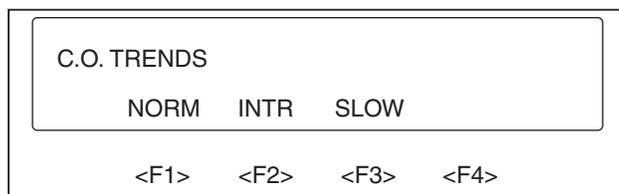
While the waveform is running, the medSim 300B display flashes. At the end of the waveform, the flashing stops. If any cardiac output selection key is pressed while a waveform is running, the newly selected waveform starts.

C.O. waveform selections and their descriptions follow:

Selections	Descriptions
rset	Terminates the running cardiac output waveform and returns to the baseline temperature
3 l/m	Normal waveform with specified accuracy of 3 L/min
5 l/m	Normal waveform with specified accuracy of 5 L/min
7 l/m	Normal waveform with specified accuracy of 7 L/min
intr	Interrupted injectate waveform
lvs	Left ventricular shunt waveform
slow	Slow injectate waveform

To select a C.O. trend:

1. Press <F3>-TREND from the CARDIAC OUTPUT MENU for the following display:



eic222.eps

2. Press the corresponding function key for the desired C.O. trend sequence.

Selections of C.O. trend sequences and listings of their segments follow:

Selections	Descriptions
NORM	5.0, 4.5, 6.0, 5.5 and 4.0 L/min
INTR	4.5, 5.5, "intr", 5.5 and 4.5 L/min
SLOW	4.5, 5.5, "slow", 5.5 and 4.5 L/min

Upon pressing a function key related to one of the three C.O. trend sequences—NORM, INTR, or SLOW—the top line of the display shows the segments of that particular trend sequence.

For illustration purposes:

1. Press <F1>-NORM and this appears:



2. One of the segments (in this case, 5.0) has a cursor under it. Press <F1>-STRT to execute the marked segment. Upon execution, the marked segment (5.0) starts flashing, and the cursor marks the next segment (4.5).
3. Press <F1>-STRT again to execute the next marked segment (4.5). The cursor then proceeds to mark the next segment (6.0). Continue in this manner to complete the sequence.

Note

Flashing stops at the completion of a segment.

4. To reset the sequence, press <F2>-RSET and the cursor returns to mark the first segment (5.0).

The three C.O. TRENDS MENU choices all follow the same pattern of menu operation.

Cardiac Output RS-232 Serial Port Operation

By category, the following is a list of the medSim 300B Cardiac Output Option RS-232 remote commands and their descriptions.

Note

For complete information on remote commands, refer to the “RS-232 Serial Port Operation” section in Chapter 3, and to the HHC3 Handheld Controller Reference Manual..

Note

Each command is preceded by a bullet (•), which is not part of the command string.

Cardiac Output Baseline Temperature:

- COB36 C.O. baseline temperature at 36 °C
- COB37 C.O. baseline temperature at 37 °C
- COB38 C.O. baseline temperature at 38 °C
- COBUSR C.O. baseline temperature—user adjusted

Cardiac Output Waveform:

- CRSET C.O. waveform/blood temperature reset
- COW3 C.O. waveform at fixed 3 L/min
- COW5 C.O. waveform at fixed 5 L/min
- COW7 C.O. waveform at fixed 7 L/min
- COWINT C.O. waveform—interrupted injectate
- COWLVS C.O. waveform—left ventricular shunt
- COWSLW C.O. waveform—slow injectate

Cardiac Output Trends:

- COTNRM Normal sequence
- COTINT Sequence with interrupted injectate
- COTSLO Sequence with slow injectate
- COTSTRT Start sequences through the selected trend

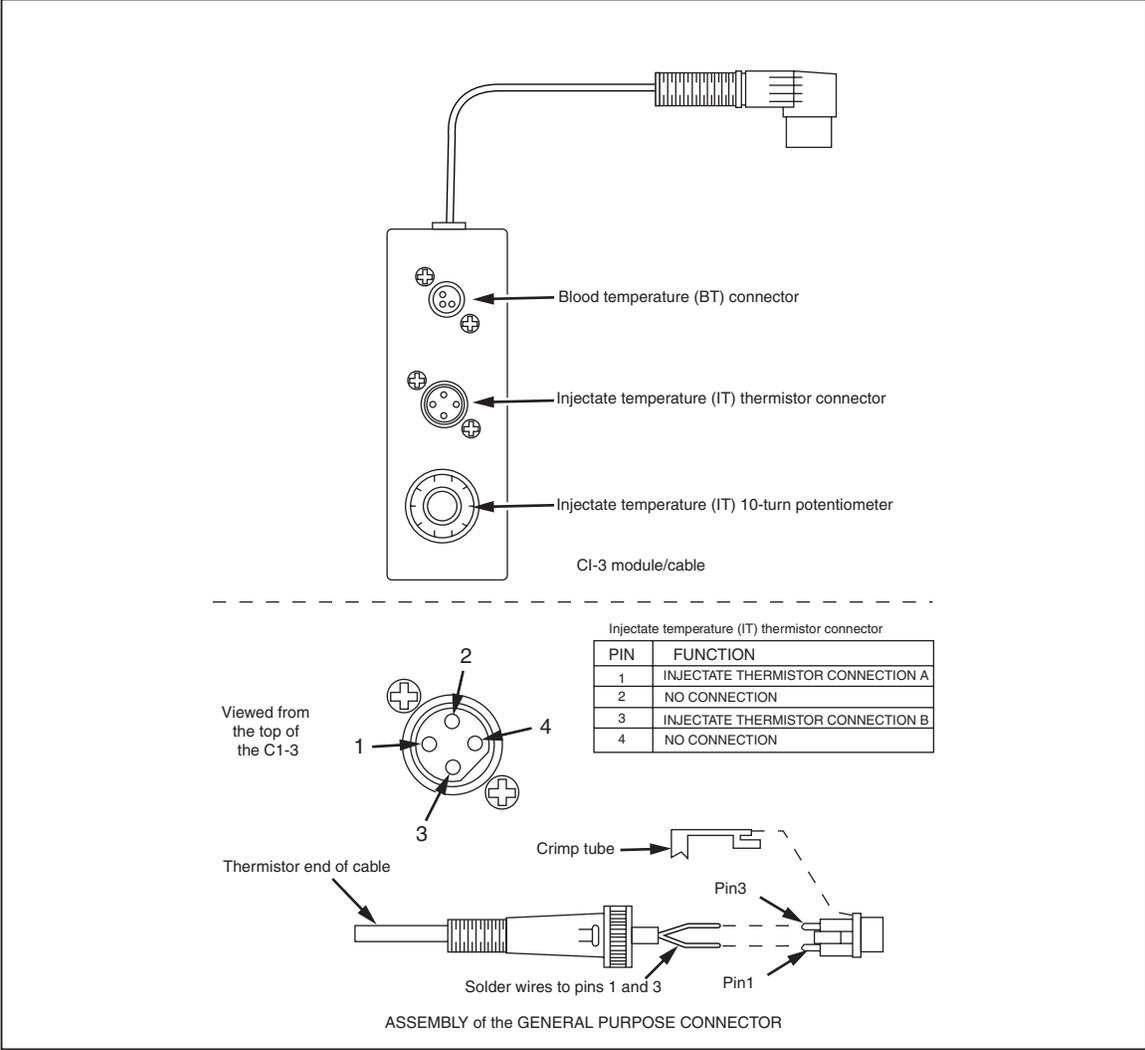


Figure 5-1. Cardiac Output Injectate Cable Modification

eic224.eps

Chapter 6

Performance Checks/Calibration

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Introduction

It is important to familiarize yourself with the operation of the medSim 300B Patient Simulator by reading Chapters 1, 2 and 3 before beginning this chapter.

Performance Check

Overview

The performance check is usually performed upon the initial receipt of the medSim 300B.

To start this check, we suggest that you visually inspect the instrument to ensure that all parts are attached properly.

Equipment Required for Performance Check

The following equipment is needed to complete the performance check:

- Patient monitor with ECG, respiration, blood pressure, temperature and cardiac output.
- Interconnect cables* for the functions mentioned above.
- RS-232 cable* for the medSim 300B.
- Personal computer with RS-232 serial port.
- Digital multimeter-Keithley 196**

Measurement Type	Measurement Range	Accuracy
Ω	450-2100 Ω	$<\pm 1 \Omega$

Note

*Cables are available from Fluke Biomedical. Refer to the current Fluke Biomedical Price List for availability, part number information and price.

Note

**Equivalent equipment is required to meet or exceed listed specifications.

Performance Check Procedure

Select operating modes from the keyboard on the medSim 300B.

Note

Please refer to Chapter 1 and Chapter 3 for detailed information.

1. Connect the battery eliminator and press the <ON/OFF> key. The medSim 300B beeps, and then displays the firmware version. After a moment the FUNCTION SELECT MENU appears.
2. Touch a good 9-volt battery to the "BATTERY TEST" terminals with the positive battery terminal touching the positive test post (left); the LED should light. Reverse the battery and the LED should not light.
3. Short the "LEAD TEST" terminals together; the LED should light.

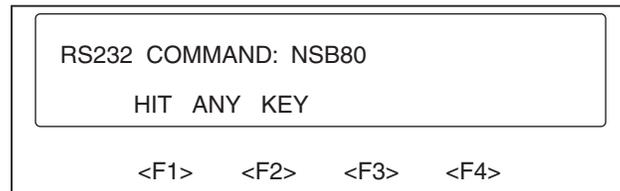
4. With the power on, check the resistance between RL and each of the other limb leads—RA, LA and LL—in all four "BASELINE IMPEDANCE" switch positions. Resistance tolerances are 475-525 Ω , 950-1050 Ω , 1425-1575 Ω and 1900-2100 Ω respectively. Return the "BASELINE IMPEDANCE" switch to 500 Ω .

Note

To measure the "BASELINE IMPEDANCE-2000" switch setting, the ohmmeter will probably need to be set to the next higher range.

5. With the power on, check the resistance between V1 and each of the other V-leads. The tolerance is 950-1050 Ω .
6. Go to the UTILITY MENU and test the viewing angle adjustment. Save the viewing angle and turn the power off. When the power is turned on again, the viewing angle should be as just set. This tests the nonvolatile memory in the medSim 300B.
7. Using the RS-232 serial port interface, connect a personal computer to the medSim 300B. Set the medSim 300B to 2400 baud (from the UTILITY MENU). Set the computer to 2400 baud, 1 or 2 stop bits, 1 start bit, and 8 data bits. Type in a few carriage returns. The medSim 300B should respond with "?". Now type in NSB80<CR>.

The medSim 300B display should read:



```
RS232 COMMAND: NSB80
HIT ANY KEY
<F1> <F2> <F3> <F4>
```

eic256.eps

Press any key. Disconnect the computer.

8. Connect the ECG posts on the medSim 300B to the monitor. Check that the R-wave amplitude on Lead II matches the rates in the medSim 300B ECG menu. Check all other leads for the presence of a waveform.
9. Set the monitor to measure respiration. Set the "LEAD SELECT" switch for the lead the monitor uses. Check that a waveform and a respiration rate on the monitor match the respiration menus on the medSim 300B.
10. Connect "BPI" (blood pressure channel 1) to the monitor. Set the "SENSITIVITY" switch for the monitor. Set the medSim 300B to "atm" and zero the monitor. Set the medSim 300B to 300 mmHg; check that the monitor reads 300 mmHg.
11. Repeat this for "BP2" and "BP4".
12. Repeat for "BP3" except set the medSim 300B to 30 mmHg.
13. Connect the monitor to the "FIXED TEMP" channel. The monitor should read 98.6 °F (37 °C).
14. Connect the monitor to the "VAR TEMP" connector. Set the "PROBE" select switch to the probe type the monitor uses. Set the medSim 300B temperature menu to 37 °C; check that the monitor reads the same.

15. Connect the monitor to the "CARDIAC OUTPUT" connector. Set the "CARDIAC OUTPUT/VAR TEMP" switch to "CARDIAC OUTPUT". Set the monitor to the parameters simulated*. Adjust the injectate temperature to 2 °C using the 10-turn potentiometer in the Cardiac Output module/cable. Set the blood temperature to 37 °C in the medSim 300B. Execute the "5 l/m" cardiac output waveform; check that the monitor registers 5 liters per minute.

Note

**See the medSim 300B specifications.*

Calibration

Calibration and Maintenance

Calibration is the procedure by which an instrument is adjusted to make its indicated values correspond as closely as possible to the actual values being measured. Sometimes calibration is accomplished by measuring a set of known values and adjusting the instrument accordingly. Verification is accomplished by comparing readings of the instrument with those of another instrument that serves as a reference or standard. Calibration must be performed at the recommended interval—one year—to ensure that the instrument's measurements remain within its specifications.

The medSim 300B Patient Simulator should be calibrated and have a maintenance check once a year. We recommend that you send your instrument to Fluke Biomedical for this service.

When we receive your instrument, we will:

- Perform a maintenance check.
- Install any firmware updates.
- Calibrate your patient simulator.
- Certify calibration.
- Return your instrument to you promptly.

Our calibration measurements are traceable to the National Institute of Standards and Technology (NIST). A certificate of calibration and performance is sent with each instrument.

Calibration On-Site

This section includes the procedure for a complete calibration of the medSim 300B.

Before beginning this calibration procedure, it is important that we make you aware of the Warranty Disclaimer (refer to Warranty Disclaimer printed at the front of this manual). According to this disclaimer, the warranty on the medSim 300B becomes void if the Quality Seal is broken without proper factory authorization. Therefore, we recommend that you send your instrument to Fluke Biomedical for factory calibration and service.

Equipment Required for Calibration

To begin the "on-site" calibration process, make sure you have the following equipment:

- Digital multimeter- Keithley 196*

Measurement Type	Measurement Range	Accuracy (\pm)	Meter Output Current
VDC	0-6 mV	10 μ V	N/A
VDC	0-12 mV	20 μ V	N/A
VDC	0-120 mV	200 μ V	N/A
VDC	10 V	10 mV	N/A
Resistance	500 Ω	0.1 Ω	N/A
Resistance	15-25 k Ω	50 Ω	1-10 μ V
Resistance	1-5 k Ω	5 Ω	10-100 μ V

- DC power supply - Instek Model PS-3225D* : 10 V \pm 10 mV @ 30 mA

- **Calibration cables**** **Part No.**

Blood Pressure	2199081
Temperature	2199278
Cardiac Output	2199269

Note

*Equivalent equipment is required to meet or exceed listed specifications.

Note

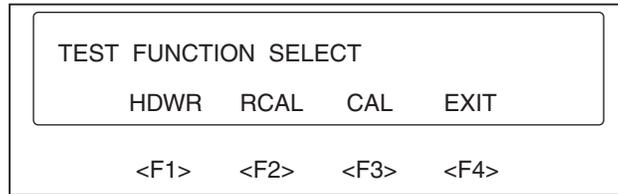
**Cables are available from Fluke Biomedical. Refer to the current Fluke Biomedical Price List for availability, part number information and price

Calibration Setup

The medSim 300B has no internal adjustments. All calibration adjustments are completed using the medSim 300B keyboard. Calibration constants are stored in the nonvolatile memory (EEPROM) within the medSim 300B.

1. Remove the Quality Seal from the bottom panel.
2. Then remove the three screws holding the metal plate and remove the metal plate.
3. Locate the "CAL" switch near the rear of the opening.
4. Set the top panel switches as follow:
 - BASELINE IMPEDANCE 500
 - LEAD SELECT II
 - SENSITIVITY 40
 - VAR TEMP-PROBE 700
 - CARDIAC OUTPUT/VAR TEMP VAR TEMP

5. Plug the medSim 300B into the battery eliminator. Press and hold down the "CAL" switch.
6. Turn on the medSim 300B and continue to hold down the "CAL" switch until the display reads:



eic257.eps

7. Press <F3>-CAL. The display shows the first calibration step.

Calibration Procedure

During calibration, the top line of the display shows the name of the calibration step, where to connect the digital multimeter (DMM) and the value to adjust for.

Some of the steps require only that a DMM reading be taken before proceeding to the next step.

For steps that require adjustment, the menu selections are displayed on four menu pages, which are accessed using the <right arrow> and <left arrow> keys. Press the function key that relates to the desired selection.

To decrement and increment, use the <F1> and <F2> keys. The <up arrow> key saves the setting and jumps back a step.

Menu selections and their functions follow:

Selections	Functions
sdn	slow decrement
sup	slow increment
mdn	medium decrement
mup	medium increment
fdn	fast decrement
fup	fast increment
next	moves to the next step
skip	moves to the next step without saving the new setting
esc	exits the calibration procedure without saving the new setting
save	exits the calibration procedure and saves the new setting

1. For the "ECG: REF" step, record the reading (including polarity).
2. Then on the next step—"ECG: 5 mV"—adjust the unit for a reading of 5 mV plus the reference step reading. This can also be done by zeroing the DMM on the reference step.
3. For "PACE: REF", record the reading as above. Then for the "ATRIAL PACE: REF V" and "VENT PACE: REF V", adjust the unit to the "PACE REF" voltage.

4. For respiration, set the "LEAD" switch to "II/RL-LL" and the "IMPEDANCE" switch to "500". The first respiration step is a reference step. Do not adjust it. Record it and add it to the value called for in the remaining respiration steps, or offset the DMM to zero.
5. For blood pressure, connect the blood pressure calibration cable to the 10-volt supply and DMM as follows:

Cable Wire	Connection
GRY	+SUPPLY
GRN	-SUPPLY
BLK	+DMM
RED	-DMM

6. Set the "SENSITIVITY" switch to "40". Set the supply to +10 V \pm 10 mV. The calibration steps call for +10 V or -10 V or 0 V. To get the -10 V exciter, reverse the connections to the supply. To get 0 V exciter, remove the connections from the supply.
7. To calibrate temperature, use the temperature calibration cable. Set the "CARDIAC OUTPUT/ VAR TEMP" switch to "VAR TEMP". Following are the three different cable and switch settings used in the calibration steps:

Cal Steps	Cable Colors	Probe Switch	DMM Current
T1	GRN-RED	700	10-100 μ A
T2	GRY-RED	700	1-10 μ A
400	BLK-RED	400	10-100 μ A

The chart above also indicates the DMM output current that must be used.

Note

Most meters use 100 μ A for the 20 k Ω range and 10 μ A for the 100 k Ω range.

8. To calibrate cardiac output, use the cardiac output cable. Set the "CARDIAC OUTPUT/VAR TEMP" switch to "CARDIAC OUTPUT".
9. Set the DMM to measure resistance using 10 μ A. Connect the black cable lead to the "+DMM" jack and the red cable lead to the "-DMM" jack.
10. When the last step is completed, the calibration constants are automatically stored in the medSim 300B and a long beep indicates that the calibration procedure is completed. Now you may reassemble the unit.

Tolerances

Adjustment tolerances for each step:

ECG REF	No adjustment; reading is \leq 5 mV
ECG 5 mV	\pm 0.02 m
PACE \pm 700	\pm 0.4 mV
PACE REF	No adjustment; reading is \leq 5 mV
ATRIAL PACE	\pm 0.2 mV

VENT PACE	± 0.2 mV
RESP REF	No adjustment; reading is about 500 Ω
RESP Ω	± 0.02 Ω
BP1, BP2 and BP4	± 0.1 mV
BP3	± 0.02 mV
CARDIAC OUTPUT/VAR TEMP	± 5 Ω

