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FLUKE®
Biomedical

ProSim™ 2/3

Vital Signs Simulator

Users Manual

FBC 0038
January 2013, Rev. 1
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7/07

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Cleveland Calibration Lab
Tel: 1-800-850-4608 x2564
Email: globalcal@flukebiomedical.com

Everett Calibration Lab
Tel: 1-888-99 FLUKE (1-888-993-5853)
Email: service.status@fluke.com

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Eindhoven Calibration Lab
Tel: +31-40-2675300
Email: ServiceDesk@fluke.com

In Asia:
Everett Calibration Lab
Tel: +425-446-6945
Email: service.international@fluke.com

To ensure the accuracy of the Product is maintained at a high level, Fluke Biomedical recommends the product be calibrated at least once every 12 months. Calibration must be done by qualified personnel. Contact your local Fluke Biomedical representative for calibration.

Certification

This instrument was thoroughly tested and inspected. It was found to meet Fluke Biomedical's manufacturing specifications when it was shipped from the factory. Calibration measurements are traceable to the National Institute of Standards and Technology (NIST). Devices for which there are no NIST calibration standards are measured against in-house performance standards using accepted test procedures.

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Manufacturing Location

The ProSim™ 2/3 Vital Signs Simulator is manufactured at Fluke Biomedical, 6920 Seaway Blvd., Everett, WA, U.S.A.

Table of Contents

Title	Page
Introduction	1
Safety Information	1
Accessories	4
Product Familiarization	5
Battery Eliminator	8
How to Turn On the Product	8
Operation	9
Cardiac Functions	10
ECG Functions	10
Pacemaker Signals	13
Arrhythmia Function	13
ECG Tests	14
How to Set a Performance Wave Output	14
R-Wave Detection Test	14
Blood Pressure Function	15
How to Set the BP Sensitivity	15
How to Set Up a BP Channel	15
Dynamic BP Waveforms	15
How to Add a Respiration Artifact to the BP Waveform	17
Cardiac Output	17

Cardiac-Output Test Set Up 17
How to Simulate Injectate Failure and Left-to-Right Shunt Fault 19
How to Simulate Output from a Calibrated Pulse Signal 19
Fetal/Maternal Function 21
Simulate Fixed Fetal Heart Rate (FHR) 21
How to Simulate a Periodic FHR with Intrauterine Pressure (IUP) 21
Other Functions 24
Respiration Functions 24
Temperature 24
Remote Operation 26
Remote Commands 27
General Commands 28
Function Commands 28
ECG Functions 28
Arrhythmia Functions 31
ECG Test Functions 32
Respiration Function Commands 35
Blood Pressure Function Commands 36
Other Function Commands 40
Maintenance 41
General Maintenance 41
Battery Replacement 42
General Specifications 43
Detailed Specifications 43
ECG Waveform 43
Pacemaker Waveform 44
Arrhythmia 44
ECG-Performance-Tests 45
Respiration 45
Blood Pressure 45
Temperature 47
Cardiac Output (ProSim 3 Only) 47
Fetal / Maternal-ECG (ProSim 3 Only) 47
Computer Setup 48

List of Tables

Table	Title	Page
1.	Symbols	3
2.	Standard Accessories	4
3.	Optional Accessories	4
4.	Front-Panel Controls and Connectors	6
5.	Top-Panel Connectors	7
6.	Product Functions	9
7.	Dynamic BP Waveforms by BP Channel	16
8.	Error Codes	27
9.	Product Control States and Modes	28
10.	General Commands	28
11.	ECG Function Commands	28
12.	Pacemaker Waveform Commands	30
13.	Arrhythmia Function Commands	31
14.	ECG Test Commands	33
15.	Respiration Function Commands	35
16.	Blood Pressure Function Commands	37
17.	Other Function Commands	40

List of Figures

Figure	Title	Page
1.	Front-Panel Controls and Connectors	5
2.	Top-Panel Connectors	7
3.	Battery Eliminator Connections	8
4.	Power-Up Screen	8
5.	Home Screen	9
6.	Home Screen – Cardiac Function	9
7.	Cardiac Output Screen	10
8.	ECG Screen	11
9.	ECG Test Connections	12
10.	Arrhythmia Screen	13
11.	Cardiac Output Injectate CI-3 Adapter	18
12.	Cardiac Output Connections	20
13.	Fetal/Maternal Connections	23
14.	Temperature Simulation Connections	25
15.	Remote Operation Connections	26
16.	Battery Replacement	42

Introduction

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, read all safety information before you use the Product.

The ProSim™ 2 and ProSim™ 3 Vital Signs Simulators (the Product) are electronic signal sources used to measure the performance of patient monitors. The Product simulates:

- ECG (with and without arrhythmias)
- Respiration
- Blood pressure
- Temperature
- Cardiac output (ProSim 3 only)
- Fetal/Maternal ECG and IUP (ProSim 3 only)

The ProSim™ 3 is shown in all illustrations.

Safety Information

A **Warning** identifies conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

Table 1 is a list of symbols used on the Product and in this manual.

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury:

- **Use the Product only as specified, or the protection supplied by the Product can be compromised.**
- **Do not connect the Product to a patient or equipment connected to a patient. The Product is intended for equipment analysis only. Do not use the Product for diagnostics, treatment, or other capacity where the Product touches a patient.**
- **Remove the batteries if the Product is not used for an extended period of time, or if stored in temperatures above 50 °C. If the batteries are not removed, battery leakage can damage the Product.**
- **Replace the batteries when the low battery indicator shows to prevent incorrect measurements.**

- **Carefully read all instructions.**
- **Do not use the Product around explosive gas, vapor, or in damp or wet environments.**
- **Do not use and disable the Product if it is damaged.**
- **Do not use the Product if it operates incorrectly.**
- **Examine the case before you use the Product. Look for cracks or missing plastic. Carefully look at the insulation around the terminals.**
- **Read all safety information before you use the Product.**
- **Remove all probes, test leads, and accessories before the battery door is opened.**
- **Remove all probes, test leads, and accessories that are not necessary for the measurement.**
- **Batteries contain hazardous chemicals that can cause burns or explode. If exposure to chemicals occurs, clean with water and get medical aid.**

Table 1. Symbols

Symbol	Description	Symbol	Description
⚠	Important information. Refer to manual.	⚠	Hazardous Voltage
CE	Conforms to European Union directives		Conforms to relevant North American Safety Standards.
N10140	Conforms to relevant Australian EMC requirements		Battery
	Conforms to relevant South Korean EMC Standards		This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste. Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as category 9 "Monitoring and Control Instrumentation" product. Do not dispose of this product as unsorted municipal waste. Go to Fluke's website for recycling information.

Accessories

Available Product Accessories are shown in Tables 2 and 3.

Table 2. Standard Accessories

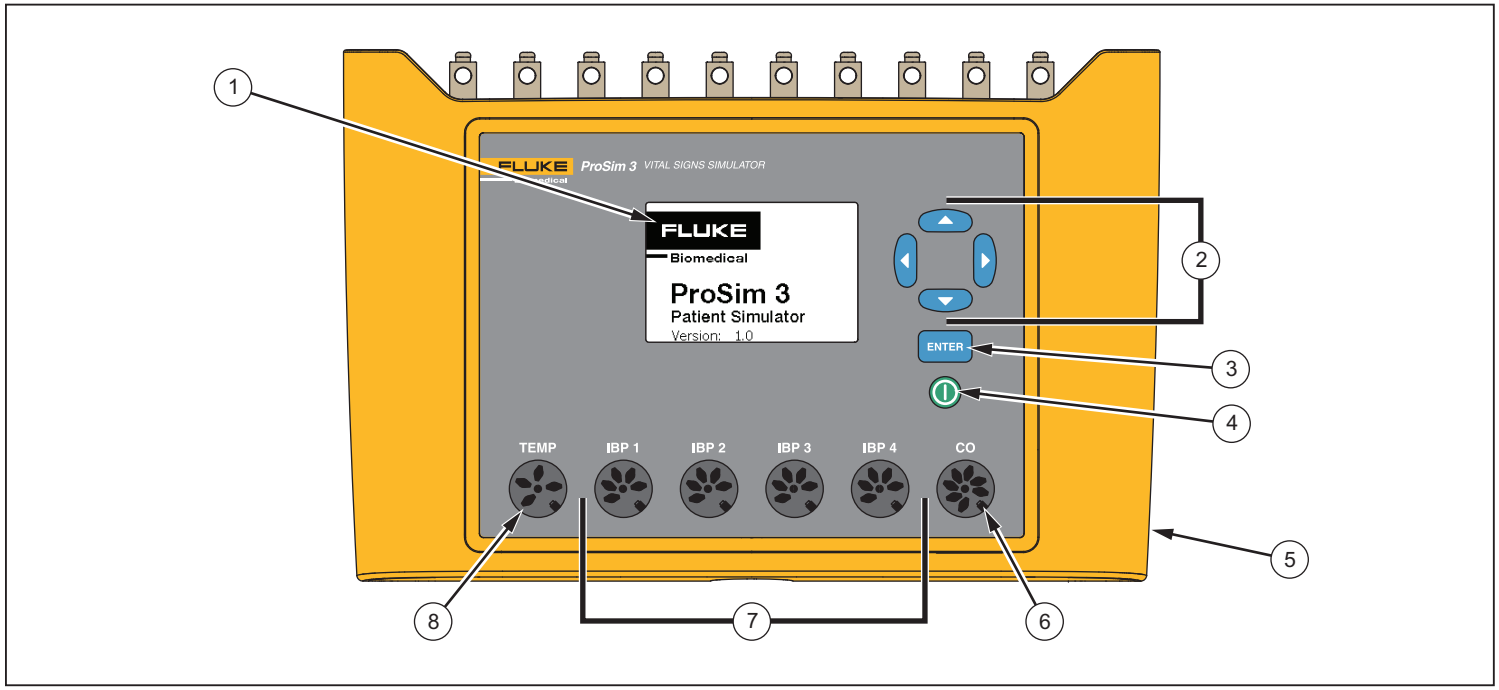
Item	Fluke Biomedical Part Number
ProSim 2/3 Safety Information	4308669
ProSim 2/3 Users Manual CD	4253822
IBP Cable, Unterminated	2392173
ProSim 2/3 Carrying Case	2248623
CI-3 Cable Assembly (Cardiac Output Box), 3010-0289FG	2392199
USB Mini-B Cable	1671807

Table 3. Optional Accessories

Item		Fluke Biomedical Part Number
Temperature Cable	YSI 400 Series (UT-4)	2523334
	YSI 700 (UT-2)	2199019
Cardiac Output Marq Eagle (Cardiac output switch for GE)		4022300
AC/DC Power Supply Set		4318692

Product Familiarization

Table 4 is a list of controls and connectors on the Product shown in Figure 1.



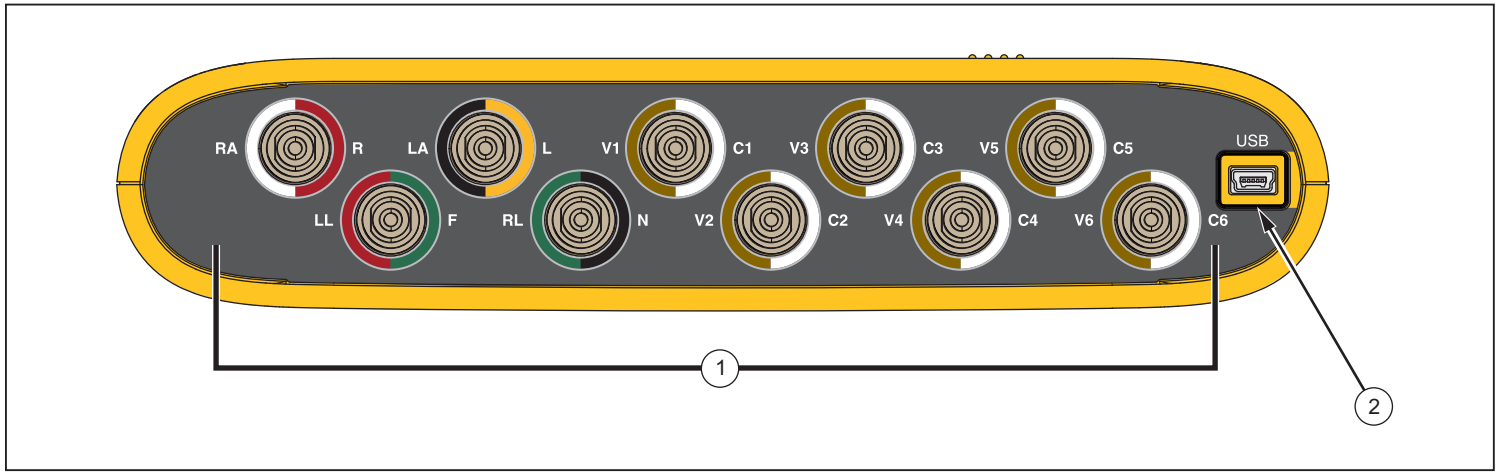
hal001.eps

Figure 1. Front-Panel Controls and Connectors

Table 4. Front-Panel Controls and Connectors

Item	Name	Description
①	Display	LCD Display
②	Navigation buttons	Cursor control buttons for navigating menus and lists.
③	Enter button	Sets the highlighted function.
④	Power button	Turns on and off the Product.
⑤	DC Power Connector	Connector for the AC/DC power supply.
⑥	Cardiac Output Connector	Connector to the Cardiac input of the patient monitor.
⑦	Invasive Blood Pressure Connectors	Four connectors to the Invasive Blood Pressure (IBP) input of the patient monitor.
⑧	Temperature Connector	Connector to the Temperature input of the patient monitor.

Table 5 is a list of connectors on the top-panel of the Product shown in Figure 2.



hal006.eps

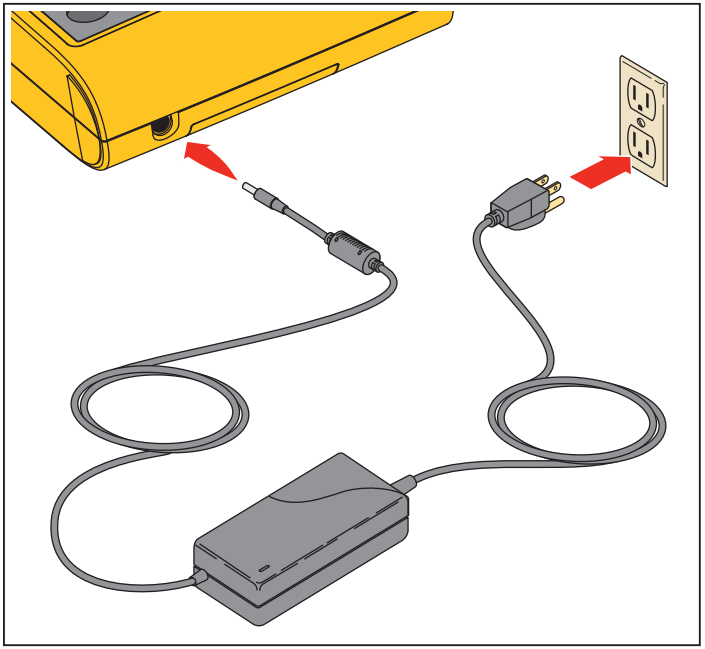
Figure 2. Top-Panel Connectors

Table 5. Top-Panel Connectors

Item	Name	Description
①	ECG Posts	Connection posts for ECG leads from the patient monitor.
②	Mini-Series B Connector	For firmware updates and calibration.

Battery Eliminator

The Product can operate on its two 9-Volt batteries or from mains power. To run on mains power, connect the Product to the optional AC/DC Power Supply as shown in Figure 3.



hal022.eps

Figure 3. Battery Eliminator Connections

How to Turn On the Product

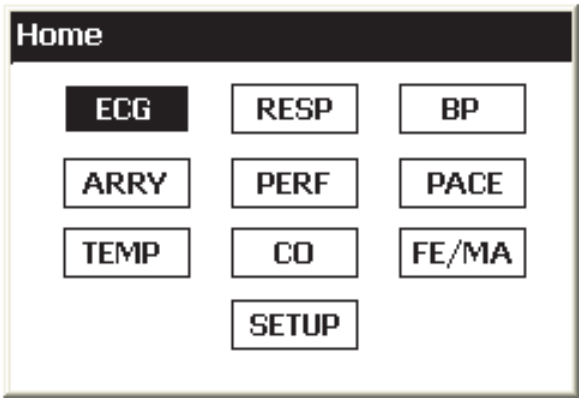
Push ⏻ on the front panel to turn on the Product. The power-up screen shows in the display (Figure 4).



hal007.bmp

Figure 4. Power-Up Screen

When the self test is complete and no errors are sensed, the home screen shows in the display (Figure 5).



hal002.eps

Figure 5. Home Screen

Operation

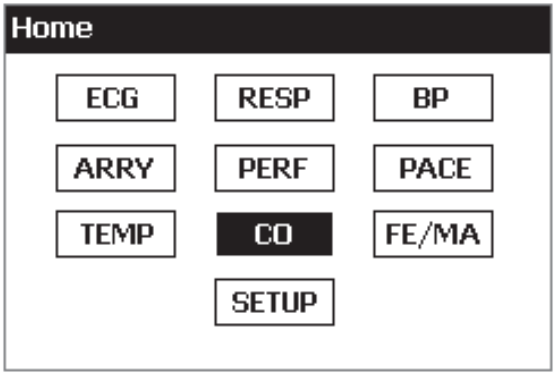
All Product functions are shown in the home screen. See Figure 5. To set parameters for a function, push the navigation buttons (◀, ▶, ▲, ▼) to move the highlight to a function icon. Push ENTER. Table 6 is a list of Product functions shown in the home screen.

Table 6. Product Functions

ICON	Description	ICON	Description
ECG	ECG Waveform	PACE	Pacemaker
RESP	Respiration	TEMP	Temperature
BP	Blood Pressure	CO	Cardiac Output
ARRY	Arrhythmia	FE/MA	Fetal/Maternal
PERF	Performance Wave	SETUP	Setup

To set a parameter of a function:

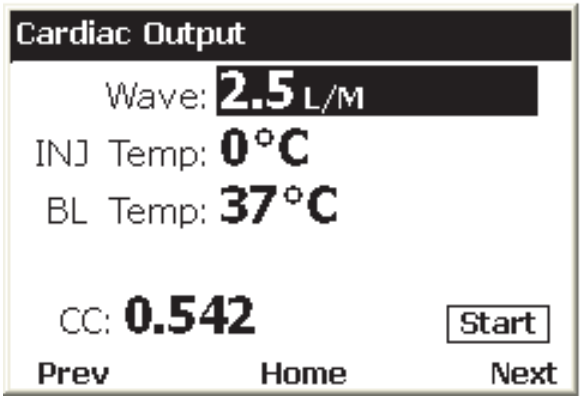
1. Push the navigation buttons to move the highlight to a function. Figure 6 shows the cardiac output icon highlighted.



hal005.bmp

Figure 6. Home Screen – Cardiac Function

2. Push ENTER. The cardiac output screen in Figure 7 shows in the display.



hal003.eps

Figure 7. Cardiac Output Screen

3. To set the injection temperature, push ▽ to move the highlight to the **INJ Temp** value.
4. Push ▷ or ◁ to change the value for the highlighted parameter. The adjusted simulated value changes the output signal immediately.

All parameter values in the Product are set with this procedure. For the parameters that cannot be set, the highlight will not move to the value of that parameter.

There are two procedures to move between Product functions. When the home screen is not shown in the display, **Prev**, **Home**, and **Next** show along the bottom of the display. To move to the home screen, move the highlight to **Home** and push ENTER. The home screen shows all the Product functions. See Figure 5.

An alternative to the Home screen is to use the **Prev** and **Next** selections. The software lets you move through the Product functions sequentially. The function sequence is:

ECG, Respiration, Blood Pressure, Arrhythmias, Performance Wave, Pacemaker Wave, Temperature, Cardiac Output, Fetal Maternal, and Setup.

For example, look at the Cardiac Output screen in Figure 7. When you move the highlight to **Prev** and push ENTER, the display shows the Temperature screen. When you highlight **Next** and push ENTER in the Cardiac Output screen, the display shows the Fetal/Maternal screen.

Cardiac Functions

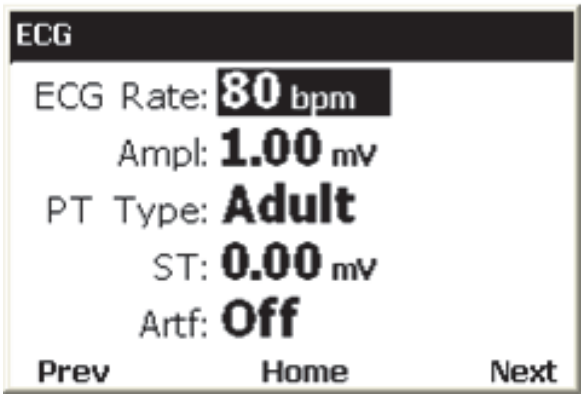
The cardiac functions of the Product are ECG, Arrhythmia, Blood Pressure, Pacemaker, Cardiac Output, and Performance Waves.

ECG Functions

The ECG function of the Product lets you set five parameters of an ECG waveform: Rate, Amplitude, Patient Type, ST, and Artifact. Figure 9 shows a typical setup for an ECG test on a patient monitor.

To set an ECG parameter:

1. In the **Home** screen, push the navigation buttons to move the highlight to ECG.
2. Push ENTER to show the ECG screen in Figure 8 in the display.



hal004.bmp

Figure 8. ECG Screen

See the Function Navigation and Parameter Selection section to learn how to set parameter values. See the detailed specifications for the range of parameter values. These parameters change the waveform that appears on the ECG posts along the top of the Product.

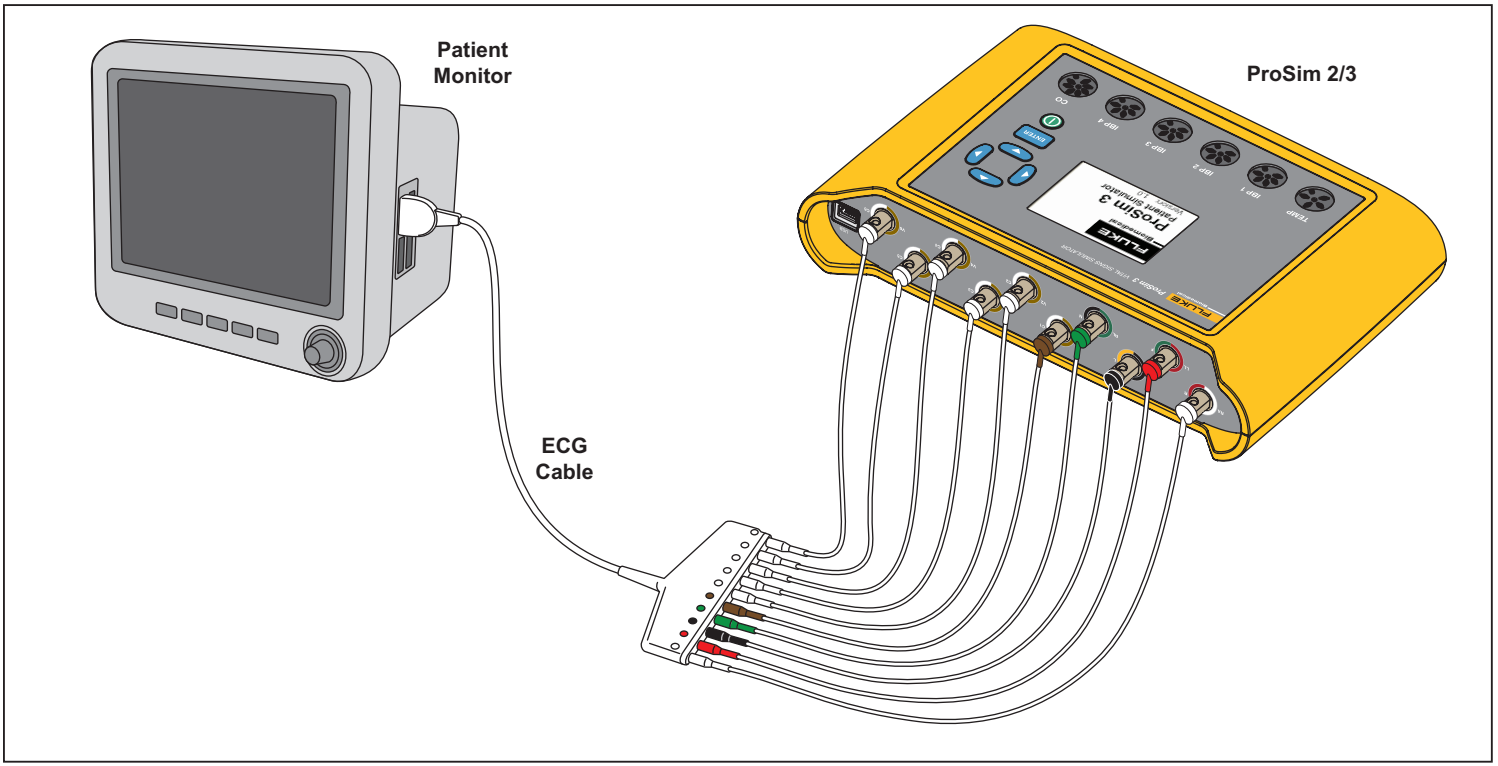


Figure 9. ECG Test Connections

Pacemaker Signals

The Product can simulate heart signals with pacemaker control signals. To set the waveform, amplitude, and width of the pacemaker signal:

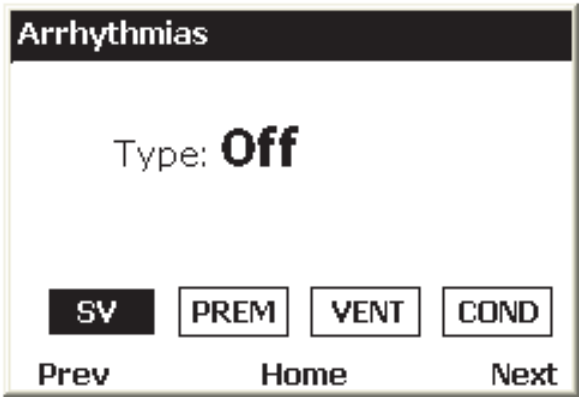
1. In the **Home** screen, push the navigation buttons to highlight PACE.
2. Push ENTER to show the **Pacemaker Waves** screen in the display.
3. Use the parameter selection procedure described in the Operation section to set the parameters of the pacemaker signal.

See the detailed specifications for the range of parameter values.

Arrhythmia Function

The Product can simulate heart arrhythmias. To start an ECG arrhythmia simulation:

1. In the **Home** screen, push the navigation buttons to highlight ARRY.
2. Push ENTER to show the **Arrhythmias** screen in the display. See Figure 10.



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Figure 10. Arrhythmia Screen

The simulated arrhythmias are grouped into four categories: Supraventricular, Premature, Ventricular, and Conduction Defect. See the specifications to learn the arrhythmias in each group.

3. Push ◀ or ▶ to move the highlight to an arrhythmia group icon.
4. Push ENTER.
5. Use the parameter selection procedure described in the Operation section to set the arrhythmia.

When the type parameter has been set to an arrhythmia, the group icon of the group the arrhythmia belongs to has a thicker border around it.

To stop an arrhythmia simulation:

1. Highlight one of the group icons.
2. Push ENTER.
3. Push ▶ or ◀ until the type value shows **Off**.

ECG Tests

The Product can source pulse, square, triangle, and sine waveforms that can be used to verify patient monitors and other ECG equipment. These waveforms are used in tests for frequency response, sensitivity, gain drift, internal calibration, stylus damping, paper speed, linearity, sweep speed, and more.

The Product also sources an R-wave that is used to verify that ECG equipment can detect the R-wave part of an ECG signal.

Note

When the Product is set to source a performance waveform, respiration and blood pressure simulations are disabled.

How to Set a Performance Wave Output

To set a performance wave on the ECG terminals:

1. In the **Home** screen, push the navigation buttons to highlight PERF.
2. Push ENTER to show the Performance Wave screen in the display.
3. Use the parameter selection procedure described in the Operation section to set the frequency, shape, and amplitude of the performance waveform.

See the detailed specifications for the range of parameter values.

R-Wave Detection Test

You can set the Product to source a normal heart ECG signal and vary the amplitude and width of the R-wave portion of the waveform. To set the R-wave portion of an ECG waveform:

1. In the **Home** screen, push the navigation buttons to highlight PERF.
2. Push ENTER to show the **Performance Wave** screen in the display.
3. Push the navigation buttons to highlight RWDET.
4. Push ENTER to show the **R-Wave Detection** screen in the display.
5. Use the parameter selection procedure described in the Operation section to set the beats per minute (bpm), width, and amplitude of the R-wave.

Blood Pressure Function

The Product simulates dynamic Blood Pressure (BP) waveforms that synchronize with all normal sinus rhythm rates and track all simulated arrhythmias. You can set each of the four BP channels independently. Each channel simulates a bridge pressure transducer. A respiration artifact can be injected into each BP channel waveform.

How to Set the BP Sensitivity

The sensitivity of the four BP channels must be set to match the sensitivity of the patient monitor. To set BP channel sensitivity:

1. In the **Home** screen, push the navigation buttons to highlight SETUP.
2. Push ENTER to show the **Setup** screen in the display.
3. Use the parameter selection procedure described in the Operation section to set the **BP Sense** parameter.

How to Set Up a BP Channel

To set up one of the four BP channels:

1. In the **Home** screen, push the navigation buttons to highlight BP.
2. Push ENTER to show the **Blood Pressure** screen in the display.
3. Push ▽ or △ to highlight the BP channel you want to set up.
4. Push ENTER to show the **Blood Pressure** screen for the channel in the display.
5. Before you start the BP simulation, you must set the simulated pressure to 0 mmHg. Push the navigation buttons to highlight ZERO.
6. Push ENTER. The static pressure parameter is set to 0 mmHg and the dynamic and artifact variables are set to Off.
7. Zero the patient monitor to set the baseline for future simulations.
8. Use the parameter selection procedure described in the Operation section to set the Blood Pressure channel parameters.

Dynamic BP Waveforms

The Dynamic parameter is used to simulate the various pressures that are found around the heart and associated blood vessels. The dynamic waveforms have a normal sinus rhythm at 80 bpm. Only the systolic and diastolic pressures change for each dynamic waveform.

All the dynamic waveforms are not available on all four BP channels. Table 7 is a list of the dynamic BP waveforms with a check to indicate which BP channel each waveform can be set on.

Note

See the Swanz-Ganz Procedure section to learn more on how the do this serial simulation.

Table 7. Dynamic BP Waveforms by BP Channel

Dynamic Waveform		BP1	BP2	BP3	BP4	
Name	**Pressures**					
Arterial	120/80	√	√	√		
Radial Artery	120/80	√	√	√		
Left Ventricle	120/00	√	√	√		
Left Atrium	14/4		√	√		
Right Atrium	15/10		√	√	√	In Swanz-Ganz Procedure
Right Ventricle	25/00	√	√	√	√	
Pulmonary Artery	25/10		√	√	√	
Pulmonary Wedge	10/2		√	√	√	

How to Add a Respiration Artifact to the BP Waveform

When the dynamic parameter for a blood pressure channel is set to a value other than off, the Product will let you move the highlight to the artifact parameter. With the highlight on the artifact value, push ⏷ or ⏶ to toggle the value between on and off.

Each BP channel has a different range of pressure change due to the respiration artifact.

Cardiac Output

The Cardiac Output function electronically simulates the dynamic temperature changes of blood that is cooled by an injectate.

Note

Cardiac output measurement devices that use the Fick dye injection, Doppler ultrasonography, and bioimpedance are not addressed or intended for this Product.

Cardiac-Output Test Set Up

To simulate cardiac output with the Product, a CI-3 adapter is necessary to connect the monitor to the Product. The adapter is shown in Figure 11. Note that the injectate temperature thermistor has to be cut off at the EUT cable to install the general-purpose connector.

This module has connections for the cardiac output measurement under test and simulates the injectate temperature (IT) thermistors at 0 °C or 24 °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 equivalent 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 kΩ potentiometer enables adjustment of the injectate temperature to 0 °C or 24 °C.

The 4-pin IT thermistors connector is not standard on all monitors. A general function connector that you can connect to the device under test (DUT) injectate cable is also available.

Note

A DUT cardiac output cable changed for this test must not be used in clinical applications.

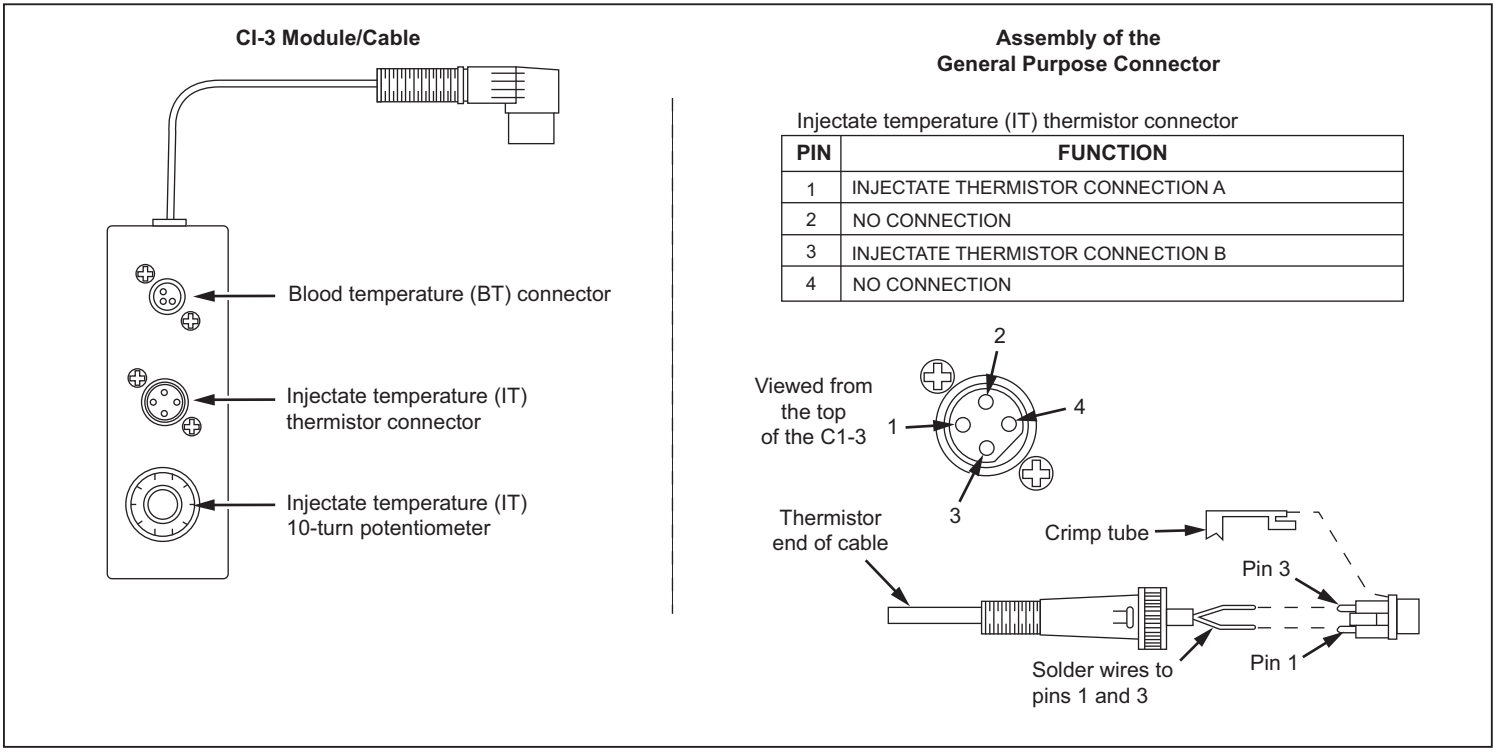


Figure 11. Cardiac Output Injectate CI-3 Adapter

For cardiac output simulation, use the supplied CI-3 adapter to connect the Product to the Device Under Test (DUT). (see Figure 12). If necessary, use the general-purpose connector.

To do a cardiac output test:

1. Connect the patient monitor to the cardiac output adapter.
2. Connect the adapter to the Product (Figure 12).

3. Set up the patient monitor to:
   - Catheter size: 7 F
   - Injectate volume: 10 cc
   - Injectate temperature: 0 °C or 24 °C
   - Computational constant: 0.542 for 0 °C injectate or 0.595 for 24 °C injectate
4. In the **Home** screen of the Product, push the navigation buttons to highlight CO.
5. Push ENTER to show the cardiac output screen.
6. Use the parameter selection procedure to set the cardiac output parameters for the test. See the detailed specifications to learn the range of each parameter.
7. Push the navigation buttons to highlight START.
8. Push ENTER to start the test. The simulation stops automatically.

To stop the simulation, highlight STOP and push ENTER.

How to Simulate Injectate Failure and Left-to-Right Shunt Fault

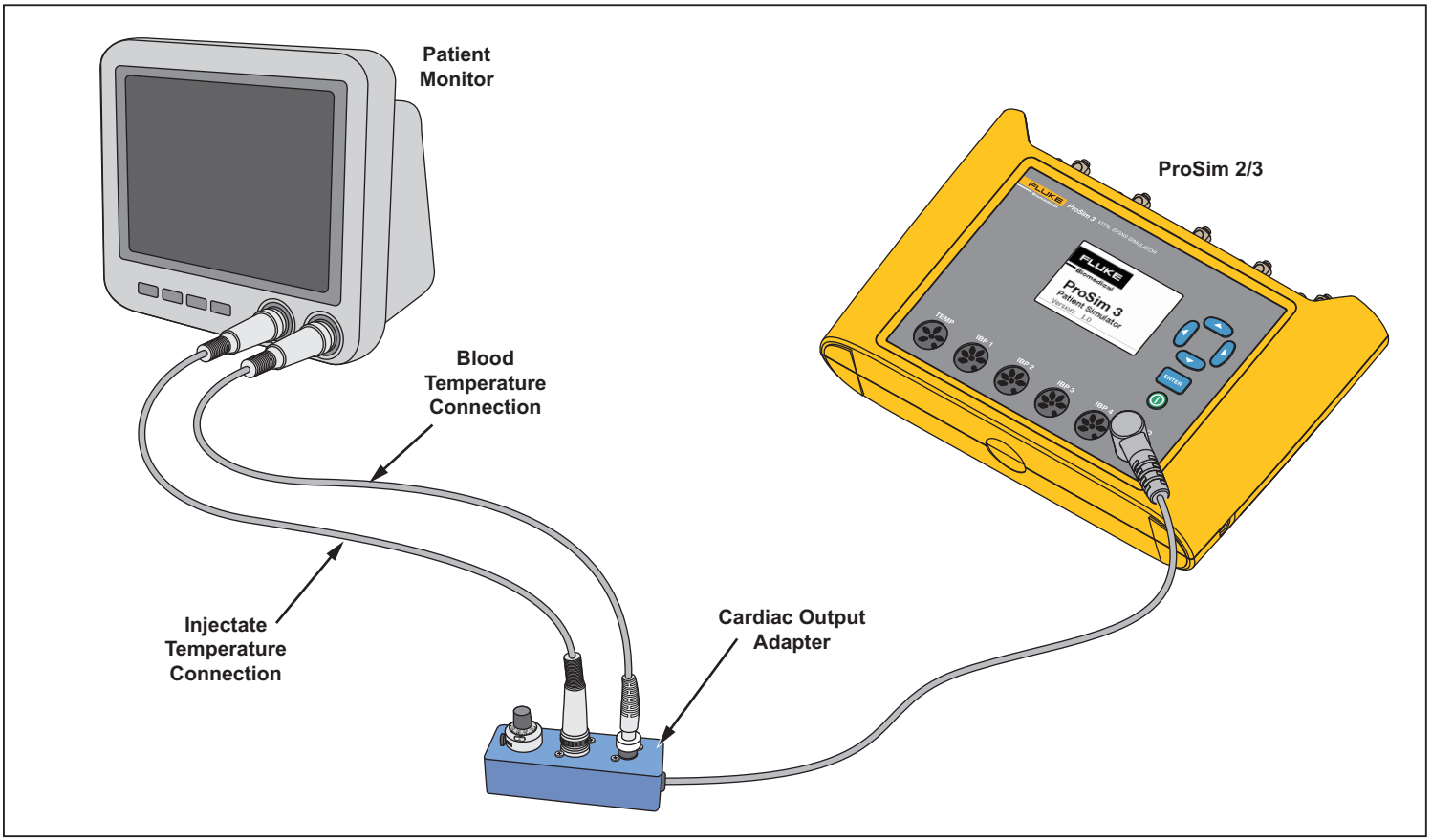
The Cardiac Output function can simulate an injectate failure or left-to-right shunt fault. To set either of these two failures:

1. Push ▲ or ▼ to highlight the **Wave** value.
2. Push ◀ or ▶ until **FAULTY INJ** or **L to R SHUNT** shows in the display.
3. Push the navigation buttons to highlight START.
4. Push ENTER to start the test.

How to Simulate Output from a Calibrated Pulse Signal

The Product sources a waveform that simulates an injectate temperature of 0 °C or 24 °C with a step of 1.5 °C for 1 second as a test for a cardiac-output monitor. To output a calibration pulse:

1. In the Cardiac Output screen, push ▲ or ▼ to highlight the **Wave** value.
2. Push ◀ or ▶ until **CAL PULSE** shows in the display.
3. Push ▲ or ▼ to highlight START.
4. Push ENTER to start the test.



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Figure 12. Cardiac Output Connections

Fetal/Maternal Function

The Product can simulate fetal and maternal electrocardiograms (ECG) that occur while in labor. Pressure waveforms of uterine contractions can also be simulated.

The fetal/maternal ECG signal is sourced on the ECG posts of the Product. The maternal signal is a P-QRS-T wave fixed at 80 bpm with an amplitude that is half the value of the amplitude parameter. The fetal signal is a narrow R-wave at full amplitude. The fetal and maternal signals are combined to make a composite signal.

Simulate Fixed Fetal Heart Rate (FHR)

To set a fixed fetal heart rate:

1. In the **Home** screen of the Product, push the navigation buttons to highlight FE/MA.
2. Push ENTER to show the **Fetal Maternal** screen.
3. Use the parameter selection procedure to set the **FHR** parameter.

   The set FHR value shown in the display is output and continues on the output until the value is changed.

How to Simulate a Periodic FHR with Intrauterine Pressure (IUP)

The Product can simulate intrauterine pressure (IUP) of a contraction of the uterus in childbirth. The IUP wave is a bell shaped curve that starts at zero and increases to 90 mmHg and decreases to zero over a 90-second period.

The frequency of contractions can be set to manual, 2, 3 or 5 minutes.

The fetal heart rate starts at 140 bpm and changes with blood pressure. Fetal heart rate and IUP are shown in the display.

The Product simulates three preconfigures waveforms for periodic FHR:

Early deceleration – The fetal heart rate follows the intrauterine pressure (no lag). FHR starts at 140 bpm, slows to 100 bpm at the intrauterine pressure peak and then returns to 140 bpm at the IUP decreases back to zero.

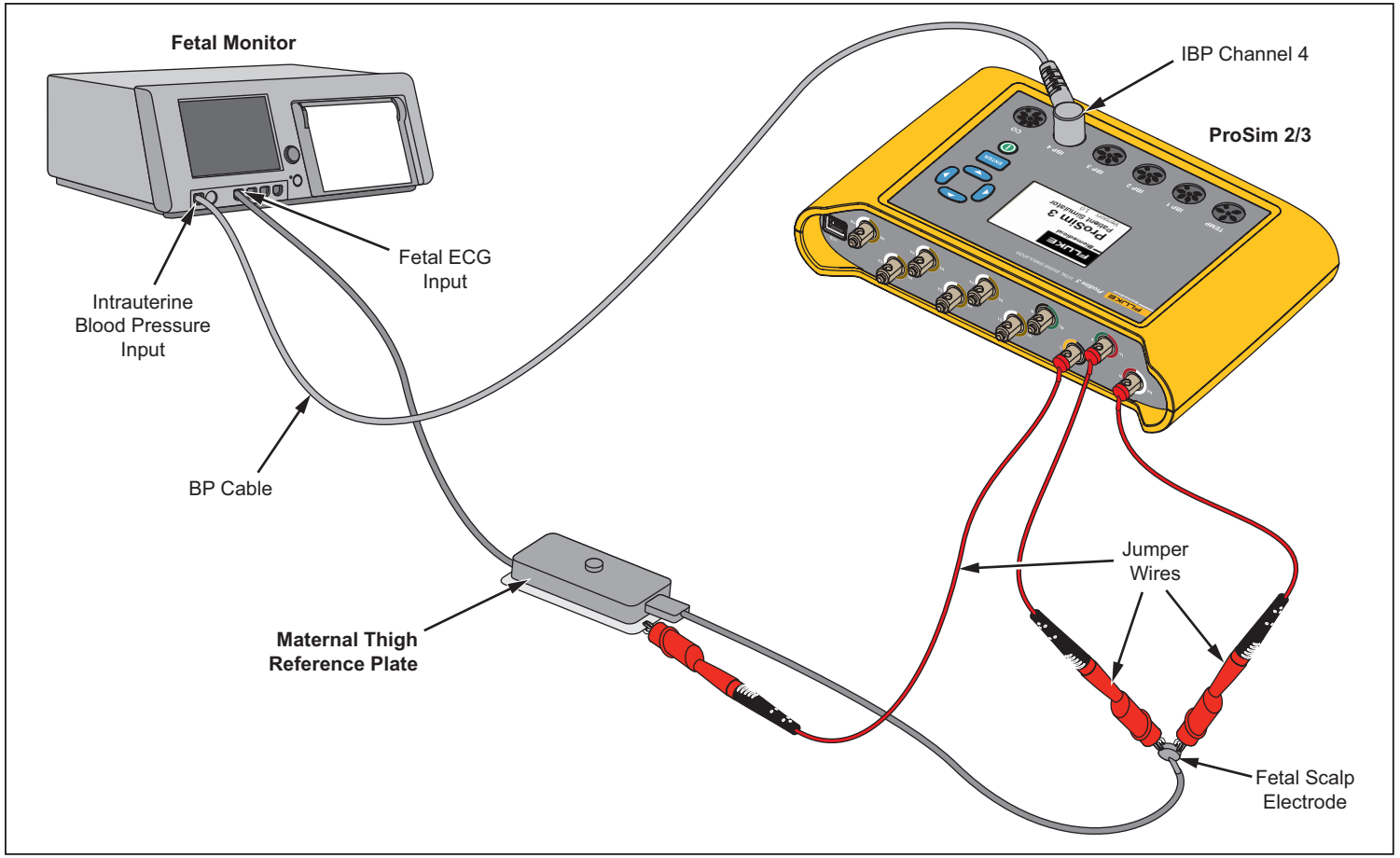
Late deceleration – The fetal heart rate change starts when the IUP is at its peak and lags the change in intrauterine pressure by 45 seconds. FHR starts at 140 bpm, slows to 100 bpm, and then increases back to 140 bpm

Acceleration – The fetal heart rate lags the change in intrauterine pressure by 30 seconds. FHR starts at 140 bpm, increases to 175 bpm, and then decreases back to 140 bpm.

To set a periodic FHR with IUP:

1. If the Fetal Maternal screen shows in the display, go to step 3. If not, go to the **Home** screen of the Product and push the navigation buttons to highlight FE/MA.
2. Push **ENTER** to show the **Fetal Maternal** screen.
3. Use the parameter selection procedure to set the **FHR**, **IUP**, and **Period** parameters
4. Push the navigation buttons to highlight START.
5. Push **ENTER** to start the test. If the **Period** parameter is set to **Manual**, the simulation stops automatically after the IUP wave stops. Each time you push **ENTER** another IUP wave starts. If not set to Manual, the IUP wave repeats at the frequency set in the **Period** parameter until the simulation is stopped.

To stop the simulation, highlight STOP and push **ENTER**.



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Figure 13. Fetal/Maternal Connections

Other Functions

The Product also simulates respiration and temperature. This section contains the procedures to set up the Product for these two functions.

Respiration Functions

The Respiration function lets you set five parameters of the respiratory waveform: Rate, Impedance, Baseline Impedance, Lead selection (left arm or left leg), and Apnea. To set the respiration waveform:

1. In the **Home** screen, push the navigation buttons to move the highlight to RESP.
2. Push ENTER to show the respiration screen in the display.

See the Function Navigation and Parameter Selection section to learn how to set the respiration parameter values. See the detailed specifications for range of parameter values. These parameters change the waveform that appears at the ECG posts along the top of the Product.

When the Apnea parameter is set to 12, 22, or 32, the apnea event starts immediately. When the event ends, the parameter is set to Off. You must set the parameter to 12, 22, or 32 to start another apnea event.

The values set for the baseline and lead parameters when the Product is turned off, become the power-up default values.

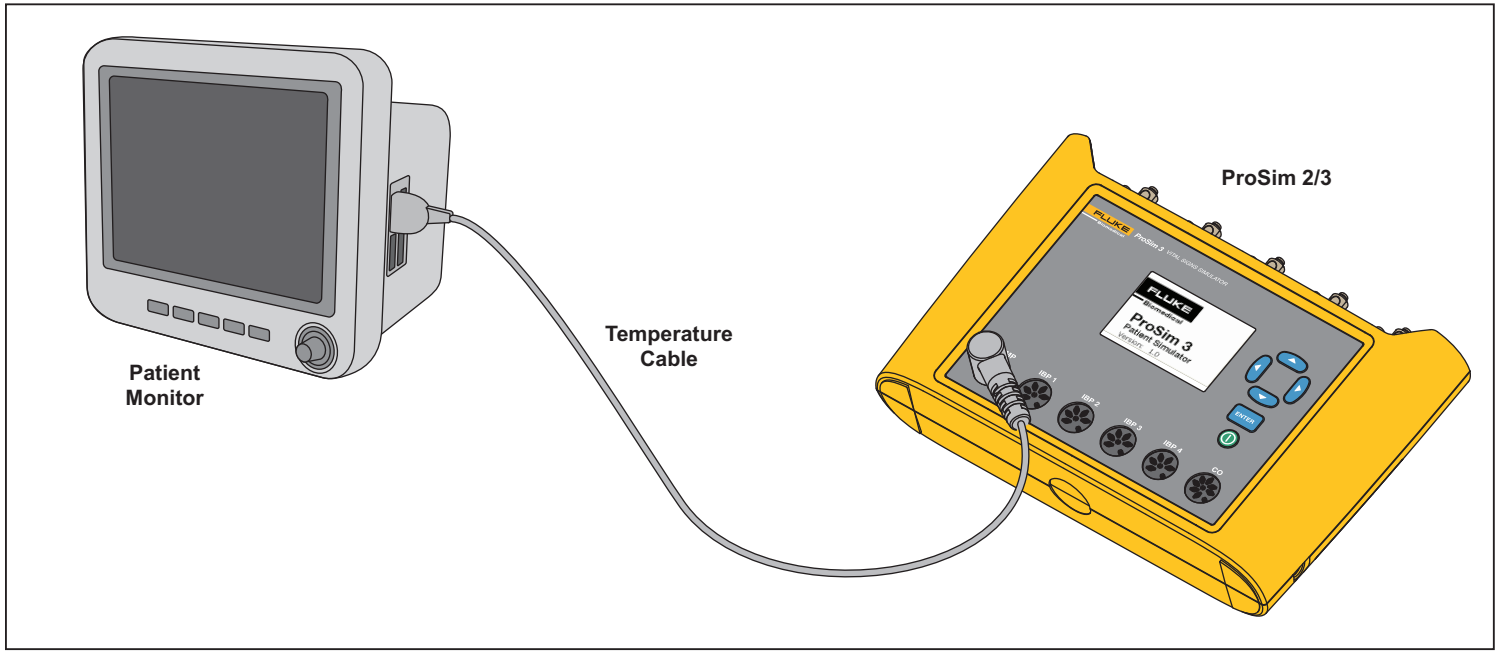
Temperature

Temperatures simulated by the Product are compatible with Yellow Springs, Inc. (YSI) Series 400 and 700 probes. The type of cable connected to the temperature jack sets the type of temperature probe simulated. Connect the temperature input of the UUT to the Temperature jack as shown in Figure 14.

To set temperature:

1. In the **Home** screen, push the navigation buttons to move the highlight to TEMP.
2. Push ENTER to show the temperature screen in the display.

See the Function Navigation and Parameter Selection section to learn how to set the temperature parameter value. See the detailed specifications for range of parameter values. These parameters change the temperature signal at the temperature connector.



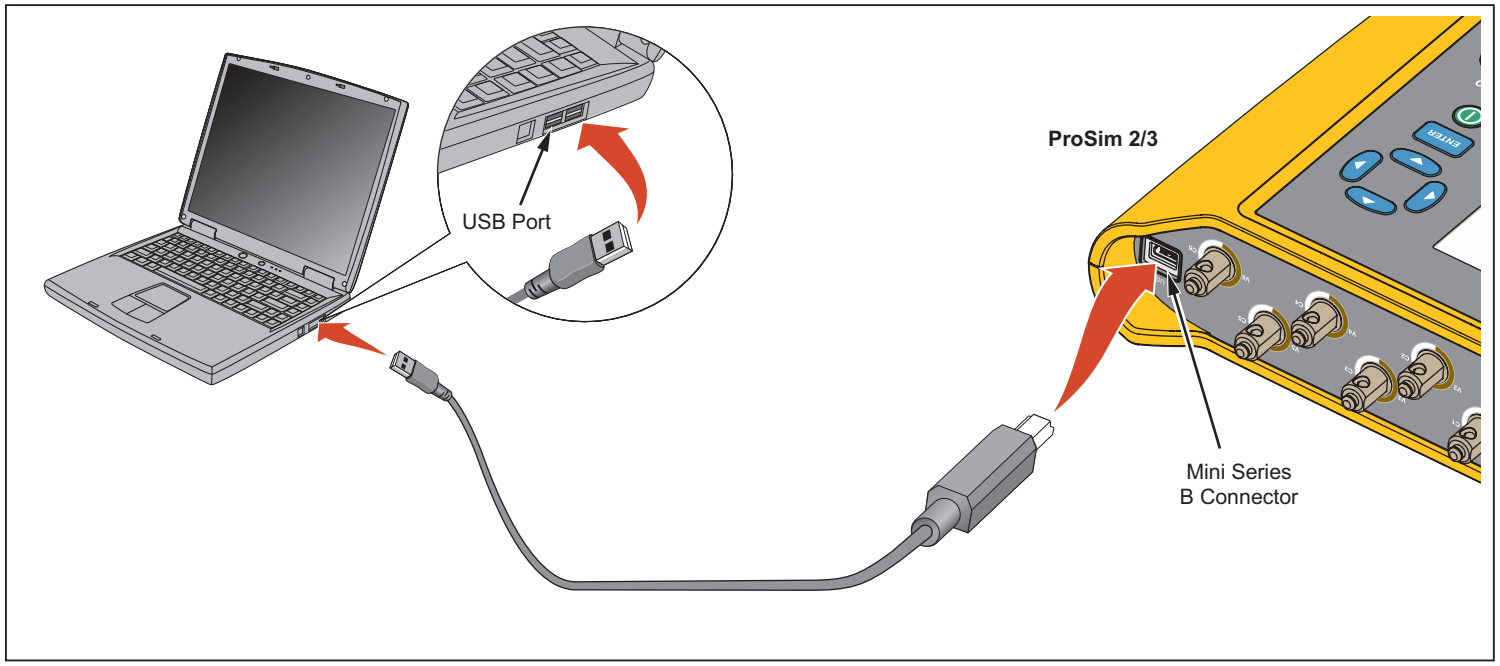
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Figure 14. Temperature Simulation Connections

Remote Operation

The Product has a USB device port that lets you control the Product remotely with a set of commands. To control the Product from a PC, connect the USB to a USB port on the PC. The PC must have the Windows XP, Vista, or Windows 7 or later operating system to control the Product.

To operate the Product from the PC, connect it to the PC as shown in Figure 15.



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Figure 15. Remote Operation Connections

When connected to a PC with a Windows operating system, the Product will communicate through a PC COM port. Make sure the COM port parameters are set to:

- 9600 Baud
- No Parity
- 8 data bits
- 1 stop bit
- Hardware handshake set to off

Remote Commands

A remote command is made up of alphanumeric characters. The first character of a command must be alphabetic. The alphabetic characters can be upper or lower case.

- Special characters are:
- Carriage return (CR)
- Line feed (LF)
- Space (SP)
- Backspace (BS)
- Escape (ESC)

The Product will do a command when it receives a carriage return and/or line feed. Alphabetic characters are not case sensitive. When you type in a command, the backspace deletes the last recorded character and the escape key discards the complete command. When a command is complete, the Product sends a response that ends with a carriage return and line feed to the PC. Unless other data is sent back from the Product, the response is “OK” if the command is accepted by the Product. When a command is not accepted by the Product, an error code shown in Table 8 is sent to the PC.

Table 8. Error Codes

Error Code	Description
ERR=00	No commands allowed at this time
ERR=01	Unknown command
ERR=02	Illegal command
ERR=03	Illegal parameter
ERR=04	Data corrupted
ERR=05	Unknown error
ERR=06	Option not installed
ERR=07	Incorrect password

While the Product is operated from the front panel (local mode) the remote interface will not respond to a command until the command REMOTE is sent to the Product through the USB port.

General Commands

Table 9 is list of the modes and their description.

Table 9. Product Control States and Modes

Mode	Type	Description
LOCAL	Local	Local control
RMAIN	Main	Main remote control
DIAG	Sub	Diagnostic tests remote sub-mode
CAL	Sub	Calibration remote sub-mode

Table 10 is a list of general commands that set the control states and modes of the Product. The table shows in which mode the command is recognized and the response the Product will send to the PC when the command is completed.

Table 10. General Commands

Command	Legal Mode	Returns	Description
REMOTE	LOCAL	RMAIN	Go to remote control
LOCAL	RMAIN	LOCAL	Go to local control
QMODE	All modes	See Table 10	Query the mode

Function Commands

The function commands are grouped by the function they support.

ECG Functions

Tables 11 and 12 are lists of commands that control the ECG functions of the Product. These are Normal-sinus ECG, ECG amplitude, adult/pediatric, ST elevation, ECG artifact simulation, pacemaker waveform, pacemaker amplitude, and pacemaker width.

Table 11. ECG Function Commands

Action	Command
Normal Sinus	
30 bpm	NSR30
40 bpm	NSR40
45 bpm	NSR45
60 bpm	NSR60
80 bpm	NSR80
90 bpm	NSR90
100 bpm	NSR100

Table 11. ECG Function Commands (cont.)

Action	Command
Normal Sinus (cont.)	
120 bpm	NSR120
140 bpm	NSR140
160 bpm	NSR160
180 bpm	NSR180
200 bpm	NSR200
220 bpm	NSR220
240 bpm	NSR240
260 bpm	NSR260
280 bpm	NSR280
300 bpm	NSR300
Amplitude [1]	
0.05 mV	NAS0.05
0.10 mV	NAS0.10
0.15 mV	NAS0.15
0.20 mV	NAS0.20
0.25 mV	NAS0.25
0.30 mV	NAS0.30
0.35 mV	NAS0.35
0.40 mV	NAS0.40
0.45 mV	NAS0.45
0.50 mV	NAS0.50
1.00 mV	NAS1.00
1.50 mV	NAS1.50
2.00 mV	NAS2.00
2.50 mV	NAS2.50
3.00 mV	NAS3.00
3.50 mV	NAS3.50
4.00 mV	NAS4.00
4.50 mV	NAS4.50
5.00 mV	NAS5.00
5.50 mV	NAS5.50
Adult/Pediatric [1]	
Adult	ADULT
Pediatric	PEDS

Table 11. ECG Function Commands (cont.)

Action	Command
ST Elevation [1]	
-0.8 mV	STD-0.8
-0.7 mV	STD-0.7
-0.6 mV	STD-0.6
-0.5 mV	STD-0.5
-0.4 mV	STD-0.4
-0.3 mV	STD-0.3
-0.2 mV	STD-0.2
-0.1 mV	STD-0.1
-0.05 mV	STD-0.05
0 mV	STD0
+0.05 mV	STD+0.05
+0.1 mV	STD+0.1
+0.2 mV	STD+0.2
+0.3 mV	STD+0.3
+0.4 mV	STD+0.4
+0.5 mV	STD+0.5
+0.6 mV	STD+0.6
+0.7 mV	STD+0.7
+0.8 mV	STD+0.8
Artifact Simulation [1]	
Off	EAOFF
50 Hz	EA50
60 Hz	EA60
Muscle	EAMSC
Wandering	EAWNDR
Respiration	EARESP

1. Set the ECG rate before you set amplitude, ST elevation, and artifact.

Table 12. Pacemaker Waveform Commands

Action	Command
Waveforms	
Atrial Pacer	ATR
Asynchronous pacer	ASN
Demand frequent sinus	DFS
AV sequential	AVS
Noncapture	NCA
Nonfunction	NFU

Table 12. Pacemaker Waveform Commands (cont.)

Action	Command
Amplitude [1]	
1 mV	PA1
2 mV	PA2
5 mV	PA5
10 mV	PA10
Width [1]	
0.1 mV	PA0.1
0.5 mV	PA0.5
1.0 mV	PA1.0
1.5 mV	PA1.5
2 mV	PA2.0

1. Set the Pacemaker waveform before you set amplitude and width.

Arrhythmia Functions

Table 13 is a list of the commands to simulate arrhythmias. These waveforms are grouped by supraventricular arrhythmia, premature arrhythmia, ventricular arrhythmia, and conduction defect.

Table 13. Arrhythmia Function Commands

Action	Command
Supraventricular	
Atrial fibrillation, coarse	AF1
Atrial fibrillation, fine	AF2
Atrial flutter	AFL
Sinus arrhythmia	SINA
Missed beat	MB80
Atrial tachycardia	ATC
Paroxysmal atrial tachycardia	PAT
Nodal rhythm	NOD
Supraventricular tachycardia	SVT
Premature	
Premature atrial contraction	PAC
Premature nodal contraction	PNC
Premature vent contraction left (PVC1), standard	PVC1S

Table 13. Arrhythmia Function Commands (cont.)

Action	Command
Premature (cont.)	
Premature vent contraction left (PVC1), early	PVC1E
Premature vent contraction left (PVC1), R on T	PVC1R
Premature vent contraction right (PVC1), early	PVC2S
Premature vent contraction right (PVC1), early	PVC2E
Premature vent contraction right (PVC1), R on T	PVC2R
Multifocal PVCs	MF
Ventricular	
PVCs 6 per minute	PVC6
PVCs 12 per minute	PVC12
PVCs 24 per minute	PVC24
Frequency multifocal PVCs	FMF
Begeminy	BIG
Trigeminy	TRG
Pair of PVCs	PAIR
5 PVCs	RUN5
11 PVCs	RUN11
Ventricular tachycardia	VTC
Ventricular fibrillation, coarse	VFB1
Ventricular fibrillation, fine	VFB2
Asystole	ASY
Conduction Defect	
First-degree block	1DB
Second-degree block	2DB
Third-degree block	3DB
Right-bundle branch block	RBB
Left-bundle branch block	LBB

ECG Test Functions

Table 14 is a list of ECG test function commands. These commands are grouped by performance waveforms, performance wave amplitude, R-wave rate, R-wave width, and R-wave amplitude.

Table 14. ECG Test Commands

Action	Command
Performance Waves	
2 Hz square wave	SQU2
0.125 Hz square wave	SQU.125
2 Hz triangle wave	TRI2
2.5 Hz triangle wave	TRI2.5
30 bpm pulse wave	PUL30
60 bpm pulse wave	PUL60
0.5 Hz sine wave	SIN0.5
5 Hz sine wave	SIN5
10 Hz sine wave	SIN10
40 Hz sine wave	SIN40
50 Hz sine wave	SIN50
60 Hz sine wave	SIN60
100 Hz sine wave	SIN100
Amplitude	
0.05 mV	PFA0.05
0.10 mV	PFA0.10
0.15 mV	PFA0.15
0.20 mV	PFA0.20
0.25 mV	PFA0.25
0.30 mV	PFA0.30
0.35 mV	PFA0.35
0.40 mV	PFA0.40
0.45 mV	PFA0.45
0.50 mV	PFA0.50
1.00 mV	PFA1.00
1.50 mV	PFA1.50
2.00 mV	PFA2.00
2.50 mV	PFA2.50
3.00 mV	PFA3.00
3.50 mV	PFA3.50
4.00 mV	PFA4.00
4.50 mV	PFA4.50
5.00 mV	PFA5.00
5.50 mV	PFA5.50

Table 14. ECG Test Commands (cont.)

Action	Command
R-Wave Rate	
R-wave at 30 bpm	RWR30
R-wave at 60 bpm	RWR60
R-wave at 80 bpm	RWR80
R-wave at 120 bpm	RWR120
R-wave at 200 bpm	RWR200
R-wave at 250 bpm	RWR250
R-Wave Width	
R-Wave width at 8 ms	RWW8
R-Wave width at 10 ms	RWW10
R-Wave width at 12 ms	RWW12
R-Wave width at 20 ms	RWW20
R-Wave width at 30 ms	RWW30
R-Wave width at 40 ms	RWW40
R-Wave width at 50 ms	RWW50
R-Wave width at 60 ms	RWW60
R-Wave width at 70 ms	RWW70
R-Wave width at 80 ms	RWW80
R-Wave width at 90 ms	RWW90
R-Wave width at 100 ms	RWW100
R-Wave width at 110 ms	RWW110
R-Wave width at 120 ms	RWW120
R-Wave width at 130 ms	RWW130
R-Wave width at 140 ms	RWW140
R-Wave width at 150 ms	RWW150
R-Wave width at 160 ms	RWW160
R-Wave width at 170 ms	RWW170
R-Wave width at 180 ms	RWW180
R-Wave width at 190 ms	RWW190
R-Wave width at 200 ms	RWW200
R-Wave Amplitude	
0.05 mV	RWA0.05
0.10 mV	RWA0.10
0.15 mV	RWA0.15
0.20 mV	RWA0.20
0.25 mV	RWA0.25
0.30 mV	RWA0.30
0.35 mV	RWA0.35

Table 14. ECG Test Commands (cont.)

Action	Command
R-Wave Amplitude (cont.)	
0.40 mV	RWA0.40
0.45 mV	RWA0.45
0.50 mV	RWA0.50
1.00 mV	RWA1.00
1.50 mV	RWA1.50
2.00 mV	RWA2.00
2.50 mV	RWA2.50
3.00 mV	RWA3.00
3.50 mV	RWA3.50
4.00 mV	RWA4.00
4.50 mV	RWA4.50
5.00 mV	RWA5.00
5.50 mV	RWA5.50

Respiration Function Commands

Table 15 is a list of respiration function commands. These commands are grouped by respiration lead, respiration baseline (impedance), respiration rate, respiration amplitude, and apena simulation.

Table 15. Respiration Function Commands

Action	Command
Lead	
Lead LA	RLLA
Lead LL	RLLL
Baseline	
500 Ω	RB500
1000 Ω	RB1000
1500 Ω	RB1500
2000 Ω	RB2000
Rate	
0 BrPM	RR0
15 BrPM	RR15
20 BrPM	RR20
30 BrPM	RR30
40 BrPM	RR40
60 BrPM	RR60
80 BrPM	RR80
100 BrPM	RR100
120 BrPM	RR120

Table 15. Respiration Function Commands (cont.)

Action	Command
Amplitude	
0.2 Ω	RO0.5
0.5 Ω	RO0.5
1.0 Ω	RO1.0
3.0 Ω	RO3.0
Apena Simulation	
12 seconds	A12
22 seconds	A22
32 seconds	A32
Continuously	AON
Apnea off	AOFF

Blood Pressure Function Commands

Table 16 is a list of blood pressure function commands. These commands are grouped by static pressure, dynamic pressure, and respiration artifact.

Table 16. Blood Pressure Function Commands

Action	Command			
	Channel 1	**Channel 2**	**Channel 3**	**Channel 4**
BP sensitivity to 5 μV/V/mmHg	BPSNS5			
BP sensitivity to 40 μV/V/mmHg	BPSNS40			
Zero each channel	P1S0	P2S0	P3S0	P4S0
Zero all channels	ZALL			
Static Pressure Levels				
-5 mmHg static	NA	NA	P3S-5	P4S-5
-10 mmHg static	P1S-10	P2S-10	NA	NA
20 mmHg static	NA	NA	P3S20	P4S20
40 mmHg static	NA	NA	P3S40	P4S40
50 mmHg static	NA	P2S50	NA	NA
60 mmHg static	NA	NA	P3S60	P4S60
80 mmHg static	P1S80	NA	P3S80	P4S80
100 mmHg static	NA	P2S100	P3S100	P4S100
150 mmHg static	NA	P2S150	NA	NA
160 mmHg static	P1S160	NA	NA	NA
200 mmHg static	NA	P2S200	NA	NA

Table 16. Blood Pressure Function Commands (cont.)

Action	Command			
	Channel 1	**Channel 2**	**Channel 3**	**Channel 4**
Static Pressure Levels (cont.)				
240 mmHg static	P1S240	P2S240	NA	NA
320 mmHg static	P1S320	NA	NA	NA
400 mmHg static	P1S400	NA	NA	NA
Dynamic Waveforms				
Arterial at 120/80	P1ART	P2ART	P3ART	NA
Radial at 120/80	P1RART	P2RART	P3RART	NA
Left vent at 120/0	P1LV	P2LV	P3LV	NA
Right vent at 25/0	P1RV	P2RV	P3RV	P4RV
Pulmonary at 25/10	NA	P2PA	P3PA	P4PA
Pulmonary at 10/2	NA	P2W	P3W	P4W
Left atrium at 14/4	NA	P2LA	P3LA	NA
Right atrium CVP at 15/10	NA	P2CVP	P3CVP	P4CVP

Table 16. Blood Pressure Function Commands (cont.)

Action		Command			
		Channel 1	**Channel 1**	**Channel 1**	**Channel 1**
Dynamic Waveforms (cont.)					
Swan-Ganz	Start auto	NA	NA	NA	STSGAUTO
	Start manual	NA	NA	NA	STSG
	Insert (manual)	NA	NA	NA	INS
	Inflate (manual)	NA	NA	NA	INF
	Deflate (manual)	NA	NA	NA	DEF
	Pull back (manual)	NA	NA	NA	PLBK
Respiration Artifact					
Artifact on		P1AOFF	P2AOFF	P3AOFF	P4AOFF
Artifact off		P1AON	P2AON	P3AON	P4AON

Other Function Commands

Table 17 is a list of commands for other Product functions. The other functions are temperature, cardiac-output wave/injectate, fetal heart rate, intrauterine-pressure wave, intrauterine-pressure period, and beeper.

Table 17. Other Function Commands

Action	Command
Temperature	
0 °C	T0
24 °C	T24
37 °C	T37
40 °C	T40
Cardiac-Output Wave/Injectate	
2.5 l/min	COW2.5
5.0 l/min	COW5.0
10.0 l/min	COW10.0
Faulty injectate	COWFLT
Left/right shunt	COWLRS
Cal pulse	COWCAL
Stop	COSTOP
Injectate to 0 °C	COI0
Injectate to 24 °C	COI24
Fetal Heart Rate	
60 bpm	F60
90 bpm	F90
120 bpm	F120
140 bpm	F140
150 bpm	F150
210 bpm	F210
240 bpm	F240
Intrauterine pressure	
Once	IUP1
2 minute period	IUP2M
3 minute period	IUP3M
5 minute period	IUP5M

Maintenance

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury:

- **Have an approved technician repair the Product.**
- **Use only specified replacement parts.**
- **Remove the input signals before you clean the Product.**
- **Batteries contain hazardous chemicals that can cause burns or explode. If exposure to chemicals occurs, clean with water and get medical aid.**
- **Do not put battery cells and battery packs near heat or fire. Do not put in sunlight.**
- **Do not disassemble the battery.**
- **Remove batteries to prevent battery leakage and damage to the Product if it is not used for an extended period.**
- **Do not short the battery terminals together.**

For safe operation and maintenance of the Product:

- **Keep cells and battery packs clean and dry. Clean dirty connectors with a dry, clean cloth.**
- **Repair the Product before use if the battery leaks.**
- **Be sure that the battery polarity is correct to prevent battery leakage.**
- **Do not keep cells or batteries in a container where the terminals can be shorted.**
- **Do not disassemble or crush battery cells and battery packs.**

General Maintenance

Clean the case with a damp cloth and weak detergent. Do not use solvent or cleaners with abrasives.

⚠⚠ Warning

For safe operation and maintenance of the Product:

- **Do not put fluid on the Product surface. Fluid leakage into the electrical circuitry can cause the Product to fail.**
- **Do not use spray cleaners on the Product. This can push fluid into the Product and cause electronic component damage.**

Battery Replacement

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury:

- **Remove batteries to prevent battery leakage and damage to the Product if it is not used for an extended period.**
- **Be sure that the battery polarity is correct to prevent battery leakage.**
- **Batteries contain hazardous chemicals that can cause burns or explode. If exposure to chemicals occurs, clean with water and get medical aid.**

When the charge in the batteries becomes low, a warning will show in the display. Replace the batteries immediately.

To replace the batteries:

1. Turn off the Product and remove all test leads.
2. Slide the battery door off on the rear of the Product. See Figure 16.
3. Remove the two 9-volt batteries and replace them with new ones. Use the correct battery orientation.
4. Install the battery door.

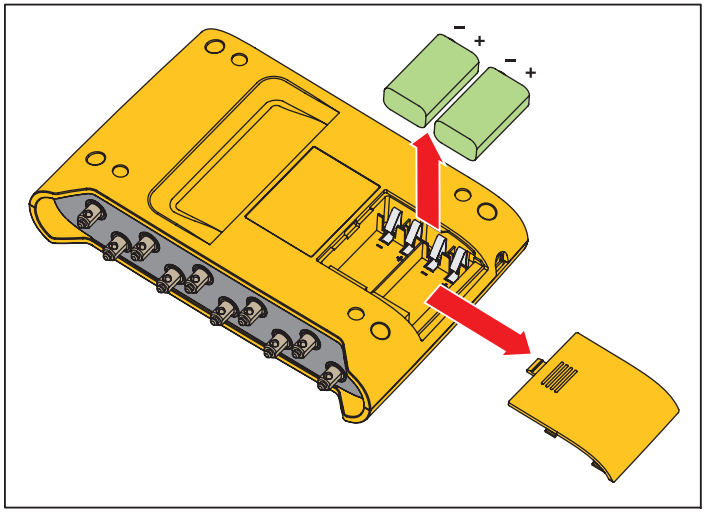


Figure 16. Battery Replacement

General Specifications

Power ..... Two 9-V alkaline batteries (IEC 6LR61, NEDA 1604A). Optional battery eliminator: 15 Vdc, 1.5 mA

Battery Life ..... 8 hours minimum

Display ..... LCD Greyscale Display

Size ..... 14.0 cm x 20.6 cm x 4.5 cm (5.5 in x 8.2 in x 1.8 in)

Weight ..... 0.47 kg (1 lb 4 oz)

Temperature

- Storage ..... -25 °C to +50 °C (-13 °F to +122 °F)
- Operation ..... 10 °C to 40 °C (50 °F to 104 °F)

Humidity ..... 10 % to 80 % non-condensing

Altitude ..... 2000 m (6,562 ft)

Safety ..... IEC 61010-1, Pollution degree 2

Electromagnetic Environment ..... IEC 61326-1, Portable

EMC ..... Applies to use in Korea only. Class A equipment (Industrial Broadcasting & Communication Equipment) [1]

[1] This Product meets requirements for industrial (Class A) electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and is not to be used in homes.

Detailed Specifications

ECG Waveform

ECG Reference ..... The ECG amplitudes specified are for Lead II, from the baseline to the peak of the R wave. All other leads are proportional in percentage per:

- Lead I ..... 70 %
- Lead II ..... 100 %
- Lead III ..... 30 %
- Lead V1 ..... 24 %
- Lead V2 ..... 48 %
- Lead V3 ..... 100 %
- Lead V4 ..... 120 %
- Lead V5 ..... 112 %

Lead V6	80 %
Normal Sinus Rhythm	12-lead configuration with independent outputs referenced to right leg (RL). Output to 10 Universal ECG Jacks, color-coded to AHA and IEC Standards.
Amplitude	0.05 mV to 0.45 mV (0.05 mV steps), 0.5 mV to 5.5 mV (0.5 mV steps)
Amplitude Accuracy	±2 % of setting Lead II. All other leads ±5 %
ECG Rate	30, 40, 45, 60, 80, 90, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280, and 300 BPM
Rate Accuracy	±1 % of setting
ECG Waveform Selection	Adult (80 ms) or pediatric (40 ms) QRS duration
Artifact (Superimposed)	50 and 60 Hz, muscle, baseline wander, respiration
ST-Segment Elevation	Adult mode only. -0.8 mV to +0.8 mV (0.1 mV steps) Additional steps: +0.05 mV and -0.05 mV
Power-On Default	80 BPM, 1.0 mV, adult QRS, ST-segment elevation of 0 mV, and a P-R interval of 0.16 seconds

Pacemaker Waveform

Pacer-Pulse Amplitude	0 (off), 1, 2, 5, 10 mV ±10 % for lead II (reference lead) with other leads proportional as for performance waves.
Pacer-Pulse Width	0.1, 0.5, 1.0, 1.5, 2.0 ms ±5 %
Pacing Rate	75 BPM
Paced Arrhythmias	Atrial 80 BPM Asynchronous 75 BPM Demand with frequent sinus beats Demand with occasional sinus beats Atrio-Ventricular sequential Noncapture (one time) Nonfunction
Power-On Default	Off

Arrhythmia

Baseline NSR	80 BPM
PVC Focus	Left focus, standard timing (except where specified)
Supraventricular Arrhythmia	Atrial fibrillation (coarse or fine), atrial flutter, sinus arrhythmia, missed beat (one time), atrial tachycardia, paroxysmal atrial tachycardia, nodal rhythm, and supraventricular tachycardia
Premature Arrhythmia	(All one-time events) Premature atrial contraction (PAC), premature nodal contraction (PNC), PVC1 left ventricular, PVC1 left ventricular – early, PVC1 left ventricular – R on T, PVC2 right ventricular, PVC2 right ventricular – early, PVC2 right ventricular – R on T, and multifocal PVCs

Ventricular Arrhythmia.....PVCs (6, 12, or 24 per minute), frequent multifocal PVCs, bigeminy, trigeminy, multiple PVCs (one-time run of 2, 5, or 11 PVCs), ventricular tachycardia, ventricular fibrillation (coarse or fine), and asystole

Conduction Defect.....First-, second-, or third-degree AV block and right- or left-bundle-branch block

Power-On Default.....None (off)

ECG-Performance-Tests

Amplitude.....0.05 mV to 0.45 mV (0.05 mV steps)
0.5 mV to 5.5 mV (0.5 mV steps)

Pulse Wave.....30 BPM, 60 BPM, with 60 ms pulse width

Square Wave.....2.0, 0.125 Hz

Triangle Wave.....2.0, 2.5 Hz

Sine Wave.....0.5, 5, 10, 40, 50, 60, 100 Hz

R-wave-Detection Waveform.....Haver-Triangle

R-wave Rate.....30, 60, 80, 120, 200, and 250 BPM

R-wave Width.....20 ms to 200 ms (10 ms steps)
Additional Steps: 8, 10, and 12 ms

Rate Accuracy.....±1 %

Amplitude Accuracy.....±2 %, Lead II (Exception: ±5 % for R waves ≤20 ms)

Power-On Default.....None (off)

Respiration

Rate.....0 (OFF), 15, 20, 30, 40, 60, 80, 100, 120 BrPM

Impedance Variations (Δ Ω).....0.2, 0.5, 1, or 3 Ω peak-to-peak variation of lead impedance

Delta Accuracy.....±10 %

Baseline.....500, 1000, 1500, 2000 Ω, Leads I, II, III

Accuracy Baseline.....±5 %

Respiration Lead.....LA or LL

Apnea Selection.....OFF, 12, 22, or 32 seconds (one-time events), or continuous (Apnea ON = respiration OFF)

Power-On Default.....20 BrPM, delta 1.0 Ω, 1000-Ω baseline

Blood Pressure

Input/output Impedance.....300 Ω ±10 %

Exciter Input Range.....2.0 V to 16.0 V rms

Exciter-Input Frequency Range..... DC to 5000 Hz

Transducer Sensitivity ..... 5 µV/V/mmHg or 40 µV/V/mmHg

Pressure Accuracy ..... ±(2 % of setting + 2 mmHg) (Valid for dc excitation only)

Static Levels, Channel 1..... -10, 0, 80, 160, 240, 320, 400 mmHg

Static Levels, Channel 2..... -10, 0, 50, 100, 150, 200, 240 mmHg

Static Levels, Channel 3 (ProSim 3 only) ..... -5, 0, 20, 40, 60, 80, 100 mmHg

Static Levels, Channel 4 (ProSim 3 only) ..... -5, 0, 20, 40, 60, 80, 100 mmHg

Dynamic Waveforms, Channel 1 ..... Arterial: 120/80
Radial artery: 120/80
Left ventricle: 120/00
Right ventricle: 25/00

Dynamic Waveforms, Channel 2 ..... Arterial: 120/80
Radial artery: 120/80
Left ventricle: 120/00
Right atrium (central venous or CVP): 15/10
Right ventricle: 25/00
Pulmonary artery: 25/10
Pulmonary-artery wedge: 10/2
Left atrium: 14/4

Dynamic Waveforms, Channel 3 (ProSim 3 only). Arterial: 120/80
Radial artery: 120/80
Left ventricle: 120/00
Right atrium (central venous or CVP): 15/10
Right ventricle: 25/00
Pulmonary artery: 25/10
Pulmonary-artery wedge: 10/2
Left atrium: 14/4

Dynamic Waveforms, Channel 4 (ProSim 3 only). Swan-Ganz sequence:
Right atrium (CVP)
Right ventricle RV)
Pulmonary artery (PA)
Pulmonary-artery wedge (PAW)

Respiration Artifact ..... BP delta changes from 3 mmHg to 16 mmHg

Output Connector..... DIN 5-Pin

Power-On Default..... 0 mmHg

Temperature

Temperature .....0 °C (32 °F), 24 °C (75.2 °F), 37 °C (98.6 °F), and 40 °C (104 °F)
Accuracy.....±0.1 °C
Compatibility.....Yellow Springs, Inc. (YSI) Series 400 and 700
Output Connector.....DIN 4-pin
Power-On Default.....0 °C (42 °F)

Cardiac Output (ProSim 3 Only)

Catheter Type.....Baxter Edwards, 93a-131-7f
Calibration Coefficient .....0.542 (0 °C injectate), 0.595 (24 °C injectate)
Blood Temperature.....37 °C (98.6 °F) ±2 %
Injectate Volume .....10 cc
Injectate Temperature .....0 °C or 24 °C ±2 % value
Cardiac Output.....2.5, 5, 10 liters per minute ±5 %
Faulty-Injectate Curve .....Waveform for simulation available
Left-to-Right-Shunt Curve.....Waveform for simulation available
Calibrated Pulse.....1.5 ° for 1 second (37 ° to 35.5 °)
Output Connector.....DIN 7-Pin
Power-On Default .....2.5 liters per minute, 0 °C injectate

Fetal / Maternal-ECG (ProSim 3 Only)

Fetal Heart Rate (Fixed).....60, 90, 120, 140, 150, 210, and 240 BPM
Fetal Heart Rate (IUP): .....140 BPM at beginning, then varies with pressure
Intrauterine-Pressure Waveforms.....Early deceleration, late deceleration, and uniform acceleration
Wave Duration.....90 seconds, bell-shaped pressure curve, from 0 mmHg to 90 mmHg and returning to 0 mmHg
IUP Period.....2, 3, or 5 minutes, and manual
Power-On Default.....FHR 120 BPM, early deceleration, manual

Computer Setup

USB Device Upstream Port ..... Mini-B connector for control by a computer
Baud Rate 9600
Parity ..... None
Stop Bits 1
Data Bits 8

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