



Chapter 6

Functional Checkout Procedure

Like all electronic monitoring devices, internal and external components are subject to fatigue, wear, and the potential for failure over time and under varying conditions of use. Additionally, events such as dropping the monitor, spilling liquids on the monitor, or crimping the lead wires or patient cables can cause damage which may affect the overall system performance.

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Equipment Required

Table 6-1 provides a complete listing of equipment required for a functional checkout procedure.

Table 6-1. Equipment Required	
Test	Equipment
FECG	<ul style="list-style-type: none"> ■ Model 325 Simulator # (14203A/B) ■ Monitor Interconnect Cable (14212A/B)
Legplate	<ul style="list-style-type: none"> ■ Legplate for Qwik Connect Plus with round connector (1590AAO)
US/FMD	<ul style="list-style-type: none"> ■ Model 325 Simulator # (14203A/B) ■ Monitor Interconnect Cable (14212A/B)
US Transducer	<ul style="list-style-type: none"> ■ Nautilus Ultrasound Transducer (5700GAX–5700MAX Series)
TOCO/IUP	<ul style="list-style-type: none"> ■ Model 325 Simulator # (14203A/B) ■ Monitor Interconnect Cable (14212A/B)
Tocotransducer	<ul style="list-style-type: none"> ■ Nautilus Tocotransducer (2264GAX–2264MAX Series)
Strain Gauge Transducer	<ul style="list-style-type: none"> ■ Reusable Strain Gauge with holder (4007BAX); or ■ Reusable Strain Gauge without holder (4007LAX); or ■ Disposable Strain Gauge (4009AAX) <p>NOTE: These items are no longer sold by GE. However, transducers in the field are compatible with the 170 Series Monitor.</p>
Pattern Memory	<ul style="list-style-type: none"> ■ Model 325 Simulator # (14203A/B) ■ Monitor Interconnect Cable (14212A/B)
Dual Heart Rate (FECG/US)	<ul style="list-style-type: none"> ■ Model 325 Simulator # (14203A/B) ■ Monitor Interconnect Cable (14212A/B)
Dual Heart Rate (US/US2)	<ul style="list-style-type: none"> ■ Two Model 325 Simulators # (14203A/B) with two sets of Monitor Interconnect Cables (14212A/B); or ■ Two Nautilus Ultrasound Transducers 5700GAX–5700MAX Series)
Alarms	<ul style="list-style-type: none"> ■ Model 325 Simulator # (14203A/B) ■ Monitor Interconnect Cable (14212A/B)

PS320 Maternal/Fetal Simulator (Fluke Biomedical)

NOTE: PS320 Maternal/Fetal simulator by Fluke Biomedical can also be used as an alternative to model 325 simulator. To use the PS320 Simulator Refer “Addendum for using PS320 Simulator” in chapter 12.”

General

Between Factory Service visits it is necessary that the proper operation of each monitor be verified by performing the functional checkout procedure described in this section. This procedure should be completed prior to initially placing the monitor on a patient, when monitor performance needs to be verified, on a semi-annual basis, or more frequently as dictated by your equipment maintenance and management policies.

NOTE: Read each step of this procedure thoroughly before actually performing the test.

Visually inspect the monitor, patient cables, and other accessories for cracks, fissures, or other signs of wear or damage. Do not use any monitor or accessory which appears to be worn or damaged. If unsure, contact your GE Service Representative to arrange for evaluation, replacement, or repair of the suspect item(s).

Monitor Self-Test

The 170 Series Monitor contains test routines which verify the unit's calibration and internal circuitry. These routines are initiated by each time the monitor is turned on. The test results are printed on the strip chart recorder paper, verifying the integrity of the unit.

This information is covered in detail in “[Monitor Self-Test Routines](#)” on [page 4-8](#).

Front Panel Pushbutton Test

This procedure ensures the functionality of the front panel pushbuttons.

1. Disconnect all transducers from the front panel.
2. Enter the service setup mode (see page 4-10) and set the recorder speed to 1 cm/min.
3. Press the **Setup** button to exit the setup mode.
4. Press the monitor's **Power** button to turn on the monitor.
5. Press the monitor's **Record** button and verify the following:
 - ◆ The yellow indicator next to the button illuminates continuously.
 - ◆ The recorder paper advances at a rate of 1 cm/min.
 - ◆ The recorder prints the correct time and date information on the strip chart paper. (If an incorrect time or date is listed, refer to “[Chapter 4, Setup Procedures](#)” in this manual.)
 - ◆ The recorder prints the messages **CARDIO INOP** and **UA INOP**, indicating that no ultrasound or uterine activity transducers are plugged into the front panel **US**, **US2**, or **UA** connectors.
 - ◆ The recorder prints the message **1 CM/MIN**, indicating the selected chart speed.
6. Press the monitor's front panel **Paper Advance** pushbutton and verify that the recorder paper advances at a rate of 36 cm/min.
7. Press the **Paper Advance** pushbutton again and verify that the recorder prints the message **1 CM/MIN**.
8. Access the service setup mode and set the recorder speed to 3 cm/min.
9. Press the **Setup** button to exit the service setup mode.
10. Press the monitor's **Power** button to turn the monitor back on.
11. Verify that the recorder paper advances at a rate of 3 cm/min and that after approximately 40 seconds, the message **3 CM/MIN** prints on the recorder paper. (The time, date and monitoring modes also print again.)
12. Press the **Mark** button and verify that an event mark (↑) prints on the bottom two lines of the recorder paper.

Connecting the Simulator

NOTE: For using PS320 simulator refer “Addendum to use PS320 simulator”
This part of the procedure prepares the simulator for use.

NOTE: You must use a Model 325 Simulator for the functional checkout procedure. (Monitors in the 170 Series do not work with Model 305 Simulators.)

NOTE: For using P320 simulator refer "Addendum to use P320 simulator" from page 12-2.

1. Ensure the Model 325 **Power** switch is in the *off* position.
2. Connect the Model 325 Simulator’s power cord to the power receptacle on the rear panel of the simulator; plug the other end of the power cord into a properly grounded wall outlet of appropriate voltage.
3. Ensure the 170 Series Monitor is turned off.
4. Connect the simulator interconnect cable’s 50-pin end to the simulator’s **Fetal Monitor** connector.
5. Connect the sub-cables of the other end of the simulator interconnect cable into the color-coded connectors on the monitor/adaptor: **US** and **UA** (as required by the procedure).
6. Turn *on* the Model 325 Simulator. Verify that the green **Power** indicator illuminates.
7. Turn *on* the 170 Series Monitor.xt

FECG Test

This portion of the functional checkout procedure ensures the integrity of the FECG circuitry and the heart rate channel of the recorder.

1. Connect the Model 325 Simulator's ECG sub-cable to the **FECG** receptacle on the monitor
2. Set the switches on the Model 325 Input Simulator according to [Table 6-2](#).
3. If not already on, press the monitor's **Record** button.
4. Turn the simulator's **Manual Adjustment** knob fully counterclockwise and verify the following on the monitor:
 - The FHR1 value is 30 BPM.
 - The FHR1 heartbeat indicator (♥) flashes at a rate of 30 times per minute.
 - The ECG "beep" volume of the rear panel speaker can be increased or decreased using the **Volume** buttons. (Set the volume to the desired level.)
 - The recorder prints a continuous line at 30 BPM on the top grid of the strip chart paper.
 - ◆ The recorder prints the message FECG on the center margin of the strip chart paper after approximately 20 seconds.
5. Turn the simulator's **Manual Adjustment** knob to input an FECG signal of approximately 120 BPM. Verify the following on the monitor:
 - ◆ The FHR1 value is 120 BPM.
 - ◆ FHR1 heartbeat indicator (♥) flashes at a rate of 120 times per minute.
 - ◆ The ECG "beep" volume of the rear panel speaker can be increased or decreased using the **Volume** buttons. (Set the volume to the desired level.)
 - ◆ The recorder prints a continuous line at 120 BPM on the strip chart paper.

Table 6-2. Model 325 Simulator Settings for FECG Test		
Section	Switch	Setting
FECG/MECG	Main	RATE
	Rate	MANUAL
	Mode	FECG
	QRS Amplitude	15 μ V
	QRS Polarity	+
GENERAL	Pattern Memory	OFF
UA	Main	CMR
	Mode	TOCO

6. Repeat step 5 for each of the following rates: 60, 210, and 240 BPM.
7. Change the simulator's **QRS Polarity** switch from + to -. Verify that the monitor does not skip any beats.
8. Set the simulator's **ECG Rate** switch to the RAMP setting. Verify that the monitor's FHR1 value counts between approximately 30 and 240 BPM and that the FHR1 trend is a ramp between the same values on the strip chart paper. (See [Figure 6-1](#).)
9. Access the Service Setup Mode and disable ECG Artifact Elimination.
10. Set the simulator's **ECG Rate** switch to the $\Delta 15$ position. Verify the following on the monitor:
 - ◆ The FHR1 value oscillates by 15 BPM.
 - ◆ The FHR1 heartbeat indicator (♥) flashes for each input signal.
 - ◆ The ECG "beep" is heard from the rear panel speaker.
 - ◆ The FHR trend oscillates 15 BPM between 115 and 130 BPM on the top grid of the strip chart paper. (See [Figure 6-2](#).)
11. Repeat step 10 for rate values of $\Delta 22$ and $\Delta 27$. The results should be the same except that the FHR1 value oscillates by either 22 or 27 BPM and the FHR trend is an oscillation of 22 or 27 BPM. The top value is always at approximately 130 BPM. (Refer to [Figure 6-2](#).)
12. Access the Service Setup Mode and enable ECG Artifact Elimination.

13. Set the simulator's **ECG Rate** switch to the $\Delta 15$ position. Verify the following on the monitor:
 - ◆ The FHR1 value oscillates by 15 BPM.
 - ◆ The FHR1 heartbeat indicator (♥) flashes for each input signal.
 - ◆ The ECG "beep" is heard from the rear panel speaker.
 - ◆ The recorder prints an oscillation of 15 BPM between 115 and 130 BPM on the top grid of the strip chart paper. (Figure 6-2. shows the strip chart paper results.)
14. Repeat step 13 for the rate value of $\Delta 22$. The result should be the same as step 13 except that the FHR1 value oscillates by 22 BPM and the trend is an oscillation of 22 BPM between the 108 and 130 BPM on the strip chart paper.
15. Set the simulator's **ECG Rate** switch to the $\Delta 27$ position. Verify the following on the monitor:
 - ◆ The FHR1 value oscillates by 27 BPM.
 - ◆ The FHR1 heartbeat indicator (♥) flashes for each input signal.
 - ◆ The ECG "beep" is heard from the rear panel speaker.
 - ◆ The trend does *not* indicate any oscillation.
16. Access the Service Setup Mode and disable ECG Artifact Elimination.
17. Set the simulator's **ECG Rate** switch to the MANUAL position and the **Manual Adjustment** knob to the fully counterclockwise position. Disconnect the ECG simulator sub-cable from the monitor's FECG receptacle. Verify the following on the monitor:
 - ◆ The FHR1 value is blank.
 - ◆ The FHR1 trend stops plotting on the strip chart paper.
 - ◆ After approximately 30 seconds, the message **CARDIO INOP** prints on the center margin of the strip chart paper.
18. Set the simulator's **ECG Mode** switch to the OFF position.

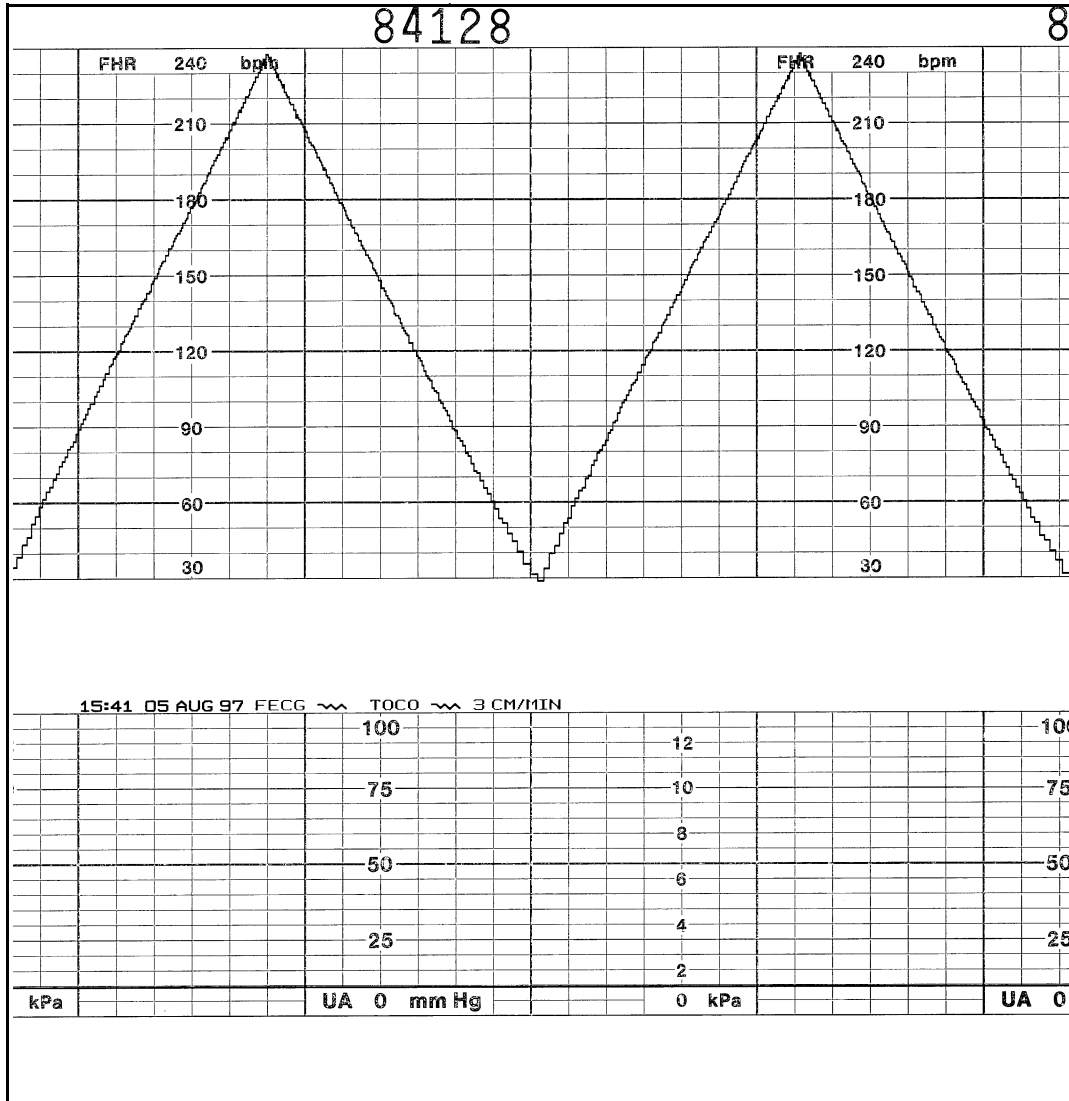


Figure 6-1. FECG Ramp

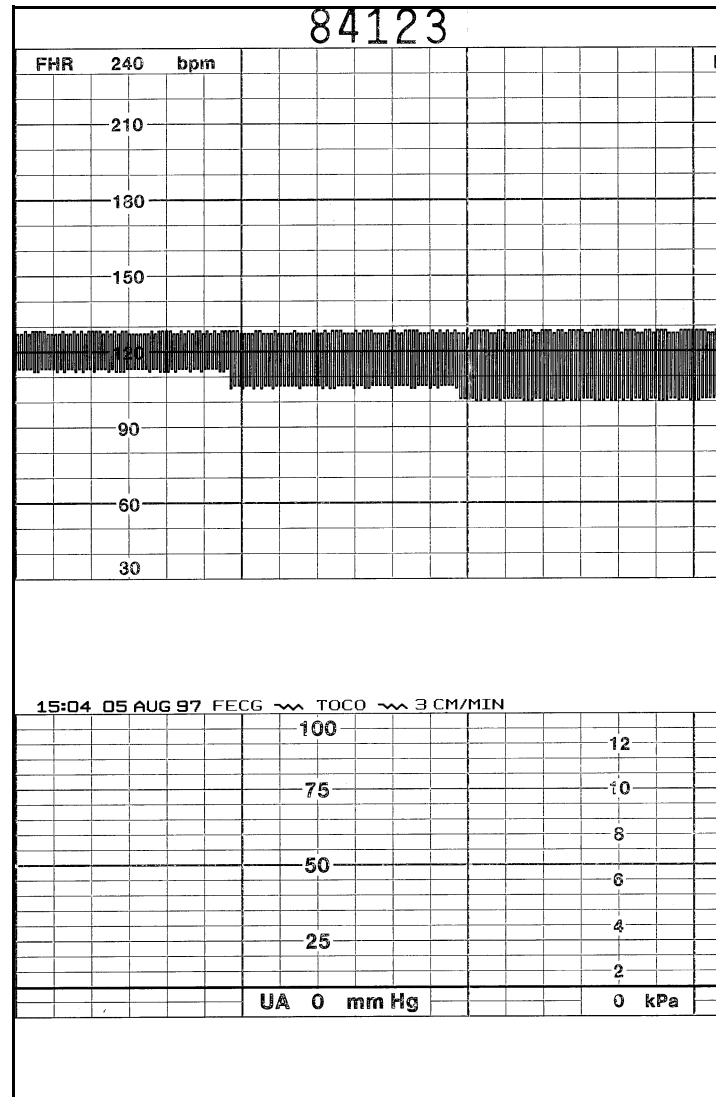


Figure 6-2. FECG Artifact Elimination

Legplate Inspection

Inspect the legplate as follows:

1. Check for a proper seal around the ground plate.
2. Ensure that no contaminants are present on either the ground plate or the push posts.
3. Visibly assess the condition of the cable, strain relief, and connector pins.

Ultrasound Test

This portion of the functional checkout procedure ensures the integrity of the ultrasound circuitry and the heart rate channel of the recorder.

1. Connect the simulator's US sub-cable to the **US** receptacle on the monitor.
2. Set the switches on the Model 325 Input Simulator according to [Table 6-3](#).
3. If not already on, press the monitor's **Record** pushbutton.
4. Turn the simulator's **Manual Adjustment** knob to input an ultrasound signal of approximately 120 BPM. Verify the following on the monitor:
 - ◆ The FHR1 value is 120 BPM.
 - ◆ The FHR1 heartbeat indicator (♥) flashes at a rate of 120 times per minute.
 - ◆ Ultrasound audio volume from the rear panel speaker can be increased or decreased using the left pair of **Volume** pushbuttons. (Set the volume to the desired level.)
 - ◆ The recorder prints a continuous line at 120 BPM on the top grid of the strip chart paper.
 - ◆ The recorder prints the message US on the center margin of the strip chart paper after approximately 20 seconds.
5. Use the simulator's **Manual Adjustment knob** to increase the heart rate value by less than 13 BPM from the 120 BPM baseline. Verify the following on the monitor:
 - ◆ The FHR1 value immediately reflects this new input rate.
 - ◆ The strip chart recorder immediately reflects this new input rate.
 - ◆ Use the simulator's **Manual Adjustment** knob to decrease the heart rate value by more than 13 BPM from the 120 BPM baseline. Verify the following on the monitor:
 - ◆ The FHR1 value immediately reflects this new input rate.
 - ◆ The strip chart recorder prints at the last input rate for an additional 3 seconds before blanking the heart rate data and printing a continuous line at the new input rate.
6. Set the simulator's **US Rate** switch to the RAMP position. Verify that the FHR1 value counts between approximately 50 and 210 BPM and that the recorder prints a ramp between the same values. (Refer to [Figure 6-3](#).)

Table 6-3. Ultrasound Test Simulator Settings

Section	Switch	Setting
US/FMD	Mode	US
	Signal Level	MED
	Rate	MANUAL

Table 6-3. Ultrasound Test Simulator Settings		
Section	Switch	Setting
General	Pattern Memory	OFF
UA	Main	CMR
	Mode	TOCO

7. Place the simulator's **US Rate** switch in each of the individual rate settings (50, 60, 120, and 210 BPM). Verify the following on the monitor:
 - ◆ The FHR1 value reflects the simulator setting ± 1 BPM.
 - ◆ The FHR1 heartbeat indicator (♥) flashes at the simulator setting.
 - ◆ Ultrasound audio is heard coming from the rear panel speaker.
 - ◆ The recorder prints a continuous line at the respective value ± 3 BPM on the top grid of the strip chart paper.
8. Repeat step 4 through step 7 using the second ultrasound channel.
9. Place the simulator's **US Mode** switch in the OFF position. Verify the following on the monitor:
 - ◆ The FHR1 value is blank.
 - ◆ The recorder stops printing the fetal heart rate trace.
 - ◆ The recorder prints the message **CARDIO INOP** on the center margin of the strip chart paper after approximately 20 seconds.

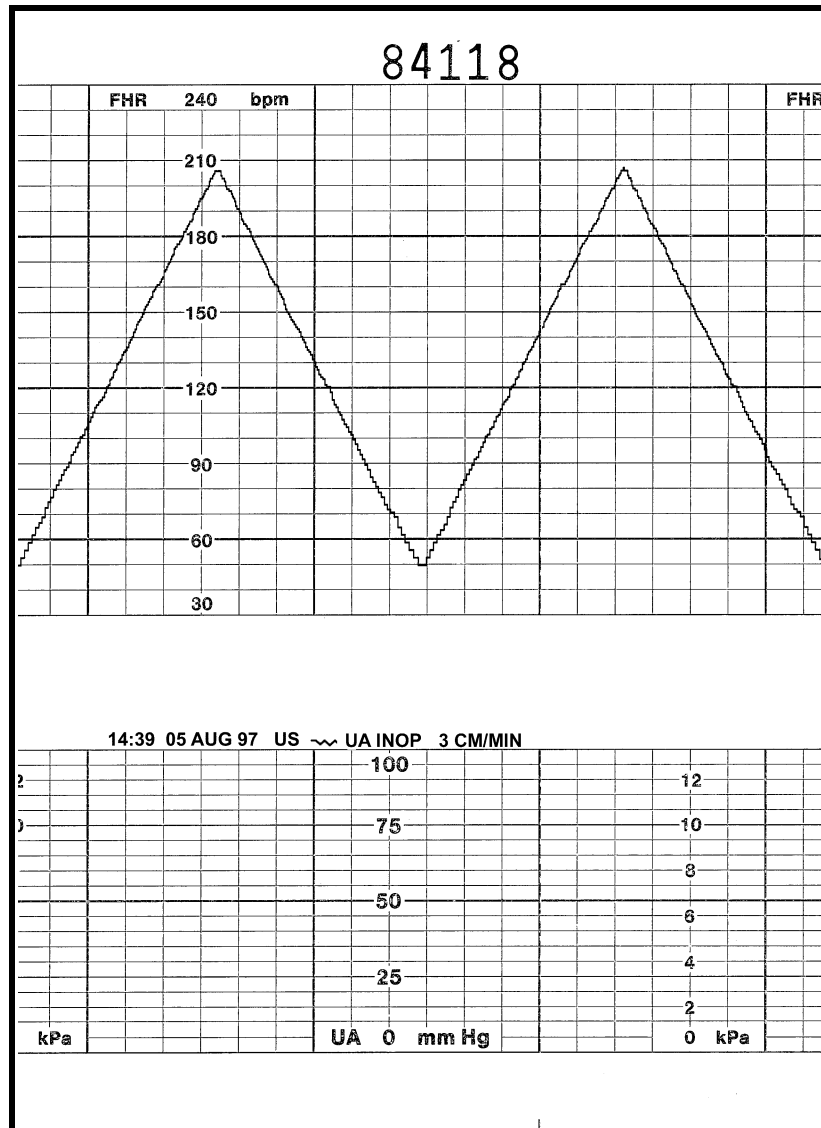


Figure 6-3. Ultrasound Ramp

Fetal Movement Detection Test

This portion of the functional checkout procedure ensures the integrity of the fetal movement detection circuitry and the heart rate channel of the recorder. (Refer to [Figure 6-4](#).)

NOTE: Fetal movement detection is an option which must be installed and enabled for use on your monitor.

1. Connect the simulator's US sub-cable to the **US** receptacle on the monitor.
2. Set the switches on the Model 325 Input Simulator according to [Table 6-4](#).
3. If not already on, press the monitor's **Record** pushbutton.
4. Turn the simulator's **Manual Adjustment** knob to input an ultrasound signal of approximately 120 BPM. Verify the following on the monitor:
 - ◆ The FHR1 value is 120 BPM.
 - ◆ The FHR1 heartbeat indicator (♥) flashes at a rate of 120 times per minute.
 - ◆ Ultrasound audio volume from the rear panel speaker can be increased or decreased using the left pair of **Volume** pushbuttons. (Set the volume to the desired level.)
 - ◆ The recorder prints a continuous line at 120 BPM on the top grid of the strip chart paper.
 - ◆ Fetal movement markers - — are shown on for a duration of one second, then off for eight seconds, then on for one second, etc.
 - ◆ The recorder prints the messages US and FMD - — on the center margin of the strip chart paper after approximately 20 seconds.

Table 6-4. Fetal Movement Detection Test Simulator Settings

Section	Switch	Setting
US/FMD	Mode	US/FMD
	Signal Level	MED
	Rate	MANUAL
General	Pattern Memory	OFF
UA	Main	CMR
	Mode	TOCO

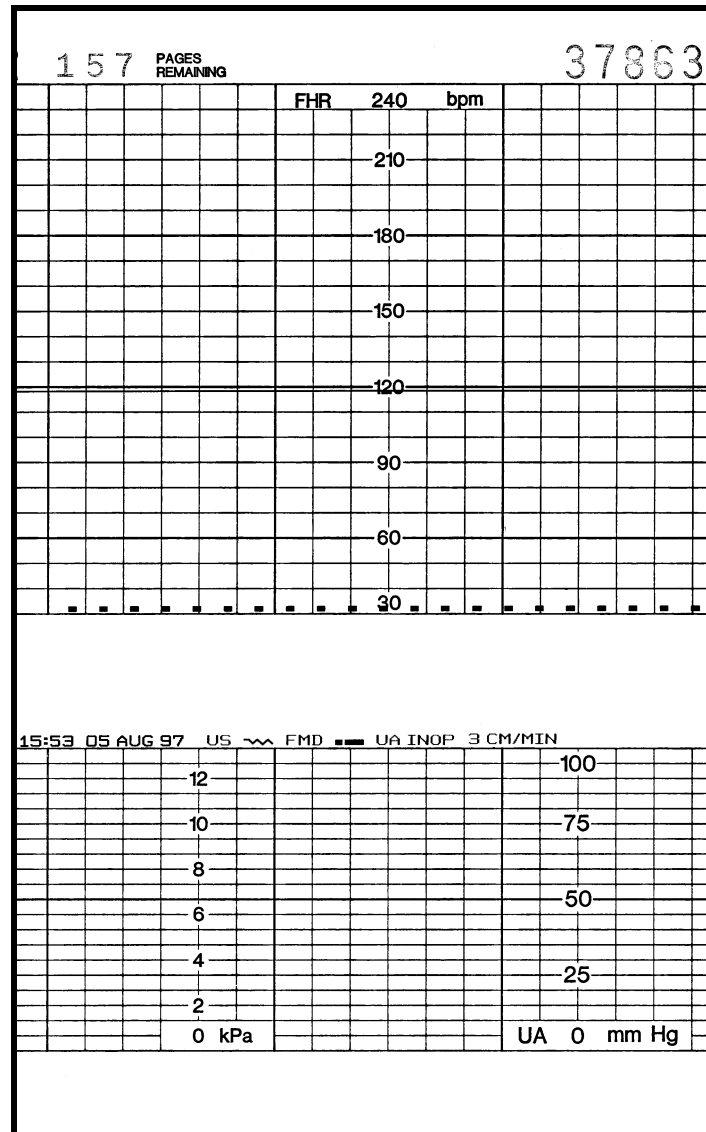


Figure 6-4. Fetal Movement Detection

Ultrasound Transducer Test

1. Inspect a Model 170/250 ultrasound transducer as follows:
 - ◆ Ensure there are no cracks around the transducer face.
 - ◆ Visibly assess the condition of the cable, strain relief, and connector pins.
2. Disconnect the simulator's ultrasound cable from the front panel of the 170 Series Monitor.

3. Connect the ultrasound transducer to either US input receptacle on the front panel of the monitor. Verify the following on the monitor:

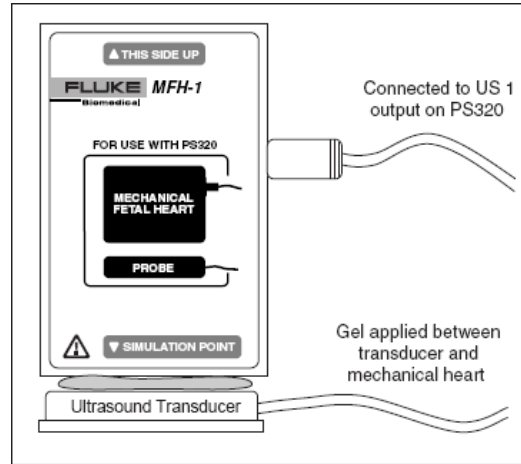
- ◆ The value shows three steady dashes “— — —” in the FHR1 display.
- ◆ The recorder prints the message US on the center margin of the strip chart paper after approximately 20 seconds.

4. Connect the MFH-1 (Mechanical Fetal Heart) to the US1 port on the PS320 Simulator via the cable supplied with MFH-1.

NOTE 1: MFH-1 cannot be used with Corometrics 325 Simulator

NOTE 2: Refer “Addendum to use PS320 Simulator” for using the PS320 Simulator

5. Place the Ultrasound Transducer face up on the work surface and coat it with Ultrasound conductive gel and place the MFH-1 on the Ultrasound transducer, as shown in Figure below



6. For MFH-1 to function, power the PS320 Simulator using the battery eliminator, the MFH-1 will not function on battery power.

7. Set the rate of the MFH-1 to 120 BPM by setting the US1 value in the PS320 Simulator to 120 BPM and verify the following on the monitor. (Refer appendix for Using PS320 Simulator)

- ◆ The FHR value in the Monitor is 120 ± 1 BPM
- ◆ The recorder prints a continuous line at 120 ± 3 BPM on the top grid of the strip chart paper.
- ◆ The FHR1 heartbeat indicator (♥) flashes at a rate of 120 times per minute.
- ◆ Ultrasound audio is heard coming from the monitor’s rear panel speaker.

8. Disconnect the ultrasound transducer from the front panel of the monitor.

Verify the following on the monitor:

- ◆ The FHR1 value and heartbeat indicator are both blank.
- ◆ The recorder stops printing the fetal heart rate trace.
- ◆ The recorder prints the message **CARDIO INOP** on the center margin of the strip chart paper after approximately 20 seconds

ABOUT LATCHING ALARMS

The fetal heart rate alarms are latching alarms which means that a clinician must acknowledge the alarm using the monitor’s Alarm Silence button in order to clear the alarm. Active Threshold Alarm: Press the Alarm Silence button to cancel the audio component of an active threshold alarm. The visual indications remain present until the FHR value returns to within the defined acceptable range. (This is tested in steps 14 to 16 for a high alarm, and steps 22 to 24 for a low alarm.)

Unsilenced, Resolved Threshold Alarm: If a threshold alarm condition is resolved, prior to be silenced (clinical acknowledgement), the visual and audible indications both remain present. Press the Alarm Silence button to cancel both the audible and visual indications. (This is tested in steps 17 to 19 for a high alarm and 25 to 27 for a low alarm.) NOTE: For continuous limit violations: a high alarm activates after 5 minutes; a low alarm activates after 30 seconds.

Uterine Activity Test

This portion of the functional checkout procedure tests the uterine activity section of the 170 Series Monitor.

1. Set the switches on the Model 325 Simulator according to [Table 6-5](#).
2. Connect the simulator's UA sub-cable to the **UA** receptacle on the monitor.
3. Access the service setup mode and note the UA reference default value. (The monitor is shipped from the factory with this value set at 10 relative units; however, your unit may have been custom configured.) Exit the service mode.
4. Press the monitor's **Power** button to turn on the monitor.
5. Press the monitor's **Record** pushbutton.
6. Briefly press the monitor's **UA Reference** pushbutton. Verify the following on the monitor:
 - ◆ The UA value matches the *default* setting.
 - ◆ The recorder prints a continuous line at the *default* value on the uterine activity channel of the strip chart paper.
 - ◆ The recorder prints the messages TOCO and UA REF on the strip chart paper.
7. Press and hold the **UA Reference** button on the monitor to cycle through the available selections for UA reference: 5, 10, 15, 20, or 25 relative units. Test each of these reference settings. Verify that the UA value is displayed accordingly and that the recorder prints a continuous line at the corresponding value on the uterine activity channel of the strip chart paper.
8. Place the simulator's **UA Level** switch at each of the level settings: 0, 10, 50, and 100 relative units. Verify that the UA value is displayed accordingly and that the recorder prints a continuous line at the corresponding value on the heart rate channel of the strip chart paper.

Table 6-5. Uterine Activity Test Simulator Settings

Section	Switch	Setting
General	Pattern Memory	OFF
UA	Main	LEVEL
	Level	0 mmHg
	Mode	TOCO

9. Press the **UA Reference** button to reference to 10 relative units. If the default is set to a different value, press and hold the **UA Reference** button to cycle to 10.
10. Place the simulator's **UA Level** switch to the RAMP position. Verify that the UA value measures a ramp between 10 and 100 relative units and that the recorder prints a ramp between the same values. Refer to [Figure 6-5](#).

11. Disconnect the Model 325 Simulator's uterine activity sub-cable from the **UA** input receptacle on the front panel of the monitor. Verify the following on the monitor:

- ◆ The UA value is blank.
- ◆ The recorder stops printing the uterine activity trace.
- ◆ The recorder prints the message UA INOP on the center margin of the strip chart paper after approximately 20 seconds.

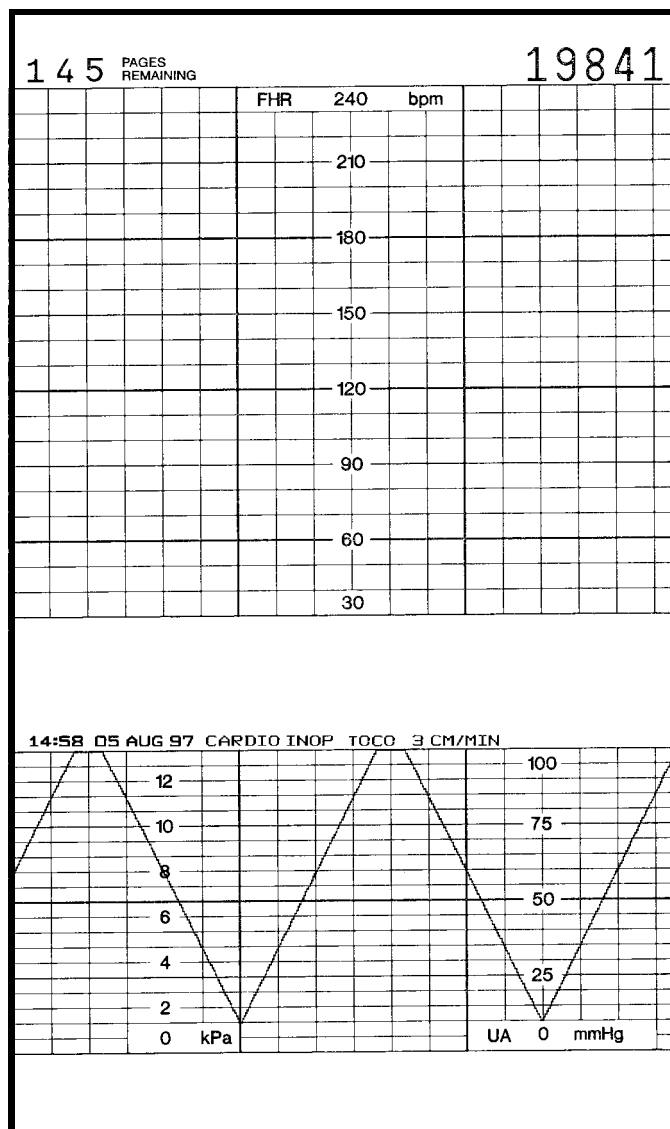


Figure 6-5. Uterine Activity Ramp

Tocotransducer Test

1. Inspect a Nautilus tocotransducer as follows:
 - ◆ Check for any cracks or contaminants on the tocotransducer especially on the diaphragm located on the bottom of the tocotransducer.
 - ◆ Visibly assess the condition of the cable, strain relief, and connector pins.
2. Connect the tocotransducer to the **UA** input receptacle on the front panel of the 170 Series Monitor.
3. Access service setup mode and note the default TOCO reference setting.
4. Exit the service setup mode.
5. Press the monitor's **Power** button to turn the monitor back on.
6. Momentarily press the monitor's **UA Reference pushbutton**. Verify the following:
 - ◆ The UA value shows the *default* setting.
 - ◆ The recorder prints the messages UA REF and TOCO on the strip chart paper.
7. Plug the TOCO transducer connector to the monitor and set the US reference as 10 on the monitor.
8. Place 52.5 gm Teflon Weight on the transducer face and verify the value as "32" (± 5.0 UA).
9. Place 100 gm Teflon Weight on the transducer face and verify the value as "53" (± 5.0 UA).
10. Place 150 gm Teflon Weight on the transducer face and verify the value as "73" (± 5.0 UA).
11. Remove the TOCO transducer from the monitor's UA input receptacle. Verify the following on the monitor:
 - ◆ The UA value is blank.
 - ◆ The recorder stops printing the uterine activity trace.
 - ◆ The recorder prints the message UA INOP on the center margin of the strip chart paper after approximately 20 seconds.

Strain Gauge Transducer Test

1. Inspect a strain gauge as follows:
 - ◆ Unscrew the plastic dome from the transducer and check for any cracks or contaminants on the transducer.
 - ◆ Visibly assess the condition of the cable, strain relief, and the connector pins.
2. Connect the strain gauge to the **UA** input receptacle on the front panel of the monitor. Verify the following on the monitor:
 - ◆ The UA value may read negative numbers indicating baseline pressure is off scale. In this case, the message BASELINE PRESSURE OFF SCALE prints on the strip chart paper.
 - ◆ After approximately 20 seconds, the message IUP prints on the center margin of the strip chart paper.
3. Select the monitor's **UA Reference** button and verify the following on the monitor:
 - ◆ The UA value is 0 mmHg.
 - ◆ The UA trend is a continuous line at 0 mmHg on the strip chart paper.
 - ◆ The message UA REF prints on the strip chart paper.
4. Apply gentle pressure on the strain gauge diaphragm and verify that the UA value and trend respond to the input. Increasing force should produce an increasing value and vice versa.
5. Disconnect the strain gauge from the front panel of the monitor. Verify the following on the monitor:
 - ◆ The UA value is blank.
 - ◆ The UA trend stops plotting on the strip chart paper.
 - ◆ After approximately 20 seconds, the message UA INOP prints on the strip chart paper.

Pattern Memory Test

The pattern memory of the simulator can be used to test any of the following mode combinations of the monitor.

- ◆ FECG/TOCO
- ◆ FECG/IUP
- ◆ US/TOCO or US2/TOCO
- ◆ US/IUP or US2/IUP
- ◆ US/FMD/TOCO
- ◆ US/FMD/IUP
- ◆ FECG/US/TOCO
- ◆ FECG/US/IUP

NOTE: US/US2 cannot be tested simultaneously unless two Model 325 Simulators or two ultrasound transducers are used. Do not attempt to test dual ultrasound using one Model 325 Simulator and one ultrasound transducer or a conflict between enable lines will occur.

NOTE: Although dual heart rate can be verified using the pattern memory, an additional procedure is given in this functional checkout procedure.

To check any of the mode combinations listed above:

1. Connect the appropriate simulator sub-cables to the corresponding receptacles on the monitor.
2. Enable the modes on the simulator.
3. Set the simulator's **Pattern Memory** switch to the ON position.
4. If not already on, press the monitor's **Record** pushbutton.
5. Verify the following on the monitor:
 - ◆ Each heart rate display (FHR1 and FHR2) responds accordingly for value and heartbeat indicator.
 - ◆ The UA display responds accordingly for the value.
 - ◆ The recorder responds appropriately in both trending and message information.

NOTE: Refer to the “**Model 325 Simulator Product Manual**” for illustrations of the patterns to be expected on the monitor.

Dual Heart Rate Test (Non-Pattern)

FECG/US Modes

1. Connect the Model 325 Simulator's ECG sub-cable to the monitor's **FECG** input receptacle.
2. Connect the simulator's US sub-cable to the monitor's **US** input receptacle.
3. Set the switches on the Model 325 Simulator according to [Table 6-6](#).
4. If not already on, select the monitor's **Record** button.
5. Verify the following on the monitor:
 - ◆ The FHR1 value reads 120 BPM.
 - ◆ The FHR1 heartbeat indicator (♥) flashes at a rate of 120 times per minute.
 - ◆ The FHR2 value varies between approximately 50 and 210 BPM.
 - ◆ The FHR2 heartbeat indicator (♥) flashes at a rate consistent with the value.
 - ◆ The messages FECG and US print on the center margin of the strip chart paper.
 - ◆ The FHR1 trend is a continuous plain black line (—) on the 120 BPM mark on the top grid of the strip chart paper. (Refer to [Figure 6-6](#).)
 - ◆ The FHR2 trend is a bold black ramp trace (—) between 50 and 210 BPM on the top grid of the strip chart paper. (Refer to [Figure 6-6](#).)

Table 6-6. Model 325 Simulator Settings for FECG/US Test		
Section	Switch	Setting
FECG/MECG	Main	RATE
	Rate	120 BPM
	Mode	FECG
	QRS Amplitude	50 μ V
	QRS Polarity	+
ULTRASOUND/FMD	Mode	US
	Level	MED
	Rate	RAMP
General	Pattern Memory	OFF

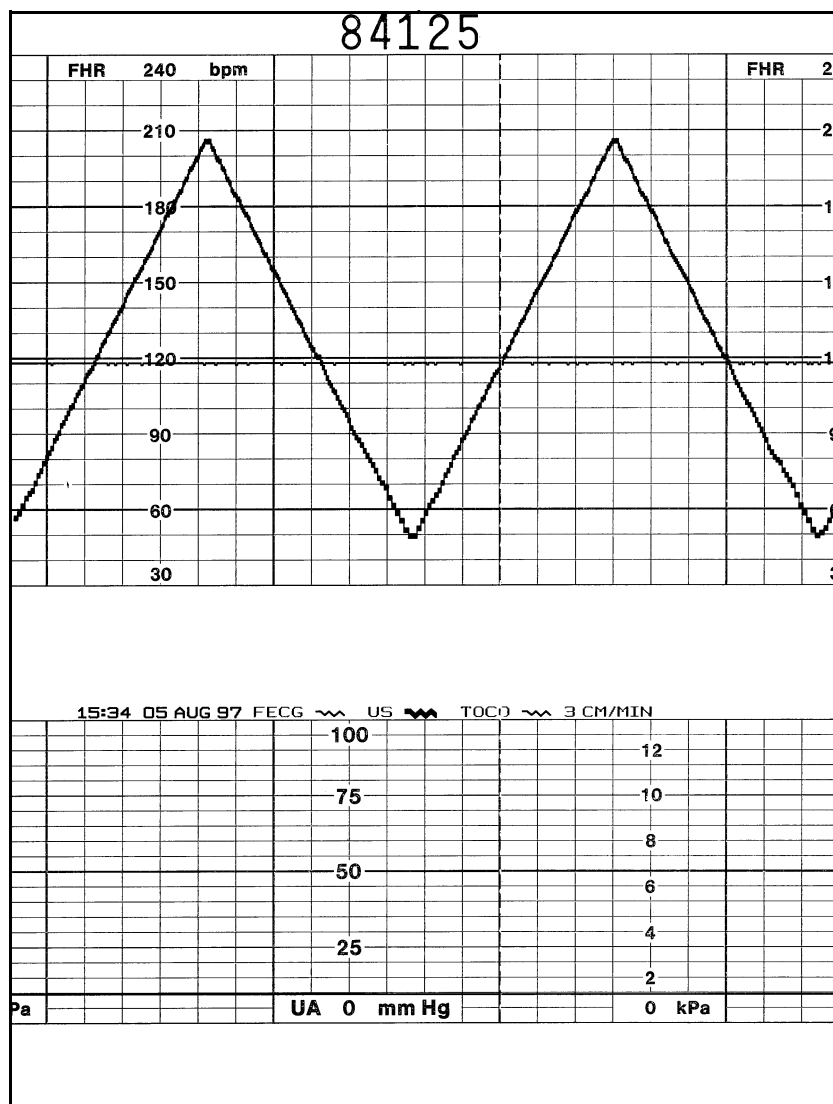


Figure 6-6. Dual Heart Rate, FECG and US

Dual Ultrasound Modes

As stated previously, the dual ultrasound mode of the 170 Series Monitor cannot be tested unless two Model 325 Simulators are used or two Nautilus ultrasound transducers. **Do not** attempt to test dual ultrasound using one Model 325 Simulator and one ultrasound transducer. This procedure details using two transducers since it is more practical for a test site.

1. If not already on, press the monitor's **Record** pushbutton.
2. Plug one ultrasound transducer into the monitor's **US** input receptacle and the other into the monitor's **US2** receptacle. Verify the following on the monitor:
 - ◆ The FHR1 value shows three steady dashes "— — —."
 - ◆ The FHR2 value shows three steady dashes "— — —."
 - ◆ The recorder prints the messages **US** and **US2** on the center margin of the strip chart paper.
3. Use your finger to rub the face of the ultrasound transducer connected to the monitor's **US** input receptacle; try to maintain a steady rate and verify the following on the monitor:
 - ◆ The FHR1 value responds to the rubbing.
 - ◆ The FHR1 heartbeat indicator (♥) responds to the input.
 - ◆ The recorder prints the heart rate tracing corresponding to the rate and the trace is plain black (—^—^—^).
4. Use your finger to rub the face of the ultrasound transducer connected to the monitor's **US2** input receptacle; try to maintain a steady rate and verify the following on the monitor:
 - ◆ The FHR2 value responds to the rubbing.
 - ◆ The FHR2 heartbeat indicator (♥) responds to the input.
 - ◆ The recorder prints the heart rate tracing corresponding to the rate and the trace is bold black (—^—^—^).

Alarm Test

This portion of the test ensures the integrity of the audio alarms and tests the alarm limit software.

1. Connect the Model 325 Simulator's US sub-cable to the monitor's **US** input.
2. Press and hold (for three seconds) **Setup** to enter the monitor's setup mode.
3. Set the FHR alarm enable to *on*.
4. Set the FHR high alarm limit value to 180 BPM.
5. Set the FHR low alarm limit value to 100 BPM.
6. Set the FHR audio alarm to a level you can easily hear.
7. Press the **Setup** button to exit the setup mode.
8. Press the monitor's **Record** button.
9. Verify that the FHR high and low limits print in the annotation area of the strip chart paper.
10. Turn off the monitor's recorder.
11. Set the switches on the Model 325 Input Simulator according to [Table 6-7](#).
12. Using the simulator's **Manual Adjustment** knob, input an US signal of 179 BPM as indicated on the monitor. Verify that there is no alarm tone sounding from the monitor's speaker.
13. Using the simulator's **Manual Adjustment** knob, increase the US rate to 180 BPM. Again, verify that there is no alarm tone sounding from the monitor's speaker.
14. Using the simulator's **Manual Adjustment** knob, increase the US rate to 181 BPM. *After five minutes*, verify the following on the monitor:
 - ◆ An alarm tone is emitted from the monitor's speaker (alternating high/low tones).
 - ◆ The Alarm indicator flashes.
 - ◆ The affected heart rate numerics flash.
15. Press the monitor's front panel **Alarm Silence** pushbutton and verify that the alarm tone silences but the visual indications remain present.

Table 6-7. Alarm Test Simulator Settings		
Section	Switch	Setting
US	Main	RATE
	Rate	MANUAL
	Mode	US
General	Pattern Memory	OFF

16. Use the simulator's **Manual Adjustment** knob to decrease the US rate to 180 BPM. Verify that the Alarm indicator goes out and the heart rate numerics stop flashing.
17. Use the simulator's **Manual Adjustment** knob to increase the US rate to 181 BPM to set off the alarm once more. It will take five minutes for the alarm appear.
18. Use the simulator's **Manual Adjustment** knob to decrease the US rate to 180 BPM. Verify the following on the monitor:
 - ◆ The alarm tone continues sounding.
 - ◆ The Alarm indicator continues flashing.
 - ◆ The affected heart rate numerics continue flashing.
19. Press the monitor's front panel **Alarm Silence** pushbutton. Verify that the visual *and* audio alarm indications disappear.
20. Using the simulator's **Manual Adjustment** knob, input an US signal of 101 BPM. Verify that there is no alarm tone sounding from the monitor's speaker.
21. Using the simulator's **Manual Adjustment** knob, decrease the US rate to 100 BPM. Again, verify that there is no alarm tone sounding from the monitor's speaker.
22. Using the simulator's **Manual Adjustment** knob, decrease the US rate to 99 bpm. *After 30 seconds*, verify the following on the monitor:
 - ◆ The alarm tone is emitted from the monitor's speaker.
 - ◆ The Alarm indicator flashes.
 - ◆ The affected heart rate numerics flash.
23. Press the monitor's front panel **Alarm Silence** pushbutton. Verify that the visual and audio alarm indications disappear.
24. Use the simulator's **Manual Adjustment** knob to increase the US signal to 100 BPM. Verify that the Alarm indicator goes out and the heart rate numerics stop flashing.
25. Use the simulator's **Manual Adjustment** knob to decrease the US signal to 99 BPM to set off the alarm one more time. It will take 30 seconds for the alarm to appear.

26. Use the simulator's **Manual Adjustment** knob to increase the US signal to 100 bpm. Verify the following on the monitor:
 - ◆ The alarm tone continues sounding.
 - ◆ The Alarm indicator stops continues flashing.
 - ◆ The affected heart rate numerics continue flashing.
27. Press the monitor's front panel **Alarm Silence** pushbutton. Verify that the visual *and* audio alarm indications disappear.
28. This concludes the functional checkout procedure.