

# 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. Therefore, 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.

## This chapter contains the following:

Equipment Required .....	6-2
General .....	6-2
Monitor Self-Test .....	6-2
Front Panel Pushbutton Test .....	6-4
Connecting the Simulator .....	6-4
MECG Test .....	6-5
FECG Test .....	6-9
Legplate Test .....	6-13
Ultrasound Test .....	6-14
Fetal Movement Detection Test .....	6-17
Ultrasound Transducer test .....	6-19
Uterine Activity Test .....	6-20
Tocotransducer Test .....	6-23
Strain Gauge Transducer Test .....	6-24
Pattern Memory Test .....	6-25
Dual Heart Rate Test (Non-Pattern) .....	6-26
Alarm Test .....	6-29



S E C T I O N

6

## SECTION 6

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### EQUIPMENT REQUIRED

The following items are necessary for performing any of the tests in this procedure:

- Corometrics Model 325 Simulator and corresponding line cord
- 120 Series Monitor interconnect cables
- Round-Connector Legplate or Rectangular-Connector Legplate
- Ultrasound Transducers (x2)
- Tocotransducer
- Strain Gauge Transducer

### GENERAL

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 Corometrics Service Representative to arrange for evaluation, replacement, or repair of the suspect item(s).

### MONITOR SELF-TEST

The 120 Series Monitor contains test routines which verify the unit's calibration and internal circuitry. These routines are initiated by depressing the front panel **Test** pushbutton. The test results are printed on the strip chart recorder paper, verifying the integrity of the unit.

It is recommended practice to initiate the self-test feature at the beginning of each monitoring session.

1. Check the **Voltage Selection** switch on the rear panel of the 120 Series Monitor and ensure it matches the line voltage of the receptacle to be used. Connect the detachable line cord to the rear panel power entry module; plug the other end into a hospital grade, grounded wall outlet of appropriate voltage.
2. Place the front panel **Power** switch in the *on* (I) position. When the power is first turned on, verify that three tones are emitted from the rear panel speaker and the green power on indicator is lit.
3. Depress the front panel **Test** pushbutton and verify the following:
  - All display pixels illuminate for one second and then all are extinguished for one second. Afterwards, a vertical line moves across the screen from left to right, followed by a horizontal line moving from top to bottom. The display then remains black.
  - The yellow **Record** indicator illuminates.

- The message **TEST: ARE ALL DOTS PRINTED?** is printed followed by two vertical lines which should appear continuous. Discontinuous lines may be an indication of damaged printhead elements if gaps occur in the same place on both lines. Simulated trends of 30 and 240 BPM (or 50 and 210 BPM, depending on the paper installed) are printed on the top grid. Simulated pressure trends at 0 and 100 mmHg are printed on the bottom grid. The values are also printed in the center margin of the strip chart. Refer to Figure 6-1.
- After the recorder test above, the display returns to the main screen; then the software generates a 120 BPM rate in the FHR1 area and a 180 BPM rate in the FHR2 area, with both mode titles displaying **TEST**.
- The monitor adds 50 mmHg to the present pressure level and displays this value in the UA display area; the mode title displays **TEST**.

**NOTE:** The monitor will add 50 mmHg to raw pressure data. In other words, the value is always referenced to 0 mmHg regardless of any UA referencing attempt.

4. The recorder returns to its original on, off, or maternal-only mode state from when the **Test** pushbutton was depressed.

**NOTE:** To disable the test, depress the **Test** pushbutton or open the recorder door.

**NOTE:** If the simulated fetal heart rate trends do not appear in the correct positions on the strip chart recorder paper, ensure the monitor's vertical scale setting matches the type of paper being used, i.e. 30 BPM/cm or 20 BPM/cm. (Refer to *Install Options Screen* on page 5-32.)



## SECTION 6

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### FRONT PANEL PUSHBUTTON TEST

This procedure ensures the functionality of the front panel pushbuttons.

1. Apply power to the 120 Series Monitor.
2. Disconnect all transducers from the front panel.
3. Access the General Setup screen and set the recorder speed to 1 cm/min; then exit the setup screen.
4. Depress the monitor's **Record** pushbutton and verify the following:
  - The yellow indicator next to the pushbutton 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 *Section 5, Setup Procedures* in this manual.)
  - The recorder prints the messages **CARDIO INOP** and **UA INOP**, indicating that no ultrasound, ECG, or uterine activity transducers are plugged into the front panel **US**, **US2**, **FECG/MECG**, or **UA** connectors.
  - The recorder prints the message **1 CM/MIN**, indicating the selected chart speed.
5. Depress and hold the monitor's front panel **Paper Advance** pushbutton and verify that the recorder paper advances at a rate of 40 cm/min.
6. Release the **Paper Advance** pushbutton and verify that the recorder prints the message **1 CM/MIN**.
7. Access the General Setup screen and set the recorder speed to 3 cm/min; then exit the setup screen.
8. Verify that the recorder paper advances at a rate of 3 cm/min and that after approximately 40 seconds, the message **3 CM/MIN** is printed on the recorder paper. (The time, date and monitoring modes are also printed again.)
9. Depress the monitor's front panel **Mark** pushbutton and verify that an event mark (■) is printed on the bottom two lines of the recorder paper.

### CONNECTING THE 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 120 Series do not work with Model 305 Simulators.)

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 120 Series Monitor **Power** switch is in the *off* position.
4. Connect the simulator interconnect cable's 50-pin end to the simulator's **Fetal Monitor** connector.
5. Insert the green plug of the FECG/MECG adapter cable, cat. no. (REF) 1442AAO, into the monitor's **FECG/MECG** connector.
6. Connect the sub-cables of the other end of the simulator interconnect cable into the color-coded connectors on the monitor/adaptor: **ECG**, **US**, and **UA**.
7. Turn *on* the Model 325 Simulator. Verify that the green **Power** indicator illuminates.
8. Turn *on* the 120 Series Monitor.

## MECG TEST

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

1. Connect the simulator's ECG sub-cable to the **MECG** connector on the monitor adapter cable.
2. Connect the simulator's UA sub-cable to the **UA** receptacle on the monitor.
3. Set the switches on the Model 325 Input Simulator according to Table 6-1.
4. If not already on, depress the monitor's **Record** pushbutton.
5. Turn the simulator's **Manual Adjustment** knob fully counterclockwise and verify the following on the monitor's display:
  - The MHR value is 30 BPM.
  - The MHR/P mode is **MECG**.
  - The MHR heartbeat indicator (♥) flashes at a rate of 30 times per minute.
  - The UA mode is **TOCO**.
6. Access the Install Options screen and note the default TOCO reference value.
7. Press the monitor's front panel **UA Reference** pushbutton.
8. Verify the following on the monitor:
  - The UA value is referenced to the default value.
  - The recorder prints a continuous line at the default value on the bottom grid of the strip chart paper.
  - The recorder prints the messages MECG, TOCO, and UA REF on the strip chart paper.
9. Turn the simulator's **Manual Adjustment** knob to input an MECG signal of approximately 60 BPM. Verify the following on the monitor:
  - The MHR value is 60 BPM.
  - The MHR heartbeat indicator (♥) flashes at a rate of 60 times per minute.
  - The ECG "beep" volume can be heard from the rear panel speaker. The volume can be adjusted on the MHR/P Setup screen.
  - The recorder prints a continuous line at 60 BPM on the top grid of the strip chart paper.

Table 6-1. ECG Test—Model 325 Simulator Settings

SECTION	SWITCH	SETTING
FECG/MECG	Main	RATE
	Rate	MANUAL
	Mode	MECG
	QRS Amplitude	500 $\mu$ V
	QRS Polarity	+
GENERAL	Pattern Memory	OFF
UA	Main	CMR
	Mode	TOCO

## SECTION 6

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10. Repeat step 9 for each of the following rates: 30, 120, 210, and 240 BPM.
11. Change the simulator's **QRS Polarity** switch from + to -. Verify that the monitor does not skip any beats.
12. Set the simulator's **ECG Rate** switch to the RAMP setting. Verify that the monitor's MHR value counts between approximately 30 and 240 BPM and that the recorder prints a ramp between the same values. (Refer to Figure 6-2.)
13. Set the simulator's **ECG Rate** switch to the  $\Delta 15$  position. Verify the following on the monitor:
  - The MHR value oscillates by 15 BPM.
  - The MHR heartbeat indicator (♥) flashes for each input signal.
  - The ECG "beep" is heard from the rear panel speaker; the volume can be adjusted on the MHR/P Setup screen.
  - The recorder prints an oscillation of 15 BPM between 115 and 130 BPM on the top grid of the strip chart paper. (Refer to Figure 6-3.)
14. Repeat step 13 for rate values of  $\Delta 22$  and  $\Delta 27$ . The results should be the same except that the MHR value oscillates by either 22 or 27 BPM and the recorder prints an oscillation of 22 or 27 BPM. The top value is always at approximately 130 BPM. (Refer to Figure 6-3.)
15. 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 y-adapter cable. Verify the following on the monitor:
  - The MHR/P value and mode are both blank.
  - The recorder stops printing maternal heart rate data on the strip chart paper.
  - The recorder prints the message **CARDIO INOP** on the center margin of the strip chart paper after approximately 30 seconds.
16. Set the simulator's **ECG Mode** switch to the OFF position.

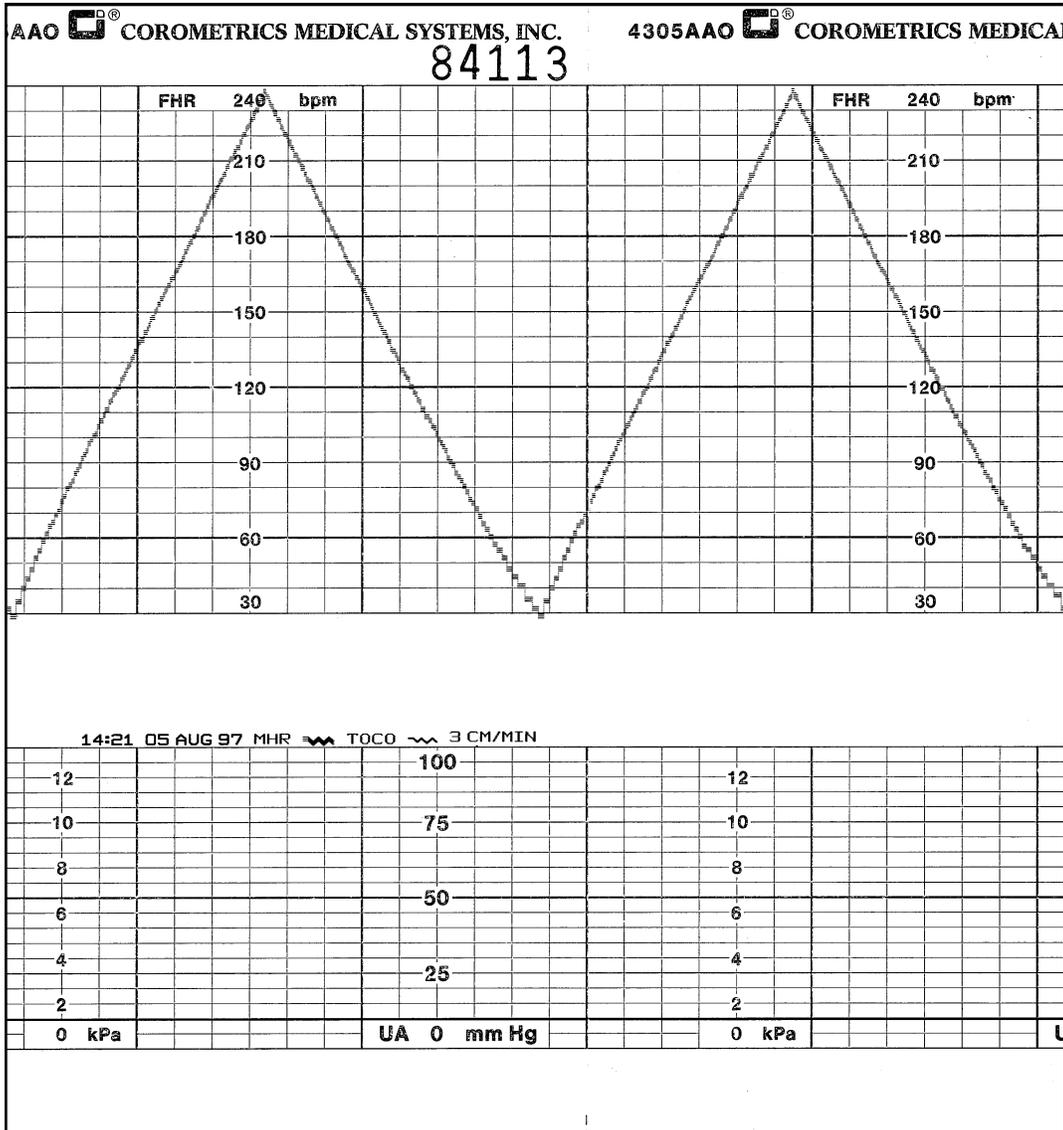


Figure 6-2. MECG Ramp

**SECTION 6**

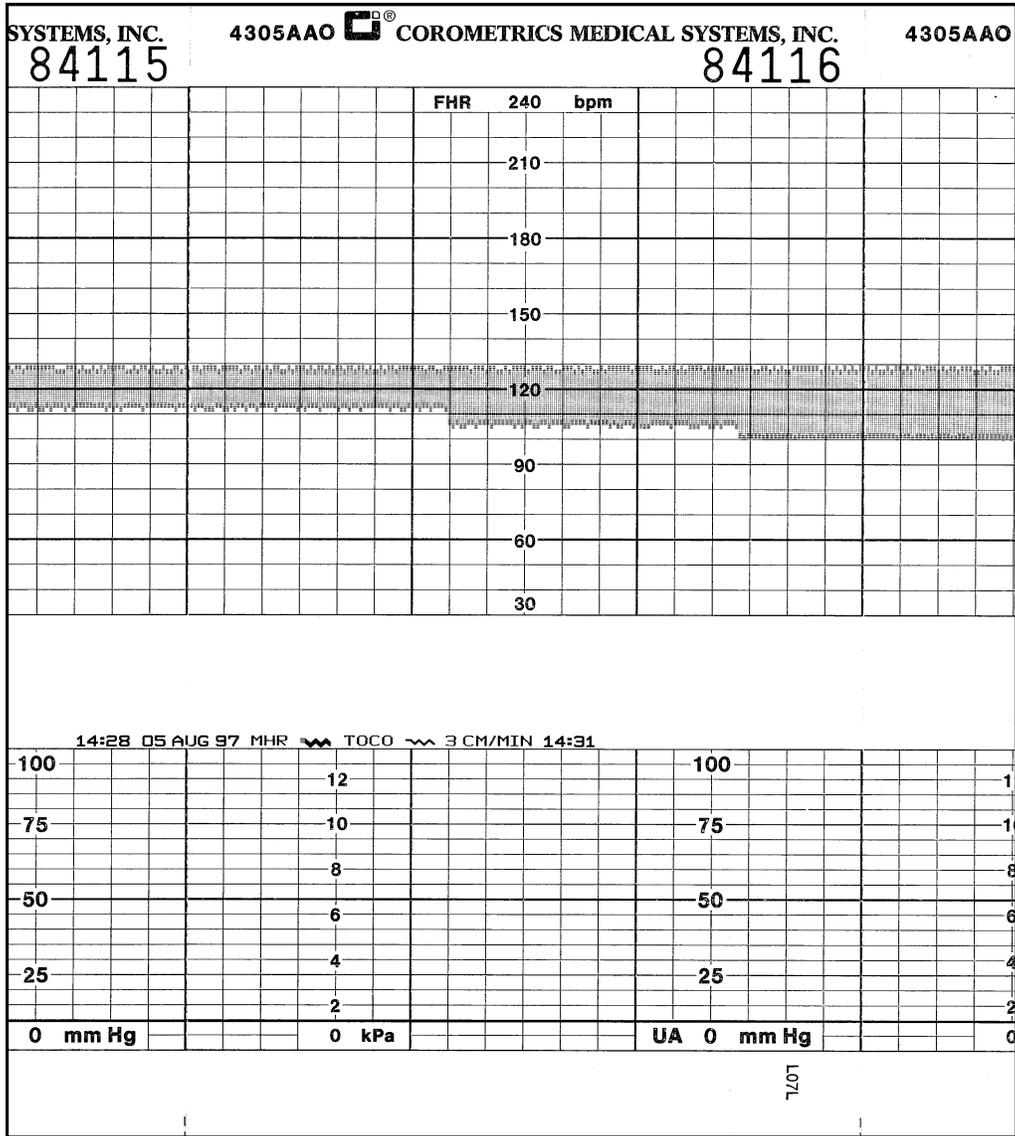


Figure 6-3. MECG Oscillation

## 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 simulator's ECG sub-cable to the **FECG** connector on the monitor adapter cable.
2. Connect the simulator's UA sub-cable to the **UA** receptacle on the monitor.
3. Set the switches on the Model 325 Input Simulator according to Table 6-1.
4. If not already on, depress the monitor's **Record** pushbutton.
5. Turn the simulator's **Manual Adjustment** knob fully counterclockwise and verify the following on the monitor's display:
  - The FHR1 value is 30 BPM.
  - The FHR1 mode is **FECG**.
  - The FHR1 heartbeat indicator (♥) flashes at a rate of 30 times per minute.
  - The UA mode is **TOCO**.
6. Depress and hold the monitor's **UA Reference** pushbutton and release when the UA value shows 10 relative units. Verify the following on the monitor:
  - The UA value is referenced to 10 relative units.
  - The recorder prints a continuous line at 10 relative units on the bottom grid of the strip chart paper.
  - The recorder prints the messages FECG, TOCO, and UA REF on the strip chart paper.
7. 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 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.

Table 6-2. ECG Test—Model 325 Simulator Settings

SECTION	SWITCH	SETTING
FECG/MECG	Main	RATE
	Rate	MANUAL
	Mode	FECG
	QRS Amplitude	15 $\mu$ V
	QRS Polarity	+
GENERAL	Pattern Memory	OFF
UA	Main	CMR
	Mode	TOCO

## SECTION 6

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8. Repeat step 7 for each of the following rates: 30, 60, 210, and 240 BPM.
9. Change the simulator's **QRS Polarity** switch from + to -. Verify that the monitor does not skip any beats.
10. 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 recorder prints a ramp between the same values. (Refer to Figure 6-4.)
11. Access the Install Options service screen and set ECG Artifact Elimination to OFF; then exit the service mode.
12. 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. (Refer to Figure 6-5.)
13. Repeat step 12 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 recorder prints an oscillation of 22 or 27 BPM. The top value is always at approximately 130 BPM. (Refer to Figure 6-5.)
14. Access the monitor's Install Options service mode screen and set the ECG Artifact Elimination to ON.
15. 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. (Refer to Figure 6-5.)
16. Repeat step 15 for the rate value of  $\Delta 22$ . The result should be the same as step 15 except that the FHR1 value oscillates by 22 BPM and the recorder prints an oscillation of 22 BPM between the 108 and 130 BPM on the strip chart recorder paper.
17. 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 recorder does not print any oscillation.
18. Access the monitor's Install Options service mode screen and set the ECG Artifact Elimination back to OFF.
19. 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 y-adapter cable. Verify the following on the monitor:
  - The FHR1 value and mode are both blank.
  - The recorder stops printing heart rate data on the strip chart paper.
  - The recorder prints the message **CARDIO INOP** on the center margin of the strip chart paper after approximately 30 seconds.
20. Set the simulator's **ECG Mode** switch to the OFF position.

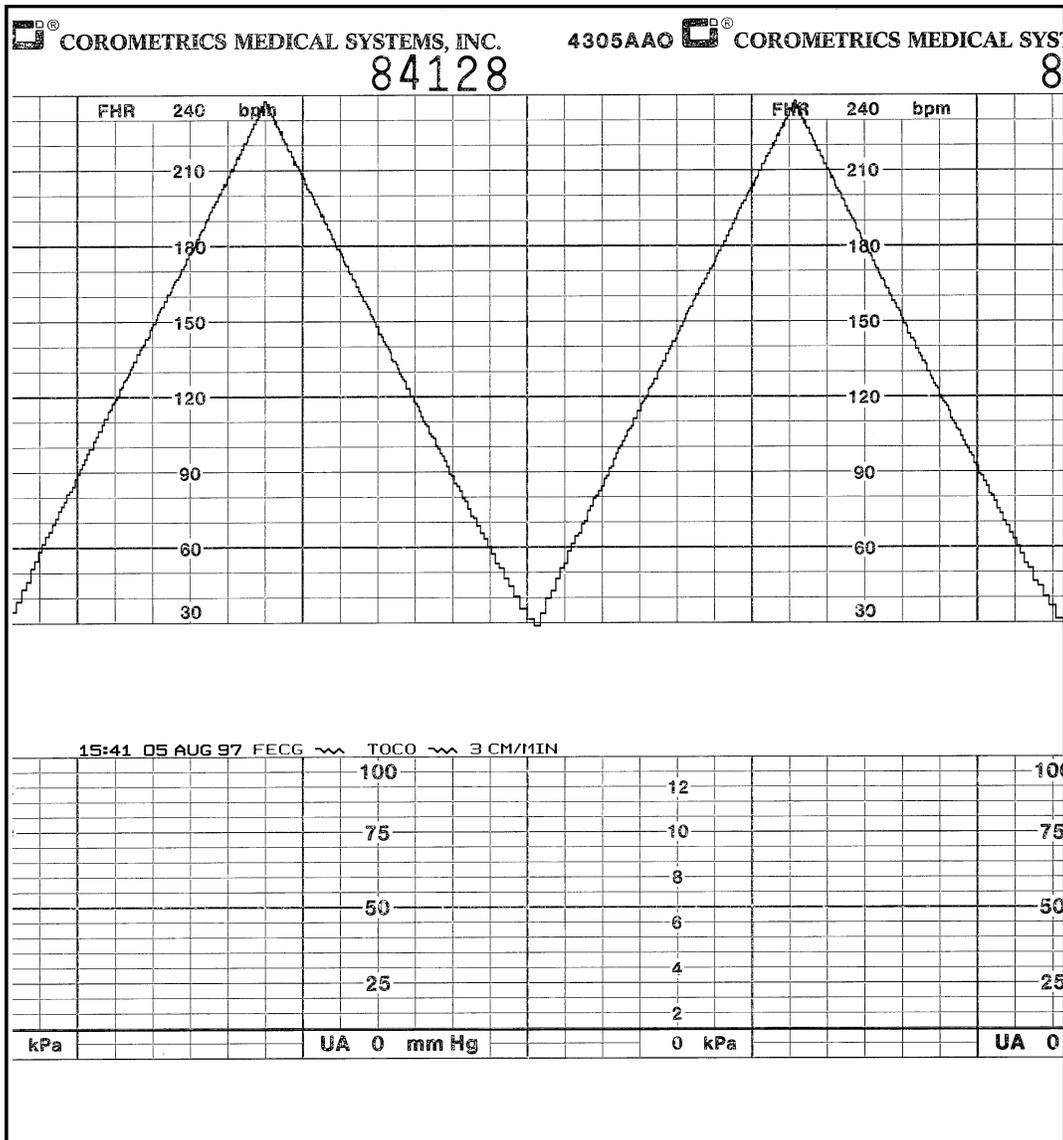


Figure 6-4. FECCG Ramp

**SECTION 6**

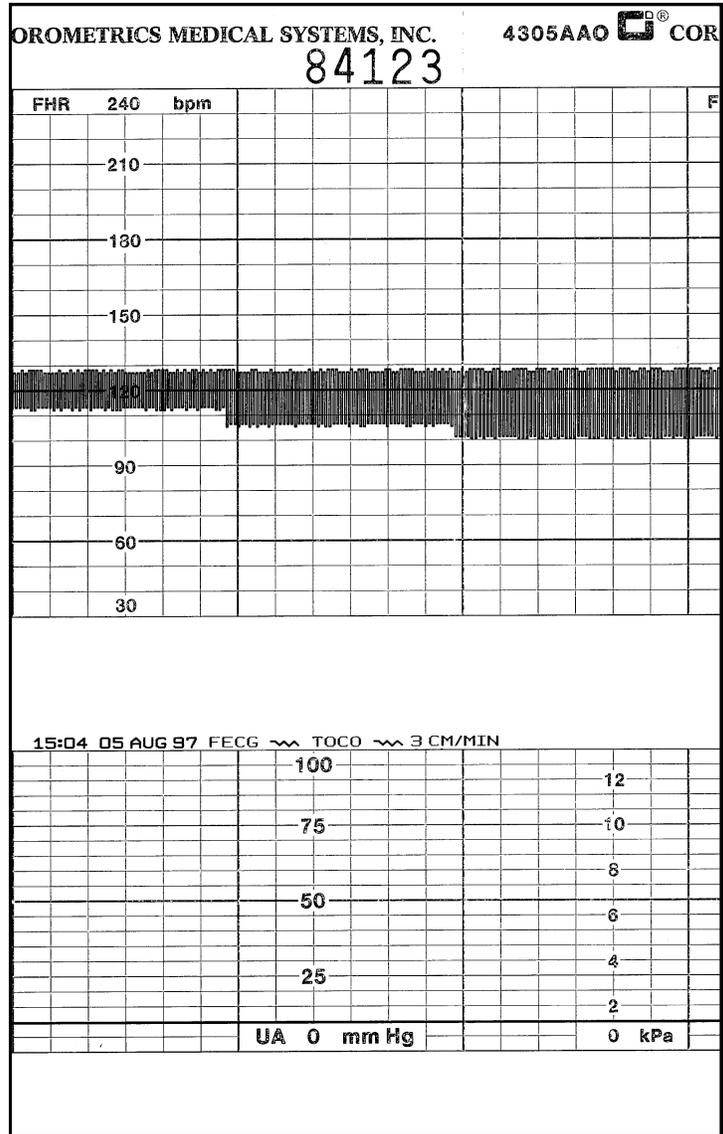


Figure 6-5. FECC Artifact Elimination

## **LEGPLATE TEST**

1. Inspect the legplate as follows:
  - Check for a proper seal around the ground plate.
  - Ensure that no contaminants are present on either the ground plate or the push posts.
  - Visibly assess the condition of the cable, strain relief, and connector pins.
2. If using a round-connector legplate, connect the legplate to the **FECG** plug on the monitor's adapter cable. If using a rectangular-connector legplate, connect the legplate directly to the monitor's **FECG/MECG** receptacle. In either case, slide the legplate into the monitor's Legplate Tester jack and hold firmly in place. Verify the following on the monitor:
  - The FHR1 value is 120 BPM.
  - The FHR1 mode is FECG.
  - The FHR1 heartbeat indicator ( ♥ ) flashes at a rate of 120 times per minute.
  - The ECG "beep" is heard coming from the rear panel speaker.
  - The recorder prints a continuous line on the top grid of the strip chart paper at 120 BPM.
  - The recorder prints the message FECG on the center margin of the strip chart paper after approximately 20 seconds, indicating that a legplate has been connected.
3. Disconnect the legplate from the monitor. Verify the following on the monitor:
  - The FHR1 value and mode are both blank.
  - The recorder stops printing the fetal heart rate trace.
  - The message **CARDIO INOP** prints on the center margin of the strip chart paper after approximately 20 seconds, indicating that there is no ECG (or ultrasound) transducer plugged into the front panel of the monitor.

## SECTION 6

### 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, depress 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 mode is **US**.
  - 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.
6. 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.
7. 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 6-6.)

Table 6-3. Ultrasound Test—Model 325 Simulator Settings

SECTION	SWITCH	SETTING
US/FMD	Mode	US
	Signal Level	MED
	Rate	MANUAL
GENERAL	Pattern Memory	OFF
UA	Main	CMR
	Mode	TOCO

8. 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  $\pm 1$  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  $\pm 3$  BPM on the top grid of the strip chart paper.
9. Repeat step 4 through step 8 using the second ultrasound channel. (The mode will show **US2**.)
10. Place the simulator's **US Mode** switch in the OFF position. Verify the following on the monitor:
  - The FHR1 value and mode 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.

**SECTION 6**

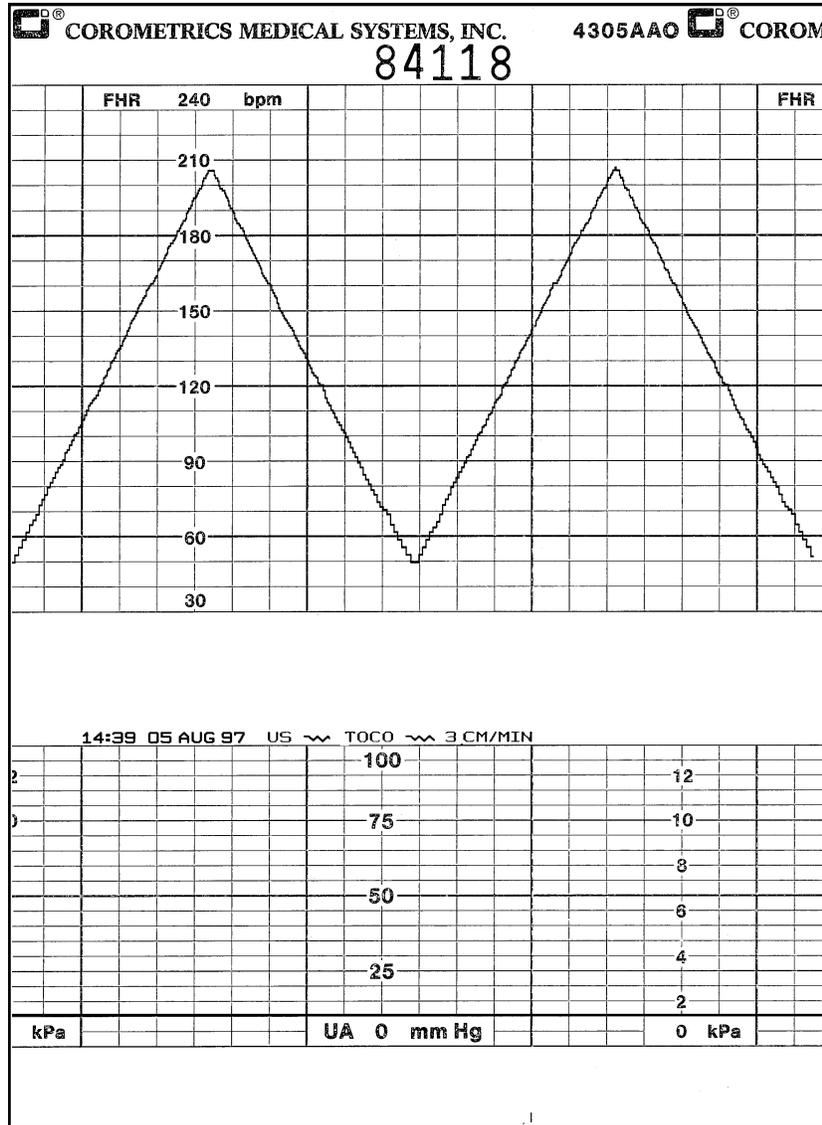


Figure 6-6. Ultrasound Ramp

**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 6-7.)

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, depress 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 mode is **US**.
  - The **FMD** indication displays in-between the FHR1 and FHR2 mode title locations.
  - 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. Ultrasound Test—Model 325 Simulator Settings

SECTION	SWITCH	SETTING
US/FMD	Mode	US/FMD
	Signal Level	MED
	Rate	MANUAL
GENERAL	Pattern Memory	OFF
UA	Main	CMR
	Mode	TOCO

**SECTION 6**

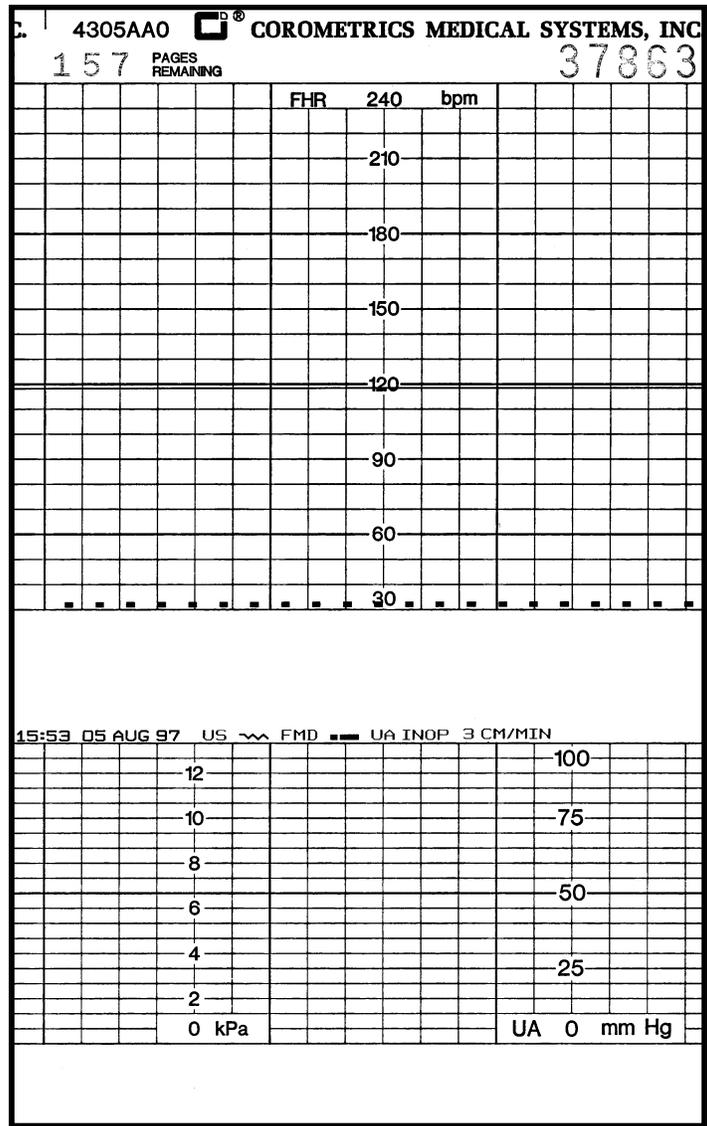


Figure 6-7. Fetal Movement Detection

**ULTRASOUND TRANSDUCER TEST**

1. Inspect a Model 116/118/120 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 120 Series Monitor.
3. Connect the ultrasound transducer to either the **US** or **US2** input receptacle on the front panel of the monitor. Verify the following on the monitor:
  - The FHR1 value shows three steady dashes “- - -.”
  - The FHR1 mode is **US**.
  - The recorder prints the message **US** on the center margin of the strip chart paper after approximately 20 seconds.
4. Gently rub each crystal of the ultrasound transducer rhythmically. (There are nine crystals. Eight are arranged around the circumference of the transducer; one is in the center.) Verify the following:
  - Good sensitivity is apparent.
  - The monitor's FHR1 value follows the input rate.
  - The recorder follows the input rate.
  - The FHR1 heartbeat indicator (♥) flashes for each input.
  - The FHR1 mode shows **US**.
  - Ultrasound audio is heard coming from the monitor's rear panel speaker.
5. Disconnect the ultrasound transducer from the front panel of the monitor. Verify the following on the monitor:
  - The FHR1 value, mode, and heartbeat indicator are all 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.

## SECTION 6

### UTERINE ACTIVITY TEST

This portion of the functional checkout procedure tests the uterine activity section of the 120 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 Install Options service mode screen and note the default TOCO reference 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 screens.
4. If not already on, depress the monitor's **Record** pushbutton.
5. Briefly press the monitor's **UA Reference** pushbutton. Verify the following on the monitor:
  - The UA value is the *default* setting.
  - The UA mode is **TOCO**.
  - 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.
6. Press and hold the **UA Reference** pushbutton 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.
7. 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.
8. Place the simulator's **UA Mode** switch in the IUP position and the **UA Level** switch to 0 mmHg. Depress the monitor's **UA Reference** pushbutton and verify that the monitor and recorder reference to 0 mmHg. Verify the following on the monitor:
  - The UA value is 0 mmHg.
  - The UA mode is **IUP**.
  - The recorder prints a continuous line at 0 mmHg on the uterine activity channel of the strip chart paper.
  - The recorder prints the messages IUP and UA REF on the strip chart paper.

Table 6-5. Uterine Activity Test—Model 325 Simulator Settings

SECTION	SWITCH	SETTING
GENERAL	Pattern Memory	OFF
UA	Main	LEVEL
	Level	0 mmHg
	Mode	TOCO

9. Place the simulator's **UA Level** switch at each of the level settings: 0, 10, 50, and 100 mmHg. 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.
10. Place the simulator's **UA Level** switch to the RAMP position. Verify that the UA value measures between approximately 0 and 100 mmHg and that the recorder prints a ramp between the same values. Refer to Figure 6-8.
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 and mode are both 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.



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## TOCOTRANSDUCER TEST

1. Inspect a Trimline 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 120 Series Monitor.

————— ⚠ IMPORTANT ⚠ —————

If the monitor is *on* when you connect or re-connect a Trimline Tocotransducer to the **UA** connector, you **must** wait at least 10 seconds before pressing the **UA Reference** pushbutton. If the monitor is *off*, you **must** wait at least 10 seconds from the time the monitor is powered *on*.

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3. Access the Install Options service mode screen and note the default TOCO reference setting.
4. Momentarily depress the monitor's **UA Reference pushbutton**. Verify the following:
  - The UA value shows the *default* setting.
  - The UA mode shows **TOCO**.
  - The recorder prints the messages UA REF and TOCO on the strip chart paper.
5. Apply gentle pressure to the tocotransducer diaphragm and verify that the UA value responds to the pressure input. Increasing force should produce an increasing value and vice versa.
6. Remove the tocotransducer from the monitor's **UA** input receptacle. Verify the following on the monitor:
  - The UA value and mode are both 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 Model 116/118/120 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 120 Series Monitor. Verify the following on the monitor:
  - The UA value may read negative numbers indicating baseline pressure is off scale. In this case, the recorder prints the message **BASELINE PRESSURE OFF SCALE** on the center margin of the strip chart paper.
  - The UA mode is **IUP** for intrauterine pressure.
  - The recorder prints the message **IUP** on the center margin of the strip chart paper after approximately 20 seconds.
3. Depress the monitor's **UA Reference** pushbutton and verify the following on the monitor:
  - The UA value is 0 mmHg.
  - The recorder prints a continuous line at 0 mmHg on the strip chart paper.
  - The recorder prints the message **UA REF** on the bottom two lines of the top grid of the strip chart paper.
4. Apply gentle pressure on the strain gauge diaphragm and verify that the display and recorder 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 and mode are both 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.

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## 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
- MECG/TOCO
- MECG/IUP
- US/TOCO
- US/IUP
- US/FMD/TOCO
- US/FMD/IUP
- US2/TOCO
- US2/IUP
- FECG/US/TOCO
- FECG/US/IUP
- FECG/US2/TOCO
- FECG/US2/IUP
- US/TOCO/MECG
- US/IUP/MECG
- US2/TOCO/MECG
- US2/IUP/MECG

**NOTE:** US/US2 cannot be tested simultaneously unless two Model 325 Simulators or two Model 116/118/120 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:** FECG/MECG cannot be tested simultaneously unless two Model 325 Simulators are used; or one simulator (for MECG) and one legplate (for FECG, using the monitor's legplate tester).

**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, depress the monitor's **Record** pushbutton.
5. Verify the following on the monitor:
  - Each heart rate area (FHR1, FHR2, and/or MECG) responds accordingly for value, mode, and heartbeat indicator.
  - The UA area responds accordingly for value and mode.
  - 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.

## SECTION 6

### DUAL HEART RATE TEST (NON-PATTERN)

#### FECG/US Modes

1. Connect the FECG/MECG adapter cable to the **FECG/MECG** connector on the 120 Series Monitor.
2. Connect the Model 325 simulator's ECG sub-cable to the **FECG** input on the monitor's adapter cable.
3. Connect the simulator's US sub-cable to the monitor's **US** input receptacle.
4. Set the switches on the Model 325 Simulator according to Table 6-6.
5. If not already on, depress the monitor's **Record** pushbutton.
6. Verify the following on the monitor:
  - The FHR1 value reads 120 BPM.
  - The FHR1 mode reads **FECG**.
  - The FHR2 value varies between approximately 50 and 210 BPM.
  - The FHR2 mode reads **US**.
  - The FHR2 heartbeat indicator (♥) flashes at a rate consistent with the value.
  - The recorder prints the messages **FECG** and **US** on the center margin of the strip chart paper.
  - The recorder prints a continuous plain black line (—∧∧) on the 120 BPM mark on the heart rate channel of the strip chart paper. (Refer to Figure 6-9.)
  - The recorder prints a bold black ramp trace (—∧∧) between 50 and 210 BPM on the heart rate channel of the strip chart paper. (Refer to Figure 6-9.)

Table 6-6. FECG/US Test—Model 325 Simulator Settings

SECTION	SWITCH	SETTING
FECG/MECG	Main	RATE
	Rate	120 BPM
	Mode	FECG
	QRS Amplitude	50 $\mu$ V
	QRS Polarity	+
ULTRASOUND/FMD	Mode	US
	Level	MED
	Rate	RAMP
GENERAL	Pattern Memory	OFF

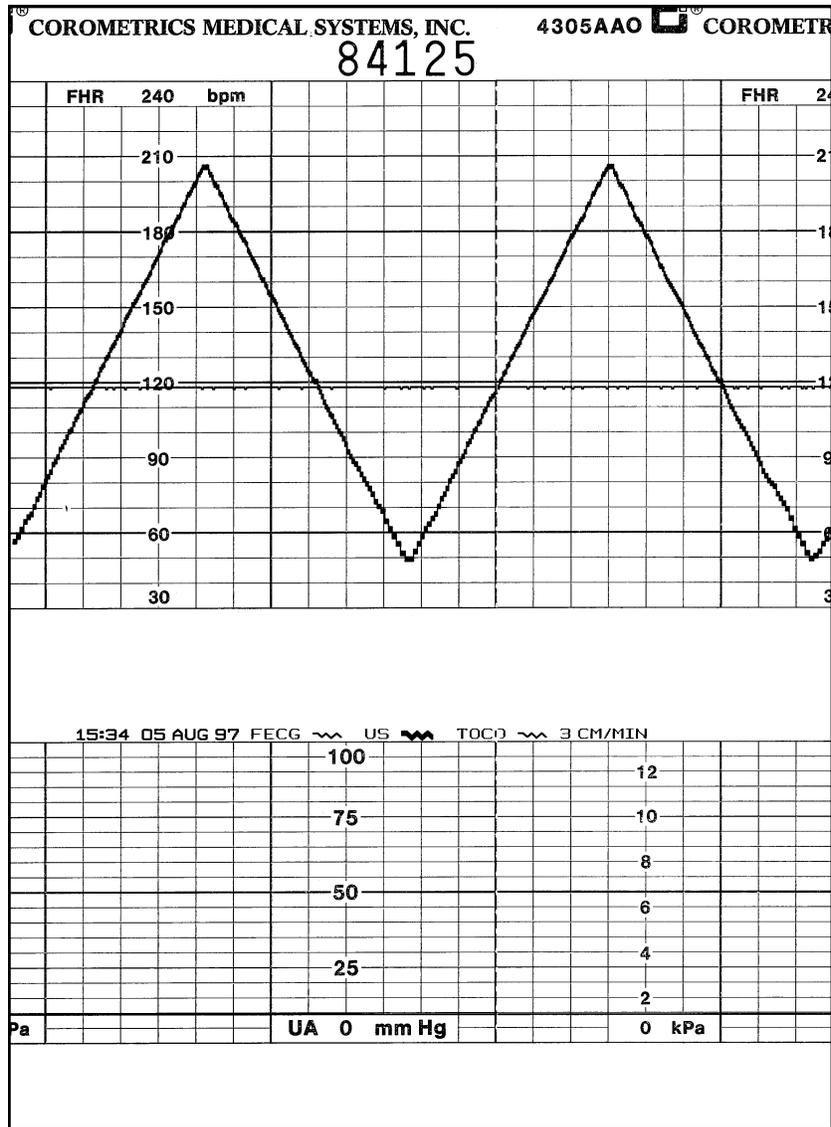


Figure 6-9. Dual Heart Rate, FECCG and US

### Dual Ultrasound Modes

As stated previously, the dual ultrasound mode of the 120 Series Monitor cannot be tested unless two Model 325 Simulators are used or two Model 116/118/120 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, depress 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 mode shows **US**.
  - The FHR2 mode shows **US2**.
  - 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 plain black (—∩∩).

## ALARM TEST

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

1. Connect the FECG/MECG adapter cable to the **FECG/MECG** input receptacle on the 120 Series Monitor.
2. Connect the Model 325 Simulator's ECG sub-cable to the adapter's **MECG** input.
3. Use the Trim Knob control to access the MHR/P Setup screen.
4. Set the MHR/P source to MECG.
5. Set the MHR/P high alarm limit value to 120 bpm.
6. Set the MHR/P low alarm limit value to 60 bpm.
7. Set the MHR/P audio alarm to ON.
8. Set the alarm volume to a level you can easily hear.
9. Exit the MHR/P Setup screen.
10. Access the Master Alarm Setup screen.
11. Set the re-alarm time to 30 seconds.
12. Exit the setup screen.
13. Set the switches on the Model 305 Input Simulator according to Table 6-7.
14. Using the simulator's **Manual Adjustment** knob, input an MECG signal of 119 bpm as indicated on the monitor. Verify that there is no alarm tone sounding from the monitor's rear panel speaker.
15. Using the simulator's **Manual Adjustment** knob, increase the MECG rate to 120 bpm. Again, verify that there is no alarm tone sounding from the rear panel speaker.
16. Using the simulator's **Manual Adjustment** knob, increase the MECG rate to 121 bpm. Verify the following on the monitor:
  - The following alarm tone is emitted from the rear panel speaker: alternating high/low tones until the alarm condition is removed (following steps.)
  - The MECG value flashes.
17. Depress the monitor's front panel **Alarm Silence** pushbutton and verify the following:
  - The alarm tone is silenced.
  - The MECG value no longer flashes.

Table 6-7. Alarm Test—Model 325 Simulator Settings

SECTION	SWITCH	SETTING
FECG/MECG	Main	RATE
	Rate	MANUAL
	Mode	MECG
	QRS Amplitude	500 $\mu$ V
	QRS Polarity	+
GENERAL	Pattern Memory	OFF

## SECTION 6

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18. Wait 30 seconds and verify the following:
  - The alarm tone is once again emitted from the rear panel speaker.
  - The MECG value flashes again.
19. Depress the monitor's front panel **Alarm Silence** pushbutton again.
20. Use the simulator's **Manual Adjustment** knob to decrease the MECG rate to 120 bpm. Verify the following on the monitor:
  - The alarm tone is silenced.
  - The MECG value no longer flashes.
  - After 10 seconds, the two above conditions are still true.
21. Using the simulator's **Manual Adjustment** knob, input an MECG signal of 61 bpm. Verify that there is no alarm tone sounding from the rear panel speaker.
22. Using the simulator's **Manual Adjustment** knob, decrease the MECG rate to 60 bpm. Again, verify that there is no alarm tone sounding from the rear panel speaker.
23. Using the simulator's **Manual Adjustment** knob, decrease the MECG rate to 59 bpm. Verify the following on the monitor:
  - The alarm tone is emitted from the monitor's rear panel speaker.
  - The MECG value flashes.
24. Depress the monitor's front panel **Alarm Silence** pushbutton and verify the following:
  - The alarm tone is silenced.
  - The MECG value no longer flashes.
25. Wait ten seconds and verify the following:
  - The alarm tone is once again emitted from the rear panel speaker.
  - The MECG value flashes again.
26. Depress the monitor's front panel **Alarm Silence** pushbutton again.
27. Use the simulator's **Manual Adjustment** knob to decrease the MECG signal to 60 bpm. Verify the following on the monitor:
  - The alarm tone is silenced.
  - The MECG value no longer flashes.
  - After 10 seconds, the two above conditions are still true.