Maintenance Schedule

Maintenance Item	Maintenance Action	Maintenance Frequency	Self-Test Frequency
TOCO		as needed	
U/S Transducers		as needed	
MECG Cables		as needed	
Main Board Battery		as needed	
Monitor Exterior		as needed	
Monitor		vacuum interior	Before each monitoring session
Printhead		as needed	
Main Board power supply voltages	calibrate	annually or when the monitor operation is suspect	
Isolated power supply board voltages	calibrate	annually or when the monitor operation is suspect	
FECG/UA board voltages	calibrate	annually or when the monitor operation is suspect	
Printhead	adjust, remove	replace as needed	
Recorder board photo sensors	adjust, remove	replace as needed	
Pneumatic pressure check		annually	
Unit to primary leakage		as needed	
Patient to line leakage for ECG		as needed	
Patient to line leakage for IUP		as needed	
Patient to line leakage for $MSpO_2$		as needed	
Patient to line leakage for US		as needed	
Patient to line leakage for US2		as needed	
Ground Continuity		annually or when the monitor operation is suspect	
FECG	Measure voltage breakdown	as needed	
MECG	Measure voltage breakdown	as needed	
IUP	Measure voltage breakdown	as needed	

Maintenance Item	Maintenance Action	Maintenance Frequency	Self-Test Frequency
$MSpO_2$	Measure voltage breakdown	as needed	
US	Measure voltage breakdown	as needed	
US2	Measure voltage breakdown	as needed	
Mains to Chassis using DC voltage for 1 min.	hi-pot voltage tester 2.121 kVdc	as needed	
Display Check	Verify DSP board operation, remove, replace, upgrade	as needed	
Trimline TOCO Calibration		as needed	
Nautilus TOCO Calibration		as needed	
$MSpO_2$ Calibration		automatic	
Diagnostic Control Screen			as needed
J102 Analog DAC Static Test			as needed
RS-232C Connector Loopback Test			as needed

Visual Inspection

The monitor and its components should be carefully inspected prior to installation, once every 12 months thereafter and each time the equipment is serviced.

- Carefully inspect the equipment for physical damage to the case, the display screen, and the keypad. Do not use the monitor if damage is determined. Refer damaged equipment to qualified service personnel.
- Inspect all external connections for loose connectors or frayed cables. Have any damaged connectors or cables replaced by qualified service personnel.
- Inspect the display face for marks, scratches, or other damage. Physical damage to a flat panel display glass may pose an implosion hazard. Have the flat panel display replaced by qualified service personnel if necessary.
- Safety labels and inscription on the device are clearly legible.

NOTE: If an accessory is not listed, consult the manufacturer's instructions.

Cleaning

General care and cleaning are required for the 250cx Series Monitor and its accessories. If an accessory is not listed, consult the manufacturer's instructions.

CAUTION
Unplug the monitor from the AC power source and detach all accessories from the monitor. Do not immerse accessories in any liquid. Do not use abrasive cloth or cleaners on monitor or accessories.

Monitor Exterior

1. The exterior surfaces of the equipment may be cleaned with a dampened, lint-free cloth. Use one of the following approved solutions:
   - Commercial diluted bleach solution
   - Mild soap (diluted)
   - Commercial diluted ammonia solution

   NOTE: Always dilute cleaning solutions per manufacturers' recommendations.
2. Wipe off cleaning solutions with a clean dry cloth.
3. Do not use a cleaning substance containing wax.
4. Do not pour or spray water or any cleaning solution on the equipment or permit fluids to run behind switches, into the connectors, into the recorder, or into any ventilation openings in the equipment.
5. Do not use the following cleaning agents:
   - Abrasive cleaners or solvents of any kind
   - Acetone
   - Ketone
   - Alcohol-based cleaning agents or
   - Betadine

CAUTION
Failure to follow these rules may melt, distort, or dull the finish of the case, blur lettering on the labels, or cause equipment failures. Cleaning products known to cause the types of problems mentioned above include, but are not limited to Sani-Cloth Wipes*, Sani-Wipes*, and Ascepti Wipes*. These should be avoided. Products containing active ingredients and solutions similar to these products should also be avoided.

Display

To clean the display screen, use a soft, clean cloth dampened with a glass cleaner. Do not spray the glass cleaner directly onto the display. Do not use alcohol or hospital disinfectants like Cidex* or Betadine.

Tocotransducer and Ultrasound Transducer

CAUTIONS

ABRASION—Do not use abrasive cloth, sharp objects, or abrasive cleaners.

ALCOHOL—Do not use Alcohol in cleaning solutions.

DISCONNECTION—Detach the transducers from the monitor.

NOTE: Only Nautilus transducers are immersible.

1. Dampen a cloth or paper towel with one of the following products; then wring out until only slightly wet:
   - Sodium Hypochlorite 5.25% (Bleach) diluted 10:1
   - Cidex*
   - Sporicidin*
   - Soap and water
2. Rub soiled area until clean, taking care not to excessively wet the tocotransducer diaphragm seal. Rub around the seal.
3. Dry with a soft, dry cloth.

Leg Plates and MECG Cables

CAUTIONS

ABRASION—Do not use abrasive cloth, sharp objects, or abrasive cleaners.

ALCOHOL—Do not use Alcohol in cleaning solutions.

DISCONNECTION—Detach the cables/legplate from the monitor.

IMMERSION—Do not immerse cables or hold under running water.

*Trademarked

1. Dampen a cloth or paper towel with one of the following products; then wring out until only slightly wet:
   - Sodium Hypochlorite 5.25% (Bleach) diluted 10:1
   - Cidex*
   - Sporicidin* Soap and water
2. Rub soiled area until clean.
3. Dry with a soft, dry cloth.

Maternal NIBP Cuffs and Hoses

General

The cuff must be thoroughly cleaned with the specified detergent before reuse. The additional use of household bleach as described below provides at least intermediate-level disinfection.

- Apply cuff hose plugs before cleaning.
- The following cleansing procedure was repeated 20 times on DURA-CUF® Blood Pressure Cuffs and once on SOFT-CUF® Blood Pressure Cuffs without affecting the performance of the cuff.
- While this procedure is adequate for cleaning/disinfection, it may not remove all stains.
- Do ***not*** immerse hoses.
- Do ***not*** immerse cuffs without prior application of cuff hose caps.

Materials

- Enzymatic detergent such as ENZOL* enzymatic detergent (US) or Cidezyme* enzymatic detergent (UK)
- Distilled water
- 10% solution of household bleach (5.25% sodium hypochlorite) in distilled water
- Soft cloths and soft-bristled brushes
- Spray bottles

Procedure

1. Prepare the enzymatic detergent according to the manufacturer's instructions and the 10% bleach solution, in separate spray bottles.
2. Spray the detergent liberally on device. If the material is dried on, allow the cuff to sit for 1 minute. For soil on the soft part of the closure or the cuff itself, wipe the material off with a soft cloth. For persistent contamination on the soft part of the closure, use a soft-bristled brush to loosen particles. Rinse with copious amounts of distilled water. Repeat until no visible contamination remains. For soil on the hook part of the closure, use a soft-bristled brush to remove the material, and rinse with copious amounts of distilled water. Repeat until no visible contamination remains.

*Trademarked

3. Spray the 10% bleach solution on the affected area until the area is saturated. Allow the cuff to sit for 5 minutes.
4. Wipe away any excess solution and rinse the cuff again with distilled water. Allow 2 hours for drying.

The user has the responsibility to validate any deviations from the recommended method of cleaning and disinfection.

For additional information on infection control procedures, contact GE Medical Systems *Information Technologies* Technical Support.

SpO_2 Sensors

Adhesive sensors are sterile and for single use only. Reusable sensors should be cleaned before reuse with a 70% alcohol solution. If low-level disinfection is required, use a 1:10 bleach solution. Do not use undiluted bleach (5% - 5.25% sodium chlorite) or any cleaning solution other than those recommended here because permanent damage to the sensor could occur. Do not sterilize the sensor by irradiation, steam, or ethylene oxide. If disposable sensors or their packaging are damaged, they must be disposed of as advised in this appendix.

To clean or disinfect the sensor:

1. Saturate a clean, dry gauze pad with the cleaning solution. Wipe all surfaces of the sensor and cable with this gauze pad.
2. Saturate another clean, dry gauze pad with sterile or distilled water. Wipe all surfaces of the sensor and cable with this gauze pad.
3. Dry the sensor and cable by wiping all surfaces with a clean, dry gauze pad.

Periodic Thermal Printhead Cleaning

The thermal printhead heater elements must be cleaned at regular intervals to remove any accumulated paper dust. The heater elements may be cleaned with methanol or isopropyl alcohol. Care must be taken to avoid touching the heater elements with bare hands.

CAUTION
AIR DRYING – Allow to air dry completely prior to using the monitor.

Cleaning the UA Strain Gauge

1. Remove the plastic dome.
2. If desired, wash the transducer with sterile water or saline solution.
3. Carefully clean the diaphragm seal with a cotton swab to remove deposits. Avoid excessive pressure since this may damage the diaphragm. If there are excessive stains on the diaphragm or sides of the transducer, remove with a cotton swab and solvents of increasing strength.

4. After cleaning, rinse the transducer thoroughly in distilled water and replace the dome loosely.
5. Dry the transducer with sterile gauze.

CAUTIONS
AUTOCLAVE—Do not autoclave pressure transducer.

IMMERSION—Do not immerse any part of the electrical connector of the transducer in the cleaning solution at any time. Examine the outer sheath of the cable for perforations. If the outer covering is damaged in any way, do not immerse the cable in the cleaning solution; this may result in moisture entering the transducer case, which is vented through the cable.

WARNING
LIQUIDS—If liquids enter the electrical connector, check the resistance between the electrical element and the transducer case. A resistance level of greater than 10 M¾ ensures that the leakage current is within acceptable levels for safe use on patients.

6. Leave transparent dome attached to the transducer during storage, but slacken the locking ring at least one quarter of a turn.

CAUTION
STERILIZATION—Prior to patient use, ensure the dome is sterile.

Disposal of Product Waste

As you use the 250cx Series monitor, you will accumulate solid wastes that require proper disposal or recycling. These include patient applied parts and packaging material.

Patient Applied Parts

Certain patient applied parts, such as those with adhesive (disposable SpO_2 sensors), are intended for single use and should be disposed of properly as medical waste in accordance with regional body controlled guideline.

Other patient applied parts, such as blood pressure cuffs, should be cleaned according to instructions. Inspect reusable applied parts for wear, replace as necessary, and dispose of used product as medical waste in accordance with regional body controlled guideline.

Packaging Material

Retain original packaging materials for future use in storing or shipping the monitor and accessories. This recommendation includes corrugated shippers and inserts.

Whenever possible recycle the packaging of accessories and patient applied parts.

Monitor

At the end of its service life, the product described in this manual, as well as its accessories, must be disposed of in compliance with the guidelines regulating the disposal of such products. If you have questions concerning disposal of the product, please contact GE Medical Systems *Information Technologies* or its representatives.

Electrical Safety Tests

Refer to the "Preventative Maintenance Inspection Report" on page 4-55 for required tools to perform all electrical safety tests in this section.

IMPORTANT

UNITS OF MEASURE—The specified leakage tester (E278-06) measures in mV. There is a direct correlation of mV to μA. In other words, on this text fixture, 1 mV = 1 μA.

220/230/240 VAC POWER CORD—For 220/230/240 VAC testing, use only P/N 600034 line cord to power the E278-06 test fixture.

Initial Conditions

1. Attach the monitor power cord to the leakage test fixture.
2. Verify that the leakage test fixture's main AC power cord is attached.

AC Line

1. With the leakage tester connected to power, connect the monitor's power cord to the leakage tester and turn monitor power on.
2. Select the leakage tester's setting to measure the line voltage.
3. Record the resulting reading in Electrical Safety section of the Preventative Maintenance Report.

Ground Impedance

1. With the leakage tester connected to power, connect the monitor's power cord to the leakage tester and turn monitor power on.
2. Select the leakage tester's setting to measure resistance.

3. Connect the leakage tester's external lead to the equipotential lug on the rear of the monitor.
4. Verify and record the results in Electrical Safety section of the Preventative Maintenance Report.

Chassis Leakage

1. With the leakage tester connected to power, connect the monitor's power cord to the leakage tester and turn monitor power on.
2. Select the leakage tester's setting to measure chassis leakage as appropriate.
3. Connect the leakage tester's external lead to the equipotential lug on the rear of the monitor.
4. Verify and record the results in Electrical Safety section of the Preventative Maintenance Report.

Patient-to-Ground Leakage for MECG/FECG

1. With the leakage tester connected to power, connect the monitor's power cord to the leakage tester.
2. Connect ECG leads to the leakage tester.
3. Select the leakage tester's settings to measure Lead-to-Ground leakage current for all leads as appropriate.
4. Turn on the monitor.
5. Verify and record the results for all conditions listed in Electrical Safety section of the Preventative Maintenance Report.

Patient-to-Line (ISO) Leakage for MECG/FECG

1. With the leakage tester connected to power, connect the monitor's power cord to the leakage tester.
2. Connect ECG leads to the leakage tester.

NOTE: Both MECG and FECG must be tested, which will require Y cable part # 1442AAO and ECG patient lead part # 1554AAO or 1554BAO as appropriate.

3. Select the leakage tester's settings to measure Lead-to-Line leakage current for all leads as appropriate.
4. Turn on the monitor.
5. Apply line voltage by pressing the appropriate leakage tester control.
6. Verify and record the results for all conditions listed in Electrical Safety section of the Preventative Maintenance Report

Patient-to-Ground Leakage for IUP/Toco

1. With the leakage tester connected to power, connect the monitor's power cord to the leakage tester.
2. Connect the transducer to the monitor.
3. Wrap the transducer in aluminum foil or immerse in normal saline solution.
4. Select the leakage tester's settings to measure Lead-to-Ground leakage current for all leads as appropriate.
5. Connect the leakage tester external clip lead/Probe and connect/immerse as appropriate.
6. Verify and record the results for all conditions listed in Electrical Safety Report.

Patient-to-Line (ISO) Leakage for IUP/Toco

1. With the leakage tester connected to power, connect the monitor's power cord to the leakage tester.
2. Connect the transducer to the monitor.
3. Wrap the transducer in aluminum foil or immerse in normal saline solution.
4. Select the leakage tester's settings to measure Lead-to-Line leakage current for all leads as appropriate.
5. Connect the leakage tester external clip lead/Probe and connect/immerse as appropriate.
6. Apply Line Voltage by pressing the appropriate leakage tester control.
7. Verify and record the results for all conditions listed in Electrical Safety section of the Preventative Maintenance Report.

Patient-to-Ground Leakage for US1/US2

1. With the leakage tester connected to power, connect the monitor's power cord to the leakage tester.
2. Connect the transducer to the monitor.
3. Wrap the transducer in aluminum foil or immerse in normal saline solution.
4. Select the leakage tester's settings to measure Lead-to-Ground leakage current for all leads as appropriate.
5. Connect the leakage tester external clip lead/Probe and connect/immerse as appropriate.
6. Verify and record the results for all conditions listed in Electrical Safety section of the Preventative Maintenance Report.

Patient-to-Line (ISO) Leakage for US1/US2

1. With the leakage tester connected to power, connect the monitor's power cord to the leakage tester.
2. Connect the transducer to the monitor.
3. Wrap the transducer in aluminum foil or immerse in normal saline solution.
4. Select the leakage tester's settings to measure Lead-to-Line leakage current for all leads as appropriate.
5. Connect the leakage tester external clip lead/Probe and connect/immerse as appropriate.
6. Apply Line Voltage by pressing the appropriate leakage tester control.
7. Verify and record the results for all conditions listed in Electrical Safety section of the Preventative Maintenance Report.

Patient-to-Ground Leakage for SpO_2

1. With the leakage tester connected to power, connect the monitor's power cord to the leakage tester.
2. Connect Simulator Cable 2006036 to the monitor.
3. Connect the leakage tester external lead to the Simulator cable.
4. Select the leakage tester's settings to measure Lead-to-Ground leakage current as appropriate.
5. Power the monitor on.
6. Verify and record the results for all conditions listed in Electrical Safety section of the Preventative Maintenance Report.

Patient-to-Line Leakage for SpO_2

1. With the leakage tester connected to power, connect the monitor's power cord to the leakage tester.
2. Connect Simulator Cable 2006036 to the monitor.
3. Connect the leakage tester external lead to the Simulator cable.
4. Select the leakage tester's settings to measure Lead-to-Line leakage current as appropriate.
5. Power the monitor on.
6. Verify and record the results for all conditions listed in Electrical Safety section of the Preventative Maintenance Report.

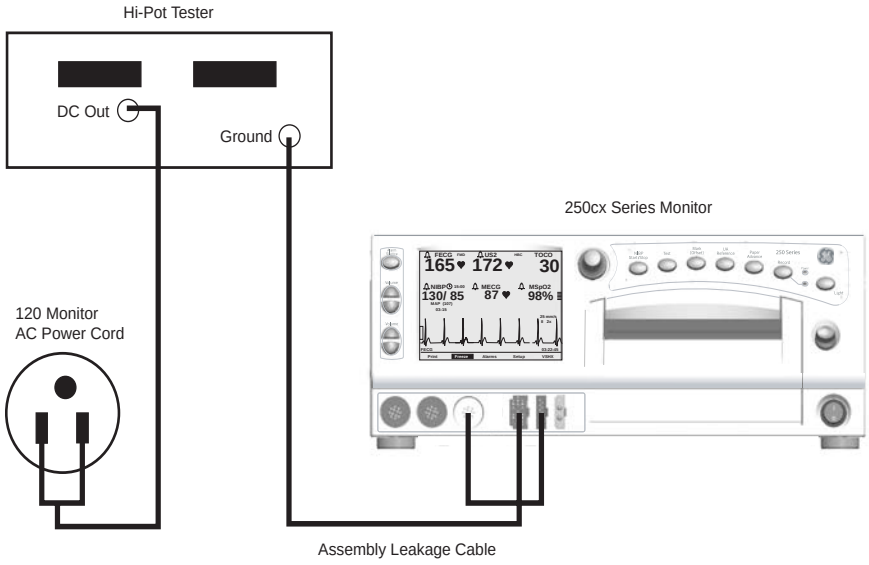
Dielectric (Hi-Pot) Tests

CAUTION
POWER OFF—Turn off the monitor prior to performing any of the hi-pot tests.

Patient–to–AC-Line Using DC Voltage for 1 Minute

Connect the monitor to the hi-pot tester as shown on in the figure below.

NOTE: The hi-pot tester voltage is 5.656 kVdc.



Patient–to–AC-Line Using DC Voltage for 1 Minute (5.656 kVdc)

- **FECG:** Connect an FECG test body to the monitor's front panel ECG input. The FECG test body can be the assembly leakage cable. Measure the voltage breakdown.
  ☐ pass ☐ fail
- **MECG:** Connect an ECG test body to the monitor's front panel ECG input. The MECG test body can be a shorted MECG cable or the assembly leakage cable. Measure the voltage breakdown.
  ☐ pass ☐ fail
- **IUP:** Connect an IUP test body to the monitor's front panel UA input. The IUP test body can be a SensorTip cable (wrapped in aluminum foil) or the assembly leakage cable. Measure the voltage breakdown.
  ☐ pass ☐ fail
- **$MSpO_2$:** Connect an $MSpO_2$ test body to the monitor's front panel $MSpO_2$ input. The $MSpO_2$ test body can be an $MSpO_2$ cable and sensor (wrapped in aluminum foil) or the assembly leakage cable. Measure the voltage breakdown.

☐ pass ☐ fail

- **US:** Connect an US test body to the monitor's front panel US input. The US test body should be an ultrasound transducer wrapped in aluminum foil. Measure the voltage breakdown.

  ☐ pass ☐ fail

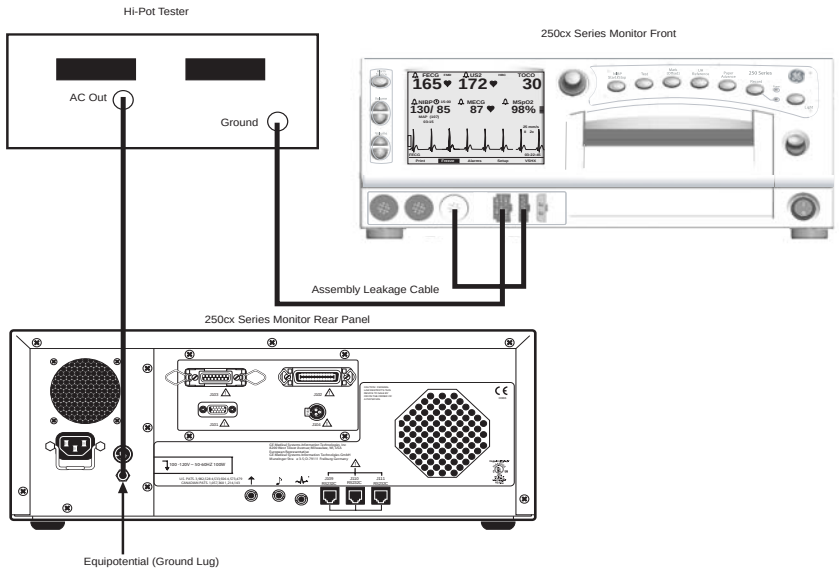
- **US2:** Connect an US test body to the monitor's front panel US2 input. The US test body should be an ultrasound transducer wrapped in aluminum foil. Measure the voltage breakdown.

  ☐ pass ☐ fail

Patient–to–Chassis Using AC Voltage for 1 Minute

Connect the monitor to the hi-pot tester as shown below.

NOTE: The hi-pot tester voltage is 2.5 kVAC.



Patient–to–Chassis Using AC Voltage for 1 Minute (2.5 kVAC)

- **FECG:** Connect an FECG test body to the monitor's front panel ECG input. The FECG test body can be the assembly leakage cable. Measure the voltage breakdown.

  ☐ pass ☐ fail

- **MECG:** Connect an ECG test body to the monitor's front panel ECG input. The MECG test body can be a shorted MECG cable or the assembly leakage cable. Measure the voltage breakdown.

  ☐ pass ☐ fail

- **IUP:** Connect an IUP test body to the monitor's front panel UA input. The IUP test body can be a SensorTip cable (wrapped in aluminum foil) or the assembly leakage cable. Measure the voltage breakdown.

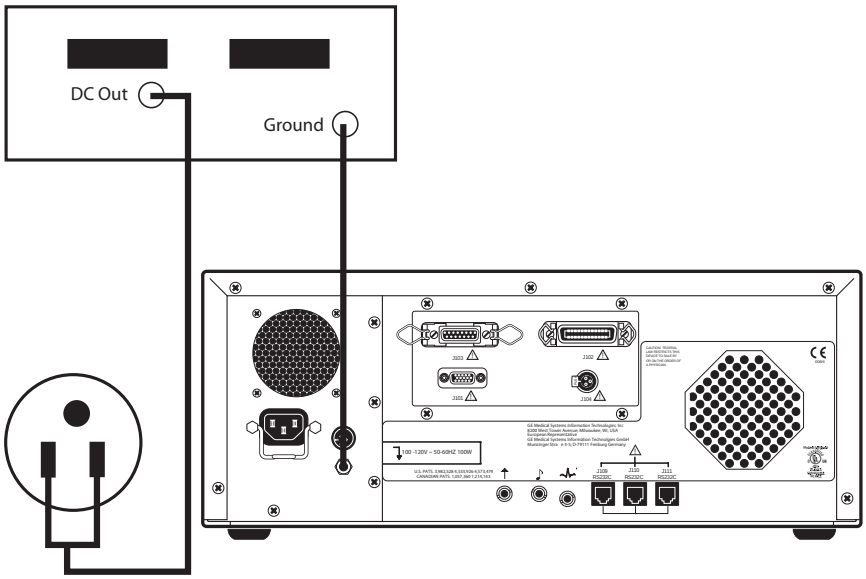
☐ pass ☐ fail

- **$MSpO_2$:** Connect an $MSpO_2$ test body to the monitor's front panel $MSpO_2$ input. The $MSpO_2$ test body can be an $MSpO_2$ cable and sensor (wrapped in aluminum foil) or the assembly leakage cable. Measure the voltage breakdown.
  ☐ pass ☐ fail
- **US:** Connect an US test body to the monitor's front panel US input. The US test body should be an ultrasound transducer wrapped in aluminum foil. Measure the voltage breakdown.
  ☐ pass ☐ fail
- **US2:** Connect an US test body to the monitor's front panel US2 input. The US test body should be an ultrasound transducer wrapped in aluminum foil. Measure the voltage breakdown.
  ☐ pass ☐ fail

Mains–to–Chassis Using DC Voltage for 1 Minute

Connect the monitor to the hi-pot tester as shown in the following figure.

NOTE: The hi-pot tester voltage is 2.121 kVdc.



Mains-to-Chassis Using DC Voltage for 1 Minute

Checkout

General

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.

Equipment Required

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

- Corometrics Model 325 Simulator and corresponding line cord
- 250cx Series Monitor interconnect cables
- Ultrasound Transducers (x2)
- Tocotransducer
- Strain Gauge Transducer

Self-Test Routine

The 250cx Series Monitor contains test routines which verify the unit's calibration and internal circuitry. These routines are initiated by depressing the front panel Test button. 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 250cx Series Monitor and ensure it matches the line voltage of the connector 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* (l) position. When the power is first turned on, verify that two tones are emitted from the rear panel speaker and the green power on indicator is lit.
3. Depress the front panel Test button and verify the following:
   - All display pixels illuminate for 1 second and then all are extinguished for 1 second. Afterwards, a horizontal line moves across the screen from top to bottom, followed by a vertical line moving from left to right.
   - The yellow Record indicator illuminates.

NOTE: The message *TEST: ARE ALL DOTS PRINTED?* prints followed by two lines which should appear continuous. Discontinuous lines may be an indication of damaged printhead elements or dust and debris accumulated under the printhead 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.

   - 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 input level and displays this value in the UA display area; the mode title displays *Test.*

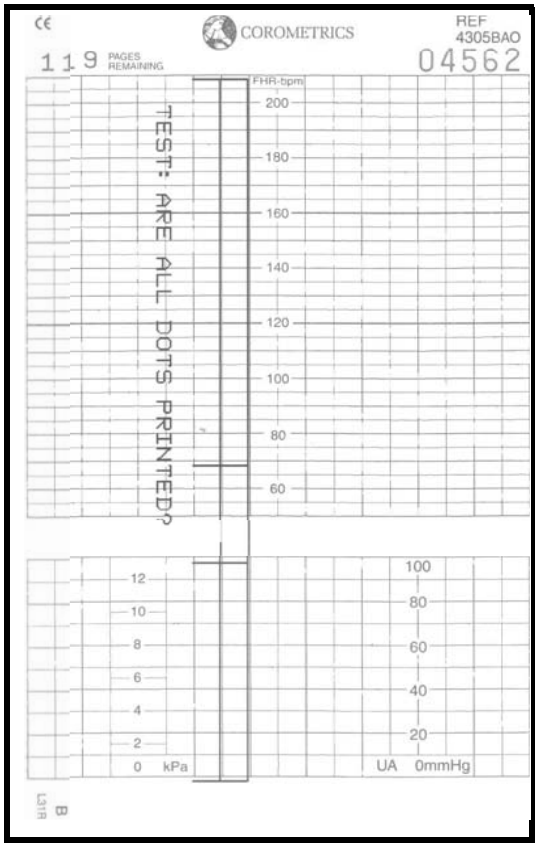
- If MECG is the selected waveform, a simulated waveform appears on the display.

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.

NOTE: The recorder returns to its original on, off, or maternal-only mode state from when the Test button was depressed.

NOTE: To disable the test, depress the Test button 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 paper scale (*30-240 bpm* or *50-210 bpm*) setting matches the type of paper being used, i.e., 30 bpm/cm or 20 bpm/cm. (Refer to"Install Options Screens" on page 3-14.)



250cx Series Self-Test

Front Panel Button Test

This procedure ensures the functionality of the front panel buttons.

1. Apply power to the 250cx Series Monitor.
2. Disconnect all transducers from the front panel.
3. Depress the monitor's Record button and verify the following:
   - The yellow indicator next to the button illuminates continuously.
   - The recorder paper should advance 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 "Setup" on page 3-9 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.
4. Depress and hold the monitor's front panel Paper Advance button and verify that the recorder paper advances at a rate of 40 cm/min by measuring.
5. Release the Paper Advance button and verify that the recorder prints the message *1 cm/min* by measuring.
6. Access the *Install Options Screen 1* again, and follow Steps 3 - 6, performing the same tests on the other two options: *2 cm/min* and *3 cm/min.*
7. Depress the monitor's front panel Mark [Offset] button and verify that an event mark (↑) is printed on the lowest portion of the HR scale on the recorder paper.

Connecting the Simulator

This part of the procedure prepares the simulator for use.

NOTE: You must use a Model 325 Simulator and 1442AAO cable "Y" adapter for the functional checkout procedure. (305 simulators do not work with the 250cx Series.)

1. Ensure the Model 325 Power switch is in the *off* position.
2. Connect the Model 325 Simulator's power cord to the power connector 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 250cx 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/adapter: ECG, US, and UA.
7. Turn *on* the Model 325 Simulator. Verify that the green Power indicator illuminates.
8. Turn *on* the 250cx 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 cable to the MECG connector on the monitor adapter cable (1442AAO).
2. Connect the simulator's UA cable to the UA connector on the monitor.
3. Set the switches on the Model 325 Input Simulator according to Table 2.
4. If not already on, depress the monitor's Record button.
5. Turn the simulator's Manual Adjustment knob counterclockwise and verify the following on the monitor's display until the monitor reads a value of 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 2* and note the *Default TOCO Reference* value. Exit the service mode by selecting *Restart* at the bottom of the screen.
7. After the monitor restarts, press the monitor's front panel UA Reference button.
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 message UA REF on the strip chart paper.
9. Turn the simulator's Manual Adjustment knob until the monitor displays 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 (1 per second).
   - The ECG "beep" volume can be heard from the rear panel speaker. The volume can be adjusted on the MHR/P Setup screen.
   - Or using the Volume increase/decrease buttons, set *HR/PR Trace* to *On* in the *MHR/P Setup* screen The recorder should print a continuous line at 60 bpm on the top grid of the strip chart paper.

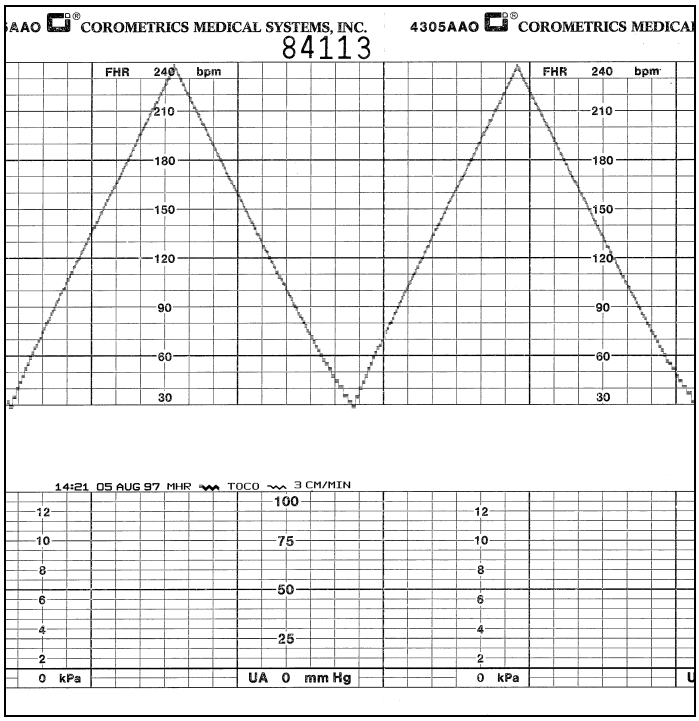
Table 2. MECG Test Simulator Settings		
Section	Switch	Setting
FECG/MECG	Rate/CMR	RATE
	Rate	MANUAL
	Mode	MECG
	QRS Amplitude	500 µV
	QRS Polarity	+
GENERAL	Pattern Memory	*Off*
UA	Main	CMR
	Mode	TOCO

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 on "MECG Ramp" on page 4-22.)
13. Set the simulator's ECG Rate switch to the Δ15 position. Verify the following on the monitor:
    - The MHR value alternates between two rates 15 bpm apart on the recorder printout.
    - 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 110 and 125 bpm on the top grid of the strip chart paper. (Refer to "MECG Oscillation" on page 4-22.)
    - Repeat Step 13 for rate values of Δ22 and Δ27. The results should be the same except that the MHR value alternates between two rates 22 bpm or 27 bpm apart and the recorder prints an oscillation of 22 or 27 bpm. The top value is always at approximately 125 bpm. (Refer to "MECG Oscillation" on page 4-22.)

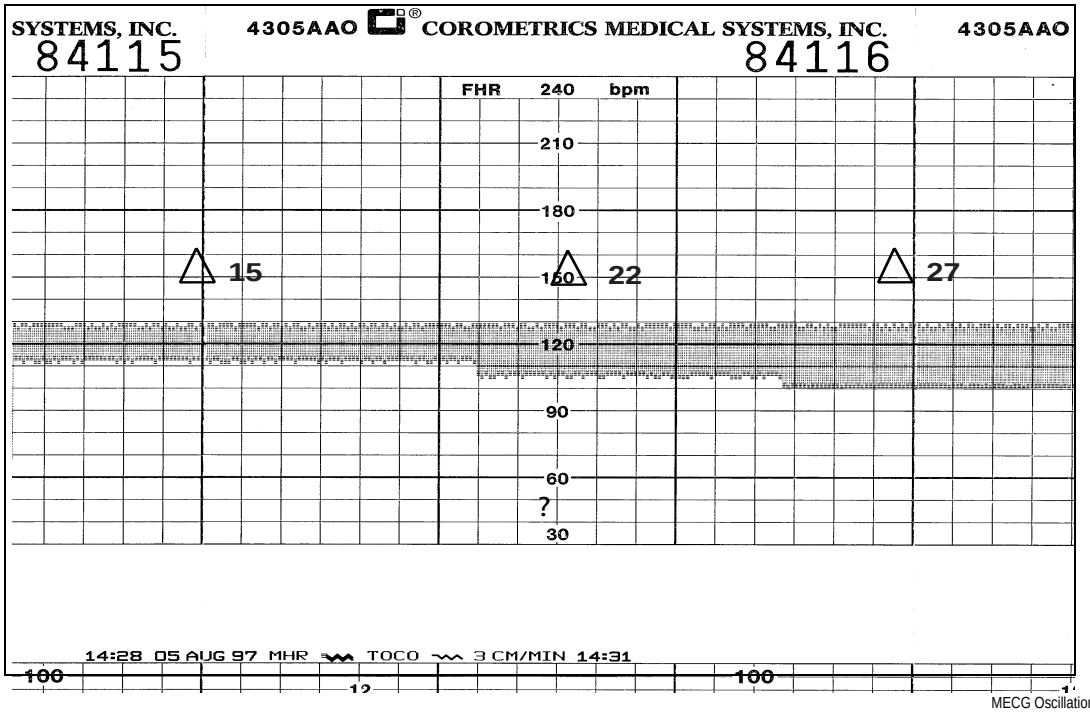
■ Set the simulator's ECG Rate switch to the MANUAL position and the Manual Adjustment knob to the counterclockwise position. Disconnect the ECG simulator cable from the monitor's y-adapter cable. Verify the following on the monitor:
    - The *MHR/P* value and *Pulse* mode are both blank.
    - The 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.

14. Set the simulator's ECG Mode switch to the *Off* position.



MECG Ramp



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.

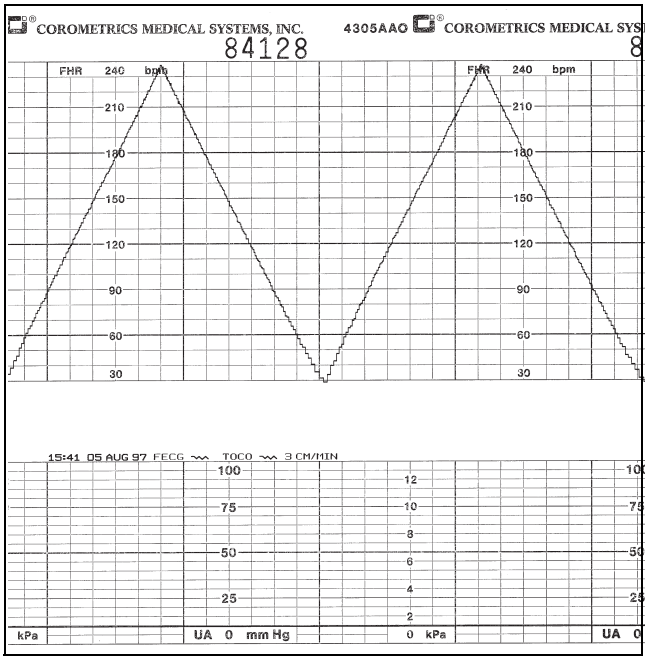
1. Connect the simulator's ECG cable to the FECG connector on the monitor's "Y" adapter cable.
2. Connect the simulator's UA cable to the UA connector on the monitor.
3. Set the switches on the Model 325 Input Simulator according to Table 2.
4. If not already on, depress the monitor's Record button.
5. Turn the simulator's Manual Adjustment knob counterclockwise and verify the following on the monitor's display:
   - The FECG value is 30 bpm.
   - The FECG mode is FECG.
   - The FECG 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 button and release when the UA value shows 10 relative units in mmHg mode or 1.3 kPa in kPa mode. Verify the following on the monitor:
   - The UA value is referenced to 10 mmHg (1.3 kPa) on the display.
   - The recorder prints a continuous line at 10 mmHg (1.3 kPa) on the bottom grid of the strip chart paper.
   - The recorder prints the messages 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 FECG value is 120 bpm.
   - FECG 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 buttons. (Set the volume to the desired level.)
   - The recorder prints a continuous line at 120 bpm on the *HR* grid of the strip chart paper.

Table 3. FECG Test Simulator Settings		
Section	Switch	Setting
FECG/MECG	Rate/CMR	RATE
	Rate	MANUAL
	Mode	FECG
	QRS Amplitude	15 µV
	QRS Polarity	+
GENERAL	Pattern Memory	*Off*
UA	Main	CMR
	Mode	TOCO

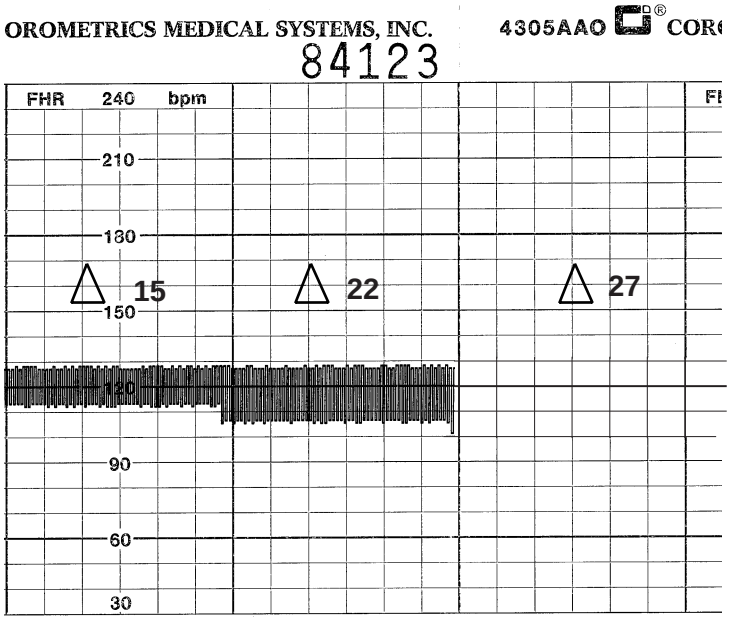
8. Repeat Step 7 for each of the following rates: 30, 60, 210, and 240 bpm.
9. Change the simulator's QRS Polarity switch from + to –. Verify that the monitor does not skip any beats.
10. Set the simulator's ECG Rate switch to the RAMP setting. Verify that the monitor's FECG value counts between approximately 30 and 240 bpm and that the recorder prints a ramp between the same values. (Refer to "FECG Ramp" on page 4-25.)
11. Access *Install Options Screen 2* and set ECG Artifact Elimination to *Off*; then exit the service mode by selecting *Restart* at the bottom of the screen.
12. Set the simulator's ECG Rate switch to the Δ15 position. Verify the following on the monitor:
    - The FECG value alternates 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 110 and 125 bpm on the top grid of the strip chart paper. (Refer to "FECG Artifact Elimination" on page 4-26.
13. Repeat Step 12 for rates values of Δ22 and Δ27. The results should be the same except that the FHR1 value alternates by either 22 or 27 bpm and the recorder prints an oscillation of 22 or 27 bpm. The top value is always at approximately 125 bpm. (Refer to figure "FECG Artifact Elimination" on page 4-26.)
14. Access *Install Options Screen 2* and set the *FECG Artifact Elimination* to *On*.
15. Set the simulator's ECG Rate switch to the Δ15 position. Verify the following on the monitor:
    - The FHR1 value alternates 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 110 and 125 bpm on the top grid of the strip chart paper. (Refer to figure “FECG Artifact Elimination” on page 4-26.)

16. Repeat Step 15 for the rate value of Δ22. The result should be the same as Step 15 except that the FHR1 value alternates between 22 bpm and the recorder prints an oscillation of 22 bpm between the 103 and 125 bpm on the strip chart recorder paper.
17. Set the simulator’s ECG Rate switch to the Δ27 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 *Install Options Screen 2* and set the *FECG Artifact Elimination* back to *Off*.
19. Set the simulator’s ECG Rate switch to the MANUAL position and the Manual Adjustment knob to the counterclockwise position. Disconnect the ECG simulator 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.
    - Set the simulator’s ECG Mode switch to the *Off* position.



FECG Ramp



FECG Artifact Elimination

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 cable to the US connector on the monitor.
2. Set the switches on the Model 325 Input Simulator according to Table 4.
3. If not already on, depress the monitor's Record button.
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 upper-left pair of Volume buttons. (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 "Ultrasound Ramp" on page 4-28.)

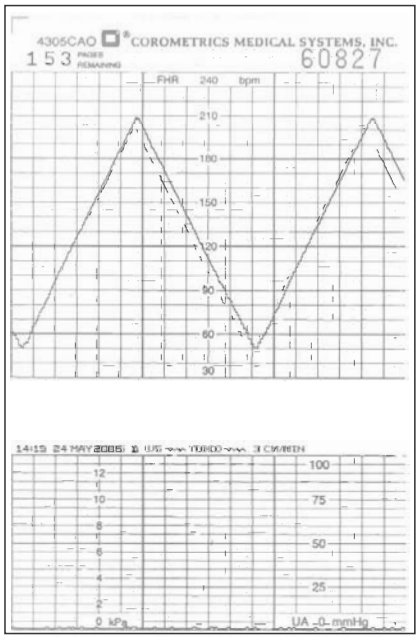
Table 4. Ultrasound Test Simulator Settings

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 ± 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.

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.



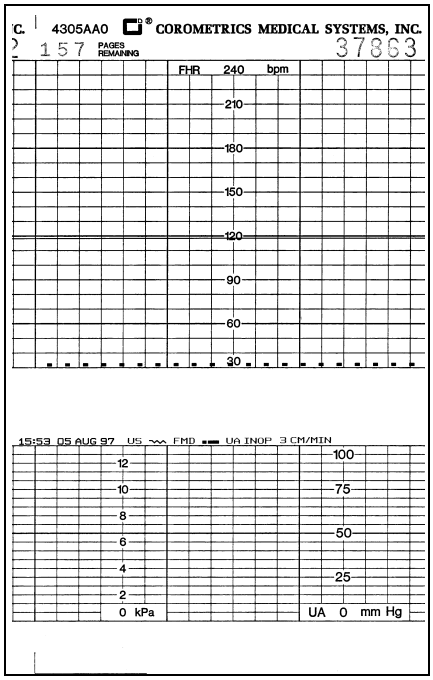
Ultrasound Ramp

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 “Fetal Movement Detection” on page 4-29.)

1. Connect the simulator’s US cable to the US connector on the monitor. Select the FHR2 mode field. Ensure *FM Detect* is *On*.
2. Set the switches on the Model 325 Input Simulator according to Table 5.
3. If not already on, depress the monitor’s Record button.
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 if alerts are not enabled.
   - 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 upper-left pair of Volume buttons. (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 1 second, then off for 8 seconds, then on for 1 second, etc.
   - The recorder prints the messages US and FMD - — on the center margin of the strip chart paper after approximately 20 seconds.

Table 5. Fetal Movement Detection Test Simulator Settings		
Section	Switch	Setting
Ultrasound/FMD	Mode	US/FMD
	Signal Level	MED
	Rate	MANUAL
UA	Main	CMR
	Mode	TOCO



Fetal Movement Detection

Ultrasound Transducer Test

1. Inspect an ultrasound transducer as follows:
   - Ensure there are no cracks around the transducer face.
   - Visibly inspect the condition of the cable, strain relief, and connector pins.
2. Disconnect the simulator's ultrasound cable from the front panel of the 250cx Series Monitor.
3. Connect the ultrasound transducer to either the US or US2 input connector 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, *INOP* 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.

Uterine Activity Test

This portion of the functional checkout procedure tests the uterine activity section of the 250cx Series Monitor.

1. Set the switches on the Model 325 Simulator according to Table 6, "Uterine Activity Test Simulator Settings," on page 4-31.
2. Connect the simulator's UA cable to the UA connector on the monitor.
3. Access the *Install Options Screen 2* and select *Pressure units*: *mmHg* mode.
4. Access the *Install Options Screen 2* and note the *Default TOCO Reference* value. (The monitor is shipped from the factory with this value set at 10 mmHg (1.3 kPa); however, your unit may have been custom configured.) Exit the service mode by selecting *Restart* at the bottom of the screen.
5. If not already on, depress the monitor's Record button.
6. Briefly press the monitor's UA Reference button. 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 *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 in mmHg mode. Test each of these reference settings. Verify that the UA value is

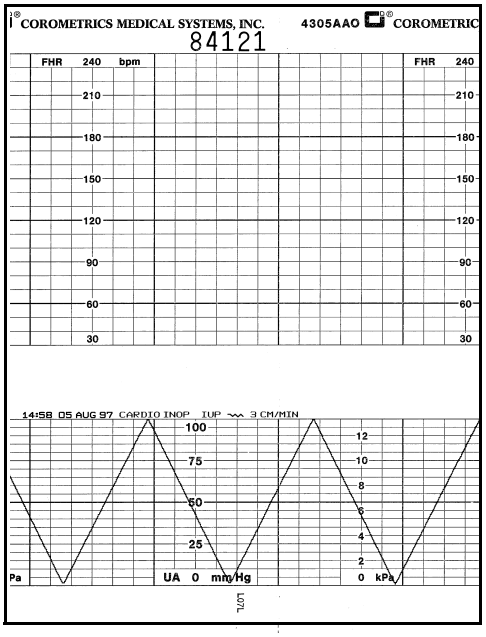
displayed accordingly and that the recorder prints a continuous line at the corresponding value on the uterine activity channel of the strip chart paper.

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.
9. Place the simulator's UA Mode switch in the IUP position and the UA Level switch to 0 mmHg/kPa. Depress the monitor's UA Reference button and verify that the monitor and recorder reference to 0 mmHg/kPa. 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 *UA REF* on the strip chart paper.

Table 6. Uterine Activity Test Simulator Settings

Section	Switch	Setting
UA	Pattern Memory	*Off*
	Main	LEVEL
	Level	0 mmHg
	Mode	TOCO

10. 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.
11. 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 "Uterine Activity Ramp" on page 4-32.
12. Disconnect the Model 325 simulator's UA cable from the UA input connector on the front panel of the monitor. Verify the following on the monitor:
    - The UA value and IUP 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.



Uterine Activity Ramp

Testing the Tocotransducers

CAUTIONS

LEAKAGE TEST—Perform a leakage and dielectric test on the tocotransducer per applicable standards.

FUNCTIONAL TEST—Perform a functional response test on the tocotransducer. Inspect a Nautilus Tocotransducer as follows:

1. Check for any cracks or contaminants on the tocotransducer especially on the diaphragm located on the bottom of the tocotransducer. Visibly inspect the condition of the cable, strain relief, and connector pins.
2. Connect the tocotransducer to the UA input connector on the front panel of the 250cx Series Monitor.

IMPORTANT

TRIMLINE TOCOTRANSDUCER—If you are using an older Trimline tocotransducer for this test, be advised of the following. 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 button. If the monitor is *off*, you ***must*** wait at least 10 seconds from the time the monitor is powered *on*.

3. Access the *Install Options Screen 2* and note the *Default TOCO Reference* setting. Exit the service mode by selecting *Restart* at the bottom of the screen.
4. Momentarily depress the monitor's UA Reference button. 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. Place tocotransducer upside down (diaphragm up) and level. Place a 52.5 g weight (part # 2003005-001) on the center of the diaphragm and record the resulting UA value.
7. Verify the difference between the default setting and the 52.5 g reading is 15± (2.0 mmHg (±kPa). Units are relative and scaled to match IUP units configured in Pressure Units system default.
8. Remove the tocotransducer from the monitor's UA input connector. Verify the following on the monitor:
   - The UA value and INOP 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 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 connector on the front panel of the 250cx 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 OFFSCALE* on the bottom of the *UA* scale on 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 button and verify the following on the monitor:
   - The UA value is 0 mmHg (0 kPa).
   - The recorder prints a continuous line at 0 mmHg (0 kPa) 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.

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 Model 250cx Series 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.

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 connectors 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 button.
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.

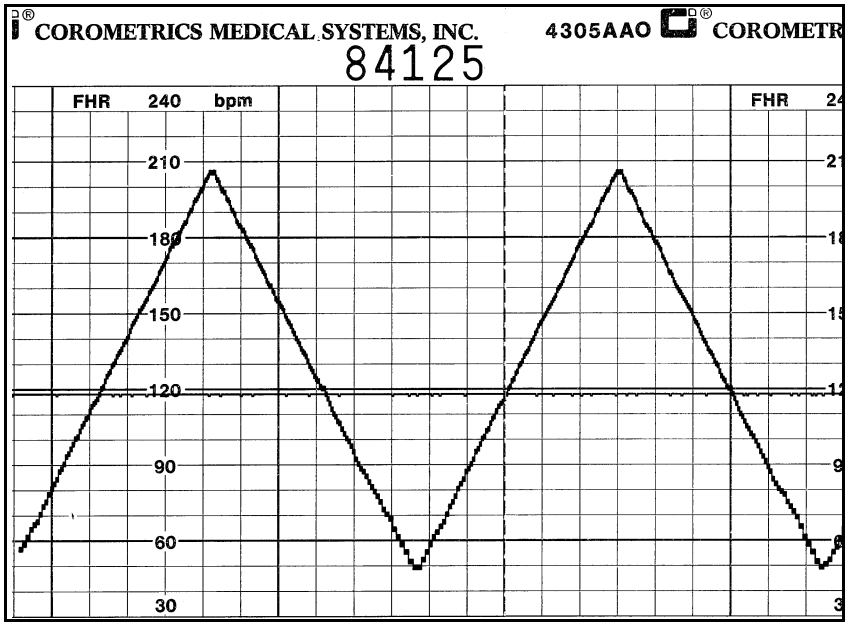
Dual Heart Rate Test (Non-Pattern)

FECG/US Modes

1. Connect the FECG/MECG adapter cable to the FECG/MECG connector on the 250cx Series Monitor.
2. Connect the Model 325 Simulator's ECG cable to the FECG input on the monitor's "Y" adapter cable.
3. Connect the simulator's US cable to the monitor's US input connector.
4. Set the switches on the Model 325 Simulator according to Table 7.
5. If not already on, depress the monitor's Record button.
6. Verify the following on the monitor:
   - The FHR1 value reads 120 bpm ± 1 bpm.
   - The FHR1 mode reads FECG.
   - 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 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 "Dual Heart Rate, FECG and US" on page 4-36.)
   - 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 "Dual Heart

Rate, FECG and US" on page 4-36.)

Table 7. Dual Heart Rate Test (Non-Pattern) Simulator Settings		
Section	Switch	Setting
FECG/MECG	Rate/CMR	RATE
	Rate	120 bpm
	Mode	FECG
	QRS Amplitude	50 µV
	QRS Polarity	+
ULTRASOUND/FMD	Mode	US
	Level	MED
	Rate	RAMP
GENERAL	Pattern Memory	*Off*



Dual Heart Rate, FECG and US

Dual Ultrasound Modes

1. As stated previously, the dual ultrasound mode of the 250cx Series Monitor cannot be tested unless two Model 325 Simulators are used or two Model 250cx Series 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.

2. If not already on, depress the monitor's Record button.
3. Plug one ultrasound transducer into the monitor's US input connector and the other into the monitor's US2 connector. 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.
4. Use your finger to rub the face of the ultrasound transducer connected to the monitor's US input connector; 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 (⌐⩘⩘).
5. Use your finger to rub the face of the ultrasound transducer connected to the monitor's US2 input connector; 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 FECG/MECG adapter cable to the FECG/MECG input connector on the 250cx Series Monitor.
2. Connect the Model 325 Simulator's ECG 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 alarm volume to a level you can easily hear.
8. Exit the *MHR/P Setup* screen.
9. Access the *Master Alarm Setup* screen.

10. Access *Install Options Screen 2*.
11. Select *Store Current to Hospital.* Exit the service mode by selecting *Restart* at the bottom of the screen.
12. Set the switches on the Model 325 Input Simulator according to Table 8.
13. 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.
14. 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.
15. 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.
16. Depress the monitor's front panel Alarm Silence button and verify the following:
    - The alarm tone is silenced.
    - The *ALARM SILENCE X:XX* message box appears on the screen and a countdown is started.

Table 8. Alarm Test Simulator Settings

Section	Switch	Setting
FECG/MECG	Main	Rate
	Rate	Manual
	Mode	MECG
	QRS Amplitude	500 µV
	QRS Polarity	+
GENERAL	Pattern Memory	Off

17. Wait the user-specified re-alarm time and verify the following:
    - The alarm tone is once again emitted from the rear panel speaker.
18. 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.
19. 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.
20. 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.

21. 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.
22. Depress the monitor's front panel Alarm Silence button and verify the following:
    - The alarm tone is silenced.
    - The MECG value continues flashing.
    - The message *ALARM SILENCE X:XX* appears on the screen and a countdown is started.
23. Wait the user-specified re-alarm time and verify the following:
    - The alarm tone is once again emitted from the rear panel speaker.
24. 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.

$MSpO_2$ Test

1. Access the 250cx Monitor's *$MSpO_2$ Setup* window and configure as follows:
    - (Nellcor only) *Response Time = Fast*
    - (Masimo only) *Sensitivity = Normal*
    - (Masimo only) *Averaging = 8*
    - *Print Interval = 2 minutes*
    - *% O2 Trace = On*
2. Access the monitor's *Install Options Screen 1* and set the *SpO_2 Scale* to *Auto.* Select *Store Current to Hospital.* Exit the service mode by selecting *Restart* at the bottom of the screen.
3. Access the monitor's MHR/P Setup window and configure as follows:
    - MHR/P *Source = $MSpO_2$*
    - MHR/P *HR/PR Trace = On*
4. Connect an SpO_2 finger sensor.
5. Allow the monitor a few seconds to obtain a steady reading.
6. Turn on the recorder and allow data to collect for at least five minutes.Verify the following on the monitor:
    - The correct waveform appears on the display.
    - The $MSpO_2$ displays a value.
    - The $MSpO_2$ pulse amplitude indicator shows a fluctuating bar graph.
    - The MHR/P display mode is *Pulse*.

- The MHR/P displays a value.
- The MHR/P trend plots in the top grid with the above value.
- The $MSpO_2$ scale grid marks stamp on the paper.
- The message *MSpO2%* stamps in the annotation line on the strip chart paper.
- A diamond ◊ (with $MSpO_2$ and MHR/P vital signs) stamps in the annotation area on the strip chart paper at 2-minute intervals.

NIBP Calibration and Testing

Purpose

This describes the information needed by a biomedical or service personnel to successfully verify or set calibration and perform field test procedures for the 250cx Series NIBP.

Required Hardware

Air Volumes

Only one air volume is required. The proper volume for all calibration procedures is a Normal cuff wrapped around a 3-inch rigid cylinder.

External Manometer

A peak reading external manometer is recommended. The external manometer must be capable of reading to 350 mmHg (46.7 kPa).

Do not use a DNI CuffLink for calibration procedures on a 250cx Series Monitor.

External Pump

Use a hand bulb for all indicated manual inflation activities. The external manometer must read pressure in the same scale (mmHg or kPa) as the monitor. Settings can be changed on the monitor *Pressure Units* to match the unit setting on the manometer.

System Setup

Wrap a Normal cuff around a 3-inch rigid cylinder. Connect a standard 12-foot NIBP hose between the Adult cuff and the monitor. For any procedure requiring hand inflation, connect a hand bulb between the Adult cuff and the NIBP hose.

General Calibration Sequence

Any calibration session consists of a sequence of individual calibration procedures. The procedures are Calibration Verification, Calibrate Transducers, Overpressure Detection, and System Leakage.

All NIBP calibration procedures are accessed from the *NIBP Calibration* screen. To access the NIBP Calibration screen:

1. Navigate to *Install Screen Options 1.*
2. Select *Tests*.
3. Select *NIBP Cal.*

The sequence of procedures for calibration of NIBP starts with Calibration Verification. If Calibration Verification shows the NIBP transducers to be out of calibration then calibration should be performed. Only after NIBP transducers have been shown to be in calibration should any other test be performed. Both Overpressure Detection and System Leakage should always be performed.

Calibration Verification

1. Select *Verify* from the *Mode:* option.
2. The monitor will inflate the cuff to approximately 200 mmHg.
3. If either PT1 or PT2 pressure, from the external manometer, are > = 2 mmHg (0.3 kPa) different from the monitor indicated pressure then perform Calibrate Transducers procedure.
4. To stop Calibration Verification select *Done,* which appears after the *Verify* softkey has been pressed.
5. The monitor will vent pressure to atmosphere and re-zero the transducers.

Calibrate Transducers

1. Select *Calibrate* from the *Mode:* option.
2. The monitor will inflate the cuff to approximately 200 mmHg (26.7 kPa).
3. Once the pressure has stabilized, enter the pressure from the external manometer in *External:*
4. Best accuracy is achieved if the system is given a short time to settle. Best accuracy is achieved if the system pressure is at or near 200 mmHg (26.7 kPa).
5. Additional pressure can be inserted into the system using a hand bulb.
6. The monitor will vent pressure to atmosphere and re-zero the transducers.
7. Perform a Calibration Verification and repeat Calibration if new calibration factors still show the transducers out of calibration
8. Commit the new calibration factors by selecting *Store Calibration.*

NOTE: Between entering the external pressure and committing the new calibration factors the *Exit* menu item will display as *Exit – No Store* to indicate current calibration factors will be lost if Service Mode is exited prior to selecting *Store Calibration.*

NOTE: The menu item *Store Calibration* will only display after Calibration Verification has been performed during the Calibration procedure.

Overpressure Detection

1. Select *OVP Test* from the *Mode:* option.
2. The monitor will close the valves.
3. Reset the peak read feature of the external manometer.
4. Using the hand bulb inflate system until overpressure is detected. When approaching the overpressure trip point inflate the system slowly.
5. If overpressure occurs outside of 300 mmHg (40.0 kPa) to 330 mmHg (44.0 kPa), on the external manometer, then:
6. Retest by slowly inflating monitor pressure.
7. Recheck Calibration Verification and retest Overpressure Detection.
8. Call Technical Support.
9. Upon detection of overpressure the monitor will vent pressure to atmosphere and re-zero the transducers.
10. The maximum monitor detected pressure will be displayed near the bottom of the *NIBP Calibration* screen.

System Leakage

1. Select *Leak Test* from *Mode:*.
   - Make sure you have the 12 foot hose and Normal Adult Cuff tightly wrapped around a rigid 3-inch cylinder. This air volume is required to properly test the units leakage rate.
2. Monitor will inflate to approximately 200 mmHg (26.7 kPa).
3. Following inflation the monitor will allow 45 seconds of settling time.
4. Following the settling period two pressure readings are taken 30 seconds apart, and used to calculate the system leakage rate.
5. The monitor vents pressure to atmosphere following the 30 second measurement period.
6. When complete the leakage rate (mmHg [or kPa]/min) will be displayed, with *PASS* or *FAIL*, near the bottom of the *NIBP Calibration* screen.
7. System leakage rate should be < = 6 mmHg (0.8 kPa)/minute.
   - If the monitor has a leakage rate > 6mmHg (0.8 kPa)/min., inspect the external and internal pneumatic hoses, valves, connectors for loose connection and or leaks.

Display Check

There is no calibration or replacement procedure for either the Display Driver Board or the Power Controller Unit. Contact your GE Service Representative for information about repair/exchange of the entire display assembly.

WARNING
HIGH VOLTAGE—The 250cx Series Monitor display backlight generates potentially dangerous voltages capable of causing personal injury (~700 VAC). Do not touch the display electronics during operation!

CAUTION
ELECTROSTATIC DISCHARGE—The 250cx Series Monitor display uses CMOS and MOS-FET components. These components are electrostatic sensitive. Unpack, assemble, and examine this assembly in a static-controlled area only. When shipping, use packing materials designed for protection of electrostatic-sensitive components.

Checking a Display

In troubleshooting, the following methods can be employed to determine whether a problem exists with the display assembly, the 250cx Series Monitor DSP Board or the interconnect cable.

Verifying the DSP Board Operation

1. Turn off the monitor.
2. Remove the nine screws which secure the monitor top cover. Four screws are located on the bottom of the monitor and five screws are located in the back.
3. Remove the cover by sliding it toward the rear of the monitor.
4. Unplug the display interconnect cable from J2 on the DSP Board.
5. Turn on the 250cx Series Monitor.
6. For making the following measurements on the DSP Board, use J2 (pin 3) on the for the ground (or negative) connection.
7. Using a digital voltmeter, measure the LCD voltage at J2 (pin 12). Verify that the LCD voltage is +3.3 Vdc $\pm$ 0.3 Vdc.
8. Using an oscilloscope, verify the presence of the periodic waveform signal PCLK at J2 (pin 1).

9. Using an oscilloscope, verify the presence of the periodic waveform signal HSYNC at J2 (pin 5).
10. Using an oscilloscope, verify the presence of the periodic waveform signal VSYNC at J2 (pin 9).
11. If you suspect that the DSP Board is not supplying the correct voltage or one of the video signals is missing and you have another properly functioning 250cx Series Monitor, substitute the DSP Board and check for proper operation. Contact your GE Service Representative for information about repair/exchange of the DSP Board.
12. If you suspect that the interconnect cable is not working properly, refer to Chapter 6, “Parts List, Drawings, and Replacement” or contact your GE Service Representative for part ordering information.
13. If you suspect that either the Display Driver Board or the Controller Power Unit are not functioning correctly and you have another properly functioning 250cx Series Monitor, substitute the entire display assembly and check for proper operation. Refer to “Checkout” and “Checkout”. Contact your GE Service Representative for ordering information.

External Display

Connect a known good display and check display. Display should match LCD display for content and closely mimic colors.

Maternal SpO_2 Calibration

The 250cx Series Monitor automatically performs a self-test on the pulse oximetry module upon power up and whenever the $MSpO_2$ module is reset. The self-test verifies the integrity of the ROM, RAM, Back-End Processor, and System Voltage levels. The module operation begins if no error was detected during the self-test.

Hardware Switches

The 250cx Series Monitor Main Motherboard contains one dip switch pack SW1, which is used to:

- enable/disable a factory test mode (for factory use only);
- select between Hewlett-Packard or Corometrics–compatible outputs from the rear panel J102 connector;
- set the clock speed;
- enable/disable the maternal NIBP option;
- enable/disable/select the $MSpO_2$ option;
- enable/disable the MECG option.

To configure these switches:

1. Turn off the 250cx Series Monitor and disconnect the power cord from the monitor.
2. Remove the nine screws which secure the monitor top cover. Four screws are located on the bottom of the monitor and five screws are located in the back.
3. Remove the cover by sliding it toward the rear of the monitor.
4. Set the switches according to the table below.
5. Replace the monitor top cover and secure with all nine screws.
6. Re-connect the power cord and turn on the monitor.

Table 9. Hardware Switch Settings

Switch #	Description	Setting
1	Factory Test	Off = Enabled
2	J102 Output Levels	Off = HP, On = Coro
3	Reserved	Set to Off
4	NIBP Option	Off = Enabled
5	$MSpO_2$ Option	5:Off 6:Off = Nellcor 5:Off 6:On = Ohmeda
6	$MSpO_2$ Option	5:On 6:Off = Masimo 5:On 6:On = No $MSpO_2$
7	Inactive	Inactive
8	MECG Option	Off = Enabled

Main Board SW1 Switch Settings

This area of the display allows you to see the hardware switch settings (SW1) on the Main Motherboard—without removing the cover of the monitor. The switch settings are displayed from left (SW1-8) to right (SW1-1). Refer to Table 17.

To access the *Diagnostic Control* screen select the *Service* softkey at the bottom of the *General Setup* Screen. Input the *Service Lock* access code, then the *Install Options Screen 1* appears. Select the *Tests* softkey from the bottom of the screen, the *Diagnostic Control* screen appears.

Example 1:

1 0 1 0 1 1 1 0

MECG MSpO2 NIBP

J102 Analog Output Connector DAC Static Test

This screen displays the J102 pin numbers, the signal descriptions, the range of allowable values for measured voltages, the expected output voltages, and the settings (meaning) adjustable using the Trim Knob control. Use this screen while verifying and calibrating the digital-to-analog converters (DACs) on the Communications Board (No. 13388 or 15297).

1. Access the *Diagnostic Control* screen by selecting the *Service* softkey at the bottom of the *General Setup* Screen. Input the *Service Lock* access code, then the *Install Options Screen 1* appears. Select the *Tests* softkey from the bottom of the screen. (Refer to"Diagnostic Control Screen" on page 5-5 for instructions.)
2. Use the Trim Knob control to select the *J102* softkey at the bottom of the screen. The *J102* screen displays. (See figure "J102 Analog Output Connector Screen" on page 4-47.)
3. The *Range* and *Voltage* fields can be displayed using a decimal point or a comma as a separator. Each activation of the *Decimal* softkey at the bottom of the screen alternates between using a decimal and a comma.
4. Use the Trim Knob control to cycle through the available settings for each field. The expected voltage for each J102 pin number changes accordingly.

Verification

For each pin, select a value in the *Meaning* field and measure the expected output.

Analog Ground

This field is not adjustable. Use J102, pin 3 as a ground when making measurements on other pins.

HR1 and HR2

Use the Trim Knob control to select: – – – (0 bpm) or 30–240 bpm in increments of 1 bpm.

UA

Use the Trim Knob control to select from the full range of mmHg or kPa in increments: mmHg ranges from 0-100 in steps of 1; kPa ranges from 0-13.3 in steps of 0.1 or 0.2 (based on rounding from mmHg).

HR1 Mode

Use the Trim Knob control to select: *– – –, FECG, Off, US,* or *INOP.*

HR2 Mode

Use the Trim Knob control to select: *TEST, FECG, INOP, US,* or *MECG.*

UA Mode

Use the Trim Knob control to select: *– – –, INOP, Off, IUP, or TOCO.*

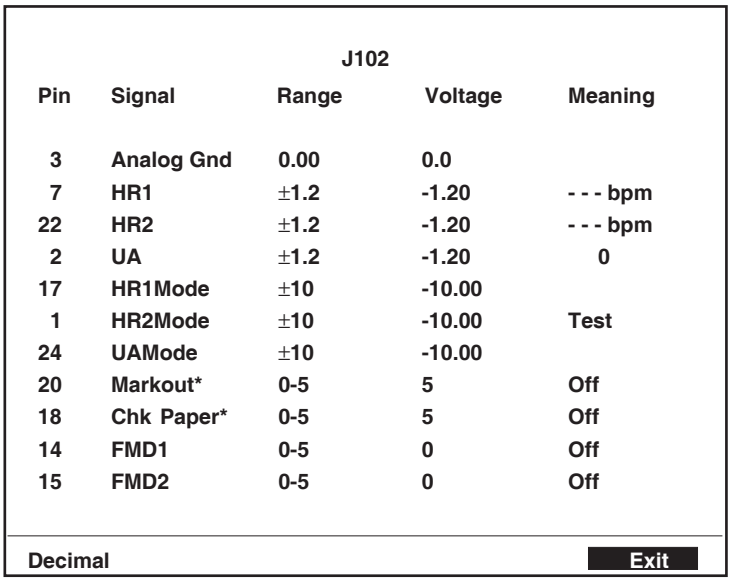
Markout*, Check Paper*, FMD1, and FMD2

Use the Trim Knob control to alternate between *On* and *Off*.

NOTE: Signal names followed by an asterisk (*) or slash (/) are active low.

Calibration

For calibration, you must use the specific values listed in Table 10 (Corometrics output levels) or Table 11 (Hewlett-Packard output levels). This tests the high and low ranges for the HR1, HR2, and UA signals. If a measured value does not fall within the given range, adjust the corresponding potentiometer accordingly (on Communications Board, No. 13388 or 15297).



J102 Analog Output Connector Screen

Table 10. DAC Output Voltages and Adjustment Points for Corometrics Central Station Outputs

Analog Signal	Measurement Site	Service Screen Setting	Expected Voltage	Adjustment Site
HR1	J102, pin 7	– – –	–1.2 V ± 10 mV	R18
		240 bpm	+1.2 V ± 10 mV	R20

Table 10. DAC Output Voltages and Adjustment Points for Corometrics Central Station Outputs				
Analog Signal	Measurement Site	Service Screen Setting	Expected Voltage	Adjustment Site
HR2	J102, pin 22	– – –	–1.2 V ± 10 mV	R27
		240 bpm	+1.2 V ± 10 mV	R29
UA	J102, pin 2	0 relative units (mmHg and kPa)	–1.2 V ± 10 mV	R42
		100 mmHg 13.3 kPa	+1.2 V ± 10 mV	R44

Table 11. DAC Output Voltages and Adjustment Points for Hewlett-Packard Central Station Outputs				
Analog Signal	Measurement Site	Service Screen Setting	Expected Voltage	Adjustment Site
HR1	J102, pin 7	240 bpm	+2.4V ± 10 mV	R20
HR2	J102, pin 22	240 bpm	+2.4 V ± 10 mV	R29
UA	J102, pin 2	100 mmHg 13.3 kPa	+10.0 V ± 24 mV	R44

RS-232C Connector Loopback Test

The Communications Setup screen includes a loopback test option for each of the communications ports: J109, J110, and J111. Running the test requires inserting a loopback test connector into each port being tested. (You can test more than one port at a time.)

Making a Loopback Test Connector

Start with an RJ-11C connector and bridge pin 2 (RXD) and pin 5 (TXD) together. The figure below shows the pinout of a communications port while you face the rear panel of a 250cx Series Monitor. Table 12 lists the signal description for each pin.

Testing the Port(s)

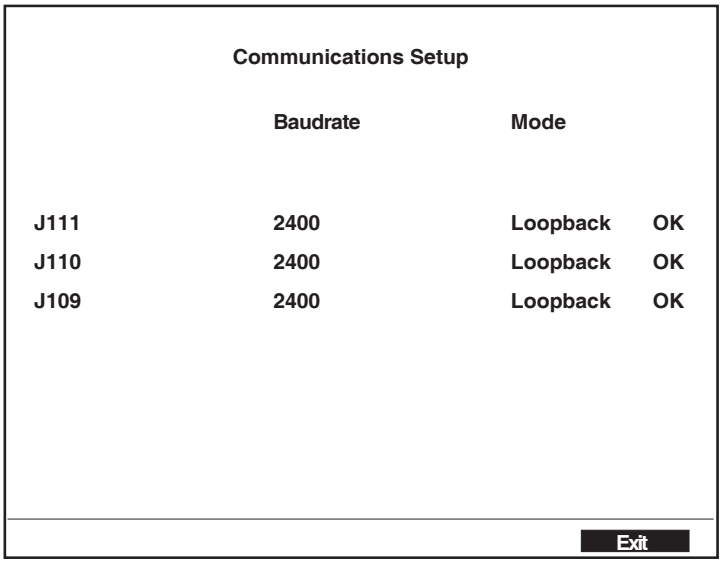
1. Access the *Communications Setup* screen (See “Communications Screen” on page 4-49).
2. Insert a loopback test connector into each communications port being tested.
3. Set the mode field on the *Communications Setup* screen to *Loopback*. Notice that the word *Off* displays to the right of the mode.

4. Verify that, after a few seconds, the status *Loopback OK* displays. *OK* indicates that the test has passed.

NOTE: If *Off* remains displayed, the test has failed; contact your GE Service Representative. Do not use this port to connect to any peripheral equipment until the port or Communications Board has been serviced.

RJ-11C Connector

Table 12. J109, J110, and J111 Communications Ports Connector Pinout	
J109, J110, Or J111 Pin #	Signal Description
1	RTS
2	RXD
3	GND
4	GND
5	TXD
6	CTS



Communications Screen

Calibration

This section of the manual provides a calibration procedure which allows authorized service personnel to perform an instrument alignment using a minimum of test equipment. This procedure is not intended to replace a complete instrument checkout and alignment as performed at the GE factory. It should be considered a performance check and troubleshooting guide to be used in conjunction with other information supplied throughout this service manual. It is important to mention, this section of the manual is not intended as a substitute for proper professional training, or familiarity with the monitor. Only qualified service personnel should attempt servicing the 250cx Series Monitor.

Before You Begin Electronic Calibration

General

Refer to the assembly drawings for the location of adjustments and test points referred to in this section. The board assembly drawing numbers are given for each board in this section. The electronic calibration procedure outlined in this section necessitates removal of the monitor's top cover. Also, the following equipment will be needed in order to carry out the procedural steps.

- Digital Voltmeter, 4 1/2 digit or equivalent
- Plastic Alignment Tool
- Oscilloscope

Handling Precautions

The following guidelines should be followed when handling *circuit boards or assemblies containing circuit boards*. Following these procedures helps resist damage that can be caused by static electricity.

- Discharge any static charge you may have built up before handling parts.
- Wear a grounded, anti-static wristband at all times.
- Use a static-free work surface.
- Store items in anti-static bags or boxes.
- Do not remove items from anti-static containers until needed.

Power Supply Voltages—Verification

There are no adjustments for the power supply voltages; however, you can verify them as follows:

Main Board Power Supply Voltages

Using a digital voltmeter, measure and verify the power supply voltages using the J14 connector on the Main Board. Refer to Table 13.

NOTE: There are no adjustments for these voltages.

Table 13. Main Board Power Supply Voltages		
2023111-001	Signal Name	Voltage Level
Pin 1	+12EL	+12 Vdc ± 0.5 Vdc
Pin 2	+20I	+20 Vdc ± 0.5 Vdc
Pin 3	+15BP	+15 Vdc ± 0.5 Vdc
Pin 4	–15V	–15 Vdc ± 0.5 Vdc
Pin 5	+15V	+15 Vdc ± 0.5 Vdc
Pin 6	+12A	+12 Vdc ± 0.5 Vdc
Pin 7	+5V	+5 Vdc ± 0.5 Vdc
Pin 8	GND	—
Pin 9	No Connection	—
Pin 10	Keying	—

Isolated Power Supply Board Voltages

Verify the following voltages, being sure to use the correct ground reference points.

Ground Reference	Test Point	Measurement Limit
TP8	TP7	16.5 ±.15 Vdc
TP8	TP17	15 ±.75 Vdc
TP8	TP16	-15 ±.75 Vdc
TP8	TP18	5 ±.25 Vdc
TP5	TP10	15 ±.75 Vdc
TP5	TP11	-15 ±.75 Vdc

Isolated FECG/UA Board Voltages

This procedure performs an adjustment on the FECG/UA Board.

- Connect the positive lead of a digital voltmeter to TP1 on the FECG/UA Board.
- Connect the negative lead to TP2 or TP3 (isolated ground).
- Adjust R28 for a reading of +4.00 Vdc ± 0.01 Vdc.

Recorder Photosensor Calibration

Adjusting the Paper-Low Photosensor

1. Load paper in the recorder. Ensure that there are *no* black squares showing to indicate a paper-low condition.
2. Press the Record button to turn on the recorder. Allow the paper to advance for a few seconds in order to tension the paper.
3. Turn off the recorder.
4. Using a digital voltmeter, connect the positive lead to J9 (pin 4) on the Recorder Board; connect the negative lead to J9 (pin 2).
5. Adjust R31 for a reading of +150 mVdc ± 2 mVdc on the digital voltmeter.

NOTE: If you open and then close the recorder door, the reading may vary 5–10 mV, due to the loss of tension in the paper. This is acceptable and you do not need to re-adjust.

6. Open the door and verify that the reading on the digital voltmeter is greater than +4.75 Vdc.
7. Re-load the paper so that black squares show on the surface (i.e., the last several sheets of a pack).
8. Turn on the recorder.
9. The value on the digital voltmeter should go up and down as the paper surface alternates between black and white. Verify that the maximum value is greater than or equal to 2.0 Vdc.
10. Turn off the recorder.

Adjusting the Paper-Out Photosensor

1. Load paper in the recorder. Ensure that there are *no* black squares showing to indicate a paper-low condition.
2. Press the Record button to turn on the recorder. Allow the paper to advance for a few seconds in order to tension the paper.
3. Turn off the recorder.
4. Using a digital voltmeter, connect the positive lead to J9 (pin 3) on the Recorder Board; connect the negative lead to J9 (pin 2).
5. Adjust R29 for a reading of +150 mVdc ± 2 mVdc on the digital voltmeter.

NOTE: If you open and then close the recorder door, the reading may vary 5–10 mV, due to the loss of tension in the paper. This is acceptable and you do not need to re-adjust.

6. Open the door and verify that the reading on the digital voltmeter is greater than +4.75 Vdc.
7. Turn off the recorder.

Adjusting the Paper-Loading Sensor

1. Load paper in the recorder. Ensure that there are *no* black squares showing to indicate a paper-low condition. You must load at least nine sheets of paper.
2. Using a digital voltmeter, connect the positive lead to J9 (pin 6) on the Recorder Board; connect the negative lead to J9 (pin 2).
3. Adjust R41 for a reading of +190 mVdc ± 5 mVdc on the digital voltmeter.
4. Although a factory-only fixture is required for this step, you may wish to try it by estimating the required distance. Load paper *backwards* with the white surface 0.380 in away from the paper tray. This creates a paper-loading error condition. Verify that the voltage at J9 (pin 6) on the Recorder Board is at least 2.70 Vdc.

Repair Log

Unit Serial Number Institution Name			
Date	Maintenance/ Repair	Technician	Date

Preventative Maintenance Inspection Report

Customer_____ Customer Number_____ Date _____

FE_____ FE ID _____Call Number _____

Equipment Serial Number _____ Software Revision CPU _____ DSP: _____

Configuration

Model 256cx_____ Model 259cx _____ Fetal Movement Detection (FMD) _____

Tools Required

• Digital Multimeter	• Static-Free Work Surface
• Plastic Alignment Tool	• Mild Soap/Water Solution
• Standard Hand Tools	• Isopropyl Alcohol
• Leakage Current Tester	• Baum Manometer
• Leg Plate (1590AAO with 1442AAO adapter cable)	• FECG/MECG Adapter (1442AAO)
• Model 325 Simulator with Cables	• Baum Test Connector
• ESD Mat and Wristband	• 250cx Operator's Manual (2020550-001)
	• SpO_2 Leakage Cable (2006036)

Visual Inspection

Inspect the following for excess wear and/or signs of damage. (Refer to "Visual Inspection" on page 4-4)

☐ AC Power Cord	☐ $MSpO_2$ Cable/Sensor
☐ Ultrasound Transducer	☐ Connectors
☐ MECG Patient Cable	☐ Interconnect Cables
☐ Leg Plate	☐ Chassis
☐ Tocotransducer	☐ 2116 Keyboard (if used)
☐ IUPC Transducer	☐ Front Panel Switches
☐ IUPC Intermediate Cable	☐ Internal Harnesses/Connectors
☐ Remote Marker	☐ Power Supply Fan
☐ NIBP Hose/Cuff	☐ FECG, MECG "Y" Adapter Cable (1442AAO)

Page	Description	Complete	Max	Actual	Pass	Fail	N/A
Cleaning							
4-5	Clean the monitor exterior.						
	Clean the monitor interior using a hand-held vacuum.						
4-8	Clean the recorder printhead.						
4-8	Clean the UA Strain Gauge.						
4-6	Clean the monitor accessories (TOCO, transducers, cables)						
4-5	Clean the monitor accessories (cuffs, hoses)						
Calibration							
Page	Description	Complete	Max	Actual	Pass	Fail	N/A
4-50	Verify the power supply voltages on the Main Board.						
4-51	Verify the power supply voltages on the Isolated Power Supply Board.						
5-9	Adjust the printhead.						
4-52	Adjust the photosensors on the Recorder Board.						

Electrical Safety Test Record		
AC Line Voltage		Nominal ± 10%
Ground Impedance		<0.1 Ohm

Condition	Neutral	Ground	Power (polarity)
1	Closed	Closed	Normal
2	Closed	Open	Normal
3	Closed	Open	Reversed
4	Closed	Closed	Reversed
5	Open	Closed	Normal
6	Open	Closed	Reversed

Parameter	Cond. 1	Required (Normal)	Cond. 2	Cond. 3	Cond. 4	Cond. 5	Cond.6	Required (Single Fault)
Chassis		<100 µA						<500 µA
MECG Ld/Gnd		<10 µA						<50 µA
MECG Ld/Line		<10 µA						<50 µA
FECG Ld/Gnd		<10 µA						<50 µA
FECG Ld/Line		<10 µA						<50 µA
IUP/Toco Ld/Gnd		<10 µA						<50 µA
IUP/Toco Ld/Line		<10 µA						<50 µA
US1 Ld/Gnd		<10 µA						<50 µA
US1 Ld/Line		<10 µA						<50 µA
US2 Ld/Gnd		<10 µA						<50 µA
US2 Ld/Line		<10 µA						<50 µA
SpO_2 Ld/Gnd		<10 µA						<50 µA
SpO_2 Ld/Line		<10 µA						<50 µA

Functional Checkout Tests							
Page	Description	Complete	Max	Actual	Pass	Fail	N/A
5-3	Monitor Self-Test						
4-19	Front Panel Button Test						
4-20	MECG Test						
4-23	FECG Test						
	Leg Plate Test (Follow Manufacturer's Directions)						
4-26	Ultrasound Test						
4-28	Fetal Movement Detection Test						
4-29	Ultrasound Test						
4-30	Uterine Activity Test						
4-32	Tocotransducer Test						
4-33	Strain Gauge Test (if used)						

4-34	Pattern Memory Test						
4-35	Dual Heart Rate Test						
4-47	Dual Ultra Sound Modes						
4-37	Alarm Test						
4-39	$MSpO_2$ Test						
4-40	Pneumatic Pressure Check (annual)						
5-6	Recorder Calibration Test						