8 Functional and electrical safety checks

Overview

Manufacturer recommendations

These safety tests and checkout procedures provide service personnel with a method to verify operational and functional performance of the patient monitor. Safety and functional checkout tests should be documented in the Checklist provided in "Checklist" on page D-1. Failure to attain any of the listed results indicates a potential malfunction of the patient monitor.

WARNING
The personnel assessing the safety of the patient monitor shall be able to recognize possible consequences and risks arising from non-conforming equipment.

The safety tests and checkout procedures are based on the assumption that the tested patient monitor has known good cables and test equipment. It also requires qualified personnel who are familiar with the operation of all test equipment required for the procedures. For more information concerning the operation of these components, refer to the respective operator manual(s).

Frequency

Qualified personnel must perform the checkout procedures:

- Every 12 months after receipt of the device (Preventive Maintenance). Refer to "Maintenance schedule" on page 5-2 for more information.
- Each time the main enclosure is disassembled or a circuit board is removed, tested, or replaced (Corrective Maintenance). Refer to "Recommended checkout" on page 7-52 for more information.

Test equipment

The safety tests and checkout procedures are written for the GE recommended test equipment listed for each test. If you use test equipment other than those GE recommends, you may need to slightly modify some test steps.

Functional Checkout procedures

Electrical safety tests

General

Electrical safety tests provide a method of determining if potential electrical health hazards to the patient or operator of the device exist.

Recommendations

Qualified personnel must perform all safety tests presented in this chapter:

- Upon receipt of the device (patient monitor and its associated equipment). Refer to "Dash installation checkout procedure" on page 3-8 for more information.
- Every 12 months thereafter (Preventive Maintenance). Refer to "Maintenance schedule" on page 5-2 for more information.
- Each time the main enclosure is disassembled or a circuit board is removed, tested, repaired, or replaced (Corrective Maintenance). Refer to "Recommended checkout" on page 7-52 for more information.

GE recommends that the qualified personnel performing the tests should record the values of each required electrical safety test in the "Checklist" on page D-1.

These instructions are intended for every component in the system.

Test equipment

The recommended test equipment required to perform electrical safety tests is listed below.

Item	Specification
Leakage Current Tester	Equivalent to the circuits shown
Digital Multimeter (DMM) (optional based on leakage tester used and locality)	AC volts, ohms
Ground Bond Tester	0 – 1 ohm
Safety Test Body Kit[1]	PN M1155870 or equivalent

[1] Instead of the test bodies in the safety test body kit, other applicable test bodies with pins connected together may be used.

Perform electrical safety tests using an electrical safety analyzer per IEC 60601-1, UL 60601-1, EN 60601-1 or CSA C22.2 No. 601.1. The schematics in the section provide a general understanding of the test equipment. Actual configuration of test equipment may vary.

The patient monitor being tested should be placed on an insulating surface.

Power outlet test

Verify that the power outlet is wired correctly per the country's electrical code standard before starting the following electrical safety tests. The results of the following tests will be inaccurate unless a properly wired power outlet is used. Use only non-isolated power outlets when performing safety tests.

Power cord and plug

Verify the power cord being used with the patient monitor is good. The following are a couple of things to check for in this regard:

- Failure of the power cord strain relief is very common. Often times users of the equipment pull on the power cord itself, rather than the power cord plug, to unplug the patient monitor from a wall receptacle. If in doubt, test for continuity through each conductor of the power cord connector and plug.
- Verify line, neutral, and earth conductors are properly connected to the power cord plug and are not short-circuited. Replace the power cord, as necessary with a regulatory-approved cord for the country of use.

WARNING
Use only AC power cords recommended or manufactured by GE.

Ground (earth) integrity

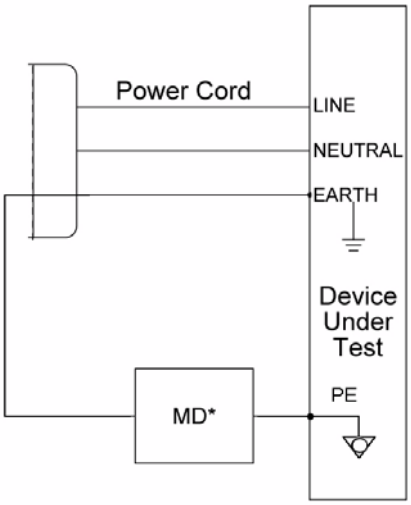
Listed below are two methods for checking the ground (earth) integrity, "Ground continuity test" and "Impedance of protective earth connection". These tests determine whether the device's exposed metal and power inlet's earth (ground) connection has a power ground fault condition.

Perform the test in accordance with your local regulations.

Ground continuity test

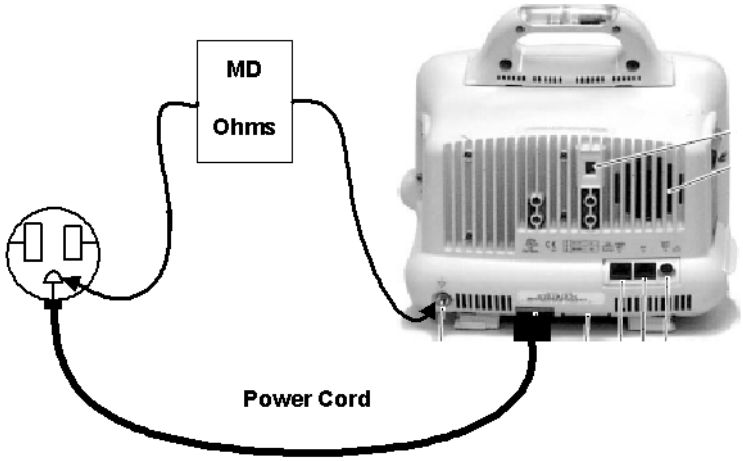
Refer to the instructions contained with the safety analyzer to perform each test.

The measuring device (MD) in the diagram below may be a DMM or part of a safety analyzer.



NOTE

*The measuring device (MD) represents the network and voltage measuring instrument and its frequency characteristics per IEC 60601-1.



Impedance of protective earth connection

This test, unlike a ground continuity test, will also stress the ground system by using special ground bond testers.

This test normally is only required as a manufacturing production test to receive safety agency compliance. Some country agencies do require this test after field equipment repairs (e.g., Germany's DIN VDE 0751 standards). Consult your country/local safety agency if in question.

Compliance is checked by the following steps:

1. A current of 25A from a current source with a frequency of 50 or 60 Hz with a no-load voltage not exceeding 6 V is passed for at least 5 seconds, but no more than 10 seconds, through the protective earth terminal or the protective earth pin in the mains plug and each accessible metal part which could become live in case of failure in basic insulation.
2. The voltage drop between the parts described is measured and the impedance determined from the current and voltage drop. It shall not exceed the values indicated.

When taking this measurement, move the unit's power cord around. There should be no fluctuations in resistance.

Acceptance criteria

For equipment without a power supply cord, the impedance between the earth terminal of the (IEC 60320-1) AC inlet receptacle and the protective earth (PE) terminal (or any accessible metal part which is protectively earthed) shall not exceed 0.1 ohms.

For equipment with a power supply cord, the impedance between the protective earth pin in the mains plug and any accessible metal part which is protectively earthed shall not exceed 0.2 ohms.

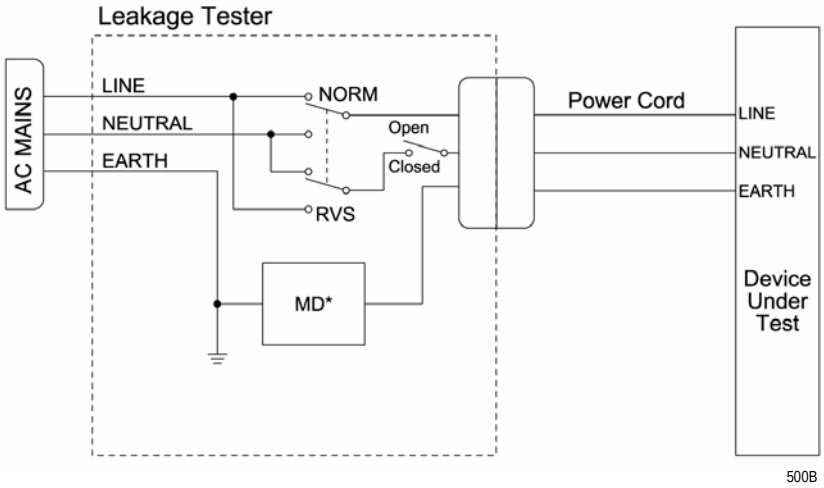
3. GE recommends that the qualified personnel performing the tests should record the values in the "Checklist" on page D-1.

Ground (earth) wire leakage current tests

Perform this test to measure current leakage through the ground (earth) wire of the equipment during normal operation.

1. Refer to the instructions contained with the safety analyzer to perform this test.
2. Configure leakage tester as follows:
   - Polarity – NORMAL

- Neutral – CLOSED



NOTE

*The measuring device (MD) represents the network and voltage measuring instrument and its frequency characteristics per IEC 60601-1.

3. Read and record the current leakage indicated on the tester.
4. Change leakage tester switches to:
   - Polarity – NORMAL
   - Neutral – OPEN
5. Read and record the current leakage indicated on the tester.
6. Change leakage tester switches to:
   - Polarity – REVERSE
   - Neutral – OPEN
7. Read and record the current leakage indicated on the tester.
8. Change leakage tester switches to:
   - Polarity – REVERSE
   - Neutral – CLOSED
9. Read and record the current leakage indicated on the tester.

If measured reading is greater than the appropriate specification below, the device under test fails. Contact GE Technical Support.

Acceptance criteria NC (Normal condition)

- (USA only) 300 µA, and the device under test is powered from 100-120 V/50-60 Hz
- (USA only) 300 µA, and the device under test is powered from a center-tapped 200-240 V/50-60 Hz, single phase circuit (UL Split Phase Exemption)
- 500 µA, and the device under test is powered from a non-center-tapped, 200-240 V/50-60 Hz, single-phase circuit

Acceptance criteria SFC (Single fault condition) – ground (earth), line or neutral open

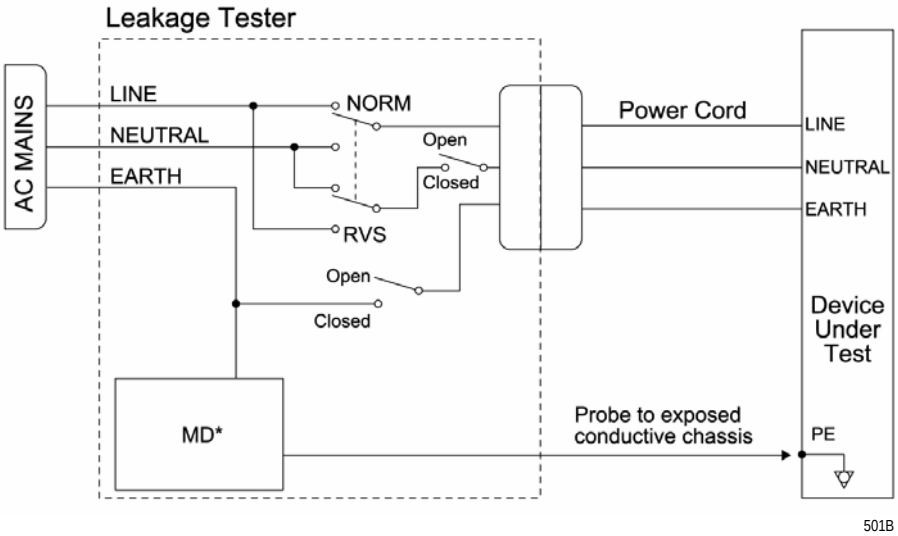
- (USA only) 300 µA, and the device under test is powered from 100-120 V/ 50-60 Hz
- (USA only) 300 µA, and the device under test is powered from a center-tapped 200-240 V/50-60 Hz, single phase circuit (UL Split Phase Exemption)
- 1000 µA, and the device under test is powered from a non-center-tapped, 200-240V/50-60 Hz, single-phase circuit.

NOTE

Center-tapped and non-center-tapped supply circuits produce different leakage currents and the UL and IEC limits are different.

Enclosure (Touch) leakage current test

Perform this test to measure current leakage through exposed conductive surfaces on the device under test during normal operation. Refer to the instructions contained with the safety analyzer to perform enclosure leakage current test.



NOTE

*The MD represents the network and voltage measuring instrument and its frequency characteristics per IEC 60601-1.

1. Configure leakage tester as follows:
   - Polarity – NORMAL
   - Neutral – CLOSED
   - GND (Earth) – CLOSED
2. Power on device under test.
3. Read and record the current leakage indicated on tester.

   NOTE

   Center-tapped and non-center-tapped supply circuits produce different leakage currents and the UL and IEC limits are different.
4. Change leakage tester switches to:
   - Polarity – NORMAL
   - Neutral – OPEN
   - GND (Earth) – CLOSED
5. Read and record the current leakage indicated on the tester.
6. Change leakage tester switches to:
   - Polarity – NORMAL
   - Neutral – CLOSED
   - GND (Earth) – OPEN
7. Read and record the current leakage indicated on the tester.
8. Change leakage tester switches to:
   - Polarity – REVERSED
   - Neutral – CLOSED
   - GND (Earth) – OPEN
9. Read and record the current leakage indicated on the tester.
10. Change leakage tester switches to:
    - Polarity – REVERSED
    - Neutral – OPEN
    - GND (Earth) – CLOSED
11. Read and record the current leakage indicated on the tester.
12. Change leakage tester switches to:
    - Polarity – REVERSED
    - Neutral – CLOSED
    - GND (Earth) – CLOSED

13. Read and record the current leakage indicated on the tester.
14. Set the power switch of the device under test to OFF.

If measured reading is greater than the appropriate specification below, the device under test fails. Contact GE Technical Support.

Acceptance criteria NC

- 100 microamperes (0.1 volts on the tester), and the device under test is powered from 100-240 V/50-60 Hz

Acceptance criteria SFC – ground (earth), line or neutral open

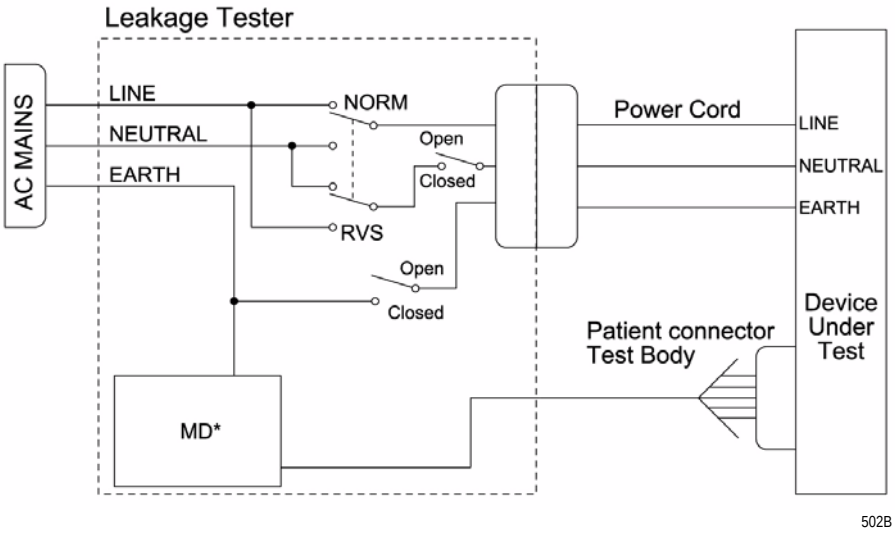
- (USA only) 300 µA, and the device under test is powered from 100-120 V/50-60 Hz
- (USA only) 300 µA, and the device under test is powered from a center-tapped 200-240 V/50-60 Hz, single phase circuit (UL Split Phase Exemption)
- 500 µA, and the device under test is powered from a non-center-tapped, 200-240 V/50-60 Hz, single-phase circuit

NOTE

If the reading is greater than the specification below, and the device under test is powered from 100-240 V/50-60 Hz, the device under test fails. Contact GE Technical Support.

Patient (source) leakage current test

This procedure only applies to Class I (grounded/earthed) equipment, and measures the leakage current from the ECG/RESP connector or the SPO2 connector of the device to ground.



NOTE

*The MD represents the network and voltage measuring instrument and its frequency characteristics per IEC 60601-1.

The patient connector test body shorts all signals in the connector together. Refer to the instructions contained with the safety analyzer to perform this test.

1. Connect the ECG/RESP Test Body to the green connector of the device under test.
2. Configure leakage tester as follows:
   - Polarity – NORMAL
   - Neutral – CLOSED
   - GND (Earth) – CLOSED
3. Power on Device under test.
4. Read and record the current leakage indicated on the tester.
5. Change leakage tester switches to:
   - Polarity – NORMAL
   - Neutral – OPEN
   - GND (Earth) – CLOSED
6. Read and record the current leakage indicated on the tester.
7. Change leakage tester switches to:
   - Polarity – NORMAL

- Neutral – CLOSED
- GND (Earth) – OPEN

8. Read and record the current leakage indicated on the tester.
9. Change leakage tester switches to:
   - Polarity – REVERSED
   - Neutral – CLOSED
   - GND (Earth) – OPEN
10. Read and record the current leakage indicated on the tester.
11. Change leakage tester switches to:
   - Polarity – REVERSED
   - Neutral – OPEN
   - GND (Earth) – CLOSED
12. Read and record the current leakage indicated on the tester.
13. Change leakage tester switches to:
   - Polarity – REVERSED
   - Neutral – CLOSED
   - GND (Earth) – CLOSED
14. Read and record the current leakage indicated on the tester.
15. Set the power switch of the device to OFF.
16. Repeat the steps in this procedure using the appropriate SPO2 Test Body. Connect the SPO2 Test Body to the blue SPO2 connector of the device under test.

Acceptance criteria NC

With Ground and Neutral CLOSED – If reading is greater than 10 μA, the device under test fails. Contact GE Technical Support

Acceptance criteria SFC – ground (earth), line or neutral open

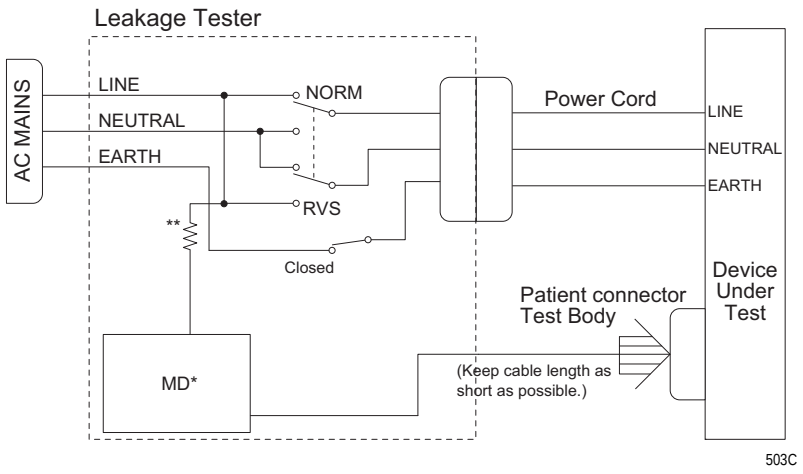
If any reading is greater than 50 μA, the device under test fails. Contact GE Technical Support.

Patient (sink) leakage current test (mains voltage on the applied part)

This procedure only applies to Class I (grounded/earthed) equipment, and measures the leakage current from a mains voltage source into the ECG/RESP connector or the SpO2 connector.

The patient connector test body shorts all signals in the connector together. Refer to the instructions contained with the safety analyzer to perform this test. Connect the ECG/RESP Test Body to the green connector of the device under test.

Refer to the instructions contained with the safety analyzer to perform each test.



NOTE

*The MD represents the network and voltage measuring instrument and its frequency characteristics per IEC 60601-1.

** Per IEC 60601-1, the impedance to protect the circuitry and the person performing the test, but low enough to accept currents higher than the allowable values of the LEAKAGE CURRENT to be measured.

1. Configure leakage tester as follows:
   - Polarity – NORMAL
   - Neutral – CLOSED
   - GND (Earth) – CLOSED

WARNING

Shock hazard. The following step causes high voltage at the test body. Do not touch the test body.

2. Power on device under test.
3. Read and record leakage current indicated on the tester.
4. Change leakage tester switches to:
   - Polarity – REVERSED
   - Neutral – CLOSED
   - GND (Earth) – CLOSED
5. Read and record the current leakage indicated on the tester.
6. Set the power switch on the device to OFF.
7. Repeat the steps in this procedure using the appropriate SPO2 Test Body. Connect the SPO2 Test Body to the blue SPO2 connector of the device under test.

Acceptance criteria

If measured reading is greater than the appropriate specification below, the device under test fails. Contact GE Technical Support.

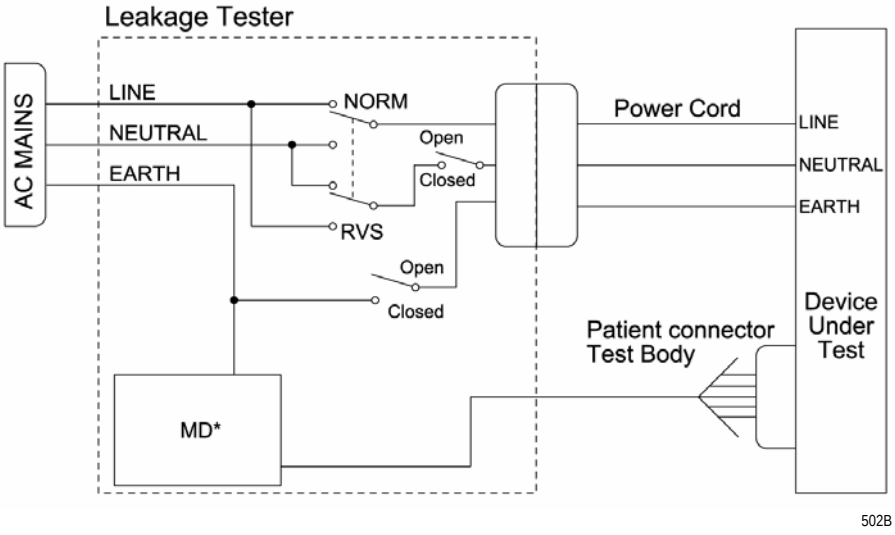
- 50 µA at 120-240 VAC using the ECG cable.

BISx (option) current leakage tests

These procedures test the integrity of the BISx isolation only, not the entire system.

BISx patient (source) leakage current test

This test checks leakage current from the patient cable connector of the BISx to ground. Refer to the instructions contained with the safety analyzer to perform each test.

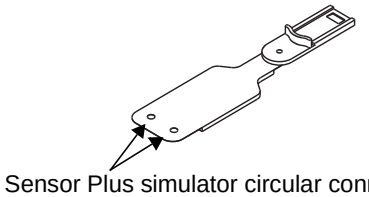


NOTE

*The MD represents the network and voltage measuring instrument and its frequency characteristics per IEC 60601-1.

Refer to the instructions contained with the safety analyzer to perform this test.

1. Connect the Sensor Plus simulator to the BISx and connect the two circular Sensor Plus simulator connections (test body) to the leakage tester.



Sensor Plus simulator circular connections

2. Configure the leakage tester as follows:
   - Polarity – NORMAL
   - Neutral – CLOSED
   - GND (Earth) – CLOSED

3. Connect the BISx power supply cord to the power outlet on the leakage tester.
4. Turn the BISx ON by connecting the AC power adaptor.
5. Read the leakage current indicated on the tester.
6. Change the leakage tester switches to:
   - Polarity – NORMAL
   - Neutral – OPEN
   - GND (Earth) – CLOSED
7. Read and record the leakage current indicated on the tester.
8. Change leakage tester switches to:
   - Polarity – NORMAL
   - Neutral – CLOSED
   - GND (Earth) – OPEN
9. Read and record the current leakage indicated on the tester.
10. Change leakage tester switches to:
    - Polarity – REVERSED
    - Neutral – CLOSED
    - GND (Earth) – OPEN
11. Read and record the current leakage indicated on the tester.
12. Change leakage tester switches to:
    - Polarity – REVERSED
    - Neutral – OPEN
    - GND (Earth) – CLOSED
13. Read and record the current leakage indicated on the tester.
14. Change leakage tester switches to:
    - Polarity – REVERSED
    - Neutral – CLOSED
    - GND (Earth) – CLOSED
15. Read and record the current leakage indicated on the tester.
16. Set the power switch of the device to OFF.
17. Leave the test configuration set up for the sink leakage test.

Acceptance criteria NC

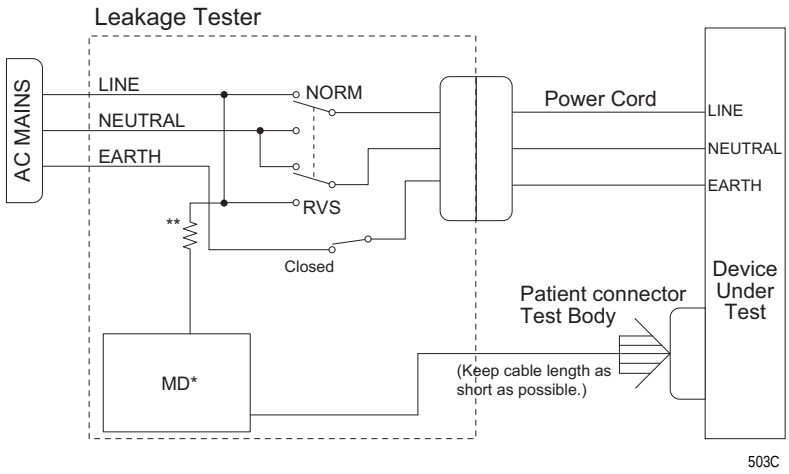
If any reading with the ground and neutral closed is greater than 100 uA, the BISx fails this test. Contact GE Technical Support.

Acceptance criteria SFC – ground (earth), line or neutral open

If any reading with the ground open is greater than 500 uA, the BISx fails this test. Contact GE Technical Support.

BISx patient (sink) leakage current test

This test checks the patient cable leakage current from a 115 or 220VAC source into the BISx. This test checks leakage current from the patient cable connector of the BISx to ground. Refer to the instructions contained with the safety analyzer to perform each test.



NOTE

*The MD represents the network and voltage measuring instrument and its frequency characteristics per IEC 60601-1.

** Per IEC 60601-1, the impedance to protect the circuitry and the person performing the test, but low enough to accept currents higher than the allowable values of the LEAKAGE CURRENT to be measured.

Refer to the instructions contained with the safety analyzer to perform this test.

WARNING

Shock hazard. The following step causes high voltage at the test body. Do NOT touch the test body.

1. With the Sensor Plus simulator connected to the BISx and the two circular Sensor Plus simulator connections (test body) connected to the leakage tester:
2. Configure the leakage tester as follows:
   - Polarity – NORMAL
   - Neutral – CLOSED
   - GND (Earth) – CLOSED

3. Read and record leakage current indicated on the tester.
4. Change leakage tester switches to:
   - Polarity – REVERSED
   - Neutral – CLOSED
   - GND (Earth) – CLOSED
5. Read and record leakage current indicated on the tester.
6. Set the power switch on the leakage tester to OFF.

Acceptance criteria

If either reading is greater than 5000 µA, the BISx fails this test. Contact GE Technical Support.

Test completion

1. Disconnect the leakage tester from the power outlet.
2. Disconnect all test equipment from the device.
3. Disconnect the device power cord from the leakage tester.

Functional Checkout procedures

Frequency

Qualified personnel must perform the checkout procedures:

- Every 12 months after receipt of the device (Preventative Maintenance). Refer to "Maintenance schedule" on page 5-2 for more information.
- Each time the main enclosure is disassembled or a circuit board is removed, tested, or replaced (Corrective Maintenance). Refer to "Recommended checkout" on page 7-52 for more information.

Identify enabled patient parameters and software options

The check out procedures support all enabled patient parameter and software options. To view the options enabled on the patient monitor, go to the Main Menu and select ***MORE MENUS*** > ***MONITOR SETUP*** > ***SOFTWARE CONFIGURATION***.

The following is a list of all available patient parameter and software options.

- 0BP (invasive)
- 1BP or 2BP (invasive)
- 3BP or 4BP (invasive)
- 12SL
- ACI-TIPI
- HI-RES TRENDS
- $ETCO_2$ (CO_2) (End-tidal CO_2)
- NETWORK
- AVOA Plus
- CARDIO-PULMONARY
- CARDIAC

Patient monitor power-up tests

NOTE

When the patient monitor is connected to a docking station, use the docking station's power cable instead of the patient monitor's power cable.

1. Remove the batteries and unplug the patient monitor (or the docking station) from AC power to turn the patient monitor off.
2. Restore the batteries to the patient monitor and plug the patient monitor (or the docking station) into AC power to turn the patient monitor on.
3. Verify all of the front panel indicators illuminate on power up.
4. Verify the AC indicator on the patient monitor stays illuminated.

   NOTE

   If the AC indicator stays on, but the screen is blank, the patient monitor is likely in "standby mode" (battery charging). Press the POWER button to enter the normal mode.

   - If the AC indicator is on, continue with the tests.
   - Optional: If either of the **CHARGING STATUS** indicators is yellow, wait for the battery(ies) to fully charge and the indicators to illuminate green. The batteries may take up to four hours to charge.
   - If the battery "fuel gauge" displays the word "***ERROR***," the battery may be asleep. Refer to "Error messages" on page 6-5.

5. Verify the optional alarm indicator lights both red and amber on power up.
6. Verify an audio "beep" sounds at the end of boot up.
7. Test all of the front panel keys and the **Trim Knob** control. Verify that an audio "beep" sounds after each key press.
8. Optional: Check battery power for both batteries.
   - Unplug the patient monitor (or the docking station) from AC power and open the battery door. Verify one LED in the battery compartment is on (batteries must have more than 10% charge).
   - Pull that battery out and verify the other LED lights, thus indicating the unit is powered by the other battery.
   - Reinstall battery and plug in patient monitor (or the docking station).

ECG tests

Equipment

Use the following equipment for these tests:

- A multiparameter patient simulator.
- ECG patient cable
- ECG leadwire set

5 leadwire ECG test

Perform this test if the patient monitor acquires 5 leadwire ECG data.

Connections

1. Attach the ECG patient cable and ECG leadwire set to the **ECG/ RESP** connector on the patient monitor and connect the leadwires to the patient simulator.

Patient Simulator Configuration

2. Set up the patient simulator as follows:
   - Heart rate – 80 bpm.
   - Heart rate amplitude – 1.0 mV.
   - 5-leadwire ECG patient cable properly attached.
3. Admit the patient to the monitor.

Normal Sinus Rhythm Procedures

1. Observe the following:
   - ECG lead II is displayed and is noise-free
   - Heart rate of 80 ±1 bpm is displayed
   - With QRS tones enabled, an audible tone sounds with each Rwave (QRS complex)
2. Verify ECG leads I, II, III, aVL, aVF, and aVR are available to view and are noise-free.

Pacemaker Detection Procedures

1. Select ***DETECT PACE*** and set to ***PACE 2***.
2. Select a pacemaker pulse on the simulator.
3. Observe the following while you view ECG leads I, II, III, aVL, aVF, and aVR:
   - a “P” appears above the PVC count indicating pacemaker pulse detection is enabled, and
   - the heart rate still reads 80 ±1 bpm.

4. Disable pacemaker pulse detection on the patient monitor and return the simulator to these conditions:
   - Heart rate – 80 bpm,
   - Heart rate amplitude – 1.0 mV,
   - 5-leadwire ECG patient cable properly attached.

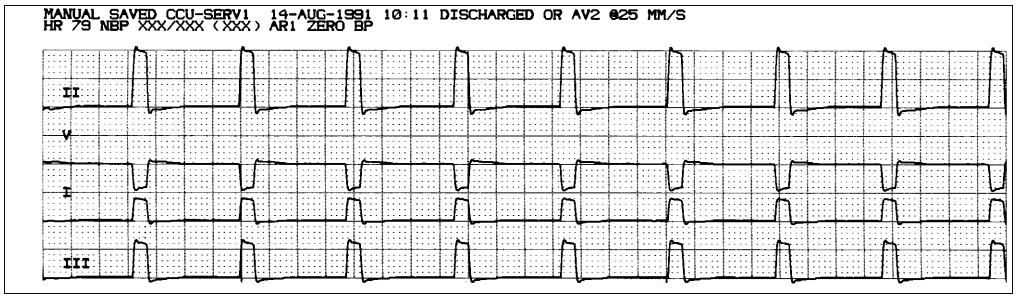
Leads Off Detection Procedures

1. Select ECG lead II to view in the top trace position on the patient monitor display.
2. Disconnect the RA leadwire from the patient simulator.
3. Observe the following:
   - an ***RA FAIL*** message appears on the display, and
   - lead III automatically displays in place of lead II in the top trace position.

4. Reconnect the RA leadwire to the patient simulator and discharge the patient monitor.

Calibration Pulse Test Procedures

5. Inject a 1-millivolt calibration signal using the patient simulator and start a manual graph.
6. Observe that the calibration pulse properly displays and graphs. Compare the printed graph with the sample shown below.



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7. Measure the cal pulse (Pulse) amplitude. These should be (+/-20%):
   - Lead I:0.5 mV
   - Lead II:1 mV
   - Lead III:0.5 mV
   - Lead V:-0.5 mV

8. This completes the 5 Leadwire ECG test. Leave the ECG patient cable connected to **ECG/RESP** and continue to the next steps of these checkout procedures.

12SL and ACI-TIPI ECG test (option)

Perform this test if your patient monitor uses the 12SL ACI-TIPI ECG option.

1. Set up the patient simulator as follows:
   - Heart rate – 80 bpm
   - Heart rate amplitude – 1.0 mV
   - 12SL ECG patient cable (5-leadwires with V leadwires) properly attached.
2. Select *ECG* from the patient monitor menu. Then, select ***12 LEAD ECG ANALYSIS***.
3. Verify that the patient monitor is displaying 12 noise-free leads.
4. Select ***12LD ECG NOW***. Wait for the patient monitor to acquire and analyze the data.
5. Select Transmit-Print.
6. Verify the 12SL ECG prints at the print location assigned in the patient monitor's ***Print Setup >12SL Print Location***.
   - If there is no print location is assigned, an error message appears on the bottom of the patient monitor's display.
7. Verify the ECG is transmitted to the MUSE Cardiovascular Information System. Verify the ECG prints out correctly as defined by the MUSE system.
   - If no MUSE system is connected, an error message appears on the bottom of the patient monitor's display.
8. Delete this test 12SL ECG from the MUSE system's edit list.

Respiration tests

Connect the ECG patient cable to the **ECG/RESP** connector of the patient monitor.

1. Set up the patient simulator as follows:
   - Respiration (RESP) baseline impedance – 750Ω or 1000Ω
   - RESP ΔR – 0.5Ω
   - Select appropriate lead for RESP on simulator
   - RESP rate (respirations per minute) – 30
2. Set up the patient monitor as follows:
   - RESP waveform – on
   - RESP waveform lead select – lead II (RESP waveform derived from ECG lead II)
3. Observe the following:
   - RESP parameter window appears on the patient monitor with a reading of 30 ±2 (respirations per minute)
   - RESP waveform appears distortion-free on the patient monitor
4. Change the RESP waveform lead select of the patient monitor to lead I (RESP waveform derived from ECG lead I), LA at the simulator.
5. Observe the following:
   - RESP parameter window appears on the patient monitor with a reading of 30 ±2 (respirations per minute),
   - RESP waveform appears distortion-free on the patient monitor.
6. Disconnect the ECG patient cable from the **ECG/RESP** connector of the patient monitor.
7. Proceed to the next steps in these checkout procedures.

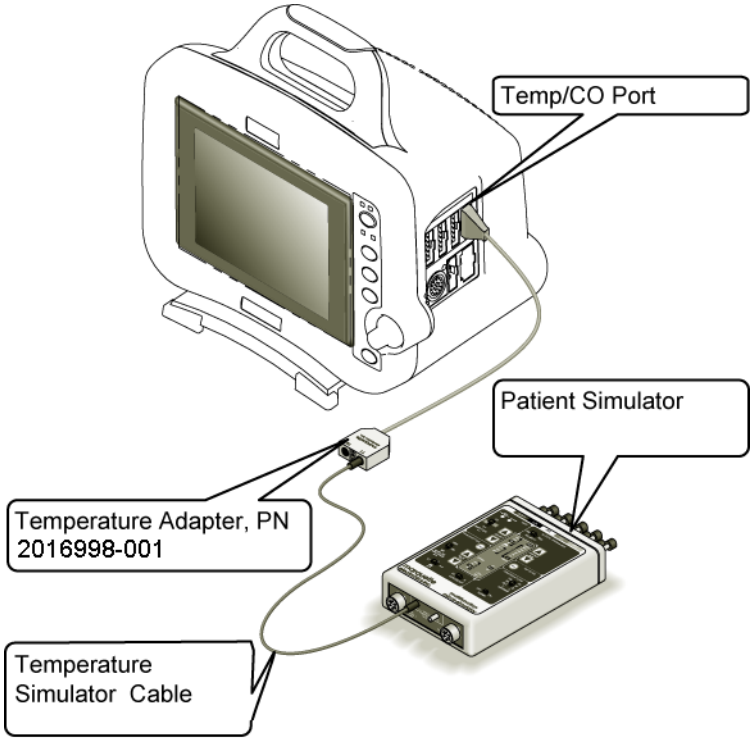
Temperature tests

Equipment

- 700/400 Series dual temperature adapter (2016998-001)
- Temperature simulator cable

Temperature test procedures

1. Set the patient simulator temperature output to 37° C.
2. Attach the temperature adaptor cable to the **TEMP/CO** connector of the patient monitor.
3. Set the switch on the temperature adaptor to the 400 or 700 position depending upon customer preference.
4. Attach the temperature simulator cable from the **SERIES 400 or 700 TEMPERATURE OUTPUT** connector of the patient simulator to the **T1** connector of the temperature adaptor.
5. Verify a TEMP parameter window appears on the patient monitor display with a T1 reading of 37.0° ±0.4° C.
6. Move the temperature simulator cable from the **T1** connector of the temperature adaptor to the **T2** connector of the temperature adaptor.
7. Verify a T2 reading of 37.0° ±0.4° C in the TEMP parameter window on the patient monitor display.



8. Remove the temperature adaptor and temperature simulator cable from the patient monitor and patient simulator.

Cardiac output tests (option)

Equipment

- A multiparameter patient simulator
- Cardiac output cable adapter
- Cardiac output simulator

Connections

1. Connect the cardiac output cable adaptor to the **TEMP/CO** connector of the patient monitor.
2. Connect the cardiac output adapter to the cardiac output simulator.
3. Verify a cardiac output parameter window appears on the patient monitor.

Cardiac output test procedures

1. On the patient monitor, select CO Parameter Box.
2. Set up the patient monitor:
   - Set ***AUTO MODE:*** to ***ON***.
   - Set ***INJECT TEMP:*** to ***BATH***.
   - Set ***SIZE:*** to ***7***.
   - Set ***INJECT VOL:*** to ***10CC***.
   - Set ***COMPUTATIONAL CONSTANT:*** to ***0.540***.
3. Set cardiac output cable adapter or simulator to **0°**.
4. Turn the simulator on. Select cardiac output menu corresponding to the injectate temperature set in step 3 at 5 liters/minute
5. When the patient monitor screen displays the message, ***INJECT WHEN READY***, press appropriate button on simulator to inject.
6. When computing is complete, the CO reading should be approximately 37°C at 5 liters of blood per minute ± 5%.

Invasive blood pressure tests (option)

Equipment

- A multiparameter patient simulator
- Dual BP cable (2005772-001 or equivalent)

The invasive blood pressure (BP) tests provide a method of verification for all BP connectors (**BP1**, **BP2**, **BP1/3** and **BP2/4**) of a patient monitor equipped with this optional function.

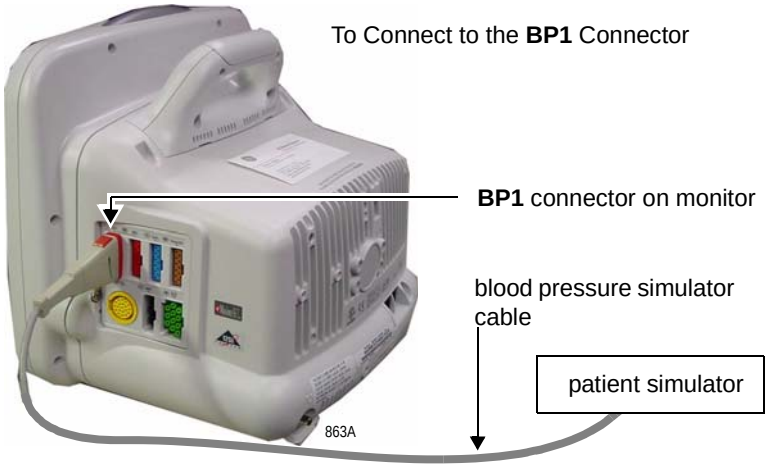
Patient simulator configuration

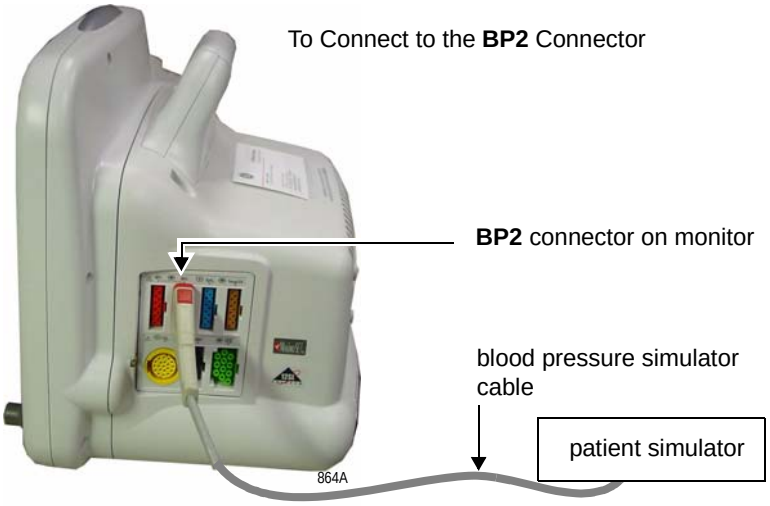
Set up the patient simulator as follows:

- Blood pressure (BP) polarity – POS, if required.
- BP output – 0 mmHg.
- BP transducer output – 5 µVolts.

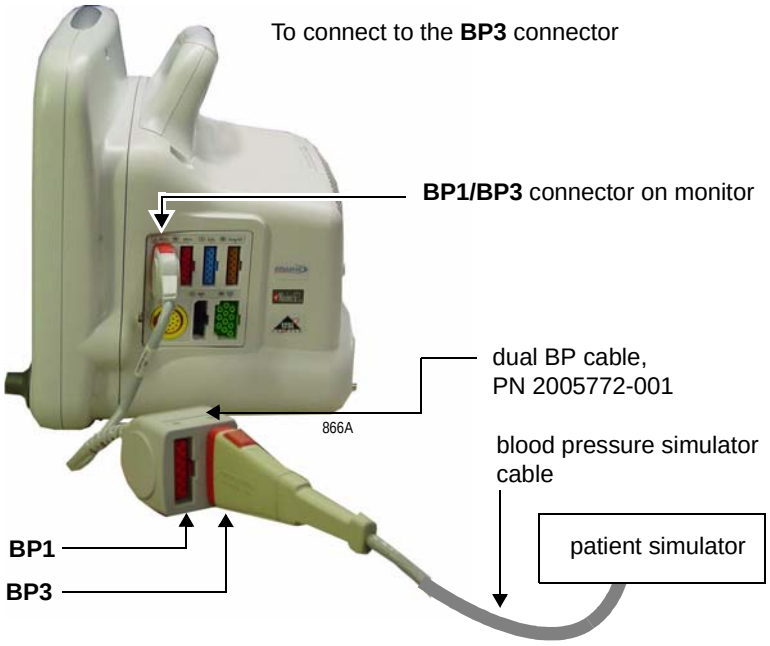
1. Connect the BP simulator cable to enabled BP connectors you are testing.

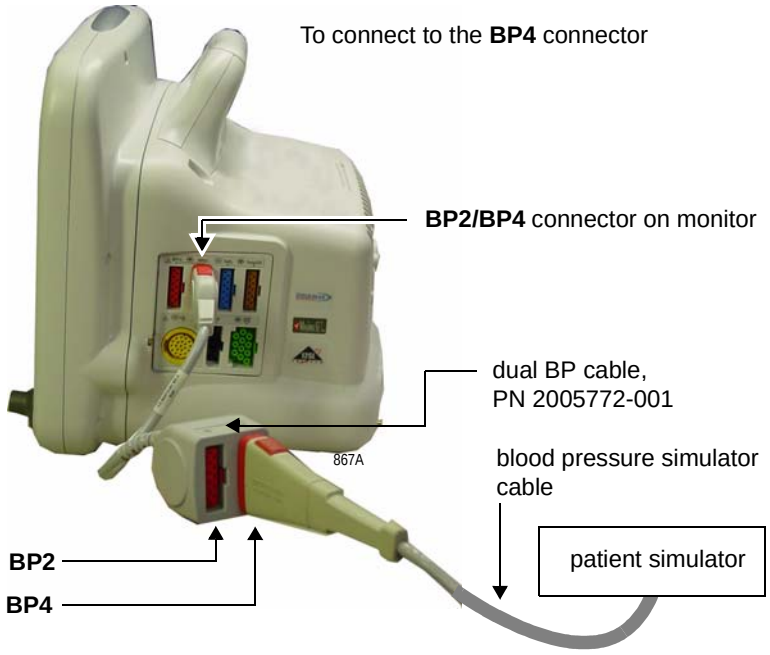
   a. To connect to the **BP1** or the **BP2** connector, see the pictures below.





b. To connect to the **BP3** or **BP4** connectors, see the pictures below.





BP connector test procedures

1. Verify the BP parameter window, waveform label, corresponding graticules, and waveform appear on the patient monitor display, along with a BP waveform requiring zero reference.
2. Press the **ZERO ALL** (**FUNCTION**) key on the front panel of the patient monitor to zero-reference the BP waveform.

3. Change the patient simulator BP output to 240 mmHg.
4. Observe a reading of 240/240 (240) ± 4 mmHg in the BP parameter window on the patient monitor display.
5. Change the patient simulator BP output to WAVE or to a 120/80 wave form (simulated BP waveform).
6. Observe a distortion-free BP waveform and a reading of approximately 120/80 in the BP parameter window on the patient monitor display.
7. Disconnect the BP simulator cable from the **BP** connector of the patient monitor.
8. Repeat steps for each enabled **BP** connector.

Pulse oximetry tests for GE Ohmeda SPO2 oximeter

Equipment

Use the following equipment for these tests:

- GEMS-IT SpO_2 simulator (408610-001 or equivalent).

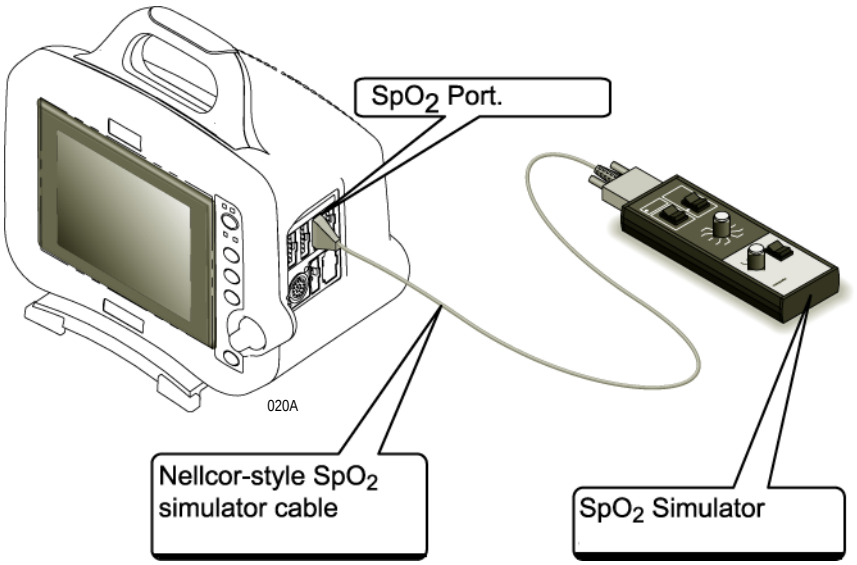
  NOTE

  The GEMS-IT SPO_2 simulator is only compatible with the GEMS-IT SPO_2 parameter.

- GEMS-IT SpO_2 simulator cable (700232-004 or equivalent)

Procedure

1. Set the pulse oximetry (SpO_2) simulator power switch to the off position.
2. Connect the Nellcor-style SpO_2 simulator cable between the SpO_2 connector of the patient monitor and the SpO_2 simulator.



SpO_2 simulator configuration

1. Set the simulator as follows:
   - Set the **MODE** to **NELLCOR**.
   - Set the SpO_2% to **99**.
   - Set the PPR to **100** beats/min.
   - Turn the power **ON**.

Pulse oximetry test procedures

1. Verify that the following are displayed at the patient monitor:
   - A sinusoidal waveform with an SpO_2 label.
   - An SpO_2% reading between 97 – 100% (97 and 102%).
   - A PPR reading between 97 and 103 beats per minute (it might be necessary to turn the SpO_2 ON).

2. Test the accuracy of these SPO_2% settings.

Accuracy of SpO_2 settings	
Simulator setting	Displayed SpO_2 value
99% (Both types)	97 – 100% (97 – 102%)
80.3% (84%)	78 – 82% (81 – 87%)
49.7 (63%)	48 – 52% (61 – 65%)

3. Test the accuracy of these PPR settings:

Accuracy of PPR settings	
Simulator setting	Displayed PPR value
70	68 – 72
100	97 – 103
160	156 – 164

4. Return the simulator to these conditions:
   - Set the SpO_2% to **99**.
   - Set the PPR to **100** beats/min.

5. Press the **NOISE TEST** button on the simulator for 30 seconds.
6. Make sure the patient monitor still displays an SpO_2 value between 97 and 100% (97 and 102%), or an interference detection message is displayed.
7. Turn the simulator off.
8. Disconnect the simulator cable from the device under test.

Pulse oximetry tests for Masimo SET SPO2

Equipment

Use the following equipment for these tests:

- Masimo SpO_2 Test Kit (2021087-001). Includes Masimo Tester and SPO2 Sensor Adapter Cable.

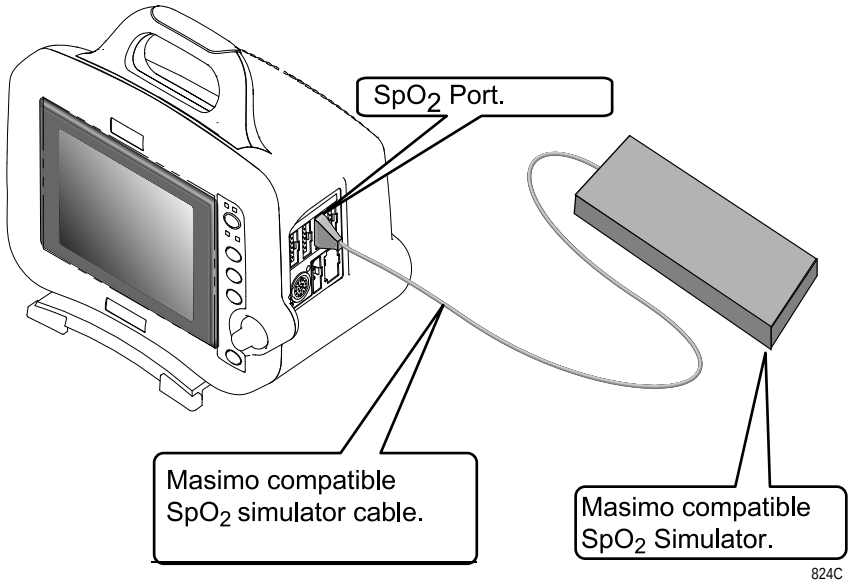
  NOTE

  The Masimo Tester is intended for use only with Masimo instruments or instruments containing Masimo SET oximetry with standard Masimo PC Series patient cable connectors. See the Masimo "Directions for Use" that came with the Tester for more information

  The PPR and SPO2 values for the Masimo Tester must be within these limits: Peripheral pulse rate: 61 bpm ± 1 bpm; and SPO2 value: 81% ± 3%.

Procedures

1. Connect the Masimo-style SPO_2 simulator cable between the SPO2 connector of the patient monitor and the SPO_2 simulator.



2. Turn on the patient monitor.
3. Verify the following are displayed at the patient monitor: (It might be necessary to turn the SPO_2 parameter on.)
   - A waveform with an SpO_2 label.
   - An SPO_2 % reading between **78 - 84**%.
   - A PPR reading between **60** and **62** beats per minute.
4. Disconnect the simulator cable from the module.

Pulse oximetry tests for Nellcor OxiMax SPO2

Equipment

Use the following equipment for these tests:

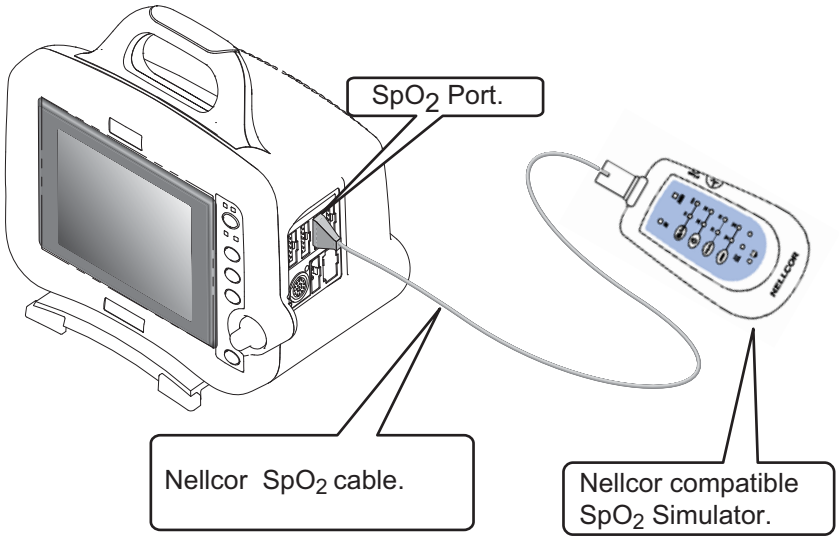
- Nellcor SRC-MAX SpO_2 Simulator (2007650-002).

  NOTE

  The Nellcor SRC-MAX SPO_2 Simulator is only compatible with the Nellcor SPO_2 parameter.

Procedures

1. Verify that 2 AA alkaline batteries are installed in the SRC-MAX Nellcor Pulse Oximetry functional tester.
2. Connect the SRC-MAX Nellcor Pulse Oximetry functional tester to the 9-pin end of sensor connector from the Dash. Make sure the Dash is powered.



3. Verify that the IR LED and RED LED drive indicators are both lit on the SRC-MAX.
4. Verify the SRC-MAX default indicators are set as follows:
   - HEART RATE = 60 bpm
   - LIGHT = LOW
   - %SpO2 = 75
   - MODULATION = LOW

   Allow the Dash a few seconds to obtain a steady reading.

5. Verify the following SpO2 readings on the Dash for saturation and pulse rate:
   - Saturation (%): 75 ±2
   - Rate (bpm): 60 ± 2

6. Press and release the **HEART RATE** switch and verify the SRC-MAX default indicators are lit as follows:
   - HEART RATE = 200 bpm
   - LIGHT = LOW
   - %SpO2 = 75
   - MODULATION = LOW

   Allow the Dash a few seconds to obtain a steady reading.

7. Verify the following SpO2 readings on the Dash for saturation and pulse rate:
   - Saturation (%): 75 ±2
   - Rate (bpm): 200 ±3% (194 to 206)

8. Press and release the **LIGHT** switch and verify the SRC-MAX default indicators are lit as follows:
   - HEART RATE = 200 bpm
   - LIGHT = HIGH
   - %SpO2 = 75
   - MODULATION = LOW

   Allow the Dash a few seconds to obtain a steady reading.

9. Verify the following SpO2 readings on the Dash for saturation and pulse rate:
   - Saturation (%): 75 ±2
   - Rate (bpm): 200 ±3% (194 to 206)

10. Press and release the %SpO2 switch and verify the SRC-MAX default indicators are lit as follows:
    - HEART RATE = 200 bpm
    - LIGHT = HIGH
    - %SpO2 = 90
    - MODULATION = LOW

    Allow the Dash a few seconds to obtain a steady reading.

11. Verify the following SpO2 readings on the Dash for saturation and pulse rate:
    - Saturation (%): 90 ±2
    - Rate (bpm): 200 ±3% (194 to 206)

12. Press and release the **8h**.
13. Switch and verify the SRC-MAX default indicators are lit as follows:
    - HEART RATE = 200 bpm
    - LIGHT = HIGH
    - %SpO2 = 90
    - MODULATION = HIGH

    Allow the Dash a few seconds to obtain a steady reading.
14. Verify the following SpO2 readings on the patient monitor for saturation and pulse rate:
    - Saturation (%): 90 ±2
    - Rate (bpm): 200 ±3% (194 to 206)

Noninvasive blood pressure tests

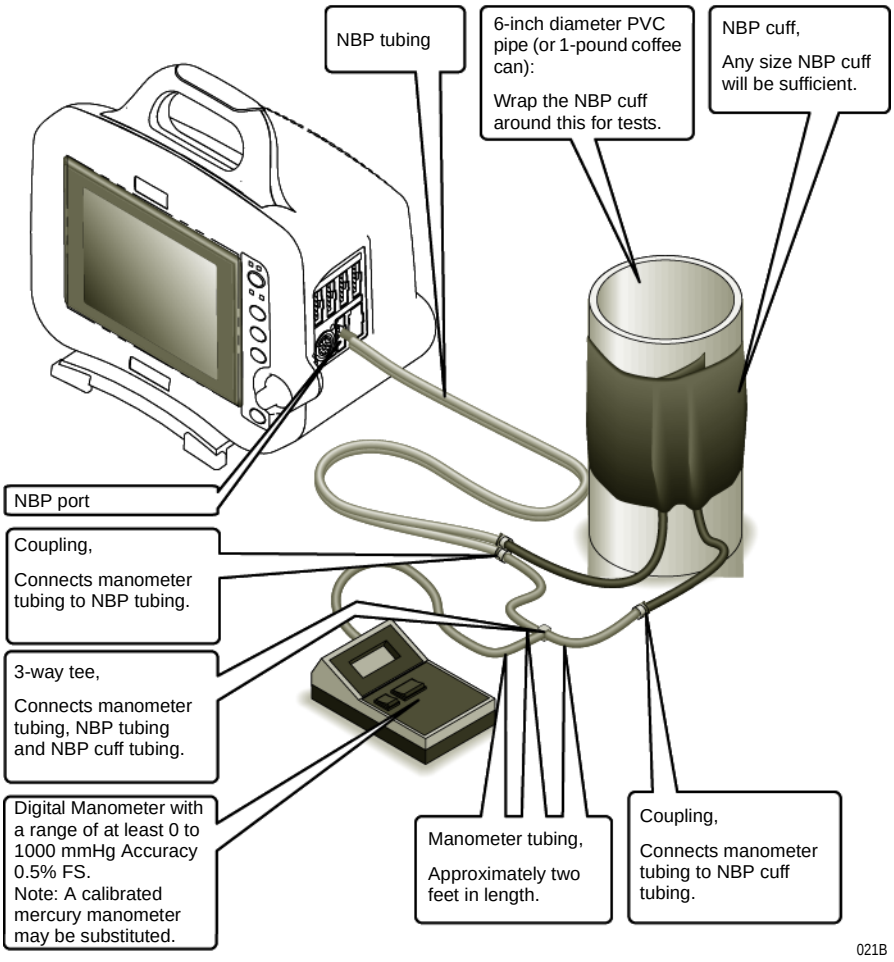
Equipment

Digital Manometer with a range of at least 0 to 1000 mmHg Accuracy 0.5% FS.

- NBP cuff coupling (400787-005 or equivalent)
- NBP hose coupling (400787-006 or equivalent)
- NBP tee (4745-101 or equivalent)
- NBP tubing 2 feet (401582-001 or equivalent)
- Manometer: mercury, digital (Sensym PDM200M – no longer available for ordering, Meriam Instrument Smart Manometer Model 350 DM2000, or equivalent)
- NBP tube (2017008-001 or equivalent)
- NBP cuff (2203 or equivalent)
- Pipe: PVC

Procedures

1. Attach the digital manometer, noninvasive blood pressure (NBP) cuff, tees and tubing, as shown in the illustration below, to the NBP connector of the patient monitor.



2. Set the digital manometer power switch to the on position.
3. Set the digital manometer range switch to 1000 mmHg.

Using the **Trim Knob** control, access the ***Service Mode*** menu starting from the Main Menu.

1. Select ***MORE MENUS*** > ***MONITOR SETUP*** > ***SERVICE MODE***.
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros (e.g. July 4 = 0407).
3. Select ***CALIBRATE*** > ***CALIBRATE NBP*** > ***CHECK CAL OFF*** > ***START***.

   The text on the menu item changes from ***CHECK CAL OFF*** to ***CHECK CAL IN PROGRESS***.

   Verify the readings in the NBP parameter window on the patient monitor display and readings on the digital manometer are equal (± 1

mmHg) for at least one full minute. If the readings are not equal for at least one full minute, the NBP circuit requires calibration. See "NBP calibration" on page 8-37.

4. Select ***CALIBRATE*** > ***CALIBRATE NBP*** > ***CHECK CAL OFF*** > ***START***.
5. Remove the NBP test setup apparatus from the patient monitor. The NBP tests are complete.

NBP calibration

NOTE
Only perform this test if the NBP pressure test fails.

The overall accuracy of noninvasive blood pressure (NBP) readings by the patient monitor depend on the following:

- the zero pressure reading, and
- the voltage span of the NBP sensor in the patient monitor.

This procedure provides a method of verifying these items are accurate and also checks the NBP pneumatic circuit plumbing for leaks.

WARNING
When the NBP cuff is used in this procedure, it must be tightly wrapped around a rigid cylinder or pipe. *Do not* put the NBP cuff around a human arm during the calibration procedures due to the potential for injury.

Calibration procedure

Using the **Trim Knob** control, access the ***Service Mode*** menu starting from the Main Menu.

1. Select ***MORE MENUS*** > ***MONITOR SETUP*** > ***SERVICE MODE***.
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros (e.g. July 4 = 0407).
3. Select ***CALIBRATE*** > ***CALIBRATE NBP*** > ***CAL ZERO OFF*** > ***START***.
4. The text on the menu item changes from Cal Zero Off to Cal Zero In Progress.

   When the process is complete, the menu item shows that it is ***OFF*** again.

Gain calibration test

NOTE

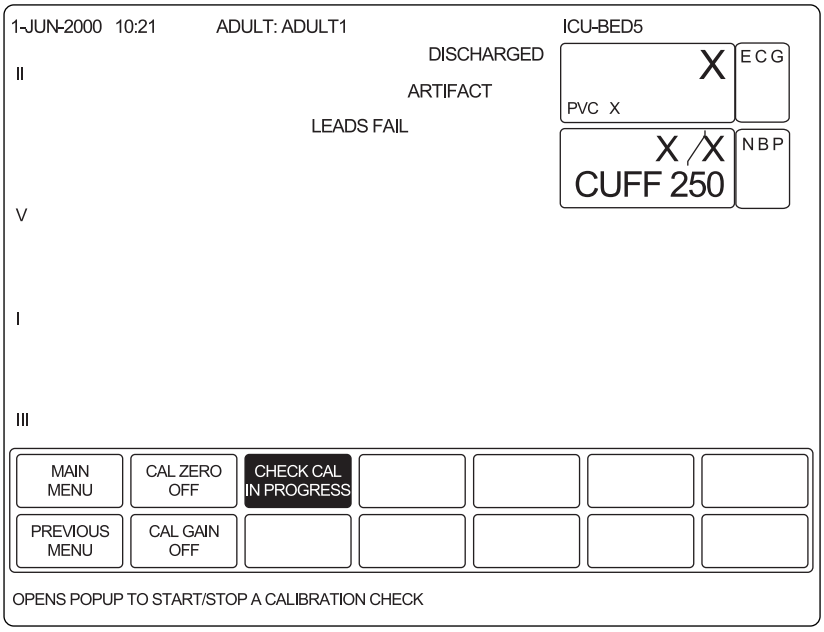
To proceed with the Gain Calibration Test, set up the patient monitor and test equipment following the guidelines in the NBP Checkout Procedure,"Functional Checkout procedures" on page 8-20.

1. Connect a cuff and manometer to the patient monitor.
2. Turn the digital manometer on and adjust the range switch to 1000 mmHg.
3. Select ***CAL GAIN OFF*** > ***CAL GAIN OFF*** > ***START***.

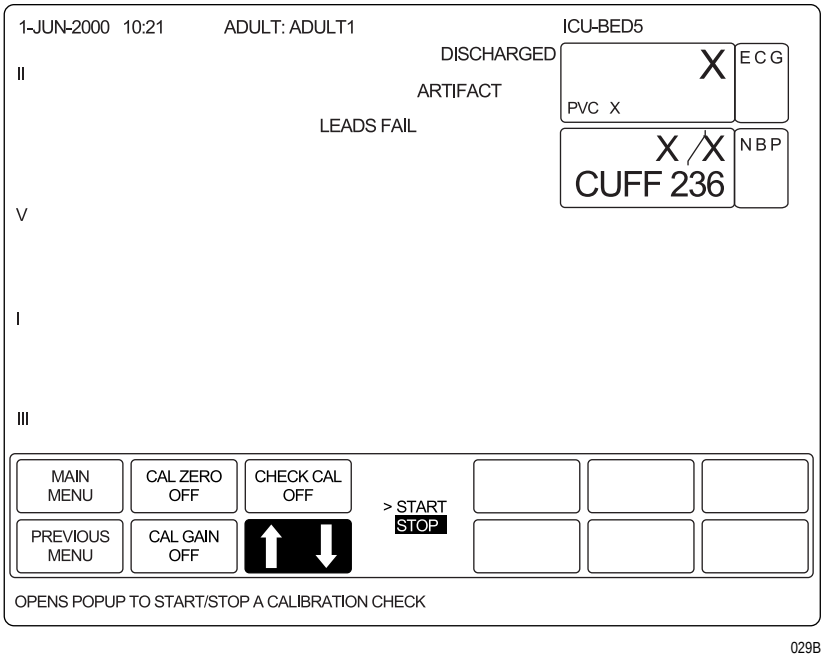
   The second line of text on the Cal Gain menu item changes from Cal Gain Holding to Cal Gain Inflating. The patient monitor starts pumping up the pressure bulb or cuff—the audible whirring sound of the NBP pump motors occurs and an increase in displayed pressures on both the patient monitor and the manometer can be observed.

   The pump shuts off at about 250 mmHg, and the pressure drops slowly to about 240 mmHg before stabilizing. The second line of text on the Cal Gain menu item changes from Inflating back to Holding.
4. If the pressure continues to drop at a rate of 1 mmHg or more for every five seconds, there is a leak in the NBP plumbing. If there is a leak in the NBP plumbing, repair it and restart this calibration procedure.
5. Select ***ENTER CAL PRESSURE*** and use the **Trim Knob** control to select a pressure value that is 1 mmHg lower than the current manometer reading. When the manometer falls to exactly the value that you selected in the pop-up window, press the **Trim Knob** control to enter the value.
6. Select ***CHECK CAL OFF*** > ***START***.
7. The text on the menu item changes from ***Check Cal Off*** to ***Check Cal In Progress***. Verify the pressure readings (shown as ***Cuff*** in the

NBP parameter box) on the patient monitor and manometer are equal (± 1 mmHg) for *at least* one full minute.



8. Select ***CHECK CAL IN PROGRESS*** > ***STOP***. The patient monitor automatically releases pneumatic pressure in the entire plumbing circuit.



9. Unplug the patient monitor from AC power source and remove the test apparatus from the patient monitor.

Analog output and defibrillator synchronization tests

Equipment

Use the following equipment for these tests:

- Oscilloscope, or equivalent
- 5.5 digit precision voltmeter (HP34401A or equivalent). Needed for calibration only.
- Analog output cable (2000633-001 or equivalent)

Setup

1. Use the figure below as a reference for connecting test devices to the **DEFIB SYNC** connector, located on the back panel of the patient monitor, for performing these tests.

Defibrillator Synchronization connector			
Pin	Name	Descriptions	 Back View of Module
1	DEFIB_MARKER_OUT	Digital defibrillator output synchronization signal	
2	DEFIB_MARKER_IN	Digital defibrillator input signal	
3	AGND1	Signal Ground	
4	DGND	Signal Ground	
5	AGND2	Signal Ground	
6	BP_ANALOG_OUTPUT	Analog BP/OUTPUT	
7	ECG_ANALOG_OUTPUT	Analog ECG output signal	

039B

Analog output cable pinout (2000633-001)	
PIN number	Color
1	Black
2	Green
3	Red
4	Brown
5	Blue
6	White
7	Yellow
8	Gray

2. Test the ECG, Arterial BP, and Marker Out signals from the **DEFIB SYNC** connector. ECG Input voltage of 1 mV = 1 V analog output +-

10%. They should closely resemble the waveforms in the figures below.

NOTE

The Marker Out amplitude and the pulse width are configured in the Boot Code settings. Refer to Boot Code settings, "Set Defib Sync Voltage and pulse width" on page 4-18 for more information.

DEFIB Sync connector:

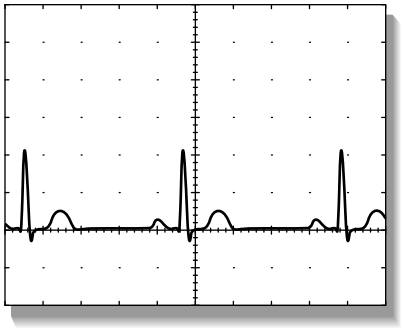
Signal Pin:—7

Ground Pin:—3

Probe Type:—x10

Time/Division:—0.2S

Volts/Division:—0.5V



023A

DEFIB Sync connector: arterial BP

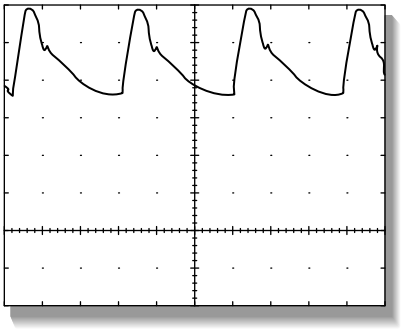
Signal Pin:—6

Ground Pin:—5

Probe Type:—x10

Time/Division:—0.2S

Volts/Division:—0.2V



024A

DEFIB Sync connector: Marker Out (frequency)

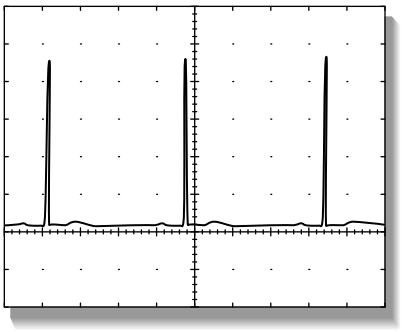
Signal Pin:—1

Ground Pin:—4

Probe Type:—x10

Time/Division:—0.2S

Volts/Division:—1V



025A

DEFIB Sync connector: Marker Out (pulse width)

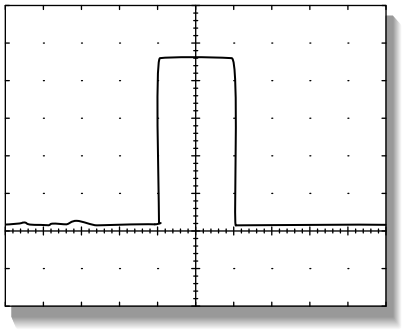
Signal Pin:—1

Ground Pin:—4

Probe Type:—x10

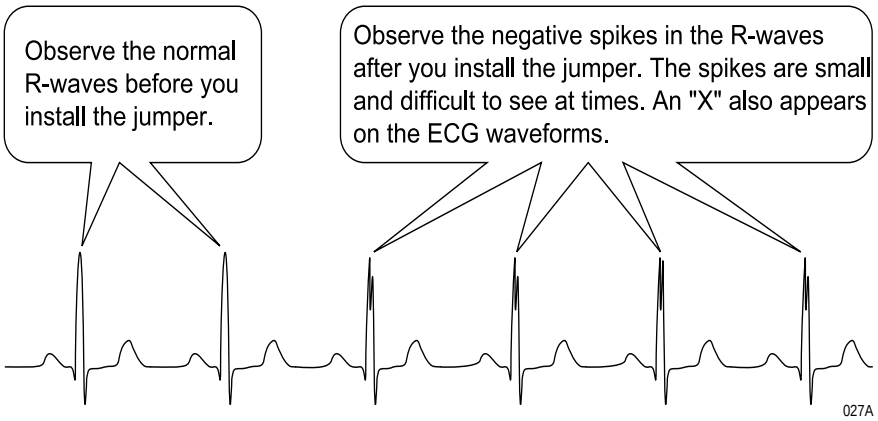
Time/Division:—5mS

Volts/Division:—1V



3. Attach a jumper wire between pin-1 (Marker Out) and pin-2 (Marker In) of the **DEFIB SYNC** connector located on the back of the patient monitor. Verify negative spikes in each of the QRS Complex (ECG waveform) R-Waves on the patient monitor display, similar to those shown in the illustration below

.



4. Remove the test cables or wires from the **DEFIB SYNC** connector. This completes the defibrillator synchronization tests.

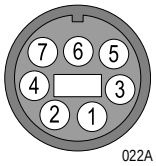
ECG or BP calibration

NOTE

Only perform this test if the ECG or BP out signals from the previous test are out of specifications.

To complete the ECG or BP calibration, connect a voltmeter to the patient monitor.

1. Attach the analog output cable (pn 2000633-001) to the patient monitor.
2. Connect a 5.5 digit precision voltmeter (such as HP34401A, or equivalent) to the port pin to be calibrated (If ECG: Pin 7 = ECG signal, Pin 3 = ground. If BP: Pin 6 = BP, Pin 5 = ground.).



3. Access the patient monitor's ***Service Mode.***
4. Calibrate the ECG or the BP parameters as follows.

ECG calibration

Using the **Trim Knob** control, access the ***Service Mode*** menu starting from the Main Menu.

1. Select ***MORE MENUS*** > ***MONITOR SETUP*** > ***SERVICE MODE***.
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407).
3. Select ***CALIBRATE*** > ***CAL ECG ANALOG OUT*** > ***SET ECG LOW***.
4. Adjust the count for –9.0 V ± 5 mV on the meter and press the **Trim Knob** control.
5. Select ***SET ECG HIGH***.
6. Adjust the count for +9.0 V ± 5 mV on the meter and press the **Trim Knob** control.
7. Select ***SET ECG ZERO***.

   Adjust the count for 0.0 V ± 5 mV on the meter and press the **Trim Knob** control.
8. Select ***CONFIRM ECG CAL*** to confirm or abort the calibration.

BP calibration

Using the **Trim Knob** control, access the ***Service Mode*** menu starting from the Main Menu.

1. Select ***MORE MENUS*** > ***MONITOR SETUP*** > ***SERVICE MODE***.
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407).
3. Select ***CALIBRATE*** > ***CAL BP ANALOG OUT*** > ***SET BP LOW***.
4. Adjust the count for –9.0 V ± 5 mV on the meter and press the **Trim Knob** control.
5. Select ***SET BP HIGH***.
6. Adjust the count for +9.0 V ± 5 mV on the meter and press the **Trim Knob** control.
7. Select ***SET BP ZERO***. Adjust the count for 0.0 V ± 5 mV on the meter and press the **Trim Knob** control.
8. Select ***CONFIRM BP CAL*** to confirm or abort the calibration.

End-tidal CO_2 test (option)

To verify the mainstream end-tidal CO2, refer to the CO2 chapter in the Dash 3000/4000/5000 Patient Monitor Operator's Manual. This test requires you perform a zero and reference check by using the sample cells provided on the end-tidal CO2 cable.

For instructions on verifying sidestream end-tidal CO2 and setting the sample line to zero, refer to the CO2 module operator instructions.

Battery tests

1. Check battery power for both batteries.
   - Unplug the patient monitor (or the docking station) from AC power and open the battery door. Verify one LED in the battery compartment is on (batteries must have more than 10% charge).
   - Pull that battery out and verify the other LED lights, thus indicating the unit is powered by the other battery.
   - Reinstall battery and plug in patient monitor to a wall outlet (or the docking station).

Graph or print tests (option)

Communication confirmation

Confirm communication across the network as follows.

1. Admit and generate a waveform at the patient monitor with a simulator.
2. Press **Print** and observe graph output at chosen locations.

Test pattern (option based on Dash having a local printer)

Using the **Trim Knob** control, access the Service Mode menu starting from the Main Menu.

1. Select ***MORE MENUS*** > ***MONITOR SETUP*** > ***SERVICE MODE***.
2. Enter password using the **Trim Knob** control to select the day and month from patient monitor screen with leading zeros. (e.g. July 4 = 0407).
3. Select ***PRINT*** (or ***GRAPH***) ***TEST PATTERN*** > ***START***.
4. Verify the following:
   - Fonts
   - Shading
   - Triangle Pattern
   - No missing dots
5. Select ***PRINT*** (or ***GRAPH***) ***TEST PATTERN*** > ***STOP***.

Graph speed

Using the **Trim Knob** control, access the Graph Setup menu starting from the Main Menu.

1. Select ***MORE MENUS*** > ***MONITOR SETUP*** > ***PRINT*** (or ***GRAPH***) ***SETUP***.
2. Select ***SPEED:25*** (default).
3. Verify that all eight speeds work.

Display test

1. Hold the **NBP Auto** and the **ZERO ALL** keys and press the **Trim Knob** control at the *same* time.
2. Release the **Trim Knob** control immediately.
3. Continue holding the **NBP Auto** and the **ZERO ALL** keys.
4. Select "***Video Test Screens***."
5. Test all screens:
   - White Screen
   - Red Screen
   - Blue Screen
   - Green Screen
   - Vertical Bars

Speaker test

1. Change the alarm volume of the patient monitor to 100%.
2. Verify the speaker volume of the patient monitor changes accordingly.
3. Return the volume of the patient monitor to the level it was previously set to, before you changed it for this test.

Network test (option)

1. Verify that the patient monitor is connected to the CARESCAPE Network MC (Mission Critical).

   NOTE
   When the patient monitor is connected to a docking station, verify the docking station is connected to the CARESCAPE Network MC.

   NOTE
   When the patient monitor is connected to a docking station, the patient monitor's network port is disabled. Only the docking station's network port is enabled at this time.

2. Select ***VIEW OTHER PATIENTS***.
3. Select ***SELECT ANOTHER CARE UNIT***.
4. Verify that you can see at least one care unit.
5. Select a care unit.
6. Select ***SELECT A BED TO VIEW***.
7. Select a bed.
8. Verify that the patient window appears on the patient monitor's split-screen.

Remote control test (option)

1. Verify the remote control is connected into an Autoport to M-Port adapter and is inserted into the **Aux** connector.
2. Select ***MORE MENUS*** > ***MONITOR SETUP*** > ***REVISION AND ID***.
3. Select ***NEXT*** from the popup menu to display the port connectors.
4. Verify the Remote Control label appears after the appropriate port and the software version for the remote control is shown.
5. Press each remote control key and verify a beep tone sounds at the patient monitor.

BISx test (option)

Before performing these procedures, complete the following Electrical Safety tests for the BISx module.

- "Ground (earth) wire leakage current tests" on page 8-7
- "BISx patient (source) leakage current test" on page 8-16
- "BISx patient (sink) leakage current test" on page 8-18

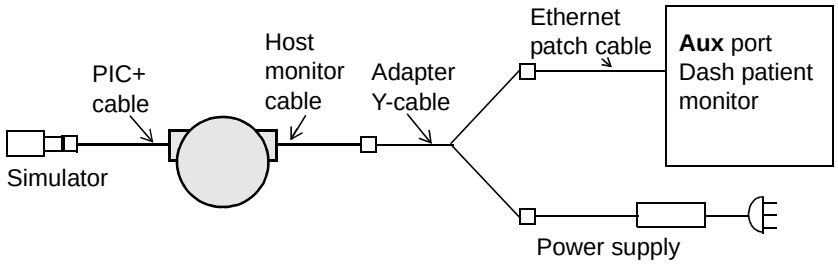
Equipment

Use the following equipment for this test:

- BISx with integrated host patient monitor cable and Patient Interface Cable (PIC+)
- BISx adapter Y-cable assembly 2026830-001
- Ethernet patch cable 2011129-001
- Power supply with power cord
- Sensor Plus Simulator (2007695-001 or equivalent)

Procedure

1. See the diagram below and connect the BISx as follows:.



   a. Connect the BISx host patient monitor cable to the BISx adapter Y-cable assembly.

   b. Connect one end of the Y to the power supply and the other to the Ethernet patch cable.

   c. Connect the Ethernet patch cable to the **Aux** port connector on the Dash patient monitor.

   d. Connect the power supply to an AC power source.

   The BIS parameter window appears. The prompt, ***CONNECT SENSOR*** displays in the parameter window.

2. Connect the Patient Interface Cable (PIC) to the Sensor Plus Simulator.

   The message ***SENSOR CHECK IN PROCESS*** displays in the parameter window.

3. Select the BIS parameter block to open the BIS parameter menu.

4. From the BIS parameter menu, select the ***SENSOR CHECK*** menu option. An information window opens with the impedance data. For example:

LEAD	IMPEDANCE	STATUS
1	4.8	PASS
2	14.0	PASS
3	2.3	PASS
4	3.3	PASS

5. Verify that the impedance values displayed in the information window fall within the range shown below.

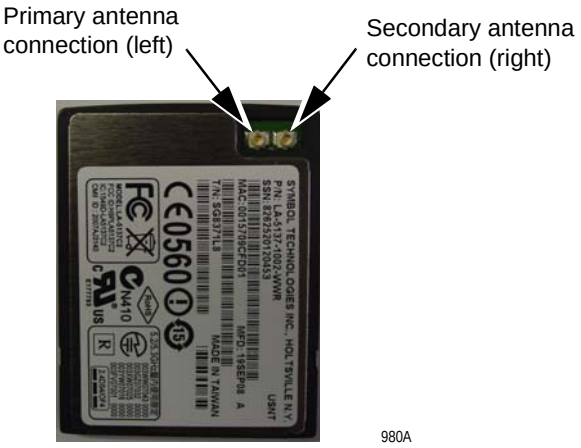
Electrode #	Acceptance range in Kohms
1	4—6
2	8—17
3	2—4
4	3—5

Wireless antenna signal strength test (option)

Purpose

This test checks the individual signal strength of the primary and the secondary wireless antennas. Physical damage to the antenna cables (e.g., pinched, crushed, abraded, or cut) or a poor connection to the wireless card connectors can reduce or stop the wireless antenna signal.

The position of the primary and secondary antenna connections on the wireless card are as follows:



The relationship between the wireless card connectors, wireless antenna cable colors and the primary/secondary antenna signal strength test settings are as follows:

Primary and Secondary Wireless Antennas		
Antenna position	Antenna color	Antenna configuration test settings *MORE WIRELESS LAN SETTINGS > ANTENNA*
Right	Black	*PRIMARY*
Left	Grey	*SECONDARY*

NOTE
The default ***ANTENNA*** configuration setting is ***ENABLED***.

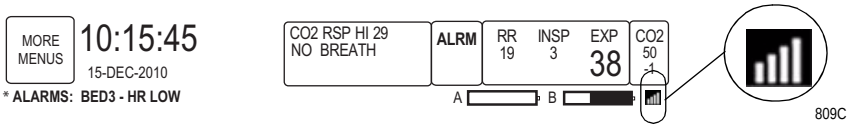
Test environment

For this test, place the Dash monitor in a wireless network environment with a known strong wireless signal.

Testing the primary antenna signal strength

Complete the following procedures to check the signal strength of the primary and the secondary wireless antennas.

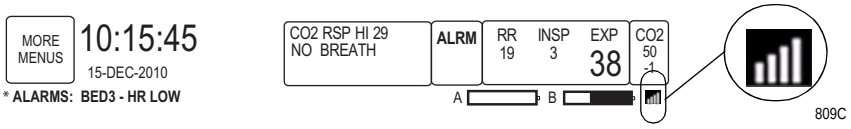
1. On the patient monitor, select ***MONITOR SETUP*** > ***SERVICE MODE***.
2. Enter the password.
3. Select ***MONITOR SETTINGS*** > ***MORE WIRELESS LAN SETTINGS***.
4. Select ***ANTENNA*** and set to ***PRIMARY***.
5. Select ***RETURN***.
6. Reset the Dash monitor and return the monitor to operating mode:
   a. Simultaneously press the **Trim Knob** control and the following keys:
   (Dash 3000) **NBP Go/Stop** and **Function**.
   (Dash 4000) **NBP Go/Stop** and **Zero All.**
   (Dash 5000) **NBP Auto** and **Zero All**.
   b. Release the **Trim Knob** control and both keys. The patient monitor returns to operating mode and displays the patient monitoring screen.
7. In the lower right corner of the monitor's display, make note of the number of bars displayed in the wireless signal strength indicator.



Testing the secondary antenna signal strength

1. On the patient monitor, select ***MONITOR SETUP*** > ***SERVICE MODE***.
2. Enter the password.
3. Select ***MONITOR SETTINGS*** > ***MORE WIRELESS LAN SETTINGS***.
4. Select ***ANTENNA*** and set to ***SECONDARY***.
5. Select ***RETURN***.
6. Reset the Dash monitor and return the monitor to operating mode:
   a. Simultaneously press the **Trim Knob** control and the following keys:
   (Dash 3000) **NBP Go/Stop** and **Function**.
   (Dash 4000) **NBP Go/Stop** and **Zero All.**
   (Dash 5000) **NBP Auto** and **Zero All**.
   b. Release the **Trim Knob** control and both keys. The patient monitor returns to operating mode and displays the patient monitoring screen.

7. In the lower right corner of the monitor's display, make note of the number of bars displayed in the signal strength indicator.



Acceptance criteria

Three or more bars displayed in the wireless signal strength indicator with no more than +/- 1 bar difference between the primary and the secondary antenna signal strengths.

NOTE

- If the signal strength of the tested antenna is less than 3 bars, the antenna under test fails.
- If there is greater than +/- 1 bar difference between the primary and the secondary antenna signal strength indicators, then the antennas under test fail.

Returning the ANTENNA configuration setting to ENABLED

The Dash monitor wireless communication will not function unless the ANTENNA configuration setting is returned to the ENABLED default setting.

1. On the patient monitor, select ***MONITOR SETUP*** > ***SERVICE MODE***.
2. Enter the password.
3. Select ***MONITOR SETTINGS*** > ***MORE WIRELESS LAN SETTINGS***.
4. Select ***ANTENNA*** and set to ***ENABLED***.
5. Select ***RETURN***.
6. Reset the Dash monitor and return the monitor to operating mode:
   a. Simultaneously press the **Trim Knob** control and the following keys:
   (Dash 3000) **NBP Go/Stop** and **Function**.
   (Dash 4000) **NBP Go/Stop** and **Zero All.**
   (Dash 5000) **NBP Auto** and **Zero All**.
   b. Release the **Trim Knob** control and both keys. The patient monitor returns to operating mode and displays the patient monitoring screen.

Wireless LAN test (option)

Purpose

These procedures check the patient monitor for wireless communication. While moving a roll-stand with a wireless patient monitor from edge to edge of the predetermined wireless network coverage area, check for the following at the edges of the wireless network:

- the ***SIGNAL LEVEL (RSSI)*** is equal to or greater than the minimum user-defined value,
- the ***TRANSMIT RATE*** is equal to or greater than 5.5, and
- a constant waveform from a stationary wireless/wired patient monitor displays without any loss of waveform.

NOTE

This is a verification of the patient monitor and must not substitute a professional site survey, installation and verification of the areas designed for the wireless network. The connectivity and coverage of the wireless network is verified through the ***SIGNAL LEVEL (RSSI)*** status and ***TRANSMIT RATE*** status in the wireless patient monitor.

Equipment

Use the following equipment and information for this test:

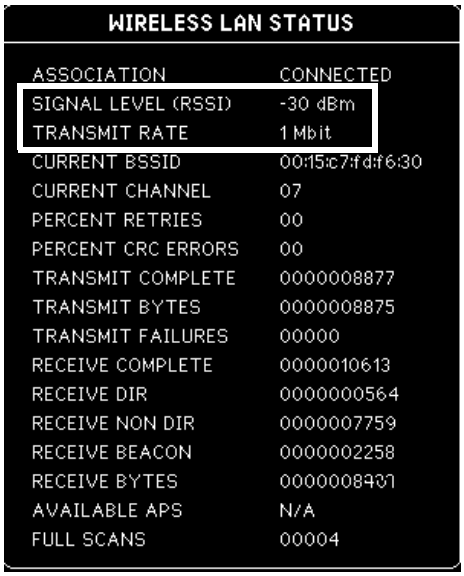
- Wireless Dash patient monitor being tested.
- Roll-stand (optional)
- Stationary wireless/wired patient monitor
- Multi-parameter patient simulator or an equivalent ECG patient simulator.
- Contact the hospital IT department to obtain the following information:
  - access point settings for ***SSID*** and ***SECURITY***, and
  - wireless network coverage area.

Procedures

1. Connect the patient simulator to the stationary wireless/wired patient monitor and generate a waveform.
2. Admit the stationary wireless/wired patient monitor to the CARESCAPE Network MC.
3. Configure the wireless Dash patient monitor to communicate with the wireless network as follows:
   a. On the patient monitor, select ***MORE MENU> MONITOR SETUP > SERVICE MODE***.
   b. Enter the password.
   c. Select ***MONITOR SETTINGS> CONFIGURE WIRELESS LAN***.

d. Ensure that the ***SSID*** and ***SECURITY*** match the wireless network and the monitor being checked is within the wireless coverage area.

4. On the patient monitor, select ***MONITOR SETUP*** > ***SERVICE MODE***.
5. Enter the password.
6. Select ***MONITOR SETTINGS*** > ***WIRELESS LAN STATUS***.



7. Verify that
   a. the ***SIGNAL LEVEL (RSSI)*** status is equal to or greater than the minimum user-defined value, and
   b. the ***TRANSMIT RATE*** status is equal to or greater than 5.5.

   If the ***SIGNAL LEVEL (RSSI)*** is less than the minimum user-defined value and/or the ***TRANSMIT RATE*** is less than 5.5, contact the hospital IT department to check for radio interference and verify that the access point's radio transmission is operating optimally.
8. Close the ***WIRELESS LAN STATUS*** window.

NOTE

The following steps require at least one other patient monitor connected to MC network.

9. Configure the patient monitor to view the stationary patient monitor's waveform as follows:
   a. On the patient monitor, select ***MORE MENU*** > ***VIEW OTHER PATIENTS*** > ***SELECT ANOTHER CARE UNIT***.
   b. Select the appropriate unit.
   c. Select ***SELECT A BED TO VIEW***.
   d. Select the appropriate bed.
10. Verify that the waveform displays without any losses.
    If a waveform gap or loss was spotted on the display, troubleshoot to determine if the problem is with the wireless network card or network.

Dash Port 2 docking station test (option)

Electrical safety tests

When the patient monitor is connected to the docking station, perform the electrical safety tests described in the maintenance section of the Dash Port 2 Service Manual.

Operation

Complete the Checkout procedures located in the Dash Port 2 Docking Station Service Manual.

TRAM-rac 2A module housing peripheral device test (option)

Electrical safety tests

Perform the electrical safety tests on the TRAM-rac 2A separate from the patient monitor.

Refer to the "Electrical safety tests" on page 8-4 and complete the following tests.

1. Power outlet test
2. Ground (earth) continuity test,
3. Ground (earth) wire leakage tests, and
4. Enclosure leakage current test.

Operation

Complete the TRAM-rac 2A Module Housing Test procedures found in the maintenance section of the TRAM-rac 2A Module Housing Service Manual.

ICG Module test (option)

Refer to the "Electrical safety tests" section of the ICG Module Service Manual.

Operation

Complete the ICG Test found in the Checkout Procedure section of the ICG Module Service Manual.

Checkout procedures completion

This completes all tests associated with the checkout procedures.

1. Discharge the test patient admitted during the “ECG tests” on page 8-22.
2. Set all test equipment power switches to the off position.
3. Unplug the patient monitor (or docking station) from AC power.
4. Remove all test equipment from the patient monitor (or docking station).
5. GE recommends that the qualified personnel performing the tests should record functional checkout test values in the “Checklist” on page D-1.