Reverse Polarity - Change the leakage current switch to the RVS position with GND switch CLOSE.

Verify that the leakage current from TurboTemp Probe to ground pin is less than 5mA (5 volts on the DMM).

Checkout Procedures

These checkout procedures provide service personnel with a method to verify operational and functional performance of the Monitor. Failure to attain any of the listed results indicates a potential malfunction of the Monitor.

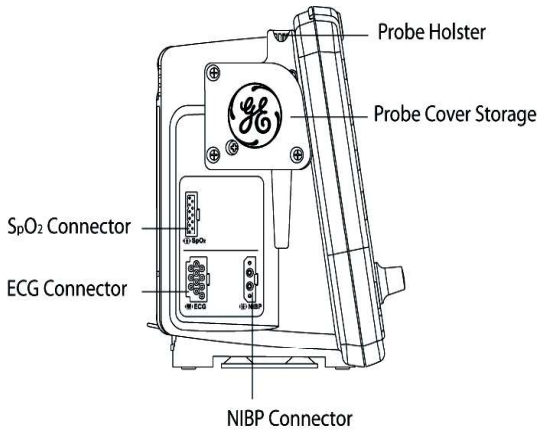
Perform the checkout procedures every 24 months thereafter, and each time you service the unit.

The checkout procedures are based on the assumption that the tested monitor has known good cables and test equipment. It also requires that the user be familiar with the operation of all test equipment required for the checkout procedures. For more information concerning the operation of these components, refer to the operation manual.

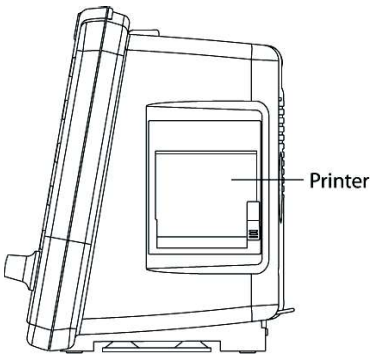
NOTE: All devices are tested and calibrated during manufacturing and are certified for operation at installation.

Parameter Level Functional Testing

After the initial configuration is complete, perform functional testing of each of the parameters. Using the accessories supplied with the Monitor, initialize the parameters.



Left Side View of Monitor



Right Side View of Monitor

Functional tests to be performed:

- **SpO_2:** The SpO_2 sensor used depends on the Monitor configuration.

  NELLCOR® —SpO_2 configured monitors use an assembly consisting of two parts: the DS-100A, and the extender cable NELL1 GE cable.

  MASIMO SET® —SpO_2 configured monitors use an assembly consisting of an interface cable and a sensor.

  Connect the cables prior to attaching to the Monitor. An SpO_2 reading displays within moments of attaching the sensor to either an SpO_2 simulator or to your finger.

- **Blood Pressure:** A blood pressure test is carried out by connecting the supplied hose and cuff together, then attaching them to the NIBP Connector on the left side of the Monitor. Press the **NIBP Go/Stop** hardkey on the front to begin the NIBP cycle.

- **ECG:** ECG monitoring uses 3-electrode or 5-electrode configuration.

  3-Lead ECG connection —Connect the ECG lead connector to the ECG trunk cable prior to connecting to the Monitor. The simplest way to function test the ECG circuits is through the usage of an ECG simulator.

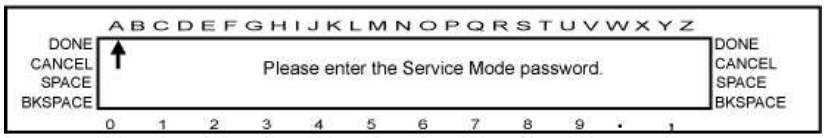
  5-Lead ECG connection —Connect the ECG lead connector to the ECG trunk cable prior to connecting to the Monitor. The simplest way to function test the ECG circuits is through the usage of an ECG simulator.

- **Temperature:** Connect the supplied temperature probe to the corresponding connection. A predictive temperature begins once the probe is removed from the holster. Replace the probe after completion of the TEMP cycle.

Service Mode Operation

The Monitor Service Mode exercises the built-in diagnostic features of the Monitor and the installed parameters. Access the Service Mode from a cold start by proceeding as follows:

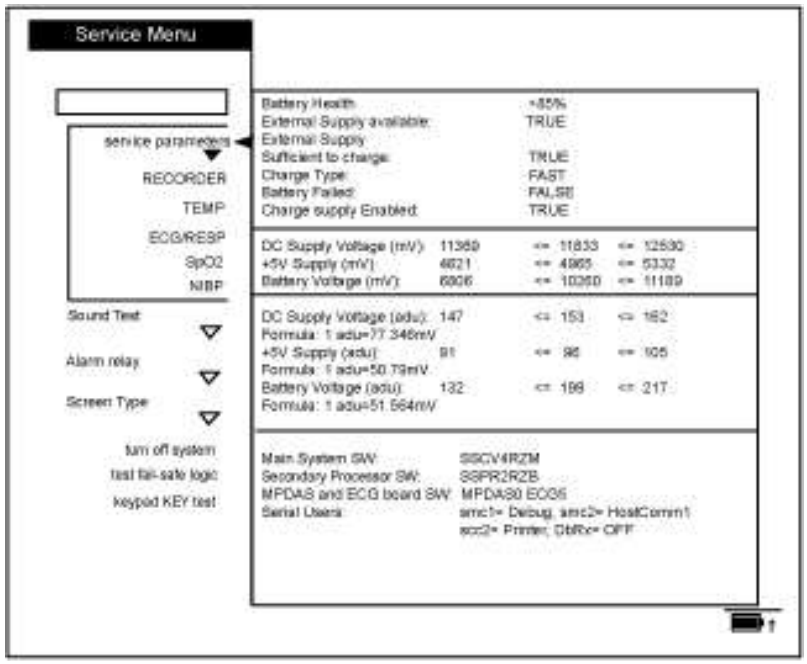
1. Power on the Monitor using the **Power** hardkey.
2. Use the Trim Knob to select the **no** option when the Monitor prompts to admit a new patient.
3. Press or turn the Trim Knob to access the **Main Menu**.
4. Turn the Trim Knob to scroll down the menu. The arrow at the bottom of the list indicates that the list continues on a second screen. Highlight the **other system settings** option and press the Trim Knob.
5. Highlight the **go to service mode** option and press the Trim Knob. Turn the Trim Knob and press the Trim Knob again to answer **yes** at the prompt to display the dialog box.



6. A row of numbers is displayed at the bottom of the screen. Turn the Trim Knob and move the arrow to the desired number, then press the Trim Knob to select the number. Enter the Service Mode password, **2213**.
7. After the password is selected, turn the Trim Knob to the **DONE** option and press the Trim Knob.
8. In the process of entering the Service Mode, the Monitor resets itself. Successful entry into the Service Mode is indicated by the **Service Menu** title displayed on the upper left side of the display.

   NOTE:
   The Service Mode can also be entered directly from a cold start by pressing and holding the following two keys until full power-up: **Power** and **NIBP Auto**. To make any changes to the **Service Menu**, the password has to be entered, follow Step 6.

9. At this point the Service Mode main screen should be present in the main display, as shown in the following graphic. The **Service Menu** service parameters area displays a list that corresponds to the number and type of parameters that have been detected by the Monitor. If the Service Mode was entered directly (as described in the **NOTE** above), enter service password appears above the service parameters on the **Service Menu**. The password MUST be entered (as described in Steps 5 and 6) before any changes to calibration can be made.



Main Service Menu

For each parameter, there are one or more service screens that display operating values and tests that are applicable to the parameter type. Refer to the following paragraphs for information about each parameter. At the conclusion of the tests, select **go to service menu** at the top of the screen to return to the **Service Menu** main screen.

NOTE:

Additional resources depend on the configuration of the Monitor.

SpO_2 Testing

For Monitors With NELLCOR® SpO_2 ? NELLCOR® recommends use of the SRC-MAX Portable Tester for use with the Dash 2500 Monitor equipped with the NELLCOR® SpO_2 system.

On occasion when testing the integrity of the NELLCOR® oximetry system, abnormal results may occur when introducing large changes in the pulse rate and/or pulse amplitude. Extreme changes in the rate sent to the NELLCOR® sensor by the SpO_2 simulator may cause the SpO_2 algorithm to completely miss finding the pulse rate. This is an expected result. To work around this, incrementally step up or down the settings on your SpO_2 simulator and allow the Monitor to detect and display the new pulse rate or saturation.

For Monitors With MASIMO SET® SpO_2MASIMO SET® ? recommends BIO-TEK SpO_2 simulators.

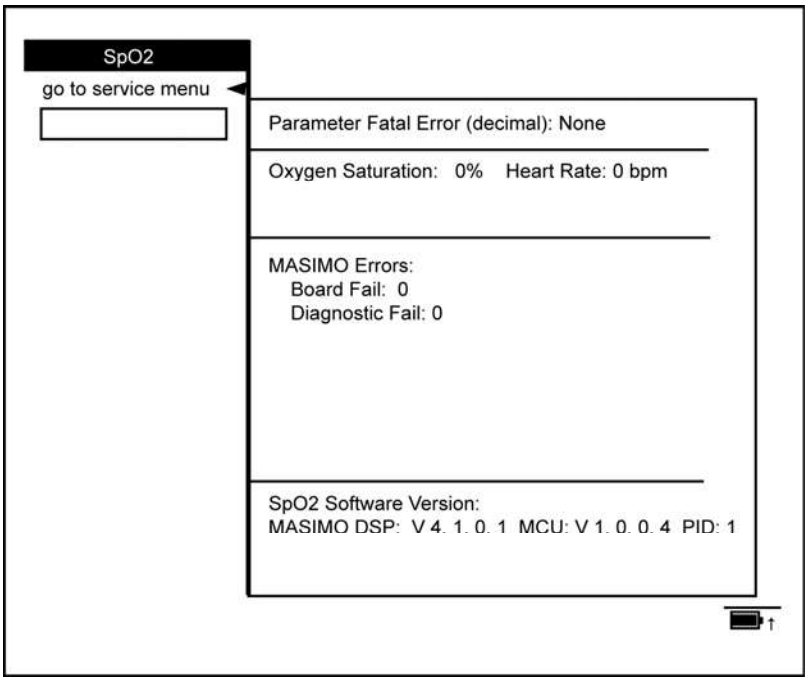
Test Procedure

The following table shows the allowable tolerance of the indicated simulator values.

Range	Accuracy
70% - 100% (Adult/ Ped)	± 2 digits
70% - 100% (Neonate)	± 3 digits
1% - 69%	No accuracy required

The following procedure applies to both Nellcor and Masimo equipped units.

1. Disconnect all sensor cables from the SpO_2 Parameter, and ensure that the SpO_2 parameter is listed within the main **Service Menu**.
2. From the **Service Menu**, turn and press the Trim Knob to select the **SpO_2** service parameter. The **SpO_2** service menu appears. The text under Error and Version sections reflects the installed type of SpO_2. The illustration shows both text examples.

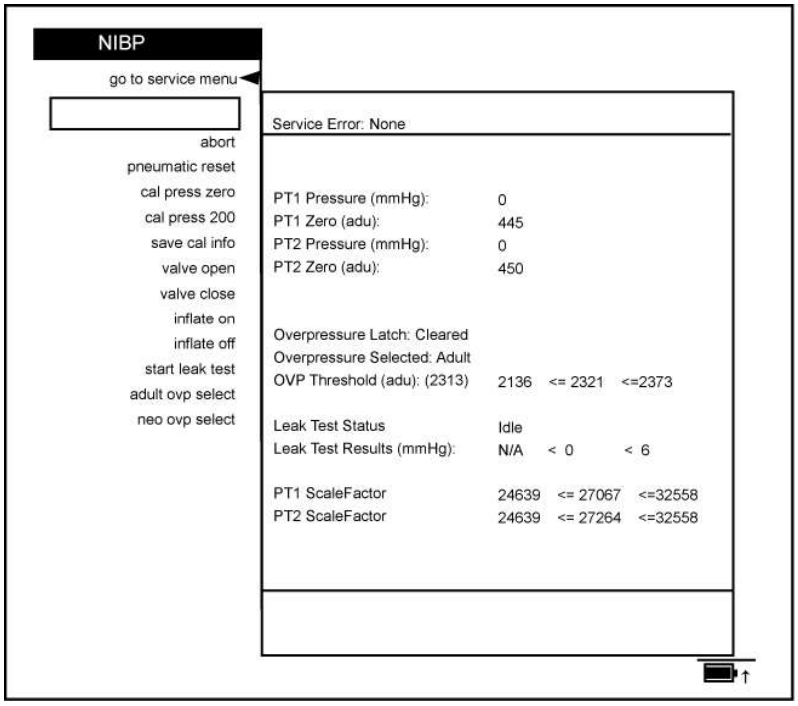


SpO_2 Service Menu

3. All SpO_2 mode operations take place with MASIMO SET® and NELLCOR® power-up defaults. No menu settings are reflected.
4. Connect the appropriate SpO_2 simulator and cable to the SpO_2 parameter. Be sure it is fully seated in the socket.

5. Vary the values on the simulator. Verify that the Monitor responds accordingly by displaying the proper heart rate value and saturation value.

NIBP Testing



NIBP Service Menu

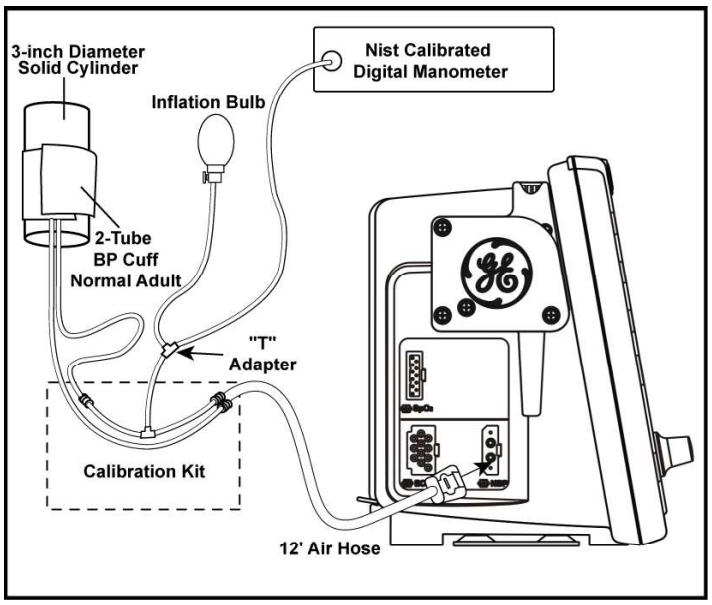
Perform the following tests to determine that the NIBP parameter is functioning normally.

Always enter Service Mode with the password before attempting to recalibrate equipment.

CAUTION
Calibration equipment should always be kept dry and free of particulate matter. Moisture or foreign substances introduced to the pneumatic system will likely cause damage to the Monitor and/or accessories.

NIBP Leak Test

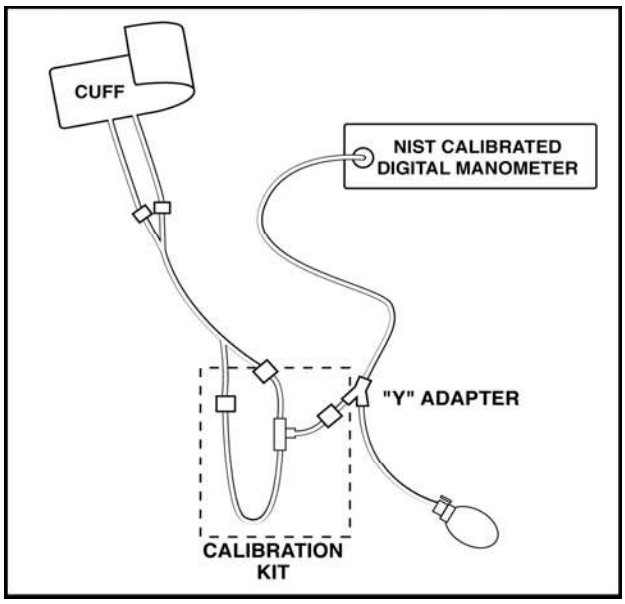
1. Using the calibration kit, an adult cuff and air hose, and a manometer, set up the equipment as shown in the **NIBP Test Setup** graphic. Connect the hose to the NIBP Parameter. Make sure that all of the fittings are tight and that the valve on the manual inflation bulb is fully closed.



NIBP Test Setup

2. From the **Service Menu**, turn and press the Trim Knob to select the **NIBP** service parameter.
3. Turn and press the Trim Knob to select **start leak test**. Observe that the **Leak Test Status** message on the menu indicates **Busy**.
4. Observe that the pump begins inflating the system to 200 - 210 mmHg, at which point the pump operation will cease. The Monitor will begin to calculate system pressure loss rate.
5. After about 60 seconds the pressure is released, and the menu should display **Leak Test Status Passed**, and the **Leak Test Results** indication should be a value less than 6. **Service Error: None** should continue to display.
6. If the menu displays **Leak Test Failed**, continue with Steps 7 through 9.

7. Using the calibration kit, an adult cuff and air hose, and a manometer, set up the equipment as shown in the **Leak Test Setup** graphic.



Leak Test Setup

8. Close the pressure release valve on the manometer inflation bulb and slowly increase the pressure to 200 mmHg ± 1 mmHg.
9. Verify the pressure indicated on the manometer remains within 5 mmHg of 200 mmHg for 60 seconds. If not, either the cuff or hose or both may be defective. If the cuff and hose pass this test, repeat Steps 1 through 7 to try to isolate the leak. Repeat the leak test for all cuff and hose combinations to be used with the Monitor.

NIBP Calibration Check

1. Using the calibration kit, an adult cuff and air hose, and a manometer, set up the equipment as shown in the **NIBP Test Setup** graphic. Connect the hose to the NIBP Parameter. Make sure all fittings are tight and that the inflation bulb valve is closed tightly.
2. From the **Service Menu**, turn and press the Trim Knob to select the **NIBP** service parameter.
3. Turn and press the Trim Knob to select **pneumatic reset**.
4. Turn and press the Trim Knob to select **valve close**.
5. Observe that both **PT1 Pressure** and **PT2 Pressure** equal initial values of 0 mmHg.
6. Connect the pneumatic hose to the Monitor's NIBP port.
7. Fold the adult cuff so the index line is aligned with the inner range mark on the inside of the cuff. Make sure all fittings are tight and that the valve on the inflation bulb is closed tightly. If there is doubt about the integrity of the system, perform the leak test before continuing.
8. Close the pressure release valve on the manometer inflation bulb and manually pump up the pressure until the manometer indicates approximately 220 mmHg.

9. Allow the pressure to stabilize for at least 1 minute. Then open the pressure release valve on the manometer inflation bulb and carefully bleed off pressure until the manometer indicates 200 mmHg.
10. Observe that the values of **PT1 Pressure** and **PT2 Pressure** on the menu indicate within 1 mmHg of the pressure shown on the manometer. If not, please check and repair the device.
11. Verify the system linearity by repeating Steps 8 and 9 using manometer readings of 250 mmHg, 150 mmHg, and 50 mmHg. Observe that the PT1 and PT2 Pressures are within 3 mmHg of manometer readings for each of these pressure indications. If not, proceed to the "Pressure Recalibration" section.

Pressure Recalibration

1. Using the calibration kit, an adult cuff and air hose, and a manometer, set up the equipment as shown in the **NIBP Test Setup** graphic. Do not connect the pneumatic hose to the NIBP port yet.
2. From the **Service Menu**, Turn and press the Trim Knob to select the **NIBP** service parameter.
3. Turn and press the Trim Knob to select **pneumatic reset**.
4. Turn and press the Trim Knob to select **valve close**.
5. Observe that both **PT1 Pressure** and **PT2 Pressure** display initial values of **0** on the menu.
6. Turn and press the Trim Knob to select **cal press zero**. Observe that the message **Inflate System to 200 mmHg Then Hit Cal Press 200** is displayed on menu.
7. Connect hose to NIBP Parameter.
8. Fold the adult cuff so the index line is aligned with the inner range mark on the inside of the cuff. Make sure all fittings are tight and that the valve on the inflation bulb is closed tightly. If there is doubt about the integrity of the system, perform the leak test before continuing.
9. Close the pressure release valve on the manometer inflation bulb and manually pump up the pressure until the manometer indicates approximately 220 mmHg.
10. Allow the pressure to stabilize for at least 1 minute. Then open the pressure release valve on the manometer inflation bulb and carefully bleed off pressure until the manometer indicates a little more than 200 mmHg.
11. Turn and press the Trim Knob to select **cal press 200**, but do not press the Trim Knob.
12. When the manometer indicates exactly 200 mmHg, press the Trim Knob. Observe that system pressure is released, and the message,**!!!!! CAL INFO NOT SAVED!!!!! Service Error: None** is displayed on menu.
13. Turn and press the Trim Knob to select **save cal info**. The message,**!!!!!CAL INFO NOT SAVED!!!!** disappears. This indicates your new calibration values have been saved.
14. Repeat the calibration check procedure to confirm the calibration setting.

Overpressure Tests

1. Using the calibration kit, an adult cuff and air hose, and a manometer, set up the equipment as shown in the **NIBP Test Setup** graphic. Connect the hose to the NIBP Parameter. Make sure all fittings are tight and that valve on inflation bulb is closed tightly.
2. From the **Service Menu**, Turn and press the Trim Knob to select the **NIBP** service parameter.
3. Turn and press the Trim Knob to select **pneumatic reset**.
4. Turn and press the Trim Knob to select **valve close**.
5. Verify the menu displays **Overpressure Latch: Cleared and Overpressure Selected: Adult**. If not, turn and press the Trim Knob to select **adult ovp select**.
6. Turn and press the Trim Knob to select **inflate on**. The pump should begin to inflate the system.
7. Watch the pressure indication increase on the manometer, and observe that the pump is shut down and the pressure is released when the manometer indicates in the range of 300 to 330 mmHg. Observe that the menu displays **Service Error: Over Pressure Condition Detected**.
8. Turn and press the Trim Knob to select **pneumatic reset**.
9. Turn and press the Trim Knob to select **valve close**.
10. Turn and press the Trim Knob to select **neo ovp select**. Verify the menu displays **Overpressure Latch: Cleared and Overpressure Selected: Neo**.
11. Turn and press the Trim Knob to select **inflate on**. The pump should begin to inflate the system.
12. Watch the pressure indication increase on the manometer, and observe that the pump is shut down and the pressure is released when the manometer indicates in the range of 150 to 165 mmHg. Observe that the menu displays **Service Error: Over Pressure Condition Detected.**
13. If the overpressure test results in an out of tolerance condition, contact GE Medical Systems *Information Technologies* Technical Support at 1-800-558-7044 (USA), 86-800-810-8188 (China) or contact your local representative. If you are a cell phone or Xiaolingtong user, or your area does not support 800 free-call service, please dial: 86-010-67882652 (China). If you are a EMEA user, please contact your local GE service provider.

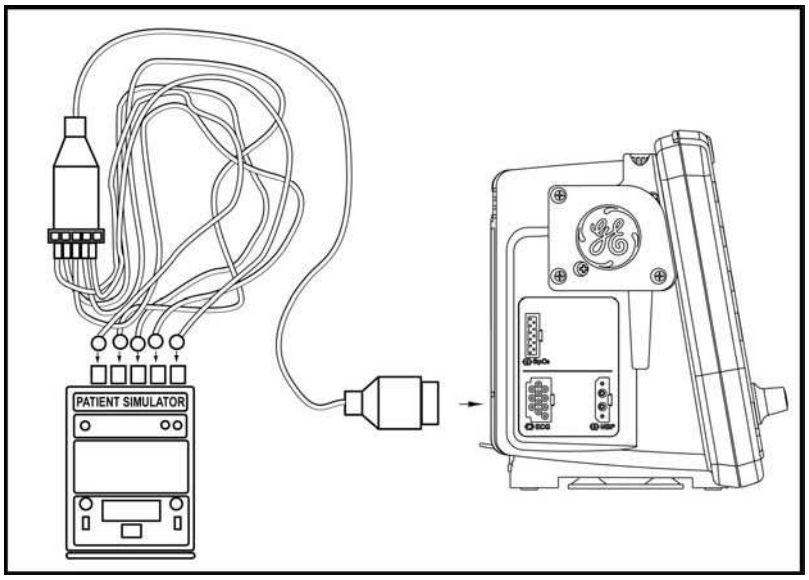
Overpressure Calibration

NOTE:

Overpressure calibration is adjusted by software based on “Pressure Calibration” section.

ECG Testing

Connect the ECG leads to the ECG trunk cable prior to connection to the Monitor. The simplest way to function test the ECG circuitry is through the usage of an ECG simulator with the Monitor in normal monitoring mode.



1. Set the ECG simulator to output a Paced ECG Waveform.
2. Press **Power** hardkey to power up UUT.
3. Select **no** at new patient prompt. Set the ECG high alarm to **150** and the low alarm to **50**.
4. Verify that the ECG waveform is displayed on LCD display.
5. From ECG menu, select **Pace 1** and verify paced marker on display waveform.
6. From ECG menu, select **Pace 2** and verify paced marker on display waveform.
7. From ECG menu, select **PACE OFF**. Turn paced off on simulator.
8. After unit has learned the patient waveform change the bpm to **30**.
9. Verify **HR LOW** alarm and HR is 30 $\pm$ 4 bpm on unit.
10. Set ECG simulator to 160 bpm.
11. Verify that the ECG waveform is displayed on the LCD display.
12. Verify **HR HIGH** alarm and HR is 160 $\pm$ 4 bpm on unit.
13. Set ECG simulator to 80 bpm.
14. Set ECG high alarm to **200** and low alarm to **30**.
15. Set ECG simulator to VTACH.
    - Set simulator MPS450 to 160 bpm
    - Set simulator MPS214B to 180 bpm
16. Verify **ECG VTACH** alarm and HR is 180 $\pm$ 4 bpm.
17. Set ECG simulator to 80 bpm.

18. Press **Silence Alarm** hardkey to acknowledge the alarm and verify HR is 80 ±4.
19. Connect scope to analog output using 1/8" stereo plug (+ to ring, - to shield).
20. Verify that the ECG waveform is displayed on the scope (amplitude approximately 1V/mV).
21. Disconnect scope from analog output.
22. Remove and reattach Leads I, II, III, sequentially and verify **ECG LEAD FAIL** alarm on display.
23. From **ECG** menu, select **turn parameter off**.

RESP Testing

1. Set simulator Respiration to 20 BrPM.
2. Set simulator delta ohms to 1.0.
3. Set simulator Baseline to 1K, and Lead to II.
4. Verify that the RESP waveform is displayed on the LCD display.
5. Record and verify the UUT RESP reading 20 ± 3bpm.
6. Set simulator Respiration to 60 BrPM.
7. Record and verify the UUT RESP reading 60 ± 3bpm.
8. From **RESP** menu, select **turn parameter off**.

Temperature (Perform if equipped with Temp module)

The Temperature Simulator for the Alaris System is available from Alaris Medical Systems, Inc. (619) 458-7000.

The Alaris® Turbo Temp® probes cannot be calibrated. These probes must be discarded after 2 years from the date of manufacture stamped into the RJ45 connector (first two digits = year, second two digits = week). Refer to the illustration example (0520 = fw20 in 2005).

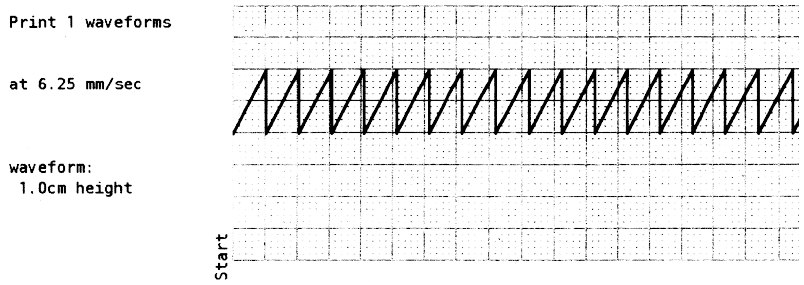
It is the responsibility of the user to maintain proper records.

Alaris® Turbo Temp® Probe Date Code

1. Turn Monitor off. Make sure the temp probe is properly stored in the probe well.
2. Disconnect the temp probe cable from the monitor.
3. Connect Temp simulator; set to 80.2°F.
4. Turn the Monitor on.
5. Put the Monitor into temp monitor mode:
   a. partially remove the probe from the well (stop when you hear the Monitor beep).
   b. Quickly re-insert the probe and remove again (you should hear two beeps of a different tone).
   c. A temperature value should appear quickly, if not, repeat Step 5b.
6. Record and verify the reading in the temp display is 80.2 ± 0.2°F.
7. Set the simulator to 98.6°F.
8. Record and verify the reading in the temp display is 98.6 ± 0.2°F.
9. Set the simulator to 107.8°F.
10. Record and verify the reading in the temp display is 107.8 ± 0.2°F.
11. Calibration is complete. If the monitor does no pass the calibration verification then contact Technical Support.

Recorder Testing (if installed)

1. Ensure that paper has been loaded into the Recorder and you are presently in the Service Mode.
2. From the **Service Menu**, turn and press the Trim Knob to select the **Recorder** test option. Turn and press the Trim Knob to select the **Print 1 Waveforms** option. Turn and press the Trim Knob to select the **Wave Test 6.25 mm/s** option. Verify that all printouts are of even tone and all pixels are present.



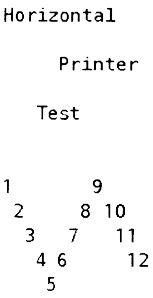
Sample 6.25 mm/s - 1 waveform chosen

3. Allow for the paper to spool out a 12-inch printed section then press **Stop Test**.

4. Select **Vertical Text** test. Verify that the printed text is legible and evenly spaced.

Vertical Text Test Printout

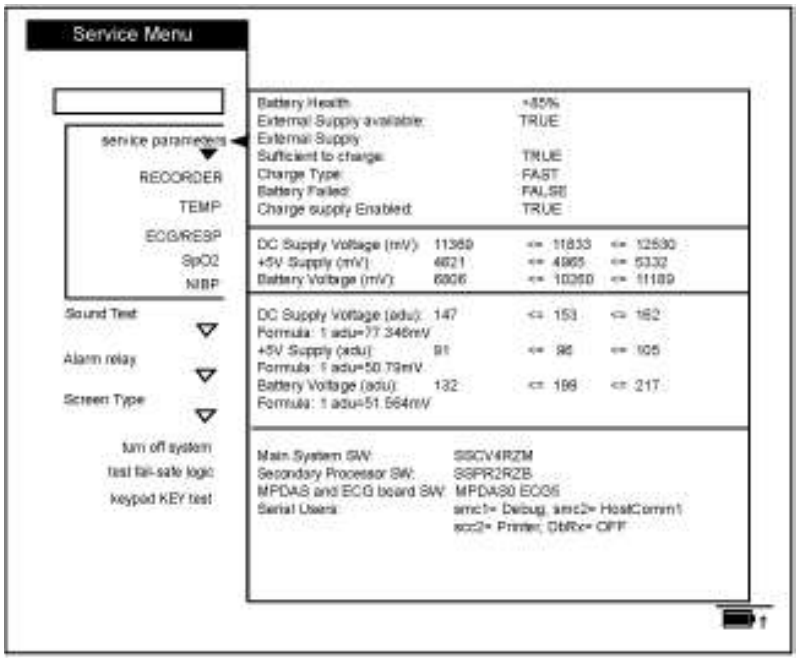
5. Select **Horizontal Text** test. Verify that the printed text is legible and evenly spaced.



Horizontal Text Test Printout

Battery Testing

From within the **Service Menu**, battery status information is displayed on the upper right-hand section of the display.



Battery/ Power Supply Menu

Battery Health

The Monitor's software approximates the true status of the battery's health. The value indicated is displayed as both a number (in percentage) on the top of the display and as an icon on the lower right area of the display.

External Supply available

TRUE indicates a source other than the internal battery is providing power for the Monitor and a source to charge the internal battery.

External Supply Sufficient to Charge

If the voltage from the external supply is greater than that of the internal battery, the Monitor will display the results as **TRUE**. **FALSE** will result if either the voltage is equal to or lower than the power available from the internal battery.

Charge Type

FAST indicates battery is charged fast when it is not full. **TRICLE** indicates battery is charged slowly when it is already full.

Battery Failed

Any result other than **FALSE** indicates that the internal battery has suffered a failure and should be investigated.

Charger Supply Enabled

This status indicator should always be **TRUE** as the Monitor consistently attempts to keep the battery at its fullest capacity. A **FALSE** indicates the battery may be faulty, not installed, or the charge circuit may have failed. Also, if no external source of power is available, the Monitor registers a **FALSE** result.

Test Procedure

1. Verify AC Mains indicator on front panel of unit near **Power** hardkey is lit with AC Mains plugged in.
2. Turn on Monitor.
3. Remove AC Mains and verify uninterrupted battery operation.

   NOTE:
   If this fails, check fuse in communications well.

4. Verify battery indicator near **Power** hardkey.

   NOTE:
   Battery life is dependent upon battery usage. A fully charged battery should last greater than 180 minutes using the following setup: (NIBP: 5-min auto cycle with adult cuff. ECG, RESP, SpO_2: Active. TEMP: predictive mode. Printer: printing 2 waveforms for 1 min every 20 min at 25 mm/s.).

Fail-Safe Logic Testing

From the **Service Menu**, turn the Trim Knob to select **test fail-safe logic**. A dialogue box displays: **CAUTION! This causes the system to freeze for approx. 2 seconds then enter the fail-safe mode. Continue?**

1. Turn the Trim Knob to the **yes** option and press the Trim Knob.
2. After 2 seconds, the system freezes, an alarm sounds, and the screen goes blank. Recycle the system power using the **Power** hardkey. To return to the Service Mode, repeat the procedures as described in “Service Mode” section.

Keypad Key Testing

1. From the **Service Menu**, turn and press the Trim Knob to select **keypad KEY test**. With the exception of the **Power** hardkey, verify that each key press produces a tone. You may hear different tones in some occasions. This does not affect the testing results.
2. After all keys have been tested, press the Trim Knob again to stop the test.

Sound Testing

1. From the **Service Menu**, turn and press the Trim Knob to select **Sound Test**.
2. Select **ON** to start the test. The monitor generates a serial of tones the Monitor has one by one every 2 seconds.
3. Select **OFF** to stop the test.

Communications Testing

Set up Terminal

1. Connect serial communication cable from PC to rear of UUT (DB9).
2. Invoke terminal program with settings:

   9600 baud,
   No parity,
   8 bits,
   1 stop bit,
   flow = None,
   no cr/lf character enabled

   NOTE:
   Terminal must be set to an available communication port (comm1 is default) or redirect the terminal program to an appropriate port.

Configure UUT for Communication

1. Turn the Trim Knob to get to the **Main Menu** and select **other system settings**.
2. Select **go to config mode**, select **yes** at the verification prompt.
3. Enter password **2508**, and select **done**.
4. After the unit reboots, turn the Trim Knob to display the **Configuration Menu**.
5. Select **other system settings**, then **Config HostComm**.
6. Configure the COMMS port for **Remote access** Serial 2.
7. Select **Serial 2 setup** and configure Serial 2 for ASCII cmd, 9600 baud.
8. Select **go to previous menu**, then **save default changes**.
9. Select **exit config mode**, select **yes** at the verification prompt.
10. After the unit reboots, select **no** at "new patient" prompt.

Communication Test

Execute the following commands (by sending text files from the terminal program) and verify the appropriate response.

NOTE:

Each string is preceded by a space. "^" represents the space character.

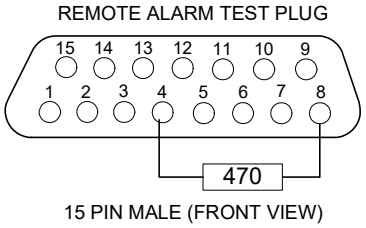
"^NC0!E" Verify that UUT pump starts.

"^ND!5" Verify that UUT pump stops.

"^TB!9" Verify return temperature status in the form "...TB-99999...".

Remote Alarm Testing

1. Install the test plug into 15 pin communications port on rear of unit, as shown in **Test Plug Assembly** graphic.
2. Use the DMM to measure voltage between pins 4 and 8 of DB15 connector and record the result.



Test Plug Assembly

3. From the **Service Menu**, turn and press the Trim Knob to select **Alarm relay**.
4. Select **Alarm relay / ON**. Measure and record voltage between pins 4 and 8 of DB15 connector. Verify the voltage is 0 V.
5. Select **Alarm relay / OFF**. Measure and record voltage between pins 4 and 8 of DB15 connector. Verify the voltage is 5 V.
6. Remove test plug assembly from DMM.

Network Testing

Install and set up the network module for Dash 2500. Check that the connector and the plugs are clean and intact, then connect the monitor into the network.

Select **View patient tab** on the CIC, set up the unit number and bed number of the connected monitor to establish communication. If the unit name is the same as CIC unit setting on the monitor, the CIC will establish communication automatically. If it does not display automatically, right click an multi-patient view window and select the correct unit/bed of the monitor.

NOTE: In general, it needs less than 30 seconds to let monitor to be detected and establish communication by CIC after you finished all above steps.

If the monitor information (e.g. bed number, unit number, and patient name) is displayed on the CIC patient tab, the communication is established successfully.

Country of Use

This option have two setting values: **CHINA** and **Other.** The **CHINA** setting will cause the monitor to have the same factory default, ECG parameter, QRS width setting between adult, pediatric, and neonate patient types. The user can still choose to change the setting for a particular patient through the ECG parameter advanced settings menu.

Turn off system

Selection of this menu item brings up a dialogue window requesting you to confirm your decision: **CAUTION! This turns the system off. Are you sure you want to do this?**

Selecting **yes** powers off the Monitor. Selecting **no** returns the Monitor to the **Service Menu**.

Service Mode Exit

To exit the Service Mode and power off the Monitor, locate and press the **Power** hardkey at the front of the Monitor.