9
Safety, Maintenance, and Calibration

Introduction

This chapter contains maintenance and safety information for the Series 50 XM/XMO monitors and accessories.

All checks that require the instrument to be opened must be made by qualified service personnel. Contact your local Philips representative if you wish safety and maintenance checks to be carried out by Philips personnel.

To ensure proper functioning of your monitor you must adhere to the standards described in this Guide for:

- Cleaning
- Performance assurance checks (self test, parameter test, quick test)
- Safety tests (safety test blocks, instrument safety test, system test)
- Service tests (cyclic test, permanent test)
- Accessory testing (transducer checks, patient module checks)

Caution
Failure on the part of the responsible individual hospital or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.

Recommended Frequency of Testing

Perform the procedures as indicated in the suggested testing timetable. These timetable recommendations do not supercede local requirements.

Suggested Testing Timetable	
Test	**Frequency**
Performance Assurance (see page 112)	Once a year (or as specified by local laws) and after repair where the power supply is removed/replaced.
Safety (see page 117)	
NIBP Performance Assurance (see page 115)	Once a year
Regular Preventive Maintenance (see page 123)	Once a year or after repair.

Cleaning the Monitor

Keep the outside surfaces of the monitor clean and free of dust and dirt. Use soap and water or Ethanol 70%. Do not pour liquid on the monitor or allow any to enter the monitor case. Although the monitor is chemically-resistant to most common hospital cleaners and non-caustic detergents, alternative cleaners are not recommended and may stain the monitor. Take extra care when cleaning the display surfaces; these are more sensitive to rough handling, scratches and breakage than the other external surfaces of the monitor. Many cleaning agents must be diluted before use. Follow the manufacturer's directions carefully to avoid damaging the instrument.

Never use an abrasive material such as steel wool or metal polish.

Wipe around the NIBP connector socket, not over it, to ensure that no water or cleaning solution enters the NBP input connector.

The *Instructions for Use* for this monitor contains more details about how to care for the monitor and the accessories.

Performance Assurance Tests

Self Test

The monitor automatically performs a basic-level self test when you switch it on. There are two possible types of error that you might see. A fatal error prevents the monitor from functioning. A non-fatal error allows you to continue to work but warns you of a problem that must be resolved swiftly.

- If a non-fatal error occurs (for example, if the batteries are low):
  - An error message is displayed for ten seconds.
  - Err xxx ⚠ , time and date are printed on the paper after ten seconds, and then every ten minutes.
    ("xxx" is the number of the error message.)
  - Switch the monitor off and then on. If the error occurs again, try to solve the problem or, if you cannot, contact your Philips Service Engineer or Response Center.

    (If the recorder is not on when the monitor is switched on, Err xxx ⚠ time and date are printed when it is switched on subsequently.)
- If a fatal error occurs (for example, if a board is defective):
  - An error message is displayed for ten seconds
  - After ten seconds, the monitor tries to restart.

  If the error occurs again contact your Philips Service Engineer or Response Center.

Parameter Test

The parameter test tests the processing of the signal to and from the transducer, but not the transducers themselves. To perform the parameter test:

- Switch on the monitor and the recorder
- Connect the transducers for the channels to be tested to the correct sockets.

- Press Test.

The monitor produces an artificial signal for each transducer connected and the signals are processed. You will see that the test signal is displayed and the mode symbols light. You will also hear a sound specific for the type of transducer connected.

The following table shows the values recorded when the different transducers are correctly connected. Ensure that the recorder is switched on. If an error occurs, it is displayed for ten seconds and then Err ⚠ is printed by the recorder together with the time/date annotation. After this time, Err ⚠ is printed every ten minutes together with the time/date annotation.

Table 9-1 Parameter Test

Signal	Monitor Response
US (Cardio 1/Combi) using M1356A:	190 is displayed and printed. Signal quality indicator is green. Fetal heartbeat is heard from loudspeaker.
US (Cardio 2) using M1356A:	170 is displayed and printed. Signal quality indicator is green. Fetal heartbeat is heard from loudspeaker.
TOCO using M1355A:	A signal alternating between 10 and 60 (for periods of 2 secs) for as long as the key is pressed is displayed and printed.
DECG using M1357A: using M1365A, M1364A (DECG cable M1362A must be connected):	200 is displayed and printed Signal quality indicator is green. Fetal heartbeat is heard from loudspeaker.
MECG using M1359A: using M1365A or M1364A (MECG cable M1363A must be connected):	120 is printed. **MECG** indicator is on. 120  is displayed on the LCD screen.
US/MECG (Cardio 1/Combi) using M1358A:	190 is displayed. 190 and 120 are printed. Signal quality indicator is green. **MECG** is on. Fetal and maternal heartbeats are heard form the loudspeaker.
Maternal SpO_2 using M1940A:	99% is displayed on LCD and printed. Pulse 120  displayed on LCD screen.
Fetal SpO_2 using M1365A:	88% is displayed.

Quick Test

The quick test takes approximately 15 seconds and tests the basic electronics of the monitor display, recorder and hardware. To carry out the test:

1. Remove any monitoring equipment plugged into the input sockets. Switch off or disconnect the telemetry receiver and any external devices connected to the monitor.
2. Switch on the monitor.
3. Press and release the test key. Check that:
   - all parts of the LED display windows light, followed by all the mode symbols. The upper and lower parts of the display flash alternately for about 10 seconds.
   - The left half and the right sides of the LCD display flash light and dark alternately.
   - A test pattern is printed on the paper.
     During the test the recorder paper speed is automatically set to 3cm/min and a test pattern is printed onto the recorder paper.

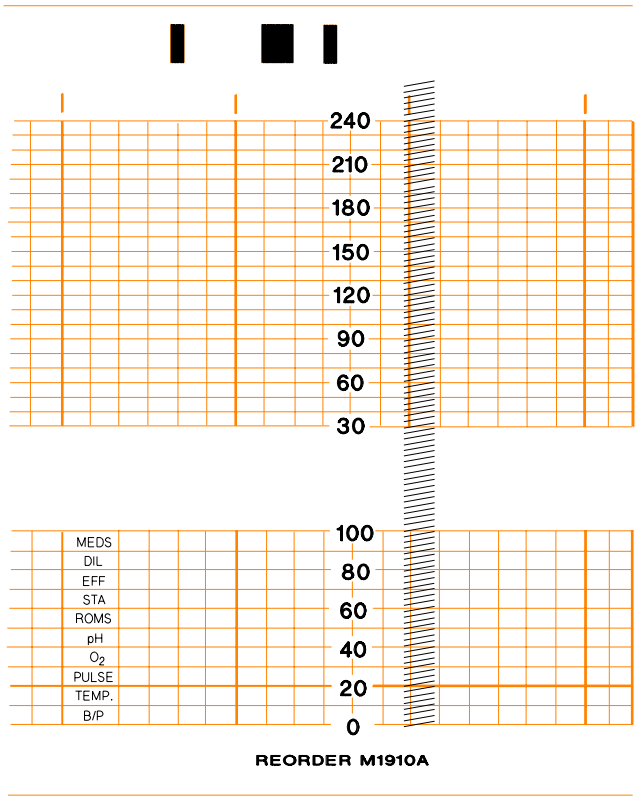


Figure 9-1 Recorder Test Pattern

The recorder ON/OFF light blinks in time with the display. Check the test pattern to ensure all the heating elements on the printer head are operational. Ensure that:

- No more than 20 dots are missing over the entire printhead.
- No more than 2 adjacent dots are inoperative.
- No dots in the mode annotation (for example, US1) are inoperative.

If any of these conditions occur, replace the printhead.

If you do not release Test at the end of the test, the monitor repeats the pattern. Dots printed on the colored grid lines might appear light. This is not a fault. After the test the recorder paper speed is automatically reset to the pre-test value.

If an error occurs it is displayed for 10 seconds. (See Chapter 10, "Troubleshooting" for a table of error messages and possible solutions.) After this time Err ⚠ is printed on the recorder together with the time/date annotation.

Performance Assurance: NIBP

When to perform:

1. Regularly once a year.
2. After any repair related to the NIBP module (this includes NIBP software updates).

Accuracy Test

1. Enter the calibration mode (see page 131).
2. Pressurize the gauge to 220 mmHg.
3. Wait ten seconds for the measurement to stabilize.
4. Compare the manometer's value with the displayed value.
5. Document the value displayed by the monitor. If the difference is greater than ±3 mmHg, calibrate the module.

Leakage Test

1. Enter the calibration mode (see page 131).
2. Pressurize the gauge to 280 mmHg.
3. Watch the pressure value for 60 seconds. After 60 seconds, the value should have decreased by less than 6 mmHg.
4. Calculate and document: Leakage test = reference value 280 mmHg - displayed value.

Linearity Test

1. Enter the calibration mode (see page 131).
2. Pressurize the gauge to 150 mmHg.
3. Wait ten seconds for the measurement to stabilize.
4. Compare the manometer's value with the displayed value.
5. Document the value displayed by the monitor. If the difference is greater than ±3 mmHg, calibrate the module.

Service Tests

Cyclic Test

The cyclic test is a permanent self test: see "Running the Cyclic Test" on page 33 for instructions on how to perform it. Any errors located are written to the error log and can be read using Read Error log (see "Reading the Error Log" on page 34).

Permanent Test

You can configure the monitor to perform a permanent/continuous test. This is similar to the cyclic test, which can be performed with the PC-based service software.

To start the permanent test:

1. Disconnect all transducers from the monitor and disconnect, or switch off, Telemetry.
2. Make sure the recorder is on.
3. While pressing F.⚠ press Test:
   - C01 is shown in the US1/US display.
   - 0 or 1 is shown in the Toco display.
4. Press F.⚠ again to select the Function Menu:
   - **A01** (Print the Error Log) is shown in the US1/US display.
5. Press + repeatedly to select **A03**.
6. Connect one or more transducers (the test performed depends on the transducers connected).
7. Plug in the marker and hold its button down with tape. You can also use a shorted phone-jack to simulate the action of the marker.
8. Press →|← to start the permanent test.

The permanent test runs until you release the marker button.

Caution
DO NOT perform this test while a patient is being monitored.

Safety Tests

This section defines the test and inspection procedures applicable to the Series 50 XM and XMO. Use the tables in the following section to determine what test and inspection results must be reported after an installation, upgrade, or repair has been carried out.

- Test Blocks in Table 9-2 tells you when to carry out the safety tests
- Test and Inspection Matrix in Table 9-3 tells you how to carry out the safety tests.

Warning
Safety test requirements are set acccording to international standards, such as IEC/EN 60601-1 and IEC 60601-1-1, their national deviations, such as UL2601-1, CAN/CSA-C22.2 No. 601.1-M90 and No 601.1-S1-94, and specific local requirements.
The safety tests detailed in this *Service Guide* are derived from international standards but may not be sufficient to meet local requirements.

Caution
The correct and accurate functioning of the equipment is ensured by the successful completion of the safety tests, performance test, and the system test (if applicable).

Safety Test Procedures

The test procedures outlined in this section are to be used only for verifying the safe installation or service of the product in its place of use. The safety tests described here refer specifically to installation, setup, repair and upgrade activities, and not to the aspects of safety that have already been tested during final acceptance at the factory.

Use safety testers complying with IEC 60601-1 internationally, or any local regulations applicable to the country of the installation. For safety test procedures see the operation instructions of the safety tester used, and follow any local regulations.

If you use the Metron safety tester, the Metron Report should print results as detailed in this chapter, along with other data.

For information and ordering guides for Metron products contact:
Metron AS, Vegamot 8, N-7048 Trondheim, Norway
www: http://www.metron-biomed.com

When to Perform Safety Tests

This table tells you when to perform specific safety tests. See page 119ff. for test details.

Table 9-2 M1350A/B/C: When to perform safety test blocks

Service Event	Test Block(s) Required
Installation The product is customer installable. For installation instructions refer also to the *Instructions for Use* for your monitor.	Perform visual, power on and performance test blocks (see Table 9-3).
Preventive Maintenance Preventive maintenance is the responsibility of the customer. For preventive maintenance see page 123.	Perform visual test block (see Table 9-3).
Repair This *Service Guide* contains repair instructions for the XM and XMO monitors.	Perform visual, power on and performance test blocks (see Table 9-3), and • when power supply is replaced perform (S) Safety test blocks • when Frontend-Board is replaced perform Safety (5) test block • **M1350B and M1350C only**: when frontend board is replaced perform S(5)(Toco) test block when Mat.SpO_2-bd. or cable is replaced perform S(3)(SpO_2) safety tests.
Upgrade For upgrade information refer to Chapter 7, "Upgrades."	Perform visual, power on, performance and safety test blocks (see Table 9-3).
Combining/Exchanging System Components	Perform system test (see "System Test" on page 120)
All other service events	Perform visual, power on and performance test blocks (see Table 9-3).

How to Carry Out the Safety Tests

Key to Table 9-3: P = Pass, F = Fail, X = test result value to be recorded.

Table 9-3 M1350A/B/C: Test and Inspection Matrix

Test Block	Test or Inspection to be Performed	Expected Test Results	What to Record on Service Record (Philips Personnel only)
Visual	Inspect the unit, transducers and cables for any damage. Are they free of damage?	If Yes, Visual test is passed.	V:P or V:F
Power On	Power on the unit. Does the self-test complete successfully?	If Yes, Power On test is passed.	PO:P or PO:F
Performance	Perform the quick test and parameter test as described on page 114 and page 112 respectively. Do these tests complete without errors?	If Yes, Performance Test is passed.	P:P or P:F
Safety:	Perform Safety Test (1): Protective Earth.	With mains cable: Maximum impedance = X1 (<= 200 mOhms)	S:P/X1or S:F/X1
	Perform Safety Test (2): Enclosure Leakage Current - Normal Condition.	With mains cable: Maximum leakage current = X2 (<= 100µA)	S:P/X2or S:F/X2
	Perform Safety Test (3): Enclosure Leakage Current - Single Fault Current Open Supply.	With mains cable: Maximum leakage current = X3 (<= 500µA) (Note: maximum leakage current in the US: 300µA)	S:P/X3or S:F/X3
	Perform Safety Test (4): Enclosure Leakage Current - Single Fault Current Open Earth.	With mains cable: Maximum leakage current = X4 (<= 500µA) (Note: maximum leakage current in the US: 300µA)	S:P/X4or S:F/X4
	Safety Test (5): Patient Leakage Current - Single Fault Current Mains on Applied Part. ONLY TOCO-input tested: Metron Testconn. (order #19528) or equivalent required. ONLY maternal SpO_2 input tested: Metron Testconn. (Metron order # 19524 and Philips Adapter M1940A) or equivalent required.	With mains cable: Maximum Leakage current = X (<=50µA @ 250V or <= 20µA @ 120V) Maximum Leakage current = X (<=50µA @ 250V or <= 20µA @ 120V)	S(5)(Toco):P/X or S(5)(Toco):F/X S(5)(SpO_2):P/X or S(5)(SpO_2):F/X
System	Perform the system test according to IEC 60601-1-1, if applicable, after combining equipment to form a system.	See Safety Test (2) and Safety Test (3)	See Safety Test (2) and Safety Test (3)

Instrument Safety Test

You must perform the instrument safety test every time you exchange, repair, upgrade or in any other way work on the front end board, the power supply, the power inlet or the maternal SpO_2 board and cable. If you intend to connect the monitor to an OB monitoring system such as Philips OB **TraceVue**, you must perform the instrument safety test with the monitor as a standalone unit, before reconnecting it to the system.

The instrument safety test is made up of four separate tests (see page 122):

- Protective Earth Test
- Enclosure Leakage Current - Normal Condition
- Enclosure Leakage Current - Single Fault Condition
- Patient Leakage Current - Single Fault Condition

System Test

After mounting or setting up a system, or combining or exchanging any system components, perform safety tests as detailed in this *Service Guide,* and the system test (see also Table 9-2, "M1350A/B/C: When to perform safety test blocks," on page 118, and Table 9-3, "M1350A/B/C: Test and Inspection Matrix," on page 119).

What is a Medical Electrical System?

A medical electrical system is a combination of at least one medical electrical device and other electrical equipment, inter-connected by functional connection or use of a multiple portable socket-outlet.

General Requirements for a System

After installation or subsequent modification, a system must comply with the requirements of the system standard IEC/EN 60601-1-1. Compliance is checked by inspection, testing or analysis, as specified in the IEC 60601-1-1 or in the *Instructions for Use*.

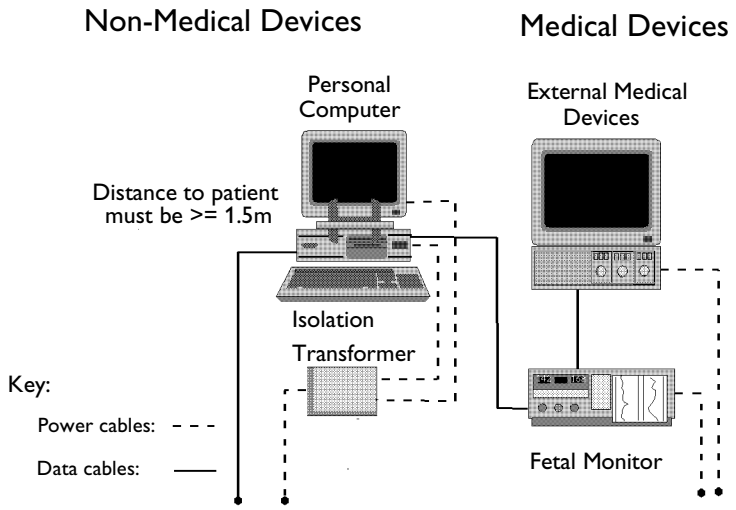
Note— **Medical electrical equipment must comply with the requirements of the general standard IEC/EN 60601-1, its relevant particular standards and specific national deviations.**

Non-medical electrical equipment shall comply with IEC and ISO safety standards that are relevant to that equipment.

Relevant standards for some non-medical electrical equipment may have limits for enclosure leakage currents higher than required by the standard IEC 60601-1-1. These higher limits are acceptable only outside the patient environment. It is essential to reduce enclosure leakage currents when non-medical electrical equipment is to be used within the patient environment.

System Example

This illustration shows a system where both the medical electrical equipment and the non-medical electrical equipment is situated at the patient's bedside.



Warning
Do not connect any devices that are not supported as part of a system.

Any non-medical device placed and operated in the patient's vicinity must be powered via an approved separation device that ensures mechanical fixing of the powercords and covering of any unused power outlets.

Do not use additional AC mains extension cords or multiple portable socket-outlets. If a multiple portable socket-outlet without a separation device is used, the interruption of its protective earthing may result in enclosure leakage currents equal to the sum of the individual earth leakage currents.

If the personal computer (or any other non-medical electrical device) is situated outside the medically used room, you must take measures to reduce leakage currents, such as providing an additional protective earth, a non-conducting enclosure, or a separation device.

We highly recommend to use a separation device whenever you connect non-medical electrical equipment.

Safety Test (1): Protective Earth Test

Test to perform:

The protective earth test measures impedance of Protective Earth (PE) terminal to all exposed metal parts of Instrument under Test (IUT), which are connected to the Protective Earth (PE) for safety reasons. Normally it includes the wiring in the mains cable (max. 200 mOhm).
A test current of 25 Amps is applied for 5 to 10 seconds. It is recommended to flex the main cable during the test to identify potential bad contact or damage to the earth wire.
Safety test according to IEC 60601-1 (Clause 18).
Report the highest value.

Safety Test (2): Enclosure Leakage Current Test - Normal Condition (NC)

Test to perform:

The enclosure leakage current: normal condition is applicable to Class 1 and 2 equipment, type B, BF, and CF Applied Parts. The test measures leakage current of exposed metal parts of the Instrument Under Test; it tests normal and reversed polarity.
For Type BF and CF Applied Parts the test measures AP/GND.
Safety Test according to IEC 60601-1 (Clause 19.4g).
Report the highest value.

Safety Test (3): Enclosure Leakage Current Test - Single Fault Condition (SFC) Open Supply

Test to perform:

The enclosure leakage current: single fault condition open supply is applicable to Class 1 and 2 equipment, type B, BF, and CF Applied Parts. The test measures leakage current of exposed metal parts of Instrument Under Test with one supply lead interrupted; it tests normal and reversed polarity.
For type BF and CF Applied Parts measures AP/GND.
Safety Test according IEC 60601-1 (Clause 19.4g).
Report the highest value.

Safety Test (4): Enclosure Leakage Current - Single Fault Condition Open Earth (Ground)

Test to perform:

The enclosure leakage current: single fault condition open earth (ground) is applicable to Class 1 equipment, type B, BF and CF Applied Parts. The test measures leakage current of exposed metal parts of Instrument Under Test with Protective Earth open-circuit; it tests normal and reversed polarity.
For type BF and CF Applied Parts the test measures AP/GND.
Safety Test according IEC 60601-1 (Clause 19.4g).
Report the highest value.

Safety Test (5): Patient Leakage Current Test - AC

Test to perform:

The patient leakage current test measures patient leakage current from the applied part to the earth caused by external main voltage on the applied part. Each polarity combination possible must be tested. This test is applicable for ECG and SpO_2.
Safety Test according IEC 60601-1 (Clause 19.4h).
Report the highest value.

Abbreviations

AP: Applied Parts	IUT: Instrument Under Test
GND: Ground	PE: Protective Earth

Regular Maintenance

The care and cleaning requirements that apply to the monitor and the monitoring accessories are described in the *Instructions for Use*. This section details the periodic maintenance recommended for the monitor and accessories.

Mechanical Inspection

Inspect all exposed screws for tightness. Check all printed circuit boards are firmly seated in their connectors. All rear panel connections must be tight. Check the condition of all external cables, especially for splits or cracks and signs of twisting. If serious damage is evident, the cable should be replaced immediately.

Recorder Maintenance

The recorder platen, thermal print head and paper sensing mechanism must be cleaned at least once per year, or when needed (when traces become faint).

Clean the assemblies as follows:

- Clean the recorder platen with a lint-free cloth using a soap/water solution.
- Wipe the thermal array using a cotton swab moistened with 70% Isopropyl alcohol based solution.
- Check the paper sensing mechanism is dust free.
- Batteries: Replace the batteries with two alkaline 1.5 Volt size N batteries (recommended type: MN9100). For instructions refer to “Batteries” on page 173.

Ultrasound Transducer

Use of ultrasound gel that is not approved by Philips may reduce signal quality and may damage the transducer. This type of damage is not covered by warranty.

Visual Check

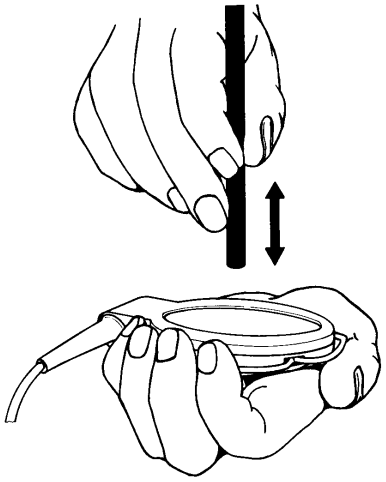
Ensure there are no cracks in the transducer dome, that the cable is not cracked or broken, and that there are no cracks on the connector plug.

Electrical Check

1. Connect the transducer to either the **Cardio 1/Combi** or **Cardio 2** socket. (Both the connector and socket are red, and keyed so that they mate in only one position.)

   Ensure that:

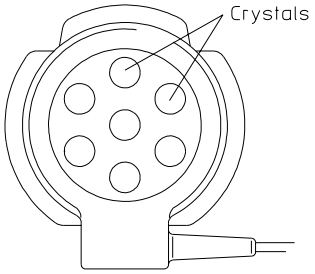
   - The signal quality indicator is red
   - The FHR numerical display is blank
   - When the recorder is switched on, the date, time, mode and paper speed are printed on the recorder trace.
2. Turn the loudspeaker volume up to an audible level.
3. The ultrasound transducer contains seven piezoelectric crystals. Basic functioning of each can be verified by holding a flat bottomed pencil or similar above each crystal and moving it up and down as shown.



psm18sca.tif

Figure 9-2 Testing an Ultrasound Transducer using a Pen

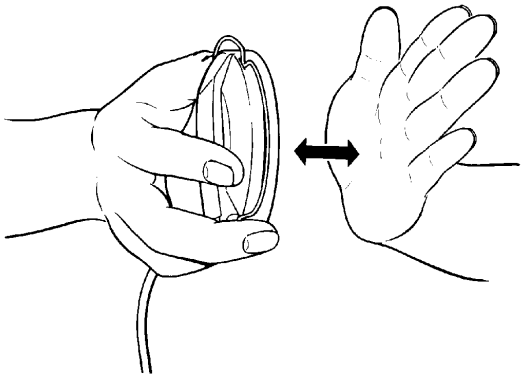
A sound should be heard for each crystal tested. The pen should be held 2 to 3 cm from the transducer surface when the test is carried out.



ustrancs.hpg

Figure 9-3 Position of Crystals in an Ultrasound Transducer

4. A sound should also be heard when the transducer is moved back and forth over a solid surface, or the hand as shown below.



pop21sca.tif

Figure 9-4 Checking an Ultrasound Transducer

If the tests are not as outlined above, repeat the tests with another transducer. If this does not solve the problem, refer to Chapter 10, "Troubleshooting."

The transducers are sealed and are **NOT** repairable, but the connectors can be exchanged.

TOCO Transducer

Visual Check Ensure that the transducer housing is sound, that the cable is not cracked or broken, and that there are no cracks on the connector plug.

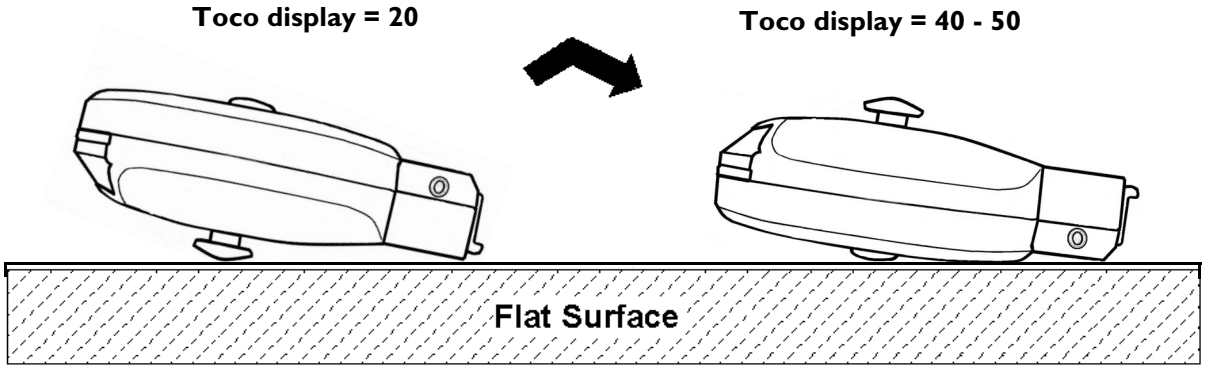
Electrical Check

1. Connect the Toco transducer to the **Toco** socket. (Both the connector and socket are brown, and keyed so that they mate in only one position.)

   Ensure that:

   - the Toco display shows 20.
   - when the recorder is switched on, the date, time, mode and paper speed are printed on the recorder trace.
2. Press the transducer button firmly and look for a deflection on the display and recorder. The external Toco display maximum is 100 units.
3. Lay the transducer face up on a flat surface for a few seconds.
4. Press the Toco Baseline Key to re-adjust the Toco display to 20.
5. Turn the transducer over so that the button is face down on the flat surface. Hold the cable at a point 25 cm from the transducer and ensure that the transducer touches the flat surface only with the button and that the transducer is parallel to the flat surface.

   The Toco display should read between 40 to 50 units.



Note— The illustration does not show the cable. The appearance of the transducer may differ from the illustration.

If the test results are not as outlined above, repeat the test with another transducer. If this does not solve the problem, refer to Chapter 10, "Troubleshooting."

The transducers are sealed and are **NOT** repairable, but the connectors can be exchanged.

The external Toco recorder display can be between 0 and 127 units. If the test fails, repeat using another transducer. If it still fails, refer to Chapter 10, "Troubleshooting." After the test, you must zero the system by pressing the Toco Baseline Key.

IUP Transducer

Visual Check Ensure there are no cracks in the transducer or its accessories, that the cable is not cracked or broken, and there are no cracks on the connector plug.

Electrical Check

1. Connect the transducer to the Toco socket.

   Ensure that:

   - the display shows 0.
   - when the recorder is switched on, the date, time, mode and paper speed are printed on the recorder trace.

2. Choose one of the tests below, according to which IUP transducer you are testing:

   - If your IUP transducer has a "zero" button built into the adapter cable itself, press this to intentionally short circuit the cable. The monitor display should read +/- 3mmHG while you press the button. This indicates that the monitor and leads are working properly.
   - If your IUP transducer has no "zero" button, press and hold Test. Ensure that the display and recorder trace alternate between 10 and 60 units (for periods of 2 seconds) for as long as the key is pressed. The IUP display is limited to +127 / -99. Gently apply pressure to the transducer diaphragm by pressing the syringe plunger, and look for an increase on the display and recorder.

If the test results are not as outlined above, try another transducer. If this does not solve the problem, refer to Chapter 10, "Troubleshooting."

Maternal SpO_2 Transducer

Visual Check Ensure there are no cracks in the transducer and that the cable is not cracked or broken, and there are no cracks on the connector plug.

Electrical Check

1. Connect the transducer to the **maternal SpO_2** socket.

   Ensure that:

   - the LEDs in the transducer head are lit
   - the LCD display shows **?** for pulse and **?%** for saturation and ⚠ `no pulse`.
   - when the recorder is switched on, the date, time, mode and paper speed are printed on the recorder trace.

2. Press and hold the **Test** key for a short while. Ensure that the display and recorder trace show maternal SpO_2 value of 99% and maternal heart rate of 120 bpm.

3. To check out the transducer perform a self measurement using your own finger.

If the test results are not as outlined above, try another transducer. If this does not solve the problem, refer to Chapter 10, “Troubleshooting” for details about how to check the SpO_2 board and cable.

ECG: M1364A Patient Module

Visual Check Ensure there are no cracks in the patient module and that the cable is not cracked or broken, and there are no cracks on the connector plug.

To verify the operation of the M1364A Patient Module with the M1362B (DECG) or M1363A (MECG) adapter cable, use the following procedure:

1. Plug the M1364A Patient Module into the Cardio 1/Combi socket of the Fetal Monitor without the adapter cable M1362B or M1363A connected.

   Result: Cardio 1/Combi channel display **must** show "NOP".

   Note—In the presence of strong fields (50-60Hz), "nop" may disappear even without additional cabling.

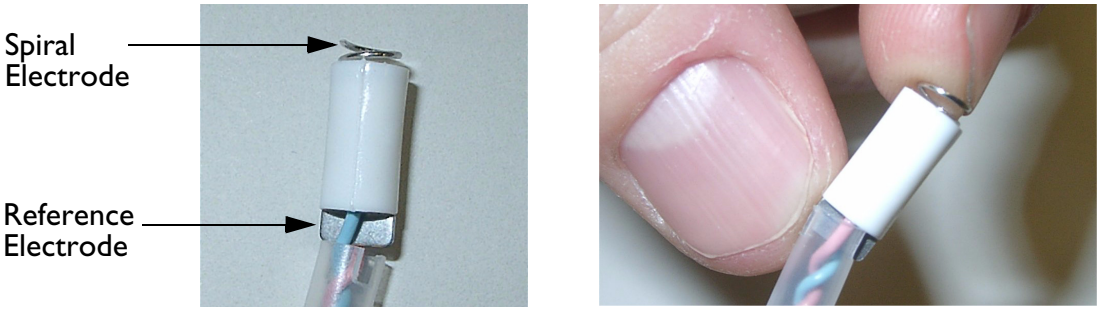
2. Connect the M1362B or M1363A adapter cable to the M1364A Patient Module. With open connections (i.e. no connection to electrode(s) on patient), the fetal monitor’s signal quality indicator should be red, and either no numeric in the display, or "nop".

   Note—The position of the M1364A and the M1362B or M1363A cable relative to each other can influence the displayed result, e.g. an antenna may be unintentionally created, receiving spurious signals.

Testing DECG Mode:

1. Take an unused Fetal Scalp Electrode, and connect it to the DECG adapter cable.
2. *EITHER*
   a. Make a short between the spiral electrode and the reference electrode with your fingers (it is best to wet your fingers first).

Caution
Take care not to injure your fingers.



Result: NOP should disappear.

OR

b. Cut off the plastic tip of the fetal scalp electrode (containing the spiral and reference electrodes) from the end of the wires. Strip the insulation from the end of the wires, and connect them to a patient simulator.

Note—We do not recommend the use of a specific patient simulator. The use of a patient simulator does not allow checking the specification of the ECG functionality; it allows only a check of general function.

Result: "NOP" should disappear.

If the test results are not as outlined above, repeat the test with another M1362B DECG adapter cable and/or M1364A patient module.

Testing MECG Mode

1. Attach the MECG adapter cable M1363A to the red color-coded socket on the M1364A.
2. *EITHER*

   a. Attach electrodes to the M1363A adapter cable, and apply the electrodes to the skin (for example on the wrists).

   OR

   b. Attach the M1363A adapter cable to a patient simulator.

   Note—We do not recommend the use of a specific patient simulator. The use of a patient simulator does not allow checking the specification of the ECG-Functionality; it allows only a check of general function.

   Result: You should see MECG values displayed on the maternal LCD display or annotated on the recorder trace.

If the test results are not as outlined above, repeat the test with another M1363A MECG adapter cable and/or M1364A patient module.

ECG: M1365A Patient Module

Visual Check Ensure there are no cracks in the patient module and that the cable is not cracked or broken, and there are no cracks on the connector plug.

To verify the operation of the M1365A Patient Module with the M1362B (DECG) or M1363A (MECG) adapter cable, use the following procedure:

1. Plug the M1365A Patient Module into the Cardio 1/Combi socket of the fetal monitor without the adapter cable M1362B or M1363A connected.

   Result: Cardio 1/Combi channel display must show " - - - ".

2. Connect the M1362B or M1363A adapter cable to the M1365A Patient Module. With open connections (i.e. no connection to electrode/s on patient), the fetal monitor's signal quality indicator should be red, and either no numeric in the display, or "NOP".

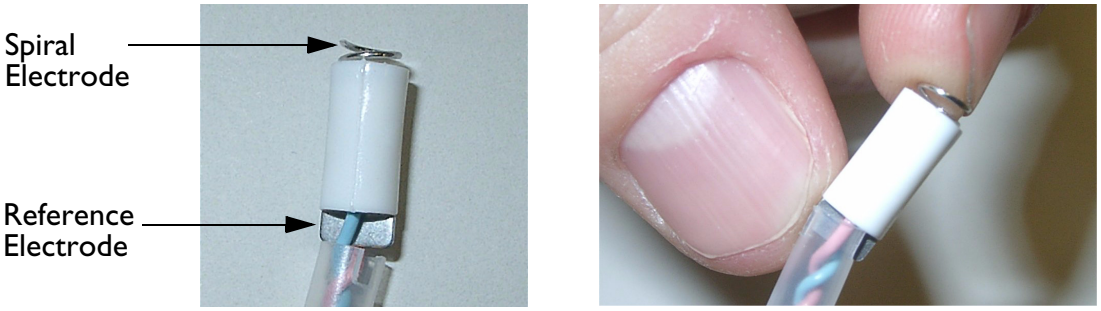
Note—The position of the M1365A and the M1362B or M1363A cable relative to each other can influence the displayed result, e.g. an antenna may be unintentionally created, receiving spurious signals.

Testing DECG Mode

1. Take an unused Fetal Scalp Electrode, and connect it to the DECG adapter cable.
2. *EITHER*

   a. Make a short between the spiral electrode and the reference electrode with your fingers (it is best to wet your fingers first)

Caution
Take care not to injure your fingers.



Result: NOP should disappear.

OR

a. Cut off the plastic tip of the fetal scalp electrode (containing the spiral and reference electrodes) from the end of the wires. Strip the insulation from the end of the wires, and connect them to a patient simulator.

Note—We do not recommend the use of a specific patient simulator. The use of a patient simulator does not allow checking the specification of the ECG-Functionality; it allows only a check of general function.

Result: NOP should disappear.

If the test results are not as outlined above, repeat the test with another M1362B DECG adapter cable and/or M1365A patient module.

Testing MECG Mode

1. Attach the MECG adapter cable M1363A to the red color-coded socket on the M1365A.

   EITHER

   a. Attach electrodes to the M1363A adapter cable, and apply the electrodes to the skin (for example on the wrists).

   OR

   b. Attach the M1363A adapter cable to a patient simulator.

Note—We do not recommend the use of a specific patient simulator. The use of a patient simulator does not allow checking the specification of the ECG-Functionality; it allows only a check of general function.

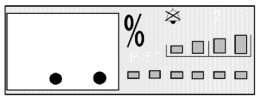
Result: You should see MECG values displayed on the maternal LCD display and annotated on the recorder trace.

If the test results are not as outlined above, repeat the test with another M1363A MECG adapter cable and/or M1365A patient module.

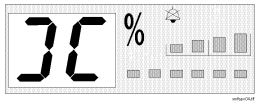
Testing with Fetal SpO_2 Sensor

To verify the operation of the M1365A Patient Module with the Fetal SpO_2 sensor, use the following procedure:

1. Connect the patient module to the Cardio 1/Combi socket of the fetal monitor.
2. Ensure that the $FSpO_2$ display shows:



3. Connect the $FSpO_2$ sensor. Check that the red LED's on the sensor are working and that the monitor $FSpO_2$ display shows:



If the test results are not as outlined above, repeat the test with another $FSpO_2$ sensor and/or M1365A patient module.

NIBP Calibration

Philips recommends that you calibrate the NIBP module at least once every year, or whenever the validity of the readings is in doubt.

Use a calibrated pressure gauge kit to calibrate the NIBP module. If you use a mercury manometer you must connect an expansion container, volume 250ml ±10% to the pressure circuit to simulate the cuff air volume (connecting material can be ordered under part number 78354-67001). A mercury manometer is not as accurate as the recommended pressure gauge and if the manometer tolerance is >1 mmHg calibration cannot be done within Philips specifications.

To enter NIBP calibration mode

1. Disconnect all transducers from the monitor and disconnect, or switch off, Telemetry. Make sure the recorder is on.
2. While pressing F.⚠ press Test:
   - C01 is shown in the US1/US display.
   - 0 or 1 is shown in the Toco display.
3. Press F.⚠ again to select the Function Menu:
   - **A01** (Print the Error Log) is shown in the US1/US display.
4. Press + repeatedly to select service setting **A04**.
5. Press →|← and you will see the **Yes** soft key on the LCD screen.

To calibrate NIBP

This test mode does not use the monitor's internal pump.

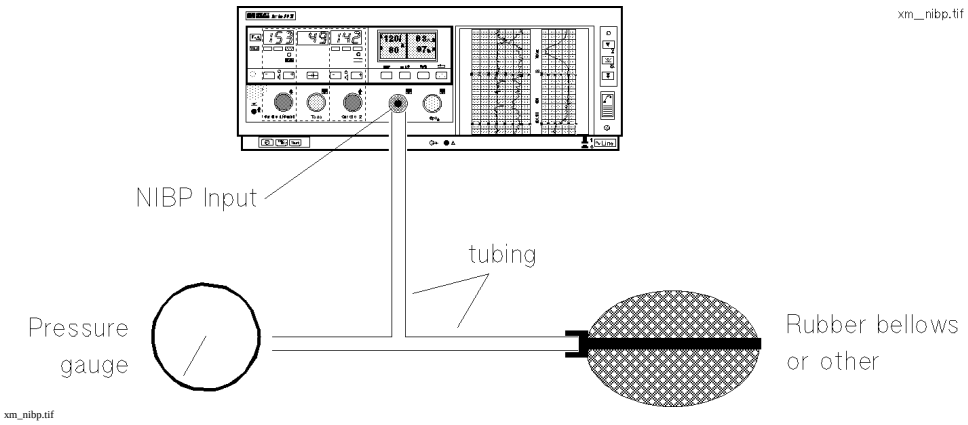


Figure 9-5 Connecting the Pressure Gauge

1. Connect a pressure gauge (0-320 mmHg) to the parameter input socket of the monitor via the cuff tubing.
2. Press **Yes** to switch the monitor into calibration mode. This allows you to apply pressure through the NIBP connector and view the current measurement.

3. Apply an exact pressure of 220 mmHg. Wait ten seconds for the measurement to stabilize.
4. Press **Store Cal**.

Both the old and the new calibration values are shown in the display. Then the monitor reboots and releases the pressure automatically.

If the NIBP calibration fails (**FAILED !** is shown in the display), repeat the calibration, ensuring that you apply an exact and stable pressure of 220 mmHg. If it fails repeatedly, you must exchange the NIBP module.

NIBP Overpressure Test

You can test the proper functioning of the NIBP overpressure safety mechanism as follows:

1. Manually pump up a blood pressure cuff and connect it to the NIBP input socket using the cuff tubing.
2. Exercise pressure on the cuff. The ventilation valves should release pressure in the cuff immediately.

The valves operate mechanically and should function whether the monitor is switched on or off. They do not function when the monitor is in calibration mode or in NIBP measurement mode. The NIBP acoustic alarm in contrast functions only when the monitor is switched on. As the actual overpressure safety mechanism consists of the ventilation valves, it is not necessary to test the NIBP alarm function. See “Maternal External Blood Pressure” on page 238 for details of the maternal NIBP alarm limits.